Taste!

Energy Cookbook

Recipes for cooperation

The mission of **Nordic Energy Research** is to fund and promote Nordic cooperation within **energy research** and make a significant contribution to **energy policymaking.**

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Taste!
Energy Cookbook - *Recipes for Cooperation*

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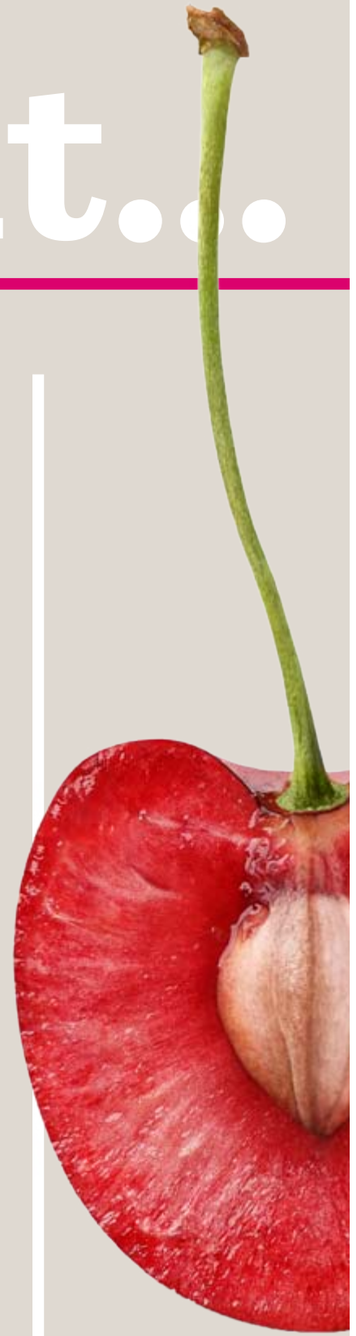
Nordic Energy Research is an institution under the auspices of Nordic Council of Ministers. The institution is partly funded directly from the Nordic countries, partly from Nordic Council of Minsters. For more than 25 years Nordic Energy Research has administrated a common pot of funds for the financing of Nordic research on energy. The institution is located in Oslo and in 2010 the turnover was 58,9 mio NOK, and the number of employees was 14.

norden
Nordic Energy Research

Taste it...



What is **energy**?
What is **cooperation**?
Is **cooperation energy**?
Is **energy cooperation**?

Yes!!!

Why an Energy Cookbook?

In all cultures, stories evolve from the culinary experience. Conducting research, like preparing a meal, requires training and learning from our colleagues through the sharing of recipes.

Good cookbooks combine tradition with more recent innovations and offer a wide variety of options to meet diverse tastes and needs. They give us recipes for how to make well-known dishes, the ability to experiment to produce new ones and ideas for using ingredients creatively. In the same way, this energy cookbook gives you a variety of recipes for research cooperation. The book emphasizes the value of Nordic cooperation and promotes use of Nordic raw materials as green energy.

While Taste! is a collection of Nordic recipes, it is also a primer on one of the hottest global issues of the day - the “grand challenge” of energy and climate change. This Energy Cookbook is therefore a tempting treat for all to enjoy.

The energy cookbook gives you a delicious collection of 16 recipes, representing the projects that Nordic Energy Research funded between 2007 and 2010. This is the result of the combined efforts of top-level researchers and industry across the Nordic and Baltic countries. The recipes are divided in two types: recipes for projects and formulas for networks. They all reflect technological and policy choices that are geared toward an efficient, secure and sustainable energy system.

A total of 86 million NOK (10,75 million EURO)[1] has been provided by Nordic Energy Research to fund the projects behind the recipes. Adding external financing, the total budget becomes 147 million NOK (18,40 million EURO).

You may be puzzled by the refreshing photos of Nordic berries that accompany the research recipes. You can even find two new Nordic food recipes for energy smoothies, created by chefs Geir Skeie and Siggi Hall, both having excelled

1 Exchange rate 8,0 EURO

in the culinary world through their playful use of Nordic raw materials and their natural flavors. We believe there are many parallels between New Nordic Food and Nordic energy research. The Nordic Council of Ministers has initiated the New Nordic Food manifesto as a way of boosting the production and consumption of traditional food products. The philosophy behind this can easily be adapted to the field of energy. In a similar style, Nordic Energy Research is committed to the manifesto points of understanding the importance of a sustainable lifestyle, respect for nature, fair use of natural resources and an emphasis on resource efficiency.

Taste! is a pleasurable way to get inside energy research without spending your entire day slaving over a "hot stove" with dense and technical hard stuff. We have focused our attention on making the recipes easy to read and follow to ensure that you are able to make the most of your precious time. At Nordic Energy Research, we are always building bridges: between research and its users, like industry and policymakers, and between content and design, so that the flow of information is smooth and easy. Possibly the most effective aspect of the energy cookbook is that it will be used, rather than sitting on a shelf gathering dust. This helps Nordic Energy Research to accomplish our mission of promoting Nordic cooperation.

Is there a secret ingredient to success in energy research projects? Clearly it is about involving the most skilled people. Simply put, we can say that Nordic Energy Research funds people, not projects. Education of highly qualified PhDs and specialists in Nordic energy systems and resources has always been vital for us.

But how do you ensure this quality? Well, that's where the secret ingredients come into play: building relationships. What we really do is to fund R&R: Research and Relationships. This was also underlined at our 25th anniversary in 2010, marking the end of our 4-year funding period and the beginning of a new research program with an even sharper focus on sustainable energy systems. The chairman at that time, Nicolai Zarganis, said: "It is the fact that the program facilitates true international technology collaboration that makes it exceptional. By binding the Nordic national research communities together we can achieve major synergies based on the five countries' complementary strengths in the energy field."

We hope this book will encourage researchers, industry and policymakers to explore Nordic cooking and cooperation. Because international collaboration accelerates the energy research and innovation we need to solve the "grand challenge" of energy and climate.

Enjoy!

Anne Cathrine Gjærde
Director

16 projects recipes

Thematic areas of Integration of the Energy Market, Renewable Energy, Energy Efficiency, The Hydrogen Society and The Effects of Climate Changes on the Energy Sector

A common culture, common goals and priorities

and small networks are

factors that help enhance

research cooperation in the

Nordic region...

Energy Smoothie

by Geir Skeie

1 dl plain yoghurt

2 tbs oatmeal

1 tbs brown natural sugar

1/2 dl blueberries

1 dl lingonberry juice

1/2 dl strawberries

Blend everything in a blender until smooth,
adjust the sweetness with sugar.

Geir Skeie
Bocuse d´Or 2009

UK: **Raspberry** DK: **Hindbær**
NO: **Bringebær** SE: **Hallon**
FIN: **Vadelma** IS: **Hindber**

ENERGY pr 100 g

kJ	142kJ	kcal	34kcal

The raspberry is most common in the Southern parts of the Nordic countries. In addition to their great taste, raspberries are a nutrition powerhouse.

[Nordic Energy, Environmental Constraints and Integration]

Combining *flavors* in the market

If we are to achieve our CO_2 targets, we need to get serious about understanding the energy markets. Efficient integration of distributed energy generation is a necessary condition for a well-functioning Nordic electricity market that provides security of supply at the lowest possible cost. Learn about adding flavors, or instruments, like green, white and black certificates to the energy market.

Cooking time

4 years of research

Ingredients

5 countries (Iceland, Finland, Sweden, Norway and Denmark)

9.4 million NOK

5 educational institutions

1 private partner

5 full-time project participants

8 doctorate degrees

150 publications

4 seminars

Process

1. You need to develop new cookware to meet the main concerns of energy policy makers in the Nordic countries, including soaring energy prices and security of supply, coupled with environmental concerns. The consequence is an increased emphasis on instruments that can foster investment in new renewable capacity and the development of energy-saving clean technologies. As energy markets become more integrated, both geographically and across energy carriers, local markets are increasingly exposed to inter-regional effects.

2. Turn on the fundamental and applied research switch.

3. Add researchers from all the Nordic countries. Build on the research network successfully established through the previous Nordic Energy Research projects.

4. Set the target to further increase understanding of the functioning of energy markets, as well as how to improve the performance of these markets.

5. Apply case studies of distributed energy generation projects throughout the Nordic region, and collect empirical data that can be used to identify barriers to distributed generation integration, given the current regulatory setup.

6. Train doctoral students for continuous cooking in the future.

Taste

The project has resulted in a large number of publications and presentations. “We had several goals in doing this work”, says project leader Torstein Bye, Director of Statistics Norway. “It is partly about new insights conveyed as theoretical and applied economic articles in journals, and presentations for government and others involved in energy and environmental issues.”

Several papers are concerned with issues of sutainable development and the implementation and effects of a variety of instruments and regulatory regimes. Green certificates, white certificates and black certificates (permit markets) are all analyzed. Several papers consider one instrument at a time, while others discuss the effects of combining instruments. Other papers study the effect of discriminatory setups (some instruments are not evenly applied to all agencies involved).

An interesting example is the study showing that a green certificate market will benefit the dirtiest power poducers when a carbon tax (or permit market) regime already exists. These research fields have directly influenced the public debate on sustainable development and the introduction of policy measures to combat climate change.

Other aspects raised are security of supply, different regulatory regimes, the role of public investments in energy markets – including uncertainty aspects – the functioning of and competititon in retail and wholesale markets, different regimes for competition including elements of cross-subsidisation, forward markets for energy and the role of information in energy markets.

One interesting aspect is the research on volatility of electricity prices and security of supply, which has also indirectly had a substantial impact on policy debates within the Nordic countries. Several of the participants have been directly involved in ministerial commissions studying these issues, as well as participating in the intra-Nordic public debates.

Cooperation how-to

Nordic Partners:

- Statistics Norway, *Norway*
- Stockholm School of Economics, *Sweden*
- Copenhagen University, *Denmark*
- Helsinki School of Economics, *Finland*
- Reykjavik University, *Iceland*

There is a significant upside to cooperating on these issues within a Nordic framework. The Nordic countries are small and have compact research communities, especially on new research areas such as energy markets. As a result of Nordic cooperation, it has been possible to reach "critical mass" in more areas than would otherwise be possible, which in turn elevates the quality of research.

PhD patisseries

To go with "Combining flavors in the market"

Olli Kauppi, *Helsinki School of Economics:* In his dissertation, Olli Kauppi discusses the efficiency of competition in the Nordic wholesale power market. He develops a statistical model to depict the operations of a power market dominated by hydroelectricity. A special characteristic of the model is that, in addition to the competitive market, it allows for the examination of situations where the ownership of hydroelectricity is concentrated in the hands of major power corporations.

Stephanie Ropenus, *Risø, DMU:* The growth of distributed electricity supply of renewable energy sources (RES-E) and combined heat and power (CHP) – so-called distributed generation (DG) - can cause technical problems for electricity distribution networks. These integration problems can be overcome by reinforcing the network. Many European Member States apply network regulation that does not account for the impact of DG growth on the network costs. The project looked into the impact of high DG deployment on the electricity distribution system costs and the impact on the financial position of the DSO. Several ways for improving network regulation to compensate DSOs for increasing DG penetration were identified and tested.

Halvor Storrøsten, *Statistics Norway:* i) Emissions trading with updated allocation: Effects on entry/exit and distribution, which has been accepted for publication in Environmental and Resource Economics; ii) Investment in abatement technology: A tax versus emissions trading under imperfect competition"; iii) "Price vs. tradable quantity regulation: Uncertainty and endogenous technology choice"; iv) Output-based allocation and investment in clean technology".

Anne Sahari, *Helsinki School of Economics:* In her dissertation, which is due to be completed in 2012, Anna takes up several issues: i) The Finnish retail electricity markets, ii) Estimating the resource rent of hydropower producers and iii) Econometrics and Computational Economics.

Hanne Marit Dahlen, *Statistics Norway, Norway:* i) Implementing the EU renewable target through green certificate markets (finished) and ii) Analyzing the impact of economic analysis on the choice and design of policy instruments. How is cost-effectiveness understood and used by Norwegian policy makers? Research question: Taking cost-effectiveness into account when designing environmental policies. Norwegian politicians' use of economic theory in their choice of instruments for reaching their (complex) targets.

Mette Graversen, *Den Konglige Veterinær og Lanbrukshøyskole, Denmark:* In her thesis, Mette Gravesen has included four papers about over-exploitation of natural resources and the consequences for armed conflicts: i) "Natural resources and conflict severity – what is the relationship?"; ii) "Oil price shocks, institutional quality and conflict severity"; iii) "Heterogeneous natural resources and onset of heterogeneous conflict types"; iv) "Regulating water extraction in a river basin with upstream-downstream communities".

Matti Ilonen, *Helsinki School of Economics, Finland (lic):* Matti Ilonen moved to work for the Finnish energy market authority and decided to complete his Licentiate thesis by 2012. The topic of the thesis is "Finish Retail Market Competition: an empirical assessment." The thesis uses a recent database that covers all retail electricity contracts offered in Finland in the period 2006-2010. Using the data, it is possible to assess regional price dispersion and to evaluate the pricing practices of local suppliers versus national electricity traders. The aim is to develop an econometric model for the determinants of local prices that exhibit systematic deviations from the prevailing national price.

Sara Fogelberg, *Research Institute of Industrial Economics (IFN):* Sara fogelberg started her PhD work in 2010 and will probably deliver primo 2013. Her subject is Energy Security issues.

UK: **Strawberry** DK: **Jordbær**
NO: **Jordbær** SE: **Jordgubbar**
FIN: **Mansikka** IS: **Jarðarber**

ENERGY pr 100 g

kJ	172kJ	kcal	41kcal

The garden strawberry is cultivated throughout all of the Nordic countries. It is an excellent source of Vitamin C, and it is one of the richest sources of antioxidants.

[Basic Phenomena in Mechanical Pulping]

Essential Fibers

With industry

With rising energy costs, the consequence of saving energy in the mechanical pulping sector has an important impact on the future competitiveness of the Nordic pulp and paper industry. This recipe promotes increased energy efficiency through new knowledge about essential wood fibers.

Cooking time

2 years of research

Ingredients

3 countries (Finland, Sweden and Norway)

9.68 million NOK

5 educational institutions

4 industry partners

8 full-time project participants

6 post-doctoral candidates

3 doctorate degrees

20 publications

10 seminars

Process

1. Start by taking a look at the industry's energy use in the Nordic countries. In 2002, Finnish industry consumed electrical energy of roughly 42 TWh, of which close to 25 TWh was consumed by the pulp and paper industry. The share of mechanical pulp production was some 10 TWh. For Swedish industry, the corresponding figures are roughly 56 TWh, 23 TWh and 7 TWh respectively. In Norway, the amount of energy used for mechanical pulping is lower. Between 2005 and 2006, the end-user price of electricity on the European market almost doubled. For an industry facing competition across the globe, these price hikes have meant tightening the belt and looking to new means of maintaining competitiveness. With the increasing cost of raw materials and especially the increase in energy prices, the outlook for sustaining the industry in the Nordic countries is that it will become tougher and tougher in the future.

2. Focus on paper industry problems. Basically, the problem is inefficient technology. It is estimated that only around 5-20% of the energy consumed in the production of mechanical paper in paper mills goes into the actual production of the mechanical pulp.

3. To solve the problem for the pulp and paper industry, build on Nordic strengths. The Nordic countries have long taken a leading role in developing value-added fiber products as well as the machines needed for producing the different paper and board grades. This leadership position is becoming ever stronger.

4. Invest in research as a tool for keeping this important industry from moving to sites with lower production costs.

5. Blend educational institutions, industry partners, full-time project participants, post-doctoral candidates and doctorate degrees. Be aware of the fact that the expertise, knowledge and research facilities you need are distributed among several research sites, including research centers and Universities. So to meet today's requirements for radical improvements with insufficient resources, the evident solution is to combine all the top expert resources in Nordic cooperation projects.

6. Set the target to a radical reduction of the specific energy (30%) in the production of mechanical pulp.

7. Find ways to reduce production costs by developing new methods. Study and measure the effects of the different process steps on wood fibers. Find the essential fiber properties that can increase energy efficiency.

8. Finalize with publications and seminars.

Taste

Unfortunately, the project was unable to achieve its very ambitious target of a 30% reduction in energy use. However, significant theoretical progress has been made and knew knowledge gained about what to do to get closer to this goal.

Much can be gained from the experience of the project, and the findings can to a large extent be directly applied to all paper-making companies in the Nordic region. This will help create greater opportunities for sustaining research and industrial drive as well as the Nordic region's competitive strength in the pulping industry.

Based on the results of the project, scientists were able to reject several older hypotheses, concluding that there is a huge difference in how the splitting of the wood fibers takes place. One example is that you need 10-15% more energy to process pine pulp than spruce pulp.

An indirect result of the project spawned a startup company. Together with Nordic colleagues, Professor Gregersen has been involved in establishing the company Collimated Chipping Technology AB in Sweden. It is based on a patented production method, which they will develop in the coming years.

Cooperation how-to

Nordic Partners:
- MIUN/ FSCN – Mid-Sweden University, *Sweden*
- Norwegian University of Science and Technology, *Norway*
- Tampere University of Technology, *Finland*
- Helsinki University of Technology, *Finland*
- The Finnish Pulp & Paper Research Institute (KCL), *Finland*

Industry:
- Stora Enso Oyj, *Finland*
- UPM-Kymmene Oyj, *Finland*
- Metsäliitto Group, *Finland*
- Myllykoski Corporation, *Finland*

Project manager Mikael Lucander from KCL in Finland is eager to emphasize the Nordic dimension of the research project, "All project participants contributed with research that is essential for the project as a whole. For instance, without detailed knowledge of the rheological, morphological and chemical properties of our raw materials, we would have no firm basis for running a simulation of the process." Within this project, each institution was responsible for its own sub-project. However, no partners worked alone; instead, everyone cooperated intensely with the other institutions. "We decided to work together not only to receive funding, but because of the great benefit generated from collaboration. We have been able to combine and integrate knowledge from the different partners in the project," Lucander observed.

Research cooperation across borders seems to have clear benefits, but how does transnational cooperation affect the project results? According to Lucander, a Nordic project generates a greater number of publications than national projects. His project has resulted in 20 reports and publications and close to 10 international conferences and seminars.

One factor that may have enhanced cooperation between the Nordic countries is culture. In the Nordic region, the differences between the countries are quite small. The research culture and methodologies are similar, easing cooperation across the Nordic region. For the project, this meant that the interests and goals within mechanical pulping and energy savings were the same in all the Nordic countries.

The knowledge and experience generated from the mechanical pulping project is that a common culture, common goals and priorities and small networks are factors that help enhance research cooperation in the Nordic region. When it comes to the pulping industry, it is important to protect competitiveness as this field is an important export commodity of common Nordic interest.

Project manager Mikael Lucander highlights the importance of the region's financial contribution to the pulp and paper sector. "As project manager, I think it is highly important to receive Nordic regional funding in addition to national funding. This creates a greater opportunity to sustain research and industrial drive, as well as the Nordic region's competitive strength within the pulping industry. We have the knowledge and research environment – this field is our strength. We are very happy to see Nordic Energy Research take an interest in our work. The industry itself, faced with the need to cut costs in the wake of rising electricity prices, has so far been reluctant to fund research like ours. It is encouraging to see things turning around."

UK: **Blueberry** DK: **Blåbær**
NO: **Blåbær** SE: **Blåbär**
FIN: **Mustikka** IS: **Bláber**

ENERGY pr 100 g

kJ	221kJ	kcal	53kcal

Blueberries grow in most Nordic countries – both in the wild and in cultivation. The deep blue color is related to the berries' high amounts of antioxidants that are said to be beneficial to health.

[Nordic Graduate School in Biofuel Science and Technology-phase 2]

Food for thought

The Nordic Graduate School is an energy cooking school devoted to education in the art of biofuels science and technology. Students can acquire experience working in an international Nordic environment and receive specialized doctoral training.

Cooking time

4 years

Ingredients

4 countries
(Finland, Sweden, Norway and Denmark)

16 million NOK

4 universities

6 senior researchers

10 post-doctorates

16 doctorate degrees

123 publications

8 courses

Process

1. Combine competences from the four universities Chalmers University of Technology (CTU), Sweden, Technical University of Denmark (DTU), Denmark, Norwegian University of Science and Technology (NTNU), Norway, and Åbo Akademi University (ÅAU), Finland to form The Nordic Graduate School in Biofuels Science and Technology – Phase 2.

2. Raise the esteem and quality of doctoral training within the Nordic universities in the area of biomass and waste conversion to fuels, heat and power.

3. Aim to provide the basic scientific and technical knowledge to solve problems related to conversion of biofuels. This is achieved by collaboration in postgraduate course arrangements, shared student supervision via student and supervisor exchanges between the base universities, and intensive industry-academia networking.

4. Widely advertise the individual BiofuelsGS-2 courses and keep the school open to students at all participating Nordic universities. Spread information through the website of BiofuelsGS-2 and a biannual newsletter sent to participants and their supervisors.

5. Continue collaborating with other Graduate Schools in the Nordic countries through collaborative courses and seminars to maintain a high level of knowledge-sharing between students, researchers, university departments and industry.

Taste

The BiofuelsGS-2 consists of 16 doctoral students (partly funded directly by the school, partly funded by other sources) and their supervisors. Additional students from the four partners are also given the opportunity to participate with funding from other sources.

In summary, the School's activities include:

- Tailor-made study and research plans for all participating students, including study and research visits to other Nordic universities.
- Intensive courses organized directly by the school in key biofuel conversion science and technology topics. Provided by senior researchers and professors within the participating universities or by invited lecturers from industry.
- Intensive courses organized by others. Additional courses were provided by cooperating partners of BiofuelsGS2, such as the Danish Graduate School of Chemical Engineering, "Molecular Product and Process Technology (MP2T)", the Finnish Graduate School in Chemical Engineering (GSCE) and the Swedish postgraduate training program CeCost.
- Annual seminars where students present their work and exchange knowledge and opinions with each other.
- An Annual Book published at the annual seminars, consisting of progress reports by the School's students.
- A website http://web.abo.fi/instut/biofuelsGS-2/

Cooperation how-to

Nordic Partners:

- Chalmers University of Technology, *Sweden*
- Denmark: Technical University of Denmark, *Denmark*
- Norwegian University of Science and Technology (NTNU), *Norway*
- Aabo Akademi University, *Finland*

BiofuelsGS2 is a direct continuation to the former Nordic graduate school "biofuelsGS", which was established in 2003. BiofuelsGS2 was funded by Nordic Energy Research for a period of four years, starting on 1 January 2007 and ending on 31 December 2010.

A team of senior researchers is cooperating closely on to organize the program planned for delivery in BiofuelsGS-2.

Project manager Professor Mikko Hupa commented: "I would particularly emphasize the importance that the doctoral school has had in building an academic network in this field in Scandinavia. The students and their mentors have had meetings where they presented their work and results for each other, and discussed and criticized the results and methods."

UK: **Redcurrant** DK: **Ribs**
NO: **Rips** SE: **Röda vinbär**
FIN: **Punaherukka** IS: **Ribsber**

ENERGY pr 100 g

kJ	203kJ	kcal	49kcal

The redcurrant is native to all parts of Scandinavia. It is an excellent source of vitamin C and other antioxidants. The berry is also a source of dietary fiber.

[Development and demonstration of an efficient and cost competitive PEMFC system for the cold Nordic climate.]

Frozen Fuel cells

With industry

With this recipe, you achieve fuel cells that can be kept in freezing environments without being destroyed. Experience a fuel cell driven forklift that can be left outside in minus ten degrees, without causing startup problems. Reduced cooking costs of 40% are included.

Cooking time

2 years of research

Ingredients

3 countries
(Denmark, Sweden and Norway)

8.8 million NOK

1 educational institution

4 industry partners

7 full-time project participants

1 publication

1 seminar

1 forklift

Process

1. Join project participants from the Nordic countries and industry and financing.

2. Set the target to develop an efficient and durable PEMFC technology suitable for cold Nordic climate.

3. Make a plan to solve the main problem with fuel cell powered vehicles operated in sub-zero environments. When the vehicle is parked and the fuel cell is shut down, the water produced during run time must be removed to avoid core components of the fuel cell being destroyed by ice.

4. Select and develop system components with a clear focus on reliable and durable operation at reduced costs. This means looking at how to secure a PEFMC stack (Proton Exchange Membrane) and a system that would be operational in -20 to -50 degrees Celsius. Test the system for a fuel cell powered forklift.

Taste

The project resulted in a fully operational fuel cell powered forklift. The project partners were able to design a complete system with decommissioning and commissioning procedures to avoid freezing of fuel cells. This was achieved by removing the water in the fuel cells by blowing dry air through the fuel cell stack. The measuring sensors detect when the fuel cells are dry. The forklift driver does not need to worry about this procedure when she leaves the truck. As she turns off the engine, the system will automatically blow dry air through the fuel cells. This allows forklifts to stand in freezing temperatures – for example, in a cold store – without breaking down.

Another important part of the project was to bring down costs in the entire fuel cell system. By finding better and cheaper components and creating a better design for fuel cell plates, the cost per kilowatt hour decreased by 40% from 2006 to 2009. An additional benefit is that the fuel cell stack has less weight and volume. But costs must be reduced another 40% for the sub-zero fuel cells to be competitive with other regular types of energy.

By addressing an early market application with less stringent cost and dynamic requirements, the partners gained invaluable competence, experience and manufacturing capabilities for next-generation fuel cell systems exhibiting lower cost and improved reliability. Furthermore, introducing PEMFCs to a niche market application reduced risk and provided an ideal approach to quickly enhance Nordic know-how on fuel cell system integration and sub-zero operation.

Fundamental knowledge was effectively linked to feedback from field tests to develop robust fuel cell technology systems for the development of materials, components and improved cell and system design. Realization of the potential and viability of PEMFC technology required system integration and testing in real applications. A transparent approach was taken by sharing experience in an open workshop with Nordic Original Equipment Manufacturers (OEMs) and small and medium-sized enterprises (SMEs), to facilitate the realization of new business opportunities.

Cooperation how-to

Research institutions:

- SINTEF, *Norway*

Industry:

- PowerCell Sweden AB, *Sweden*
- Statoil Hydro ASA, *Norway*
- Volvo Technology AB, *Sweden*
- H2 Logic Aps, *Denmark*

DanishH2 Logic develops systems for hydrogen vehicles. Swedish PowerCell Sweden develops fuel cells. Volvo Technology, which at the time owned the power cell, is Volvo's research department in Sweden. StatoilHydro (now Statoil) was active in the development of a hydrogen market for the transport sector. SINTEF was the only research institution involved. Together, these agencies mobilized the critical mass needed to address the challenges and reach the project goals. Project partners worked closely together in small, efficient and dynamic Task Forces focused on solving specific problems such as System Requirements, Freeze Tolerance issues and System Integration and Modeling. Exchange of scientific personnel between Nordic Countries was a crucial factor in developing a strong Nordic cooperation.

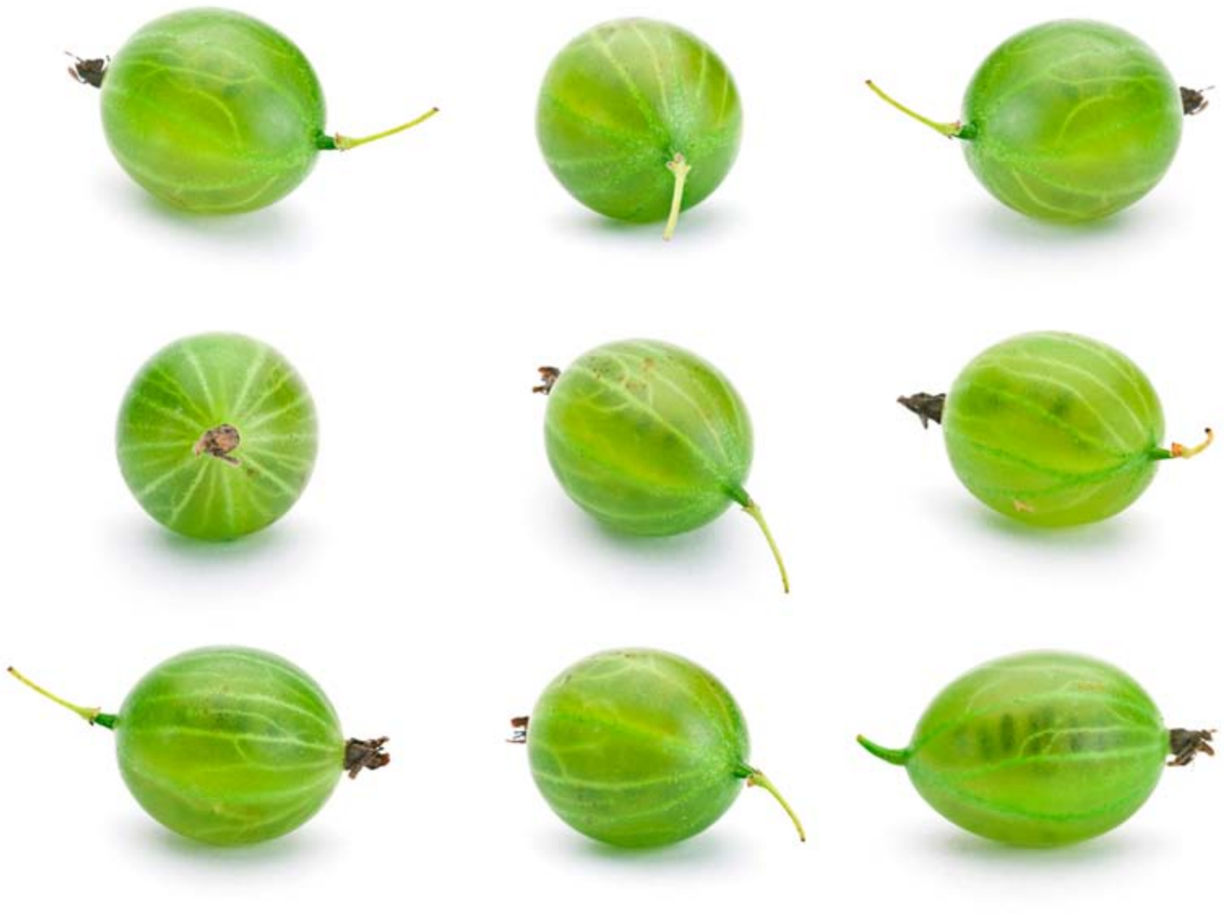
It is not always possible to find suitable industry partners in each country. For SINTEF, the project resulted in several research projects with industrial companies and access to large EU projects. As project manager Anders Ødegaard observed, "One of the finest aspects of Nordic Energy Research is that hydrogen operators can get financial support to cooperate with other Nordic partners".

UK: **Gooseberry** DK: **Stikkelsbær**
NO: **Stikkelsbær** SE: **Krusbär**
FIN: **Karviaismarja** IS: **Stikilsber**

ENERGY pr 100 g

kJ	160kJ	kcal	38kcal

The gooseberry bush is native to the Nordic region. It is rich in vitamin C and a source of vitamin B6 and antioxidants. Antioxidants protect the body's tissues against damage from free radicals.



[Distributed generation integration in the Nordic Energy market]

Mixed *green* policies

With industry

Learn how to mix green policies for efficient long-term integration of distributed generation in the Nordic market. Good for beginners, as you get a full overview of the main challenges and barriers to distributed generation, both technical and financial.

Cooking time

2 years

Ingredients

4 countries
(Norway, Finland, Sweden and Denmark)

4.540 million NOK

1 state enterprise

1 energy directorate

15 industry partners

11 full-time project participants

3 reports

Process

1. Use plenty of industry partners working with participants from state enterprises, directorates and institutions, together with financing.

2. Investigate the prospects of distributed generation depending on technological and power market developments, based on a range of scenarios.

3. Identify the main barriers to development of distributed generation in the Nordic countries and in North-West Russia through a questionnaire sent to the majority of stakeholders, as well as interviews with selected stakeholders in these countries. Based on the barriers found in the survey, carry out focus group interviews in the different Nordic countries to elaborate the results of the survey.

4. Enter into dialogues with regulatory authorities in each of the countries to see which policy tools are best.

Taste

The main barriers to development of distributed generation in the Nordic countries and in North-West Russia were found to be:

- feed-in tariffs or other incentives too low or non-existent
- instability of politics
- public resistance issues
- environmental issues

The project recommends a mix of different national policies to develop distributed generation:

- Green certificates or transport tariffs should be introduced or continued in Norway, Sweden, Finland, North-West Russia
- More local involvement and local ownership in projects is needed in Norway, Sweden and Denmark
- Inform the public more about the positive effects of distributed generation facilities in Norway, Finland and Denmark
- Establish technology-neutral and long-term support in Norway and Sweden
- Form a joint Nordic TSO

Cooperation how-to

State enterprises, directorates and institutions:

- Norwegian Water Resources and Energy Directorate (NVE), *Norway*
- Statnett, *Norway*
- Enova, *Norway*

Industry:

- Norwegian Electricity Industry Association, *Norway*
- Elforsk, *Sweden*
- Kainuum Energia, *Finland*
- Kymppivoima, *Finland*
- Sogn & Fjordane Energy, *Norway*
- Skagerak Energi, *Norway*
- Smaakraft, *Norway*
- Statkraft, *Norway*
- Tussa Kraft, *Norway*
- Vattenfall Sverige, *Sweden*
- Vattenfall Danmark, *Denmark*
- Vestavind, *Norway*
- Østfold Energi, *Norway*
- Enova, *Norway*

Studies were carried out by Sweco, Econ Pöyry, VTT Technology, Norwegian Electricity Industry Association and the Kola Science Center.

Stakeholders were involved through interviews and focus group dialogues.

UK: **Black Currant** DK: **Solbær**
NO: **Solbær** SE: **Svarta vinbär**
FIN: **Mustaherukka** IS: **Sólber**

ENERGY pr 100 g

kJ	264kJ	kcal	63kcal

The black currant is known in all Nordic countries. The black color indicates their high antioxidant content. Compared with the red currant, the black currant holds 6 times as much vitamin C.

[Primary Energy Efficiency]

Raw energy

With industry

Efficient energy cooking requires the ability to compare different sources of primary or 'raw' energy in terms of their wastefulness. This recipe gives common standards for measuring exactly how much energy is lost along the way from energy production to the end-user in the building sector. Try out this new green cooking method for energy produced from combined heat and power plants.

Cooking time

4 years of research

Ingredients

4 Nordic countries (Finland, Sweden, Norway and Iceland)

1 Baltic country (Estonia)

13.380 million NOK

6 educational institutions

5 industry partners

6 doctorate degrees

2 post-doctorates

13 publications

3 seminars

41 seminar participants

Process

1. Junk food might taste good, but it doesn't make you feel good. Electricity provides the foundation for our modern society. But a major part of the electricity in the EU and the rest of the world is still produced from fossil fuels in condensing power plants with low fuel efficiency. Starting a raw energy diet is becoming more and more common because everyone seems to want to waste less and feel better. The "Directive on the energy performance of buildings" and the mandated EN standards developed to support the implementation of this directive have created a strong movement in the whole EU environment. New energy performance indicators, "Primary energy use and CO2-production" have been introduced.

2. The overarching objective of the new green cooking method is to reduce the amount of CO2 released into the atmosphere for every kWh of energy consumed by end-users. The growing emphasis on Primary Energy Efficiency reflects the scientific and political communities' growing realization that, if we want to combat the looming energy crisis, we must look at the number of units of primary energy – be it fossil or other energy sources – that go into supplying one unit of energy for the end-user to consume. This factor – the number of units produced per unit consumed – varies quite a lot depending on how that energy is produced and transported in the first place.

3. Gently blend educational institutions, industry partners, full-time doctorate students, post-doctorates and abundant financing. Allow them to develop systems, methods and credible data for calculating primary energy efficiency in general and for energy systems in the Nordic region with a special focus on energy systems applying CHP-technology with bio-based fuel in particular.

4. Demonstrate home cooking by supplying washing machines, dishwashers and dryers with heat from district heating systems to increase the market for useful heat. Analyze the economical consequences for CHP systems in general and systems based on renewable heat in particular.

Taste

Especially for co-generation, calculating the primary energy factors is complicated. It requires great technical skill and experience. The new methods developed by Finnish, Norwegian and Estonian doctoral fellows makes it easier for end-users to calculate primary energy use and identify their carbon footprint.

The Icelandic contribution can be characterized as pioneering work within the calculation of primary energy factors for geothermal systems. Values for the entire energy chain have been calculated, including work performed during drilling and operation. This has never been done before.

The PhD studies have concentrated on ways of making households and businesses less dependent on electrical energy by improving the technological and economic conditions for a market in district heating and cooling. The researchers focused largely on consolidating an infrastructure that will allow for the emergence of a market in district heating. The idea is to have technological solutions in place that allow other sources of heat, such as local industry, to provide this energy to the district heating scheme at a net profit.

In addition to heating and cooling homes and offices, the project tried to further develop a concept whereby combined heat and power plants (CHP) could be adapted to produce biofuels for transportation.

Two of the PhD students, Patrick Lauenburg from Sweden and Eduard Latusov from Estonia, have already defended their theses and have received their PhD degrees. The other four doctoral candidates are expected to defend their theses in 2011.

Cooperation how-to

Nordic Partners:

- University of Iceland, *Iceland*
- Lund University, *Sweden*
- Malmö Stad, *Sweden*
- Krisberedskabsmyndigheten, *Sweden*
- Helsinki University of Technology, *Finland*
- Finnish Energy Research School, *Finland*
- Tampere University of Technology, *Finland*

Industry:

- VEKS, *Denmark*
- Orkuveita Reykajavikur, *Iceland*
- E.ON Sverige AB, *Sweden*
- Svensk Fjärnvärme AB, *Sweden*
- Göteborg Energi AB, *Sweden*
- ÅF-Estivo Ltd., *Estonia*

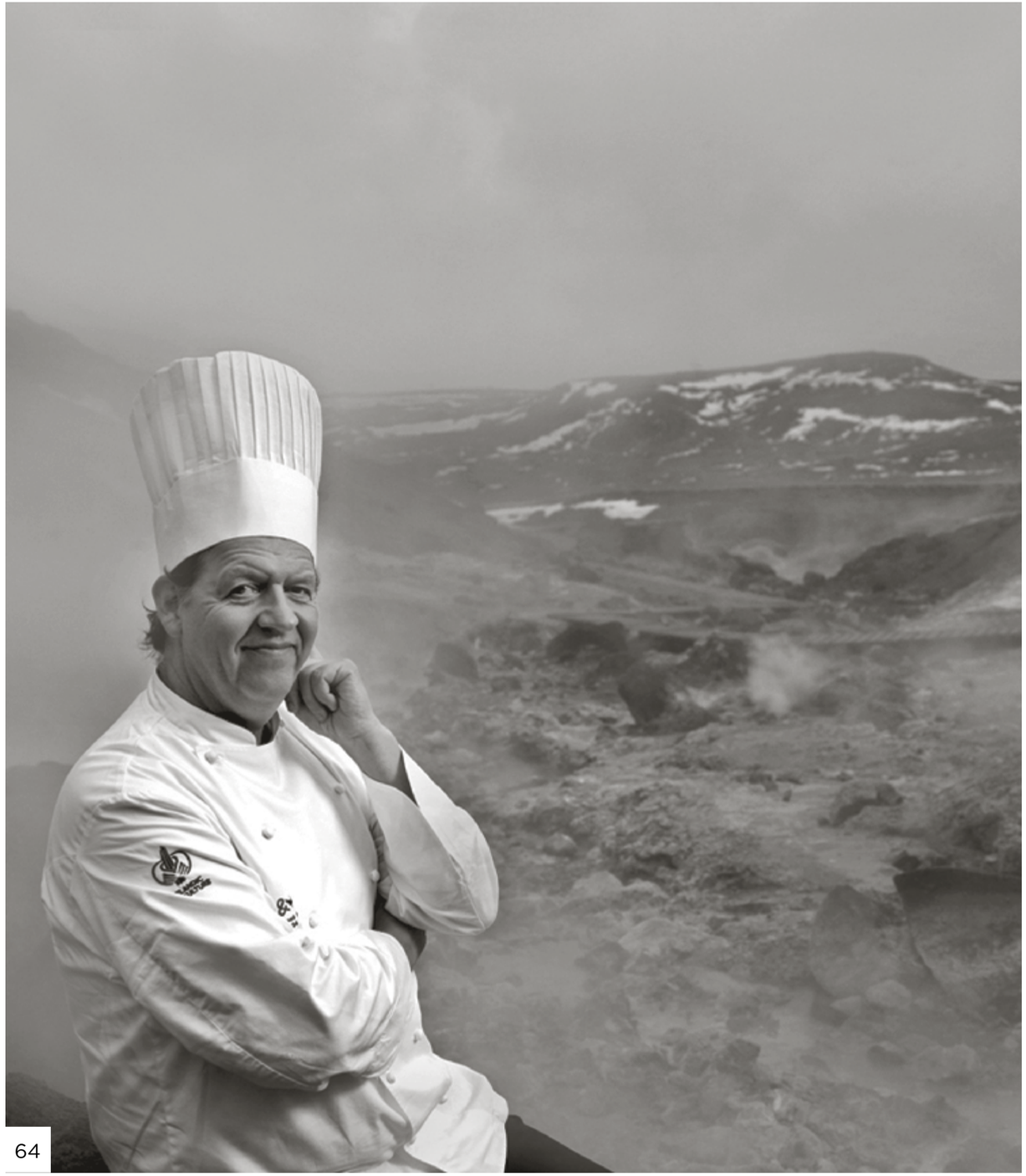
The project consisted of a joint PhD project with six PhD students in different Universities across the Nordic/Baltic research environment.

PhD patisseries

To go with “Raw energy”

Patrick Lauenburg: *Improved supply of district heat to hydronic space heating systems*
The main ambition of this thesis was to attempt to bring known ideas behinds district heating closer to practical applications. Modern building automation has made it possible to accomplish control of radiator systems, including controlling flow rate as well as more sophisticated connection schemes for substations. A new control algorithm has shown promise for a reduced district heating return temperature through a variation of not only the supply temperature but also the flow rate in the radiator system.

Eduard Latusov: *Model for the analysis of Combined Heat and Power (CHP) production*
This thesis presents a computer program that can analyze the technical and economic consequences of building a CHP plant based on renewable energy, combining heat and power systems and taking local conditions into account. The computer program also calculates primary energy use and CO_2 reduction potential for the actual plant.



Energy Smoothie

by Siggi Hall

5 dl Skyr - plain, natural

1 large (2 small) bananas

1 1/2 dl crowberry-rhubarb nectar

3 dl fresh wild blueberries, from the Icelandic mountain hillsides.

1 - 2 dl ice cubes.

Place all in a 2 liters Smoothie-mixer and mix until all is well together.
This recipe is for a cold refreshing energy smoothie in the afternoon.

The skyr is a very protein rich product, bananas give it a sweetness and filling but is also richness of nourishment, vitamins, proteins and minerals. The rhubarb and crowberry nectar made of equal parts of crowberries, rhubarb and raw sugar gives it the tangy taste of crowberries and the sour but appealing taste of the rhubarb but a little sweet as a nectar should be. The most important is the healthy fresh natural blueberries from the Icelandic hillsides - one of the best berries in the world. All this gives this smoothie a full energy and healthy natural taste in every sip.

It is important to put the ice cubes in because the whole process of mixing all together heats up the blend. For a more nutrient smoothie - a breakfast type add some wheetabix cookies or müsli for better content of fibers.

“A transparent approach was taken by sharing experience in an open workshop with Nordic Original Equipment Manufacturer (OEMs)

and Small and Medium Enterprises (SMEs), in order to facilitate realization of new business opportunities.”

Frozen Fuel Cells, Final Project Report

“Projects like this are very important in building up the Nordic network in the biomass area. It helps increase the

competencies of both the academic and industrial partners, and will ensure an effective path to good industrial products.”

Softwood Sugar, Project manager Karin Øyaas – Paper and Fiber Institute (PFI), Norway

UK: **Blackberry** DK: **Brombær**
NO: **Bjørnebær** SE: **Björnbär**
FIN: **Karhunvatukka** IS: **Brómber**

ENERGY pr 100 g

kJ	184kJ	kcal	44kcal

The blackberry grows in all Nordic counties, but in the coldest parts of the region only in small quantities. The berries are high in vitamin C and are a source of dietary fiber.

[Innovative pre-treatment of Nordic wood for cost-effective fuel-ethanol production]

Softwood Sugar

With industry

If sugar and maize crops are best left to feeding the world's starving, why not use all the plants that people cannot eat to fuel their cars instead? To produce bio-ethanol from wood, you need to harness the sugars locked in the cellulose and convert them by fermentation. Too expensive? Not necessarily any more. Look at this cost-cutting recipe using Nordic softwood and hardwood.

Cooking time

4 years of research

Ingredients

4 countries
(Iceland, Finland, Sweden and Norway)

12.7 million NOK

5 educational institutions

6 industry partners

10 full-time project participants

1 doctorate degrees

14 publications

2 seminars

Process

1. The world's appetite for transportation fuels is huge and rising. According to the International Energy Agency, it is possible to reduce CO2 emissions in the transport sector by up to 90% by substituting gasoline with fuel-ethanol from lignocelluloses like wood.

2. Take advantage of the abundant local commodities of wood for home cooking. The forest balance in the Nordic countries amounts to a surplus of approx. 60 million m3, which can theoretically be converted to 10,000 million liters of fuel-ethanol, or approx. 80% of total gasoline consumption in the Nordic countries. Thus, Nordic forests represent a significant biomass resource that is of vital importance to the expansion of the biofuels industry in our region.

3. The level of difficulty for this recipe is increased by the problem of high production costs for deployment of wood-based fuel-ethanol. In particular, it is generally recognized that the front-end steps (pretreatment, fractionation, enzymatic hydrolysis) represent a major proportion (up to 60%) of the total costs. Thus, these steps offer great potential for improvement. A better understanding of the chemical and physical processes involved in wood pretreatment is a prerequisite for the development of promising pre-treatment technologies.

4. Take a truly Nordic mix of researchers and industry participants together with financing, and let them conduct research into the entire process from the moment the biomass is harvested, through pre-treatment, hydrolysis, fermentation and final delivery to market. Their aim is to maximize efficiency at every stage of production to achieve profitability.

5. Allow the researchers to look at the place of biofuels in the broader energy system, such as the geographic distribution of infrastructure. For instance, it may make sense to locate processing plants near other industrial sites, such as oil refineries, to tap into residual heat. Alternatively, they may find that to minimize transport-related emissions, plants need to be located close to where the timber is.

6. Build a Nordic "center of competence" in the liquid biofuels area.

Taste

The project has concentrated on various types of pre-treatment of pine and aspen to find the best methods and make them as efficient as possible. The challenge is to extract the sugar that is bound up in the tree. This can be achieved using various combinations of heat treatment, steam and chemical treatment.

The main contributors to overall ethanol production costs for all processes are found to be raw material and equipment costs.

The project recommends developing processes or bio-refinery concepts for the co-production of biofuels, materials and chemicals that can make bio-energy production from local biomass in Scandinavia more profitable.

"This project has been very important in building up the Nordic network in this area. It has helped to increase the competence of both the academic and industrial partners and will ensure an effective path to good industrial products," said project manager Karin Øyaas.

Further work will be done in a project starting in 2011 called SustBioFuel, funded by the Top Level Research Initiative, administrated by Nordic Energy Research.

Cooperation how-to

Nordic Partners:

- Paper and Fiber Research Institute (PFI), *Norway*
- Innventia, *Sweden*
- Matis Prokaria, *Iceland*
- SINTEF, *Norway*
- VTT Technical Research Centre of Finland, *Finland*

Industry:

- Norwegian Forest Owners' Association, *Norway*
- Norske Skog, *Norway*
- Borregaard Industries, *Norway*
- SEKAB E-technology AB, *Sweden*
- Nowozymes, *Denmark*
- STATOIL, *Norway*

During the project, the Finns worked mostly on the fermentation process and how it can be achieved most efficiently with as high a content of solids as possible. The Swedes contributed technical and economic analysis and an integration study of a possible pilot project at Mongstad. They also looked at one of the four pre-treatment processes. Norwegian researchers worked with the other preparation, in addition to looking at the potential for different types of yeast, while the Danish industrial company delivered enzymes.

The Icelandic contribution merits special focus. They studied whether there are other types of microorganisms that can contribute to the process, and actually found a type of bacterium - Thermoanaerobacter islandicum - which can theoretically replace yeast.

UK: **Plum** DK: **Blomme**
NO: **Plomme** SE: **Plommon**
FIN: **Luumu** IS: **Plóma**

ENERGY pr 100 g

kJ	189kJ	kcal	47kcal

The plum can be cultivated in the entire Nordic region. Plum juice can be fermented into plum wine. Their strong antioxidant properties gives them celebrity status within super food.

[Climate and Energy Systems: Risks, Potential and Adaption]

Sunny Side up

Climate

With industry

The recipe gives an insight into the future climate of the Nordic countries. It shows the sunny side of climate change, with increased potential for production of renewable energy. However, the future safety of the production systems can be at risk as uncertainty of the estimates is large.

Cooking time

4 years of research

Ingredients

5 countries (Iceland, Finland, Sweden, Denmark and Norway)

18.235 million NOK

7 educational institutions

7 industry partners

17 full-time project participants

15 post-doctorates

11 doctorate candidates

286 publications

8 conferences

Process

1. Turn up the heat. Experts predict that by the year 2100, the earth's mean temperature will have increased by about 3°C, average rainfall will be 10% higher and the sea level may rise by 40cm on average in the Nordic countries. Such changes will have an influence on the production of renewable energy, especially for hydropower and biomass. At the same time, the increase in temperature will have an effect on the amount of energy consumed, mainly in the form of a reduction in energy used for heating.

2. Add financing together with full-time project participants and post-doctorates from educational institutions and industry partners in the Nordic countries.

3. Cook for 4 years to improve the decision framework of the energy sector in the face of the imminent impacts of climate change. Wait to see the outline of future development of the electricity system with a focus on possible developments of the Nord Pool electricity system up to 2050.

4. For the topping: 286 publications and 8 conferences.

Taste

The results represent the most comprehensive analysis so far on the basis of Nordic and European climate data. The project results include: review of risk and uncertainty management approaches used in the energy sector. Integration of risk and uncertainty in decision support tools.

Comprehensive changes in climate, like the ones we have experienced over the last 20-30 years, are expected in the decades leading up to 2050. These will have profound effects on Nordic energy supply. Energy companies are making good progress in adapting to both production risks and plans for further investments and operations.

Cooperation how-to

Nordic Partners:

- National Energy Agency (NEA), *Iceland*
- Swedish Meteorological and Hydrological Institute (SMHI), *Sweden*
- International Maritime Organization (IMO), *Iceland*
- University of Joensuu, *Finland*
- Risø, *Denmark*
- VTT Technical Research Centre (VTT), *Finland*
- SINTEF, *Norway*
- Norwegian Water Resources and Energy Directorate (NVE), *Norway*

Industry:

- Statkraft, *Norway*
- Elforsk, *Sweden*
- Finnish Energy Industries, *Finland*
- National Power Company, *Iceland*
- DONG Energy, *Denmark*

In the early 2000s, Nordic Energy Research initiated the pre-project "Climate, Water and Energy", which developed a comprehensive research program addressing the impact of climate change on the Nordic energy system. This in turn resulted in the funding of a four-year Nordic-Baltic project from 2003-2006, which focused chiefly on the impact of climate change on production capabilities as well as the development of the Nordic energy system. The present "Climate and Energy Systems" project is a follow-up project focusing on the improved assessment of the impact of climate change on energy resources.

The Top-Level Research Initiative (TFI) of the Nordic Council of Ministers has opened up possibilities and reinvested network resources set up in the climate projects described above. The "ICEWIND" project is part of the TFI program "Integration of large-scale wind power" administrated by Nordic Energy Research. The "SVALI" project is part of the "Interaction between climate change and the cryosphere" program administrated by NordForsk.

This development demonstrates the success of investments by the Nordic system in building up the capabilities, technology transfer and research innovation that are essential in addressing the challenges of adapting to climate change in the future.

Take away lessons:

Stakeholder dialogue

The project "Climate and Energy Systems: Risks, Potential and Adaption" had a structured dialogue with key stakeholders from the Nordic energy sector, such as the Swedish energy company Vattenfall. The objective was to discuss the relevance of the project and methods to stakeholder communication in the existing project phase, as well as to propose methods and approaches to increase stakeholder involvement and relevance in future research programs on climate effects on renewable energy.

The background for the stakeholder dialogue was the aim of the "Climate and Energy Systems" project to increase stakeholder involvement in the project. **The energy sector is represented on the program committee and contributes to financing the program.**

One key result of the stakeholder dialogue is that the "Climate and Energy Systems" project deals with very relevant issues that may considerably affect the energy sector. However, the potential effects of climate change on the energy sector are considered **uncertain and long-term** by many stakeholders. For this reason, these topics may be less prioritized than other issues of more immediate and everyday importance to the energy sector, such as mitigating greenhouse gas emissions, maintenance, etc.

All research was considered **relevant** by the stakeholder dialogue group. The work within the topic of risk assessment was believed to be most stakeholder friendly and the risk assessment procedure was appreciated and considered stakeholder-relevant.

The dialogue group believed that the project **web page** was a very important source of communication. However, it could be improved, for example by making it **simpler and easier** to grasp.

The **list of publications** is important, but at present the publications cannot be downloaded. A future improvement would be to have a list of downloadable publications. A substantial improvement would be **executive summaries** of publications adapted for stakeholders.

Fact sheets could be an important way to inform stakeholders about the research. However, the fact sheets need to be more concise with less text and a more direct focus on the main messages for stakeholders.

To increase stakeholder involvement in future R&D programs on climate and energy, the dialogue group suggested several actions. One of the most important actions to increase involvement is direct contact with stakeholders at a **strategic level**, for example through visits, meetings and workshops. The steering group could also be an important communication channel to other stakeholders.

Temperature

Temperature changes will be most marked during the winter season with between 1 and 5°C, mainly in the northern and eastern areas. In summer, the change will be between 1 and 3°C across all Nordic land areas. This will reduce snow supplies and spring floods while creating more rain floods.

Precipitation

The increase will be largest over parts of the Scandinavian region, most notably over the Scandinavian countries in winter and over the Baltic Sea in summer.

Biomass

The results showed that changes both in climate and thinning regimes may substantially increase the production potential of energy biomass. In addition to this, energy biomass production will be enhanced by increasing initial planting density and basal area thinning thresholds compared in the current forest management recommendations.

Power production

Increased inflows to hydropower reservoirs help increase hydropower production by about 10 percent, while thermal power generation is expected to be eight per cent less. In total, electricity consumption in Denmark, Norway, Sweden and Finland is expected to decrease by approximately two percent compared with 1990.

Energy market NordPool

Annual average thermal production is expected to decrease by 7-8% for the NordPool region. No particular seasonal pattern has been found. This is paired with an annual average demand decrease of 2-2.5% for the NordPool region. The decrease is relatively stronger during winter than summer.

Electricity spot prices will go down in all countries in the climatic scenarios. The reduction in Denmark is relatively small compared to other countries due to its strong connection to the European market and its lack of hydropower generation.

All countries (excluding Finland) increase their net export to continental Europe. The hydro-dominated systems (Norway and Sweden) also increase their net export to other NordPool countries. Total net export increases for hydro-dominated systems, while Denmark and Finland reduce their total net export.

Due to the reduction in thermal power production, all countries contribute to a reduced total CO_2 emission in the Nordic region. The increased hydropower production stimulates increased exports to and reduced imports from mainland Europe.

Risks

Results so far show that global warming may have great significance for dam safety, flood risks and the production of hydroelectric power in Sweden.

Milder and more unstable winters in the future also mean that there is a risk that spill will be released more often. This affects both dam safety and the lives of those who live along the rivers. At the same time, higher winter flows are beneficial to the production of hydroelectric power.

The results also show considerable uncertainty. The difference between the various climate scenarios is large when it comes to impacts on design floods. These floods can either increase or decrease, depending on how changing precipitation patterns interact with new snowmelt conditions.

[Nordic BioH2: Renewable production of H_2 using a biological system]

Superior Algae

With industry

Hydrogen (H_2) is perceived as one of the most promising options for energy storage and transportation in the future. If H_2 can be produced from renewable energy sources, it could help to solve energy-related problems such as climate change, air pollution and energy supply. This recipe reveals the secrets of Nordic superior algae – high producers of Hydrogen.

Cooking time

4 years of research

Ingredients

5 Nordic countries (Denmark, Iceland, Finland, Sweden and Norway)

2 Baltic countries (Estonia, Latvia)

8.145 million NOK

10 educational institutions

2 industry partners

11 full-time project participants

5 post-doctorates

17 doctorate degrees

200 publications

4 seminars

Process

1. Turn on the basic science button. This recipe advances scientific knowledge related to both photobiological and fermentative hydrogen production. It also initiates the first life-cycle assessments of biological hydrogen production systems.

2. Cook up a network of educational institutions and industry players from Nordic and Baltic countries, involving full-time project participants and post doctorates.

3. Collect cyanobacterial strains from the Baltic Sea and Finnish lakes.

4. Use different types of inocula (sludge from farm-scale digester, sewage sludge, sludge from thermophilic laboratory digester, rumen fluid, compost, mesophilic granular sludge) mixed with grass silage, maize, cellulose and glucose for dark fermentation.

5. Gently characterize the best/superior H2 producers to enhance their capacity for H2 production.

6. Analyze the life-cycle of hydrogen produced biologically: bio-hydrogen. This enables you to compare different technologies in terms of environmental impact, energy needs and costs.

7. Apply doctorate degrees, publications and seminars as finishing touch.

Taste

The final report of the project concludes that it has been a success: "Good science, numerous publications, many PhD students and interactions and both European and International visibility for Nordic and Baltic bio-hydrogen research. The financial contribution from NER made a most significant contribution in reaching the results – in fact, without the Nordic BioH2 project support from Nordic Energy Research, they would never have been achieved."

Cooperation how-to

Nordic Partners:

- Uppsala University, *Sweden*
- University of Bergen, *Norway*
- University of Turku, *Finland*
- The Royal Veterinary & Agricultural University, *Denmark*
- University of Akureyri, *Iceland*
- Tampere University of Technology, *Finland*
- University of Jyväskylä, *Finland*
- SEI-Tallin, *Estonia*
- Roskilde University, *Denmark*
- Riga Technical University

Industry:

- Prokaria (biotech company), *Iceland*
- Mannvit (engineering company), *Iceland*

Project manager Peter Lindblad of Uppsala University observed that "The project has boosted Nordic basic research into bio-hydrogen and renewable energy. Internationally, Nordic BioH2 is viewed as a successful regional cooperation project." Due to the many countries, researchers and PhD students involved in the project, the group held annual project meetings resulting in cross-border interactions. The high number of PhD students involved in the project resulted in many PhD theses being finished at the end of the project. This in turn led to increased international awareness of Nordic and Baltic science and competence in the field of BioH2.

UK: **Pear** DK: **Pære**
NO: **Pære** SE: **Päron**
FIN: **Päärynä** IS: **Pera**

ENERGY pr 100 g

kJ	226kJ	kcal	54kcal

You can get a quick and natural energy boost from pear juice, due largely to the pear's high amounts of fructose and glucose.

[Model Development for Power System Analysis with a substantial wind energy capacity installed in the Nordic grid]

Wind-packed *power* goodness

With industry

Cooking in a changing electricity system requires renewal of the planning tools and system models, especially for wind farms. Several utilities already enjoy this new recipe for everyday work

Cooking time

4 years of research

Ingredients

4 Nordic countries (Finland, Sweden, Norway and Denmark)

1 Baltic country (Estonia)

11.082 million NOK

3 educational institutions

6 industry partners

6 full-time project participants

4 post-doctorates

2 doctorate degrees

35 publications

2 seminars

3 patents

Process

1. The impact of wind power generation in the power system is no longer negligible. For this reason, there is an urgent need for wind turbine models capable of accurately simulating the interaction between wind turbines or wind farms and the power system. One problem is that no standardized model of wind turbine for power system stability studies is currently available.

2. Allow Nordic and Baltic researchers to develop models for studying the implications of operating the Nordic grid with a large amount of the electric power and energy coming from wind farms. To achieve 10% of energy production from wind energy, it is necessary to install 15 GW of wind power. As a comparison, the present installed power capacity in nuclear power plants in Sweden and Finland is 12 GW.

3. Aim for a model with a substantial wind energy capacity installed into the grid. “Substantial” means electric energy production of at least 10-20% of total Nordic electricity consumption.

4. Add different amounts of fluctuating wind power into the real power system of the 6 MW Högsåra wind farm in Finland. Perform real scale tests of frequency control.

5. Toss PhD students, post-doctoral and senior researchers together to work on power system and market consequences involved in using large amounts of wind energy. Strengthen existing work relationships between the partner institutions in the project. Encourage mobility of PhD students.

6. Establish a wider Nordic forum for exchange of knowledge and experience within the field. This includes arrangement of Nordic Wind Power Conferences and reference group meetings.

Taste

Cooperation within the Nordic countries has meant that existing knowledge has been spread, new knowledge has been created and the results have been transferred to utilities. Over 35 journal or conference publications and five PhD theses have been presented. Two more PhD theses are on the way during 2011. Two Nordic Wind Power Conferences have been organized during the project period. The project set out to solve the problem of the lack of a standardized model of wind turbine for power system stability studies. The results show that the proposed models are able to simulate wind turbine responses with sufficient accuracy. The generic models proposed by this project can be seen as a contribution to the ongoing discourse on standardized models of wind power generation for power system stability studies.

The main conclusion is that development work with models for power system simulation has suggested several models that are suitable. These models have been transferred to the utilities and can be used in their everyday work. The generic models provide more opportunities for transmission system operators and wind farm developers to confidently perform system planning studies without being dependent on proprietary models or restricted by non-disclosure agreements with manufactures. The method described in the project report concerning model validation against measurements is recommended for use in model development procedures.

The utilities involved in the project have been encouraged to use the models developed in this project and to test them further in simulations of larger, more complete power systems.

The tests carried out in the course of the project clearly show the limited capability of several wind turbines manufactures to pass the fault ride-through test. The project strongly recommends that the requirements in the Grid Codes are tested for every type of wind turbine against different grid parameters.

Cooperation how-to

Nordic Partners:

- Technical University of Denmark, *Denmark*
- Tallinn University, *Estonia*
- Chalmers University of Technology, *Sweden*

Industry:

- ABB, *Sweden*
- Vattenfall, *Sweden*
- Svenska Kraftnät, *Sweden*
- Vestas, *Denmark*
- Energinet.dk, *Denmark*
- Nelja Energia LLC, *Estonia*

This Nordic project has created a valuable link between national projects and international cooperation. Several of the partners also work together in EU and IEA projects. The partners in the project cover a broad category of electric power industries, from generator and wind turbine manufactures to power utility companies and wind turbine operators.

Working with measurements is time consuming and cooperation, where a group of researchers share their measurement results, has shown itself to be very effective.

“A Nordic collaboration among economists provides a new common understanding of how

energy markets work, and strengthens Nordic network and expertise”

Combining flavors in the market, project manager Torstein Bye Statistics Norway

“This Nordic project has also been a valuable link between national projects and international cooperation.

Several of the partners are also working together in EU - as well as IEA-projects.”

Wind-packed Power Goodness, Final project report.

Cooking Up Networks

#1 Cooking up networks

Energy Foresight Forum

Network formula

3 years
1.2 million NOK
3 conferences
University of Bergen, Norway
RISØ, Denmark
University of Helsinki, Finland
Ridikas, D., Lithuania
Bergen Energi, Norway
Bergenshalvøens Kommunale Kraftselskab AS, Norway
Norges Naturvernforbund, Norway
Statoil Hydro, Norway

Energy Foresight Forum has conducted an annual conference with great success throughout the 3-year project period. The conferences have brought together experts in the energy sector from across the Nordic and Baltic regions. Participants came from all parts of the energy sector, ranging from academia and the public sector to industry. A yearly study on selected topics in the energy sector has been presented and outstanding students have also been awarded with prizes for their work in the field.

#2 Cooking up networks

Automatic Reading Forum

The forum was a common initiative of four Nordic institutions: SINTEF Energiforskning AS, VTT Technical Center of Finland, Elforsk and DEFU. The initiative was inspired by plans for establishing a common Nordic retail electricity market. The main objective of the forum was to establish a common Nordic Automatic Meter Reading (AMR) Forum and to encourage cost-effective implementation of AMR solutions in the Nordic countries. In this way, it was intended to support the establishment of a common Nordic Electricity retail market.

Structural and organizational bases for the Nordic AMR Forum were developed, including a Forum Mandate with a formal organizational model and financial model for the Forum. The Mandate was approved by the Steering Group. Contacts and cooperation with the Nordic Regulators (NordReg), national electricity associations and other relevant players were established to ensure that the forum achieved its goal of being a truly Nordic platform.

However, the project group did not succeed in involving electricity suppliers and consumer organizations in the Forum. This was most likely due to the Forum's current focus on concrete technical issues, which are important for the implementation of AMR.

Network formula

2 years
2.740 million NOK
6 seminars
SINTEF, Norway
Norwegian Electricity Industry Association, Norway
VTT Technical Research Centre of Finland, Finland
Finnish Energy Industries, Finland
Elforsk AB, Sweden
Svensk Energi, Sweden
Danish Energy Association, Denmark
Forum of Nordic Regulators (EMV), Finland

The project was completed in 2008. At that time Sweden, Norway, Denmark and Finland were not all ready to establish a closer cooperation to develop the infrastructure for the Automatic Meter Reading.

#3 Cooking up networks

Nordic Centre of **Excellence** in Photovoltaic

Network formula

4 years

12.766 million NOK

Elkem Solar AS, Norway

REC ASA, Norway

Solibro Research AB, Denmark

Topsil A/S, Denmark

Energinet.dk, Denmark

Luvata, Finland

Other Nordic industry

Norwegian Institute of Science and Technology, Norway

Institute for Energy Technology, Norway

Uppsala University, Sweden

Helsinki University of Technology, Finland

Danish Technological Institute, Denmark

Tallinn University of Technology, Estonia

Ioffe Physico-Technical Institute in St. Petersburg, Russia

7 PhD candidates

The Nordic Centre of Excellence in Photovoltaic (PV) has strengthened the cooperation between universities, research institutes and industry in this field. Bilateral collaborations have been established, both between research institutes in the Nordic countries and between companies and research institutions.

A strong network for PhD students and a number of courses within the field of PV have resulted in a better understanding of the physics of solar cells. Candidates have been educated to meet the needs of a fast-growing PV industry. A better scientific foundation for increased business development has also been established. One of the key outcomes is the unlocking of synergy effects due to access to process and characterization equipment across the Nordic region.

The centre has also been a pool of PV knowledge and has formed a strategy for publication of popular science, thus creating an interest in PV across the Nordic/Baltic region. In the long run, this will help with the acceptance and introduction of PV in our region.

#4 Cooking up networks

Nordic Centre **of Excellence** in H2 storage

The Nordic Centre of Excellence in H2 storage is a research network of 12 research groups in the Nordic countries, including Baltic and North-West Russia.

The goal of the centre is to synthesize, characterize and model new materials that can be used as the primary component in hydrogen storage for mobile applications, such as cars and boats.

Many different lines of research have been pursued in this project because there is still no known material that satisfies all the requirements that have been specified for hydrogen storage in cars. Sharing of equipment, facilities and knowledge across national borders enabled a more comprehensive approach to the research and created an exciting international working environment for the students and post-docs.

Workshops, conferences and a summer school were all organized during the project period. Several students and post-docs have been hired and have undergone various types of training.

Network formula

4 years

10.808 million NOK

University of Iceland, Iceland

Institute for Energy Technology, Norway

Stockholm University, Sweden

Uppsala University, Sweden

Technical University of Denmark, Denmark

Risoe National Lab, Denmark

28 PhD candidates

9 Post doctorate students

#5 Cooking up networks

Nordic Network for **sustainable development in isolated areas**

Network formula

4 years

7.060 million NOK

Risø Centre, Denmark

Institute for Energy Technology, Norway

UNEP GRID-Arendal, Norway

PURE Energy Centre Ltd, United Kingdom

Technical University of Denmark, Denmark

Nordic Council's Densely Populated Areas Task Force, Greenland

Nukissiorfiit, Greenland

Bitland, Faroe Islands

IRD fuel cells, Denmark

Statoil New Energy, Norway

APC Denmark, Denmark

Danish Polar Centre, Greenland

REEEP South East & Asia Pacific Secretariat, Australia

The Natural Edge Project, Australia

The Danish Society of Engineers, Denmark

This forum was established for motivated participants who wanted to find relevant partners and the knowledge and skills required to 'get sustainable energy projects happening' in isolated areas of the Nordic region.

The network has organized several conferences and workshops in Greenland and Copenhagen, in addition to training courses on 'sustainable energy solutions in Nordic regions', run together with partners in the Arctic and Greenland and aimed at students and stakeholders. Furthermore, workshops with local communities, networking, conferences and workshops in Svalbard and Copenhagen have been held to 'promote' the project, to report on tasks, and to secure feedback from all stakeholders. Network members have participated in and held presentations at international arctic conferences.

#6 Cooking up networks

Scandinavian **Hydrogen Highway Partnership**

The aim of the network is to build a strong partnership with commitment from the industry and to position the partnership towards EU demonstration activities. The vision is to make the Scandinavian Region one of the first regions in Europe where hydrogen is commercially available and used in a network of refuelling stations.

With support from Nordic Energy Research Norway, Denmark and Sweden established a partnership in 2007 to introduce hydrogen as fuel in cars. The Scandinavian Hydrogen Highway Partnership (SHHP) lasted two years, but its effects have been lasting. In 2008, the network had 40-50 partners, although Nordic Energy Research is no longer one of them.

Norway and Denmark are already well on the way to building a network of hydrogen fueling stations along the Norwegian HyNor hydrogen highway and the Danish Hydrogen Link. Meanwhile, Sweden has made plans to do the same along the country's west coast. The development of hydrogen stations has progressed a little more slowly than the network projected in 2008, but the vision of achieving an operational network by 2015 is still fully achievable.

Network formula

2 years

1 million NOK

StatoilHydro, Norway

Rogaland Fylkeskommune, Norway

Vätgas Sverige, Sweden

H3Logic, Denmark

Region Midt Jylland, Denmark

“It is highly important with Nordic funding in addition to national funding. This creates a greater opportunity to sustain the research and industrial drive as well as the Nordic competitive strength ...”

Essential Fibers, Project manager Mikael Lucander from the The Finnish Pulp & Paper Research Institute (KCL)

Energy
Cooking Utensils

To be a success in the kitchen, you must have the right tools. Three types of funding instruments, or utensils were offered to the Nordic research communities and industry in the period 2007 to 2010.

1. **Utensils for Capacity and Competence Building Projects**
   Key activities in capacity and competence building projects shall contribute to consolidating and developing the knowledge base in new energy technologies, markets and systems.

   - Duration 4 years maximum.
   - Require a minimum 15% of total project eligible costs to stem from other sources..
   - Possibility for financing up to a maximum of 85% of the total project eligible costs.
   - Apply for funds of up to 3 million NOK per year from Nordic Energy Research, or up to 12 million NOK over four years.

2. **Utensils for Business Development and Innovation Projects**
   The key activities of business development and innovation may comprise pre-competitive activities related to the development, innovation and public acceptance of new energy technologies within the thematic focus areas.

   - Duration maximum 2 years.
   - Require industry participation and co-financing of minimum of 50% of the total project eligible costs.
   - Remaining 50% of the total eligible costs may be financed by Nordic Energy Research.
   - Apply for funds up to 3 million NOK per year from Nordic Energy Research, or up to 6 million NOK over two years.

3. **Utensils for Integrated Projects**
   Integrated projects with elements from capacity building and innovation acknowledge that the speed under which knowledge creation and diffusion takes place is so rapid that it does not make sense to distinguish between more fundamental knowledge and pre-competitive market activities, but that knowledge creation takes place in close collaboration between producers and users of technology.

   - Duration maximum 4 years.
   - Require user participation and co-financing of minimum of 25% of the total project eligible costs should stem from users such as the energy sector, industry and others.
   - Nordic Energy Research will finance up to a maximum of 75 % of the total project eligible costs.
   - Apply for funds up to 3 million NOK per year from Nordic Energy Research, or up to 12 million NOK over 4 years.

Who's who

Participants and facts

Combining Flavors in the Market

[Nordic Energy, Environmental Constraints and Integration (NEECI)]

Period: 2007-2010
Project Manager: Torstein Bye, SSB, Norway,
Funding Nordic Energy Research/ (Total): 8.0 (9.4) MNOK

Partners:
Stockholm School of Economics, Sweden
Copenhagen University, Denmark
University Of Iceland , Iceland
Helsinki School of Economics, Finland
University of Bergen, Norway
University of Oslo, Norway
Gothenburg University, Sweden
Risø Technical University Of Denmark , Denmark

Project Steering Group:
Torstein Bye, Statistics Norway, Norway
Lars Bergman, Stockholm School of Economics, Sweden
Jørgen Birk Mortensen, Copenhagen University, Denmark
Matti Liiski, Helsinki School of Economics, Finland
Fridrik Baldursson, Reykjavik University, Iceland

PhD Candidates:
Mette Graversen, Copenhagen University, Denmark
Halvor Storrøsten, Statistics Norway, Norway
Matti Ilonen, Helsinki School of Economics, Finland
Sara Fogelberg, Research Institute of Industrial Economics (IFN), Sweden,
Hanne Marit Dahlen, Statistics Norway, Norway
Anne Sahari, Helsinki School of Economics, Finland
Olli Kauppi, Helsinki School of Economics, Finland
Stephanie Rophenius, Risø Technical University Of Denmark, Denmark

PhD degrees:
Olli Kauppil, Finland, Helsinki School of Economics, Finland

Post-docs:
None listed

Other Participants:
Lennart Hjalmarsson, Gothenburg University, Sweden
Eirik Amundsen, The Royal Veterinary and Agricultural University, Denmark
Nils Henrik Mørck v.d. Fehr, Oslo University, Norway
Thomas Tangerås, Researh Institute of industry studies, Sweden

Essential Fibers

[Basic phenomena in mechanical pulping]

Period: 2007-2009
Project Manager: Mikael Lucander, KCL, Finland,
Funding Nordic Energy Research/ (Total): 4.0 (9.7) MNOK

Partners:
Mid Sweden University, Sweden
Norwegian University Of Science And Technology, Norway
Tampere University of Technology, Finland
Helsinki University of Technology, Finland

Project Steering Group:
Annikki Vehniäinen, KCL, Finland
Per Engstrand, Mid Sweden University, Sweden
Øyvind Gregersen, Norwegian University Of Science And Technology, Norway
Pentti Lautala, Tampere University of Technology, Finland
Tapani Vuorinen, Helsinki University of Technology, Finland
Mikael Forss, Nordic Energy Research, Norway
Mikael Lucander, KCL, Finland

PhD Candidates:
Marius Rusu, M.Sc., Norwegian University Of Science And Technology, Norway
Tuomas Hänninen, M.Sc., Tampere University of Technology, Finland
Ari Salmi, M.Sc., KCL, Finland

PhD Degrees:
Birgitta Svensson, Mid Sweden University, Sweden

Post-docs:
D.Sc.(Tech)., Birgitta Engberg (former Svensson), Mid Sweden University, Sweden
D.Sc.(Tech), Tomas Björkqvist, Finland
D.Sc.(Tech),Lauri Salminen, KCL, Finland
PhD, Eero Kontturi, Helsinki University of Technology, Finland
PhD, Jari Sirviö,Finland, KCL, Finland
D.Sc.(Tech), Christiane Laine, KCL, Finland

Other Participants:
Lis.(Tech)., Sari Liukkonen, KCL, Finland
Ph.Lis., Erkki Saharinen, KCL, Finland
M.Sc., Antti Fredrikson, KCL, Finland
M.Sc., Ilkka Nurminen, KCL, Finland
M.Sc., Valtteri Saari, Tampere University of Technology, Finland
Prof., Øyind Gregersen, Norwegian University Of Science And Technology, Norway
Prof., Per Gradin, Mid Sweden University, Sweden
M.Sc., Mikael Lucander, KCL, Finland

Food for Thought

[Nordic Graduate School in Biofuel Science and Technology-phase 2]

Period: 2007-2010
Project Manager: Mikko Hupa, Åbo Akademi, Finland
Funding Nordic Energy Research/(Total): 8.0 (16.0) MNOK

Partners:
Chalmers University of Technology, Sweden
Norwegian University of Science And Technology, Norway
Technical University Of Denmark, Denmark

Project Steering Group:
Bo Leckner, Chalmers University of Technology, Sweden
Kim Dam Johanssen, Technical University of Denmark, Denmark
Johan Hustad, Norwegian University of Science and Technology, Norway
Mikko Hupa, Åbo Akademi University, Finland

Coordination:
until Oktober 2007: Doc. Bengt-Johan Skrifvars, from October 2007 onwards: Dr. Tech. Maria Zevenhoven

Coordinating assistant:
until April 2007: Mrs Frauke Mueller
from April onwards MSc. Anne-Leena Gröning

PhD Candidates:
Sven Hermansson, Chalmers University of Technology, Sweden
Stefan Hjärtstam, Chalmers University of Technology, Sweden
Fredrik Lind, Chalmers University of Technology, Sweden
Johanna Ohlsson, Chalmers University of Technology, Sweden
Hao Wu, Technical University of Denmark, Denmark
Norazana Ibraham, Technical University of Denmark, Denmark
Anders Rooma Nielsen, Technical University of Denmark, Denmark
Muhammad Shafique Bashir, Technical University of Denmark, Denmark
Linda Norskov, Technical University of Denmark, Denmark
Geir Skjevrak, Norwegian University of Science and Technology, Norway
Liang Wang, Norwegian University of Science and Technology, Norway
Kavitha Pathmanatan, Norwegian University of Science and Technology, Norway
Roger Kahlil, Norwegian University of Science and Technology, Norway
Frida Claesson, Åbo Akademi University, Finland
Markus Engblom, Åbo Akademi University, Finland
Oskar Karlström, Åbo Akademi University, Finland
Johan Lindholm, Åbo Akademi University, Finland

PhD Degrees:
David Pallares, Spain, Chalmers Technical University, Sweden
Niels Bech, Denmark, Danish Technical University, Denmark
Daniel Stanghelle, The Norwegian University of Science and Technology , Norway
Robert Johansson, Sweden, Chalmers Technical University, Sweden
Kim Hougaard Pedersen, Denmark, Danish Technical University, Denmark

Post-docs:
Assoc. prof. Henrik Thunman, Chalmers University of Technology, Sweden
Assoc. prof. Lars-Erik Åmand, Chalmers University of Technology, Sweden
Assoc. prof. Flemming Frandsen, Technical University of Denmark, Denmark
Assoc. prof. Peter Glarborg, Technical University of Denmark, Denmark
Assoc. prof. Peter Arendt Jensen, Technical University of Denmark, Denmark
Assoc. prof. Anker Jensen, Technical University of Denmark, Denmark

Dr. Oyvind Skreiberg, Norwegian University of Science and Technology, Norway
Dr. Morten G. Gronli, Norwegian University of Science and Technology, Norway
Doc. Bengt-Johan Skrifvars, Åbo Akademi University, Finland
Dr. Anders Brink, Åbo Akademi University, Finland
Dr. Maria Zevenhoven, Åbo Akademi University, Finland

Other Participants:
None listed

Frozen Fuel Cells

[Development Demonstration of an efficient and cost competetive PEMFC system for cold Nordic climate]

Period: 2007-2008
Project Manager: Steffen Møller-Holst, SINTEF, Norway
Funding: Nordic Energy Research/(Total): 4.4 (8.8) MNOK

Partners:
Powercell Sverige AB, Sweden
Volvo Technology, Sweden
StatoilHydro, Norway,
H2 Logic, Denmark

Project Steering Group:
Per Ekdunge, PowerCell Sverige AB, Sweden
Børre Tore Børresen, StatoilHydro, Norway
Azra Selimovic, Volvo Technology Co, Sweden
Steffen Møller-Holst, SINTEF, Norway
Jacob Hansen, H2Logic, Denmark
Anders Ødegård, SINTEF, Norway

PhD Candidates:
None listed

PhD Degrees:
None listed

Post-docs:
None listed

Other Participants:
None listed

Mixed Green Policies

[Distibuted generation integration in Nordic Energy Market]

Period: 2007-2008
Project Manager: Jesper Munksgaard, ECON, Denmark
Funding NEF/(Total): 1.3 (2.6) MNOK

Partners:
The Norwegian Electricity Industrial Association, Norway, Norway,
VTT Technical Research Centre of Finland, Finland
Sweco Grøner, Norway
Norwegian University of Life Science, Norway
University Catholique de Louvain, Belgium
University of Copenhagen, Denmark
Norwegian School of Management, Norway
Kola Science Centre, Russia

Project Steering Group:
Lene Mostue, EBL, Norway
Mikael Forss, Mikael Forss, Norway
Stefan Montin, Elforsk, Sweden
Markku Ryymin, Kainuun Energia, Finland
Anders Renvall, Kymppivoima, Finland
Atle Isaksen, Sogn og Fjordane Energi, Norway
Bengt Reuterdahl, Skagerak Energi, Norway
Rein Husebø, Småkraft, Norway
Henriette Rogde Haavik, Statkraft, Norway
Jan Bråten, Statnett, Norway
Terje Mykleburt, Tussa Kraft,Norway
Mats Nilsson, Vattenfall Sverige, Sweden
Felicia Fock, Vattenfall Denmark, Denmark
Håkon Sandvik, Vestavind, Norway
Tommy Frederiksen, Østerfold Energi, Norway
Ingrid Kristensnen, Enova, Norway
Knut Hofstad, NVE, Norway

PhD Candidates:
None listed

PhD Degrees:
None listed

Post-docs:
None listed

Other Participants:
None listed

Raw Energy

[Primary energy efficiency (PEE)]

Period: 2007-2010
Project Manger: Rolf Ulseth, SINTEF, Norway
Funding Nordic Energy Research/(Total):
8.0 (13.4) MNOK

Partners:
University of Iceland, Iceland
VEKS, Denmark
Lund University, Sweden
Helsinki University of Technology, Finland
Tallinn Technical University, Estonia

Project Steering Group:
Olafur Petur Palsson, University of Iceland, Iceland
Lars Gullev, VEKS, Denmark
Svend Frederiksen, Lund University, Sweden
Carl-Johan Fogelholm, Helsinki University of Technology, Finland
Andres Siirde, Tallinn Technical University, Estonia
Rolf Ulseth, Norwegian University Of Science And Technology/SINTEF, Norway

PhD Candidates:
Marta Rós Karlsdóttir, University of Iceland, Iceland
Per-Olof Johansson, Lund University, Sweden
Patrick Lauenburg (Ljunggren), Lund University, Sweden
Thomas Kohl, Helsinki University of Technology, Finland
Edward Latosov, Tallinn Technical University, Estonia
Monica Berner, Norwegian University Of Science And Technology, Norway

PhD Degrees:
Patric Lauenburg, Lund University, Sweden (During year 2010)

Post-docs:
Patric Lauenburg, Lund University, Sweden (During year 2010)

Other Participants:
None listed

Softwood Sugar

[New innovative pretreatment of Nordic wood for cost-effective fuel-ethanol production]

Period: 2007-2010
Project Manager: Karin Øyaas, PFI, Norway
Funding Nordic Energy Research/(Total):
8.0 (12.7) MNOK

Partners:
Prokaria EHF , Iceland
STFI-Packforsk AB , Sweden
SINTEF, Norway
Lund Technology University , Sweden
VTT Technical Research Centre of Finland, Finland

Project Steering Group:
Karin Øyaas, Paper and Fiber Research Institute, Norway
Niklas Berglin, INNVENTIA (formerly STFI-Packforsk), Sweden
Nils Dyrset, SINTEF, Norway
Jaana Uusitalo, VTT Technical Research Centre of Finland, Finland
Gudmundur Oli Hreggvidsson, Matis of Prokaria, Iceland
Johan Börjesson, Novozymes, Denmark
Sune Wännström, SEKA E-technology AB, Sweden
Bjørn Håvard Evjen, Norweigan Forrest Owners, Norway
Per Nygård, Statiol, Norway
Martin Lersch, Borregaard Industries, Norway

PhD Candidates:
Kando K. Janga, Norwegian Institute of Science and / Paper and Fiber Research Institute, Norway (Defense during 2011)

PhD-Degrees:
None listed

Post-docs:
None listed

Other Participants:
Professor Guide Zacchi, Lund Technical University, Sweden

Sunny Side Up Climate

[Climate and energy systems: Risks, Potential and Adaption]

Period: 2007-2010
Project Manager: Arni Snorrason, National Energy Agency , Iceland
Funding Nordic Energy Research/(Total): 10.0 (18.2) MNOK

Partners:
Swedish Meteorological and Hydrological Institue, Sweden
Norwegian Water Resources and Energy Directorate, Norway
VTT Technical Research Center of Finland, Finland
SINTEF, Norway
Landsvirkjun, Iceland
Elforsk, Denmark
Finnish Energy Industries, Finland
Dong Energy, Denmark
Statkraft, Norway

Project Steering Group:
Árni Snorrason, National Energy Agency, Iceland
Erik Kjellström, Swedish Meteorological and Hydrological Institute, Sweden
Sten Bergström, Swedish Meteorological and Hydrological Institute, Sweden
Tómas Jóhannesson, International Maritime Organization, Iceland
Seppo Kellomaki, University of Joensuu, Finland
Niels-Erik Clausen, Risö, Danmark
Helena Kortelainen, VTT Technical Research Center of Finland, Finland
Jari Schable, VTT Technical Research Center of Finland, Finland
Birger Mo, SINTEF, Norway
Hege Hisdal, Norwegian Water Resources and Energy Directorate, Norway
Deborah Lawrence, Norwegian Water Resources and Energy Directorate, Norway
Jórunn Harðardóttir, National Energy Agency, Iceland
Tom Andersen, Statkraft, Norway
Cristian Anderssen, Elforsk, Sweden
Kati Takala, Finnish Energy Industries, Finland
Óli Grétar Sveinsson, NPC, Iceland
Aksel Hauge Pedersen, DONG Energy, Denmark

PhD Candidates:
11 listed without names

PhD Degrees:
Anne Fleig, Germany, Norwegian Water Resources and Energy Directorate/University of Oslo, Norway
L. Lizuma, Latvia, Latvian University, Latvia
D. Meilutyte-Baruskiene, Lithuania, Tallinn University of Technology, Estonia
J. F. Jonsdottir, Iceland, National Energy Authority, Iceland

Post-docs:
None listed

Other Participants:
None listed

Superior Algae

[Nordic BioH2; Renewable production of H2 using biological system]

Period: 2007-2010
Project Manager: Peter Lindblad, Uppsala University, Sweden
Funding Nordic Energy Research/(Total): 6.0 (8.1) MNOK

Partners:
University of Bergen, Norway
University of Turku, Finland
University of Copenhagen, Denmark
University of Akureyri, Iceland
Tampere University of Technology, Finland
University of Jyväskylä, Finland
Stockholm Environment Inst., Sweden
Tallinn Centre, Estonia,
Roskilde University, Denmark
Riga Technological University, Lithuania

Project Steering Group:
Peter Lindblad, Uppsala University, Sweden
Svein Rune Erga, University of Bergen, Norway
Stenbjörn Styring, Uppsal University, Sweden
Eva-Mari Aro, University of Turku, Finland
Paul Erik Jensen, The Royal Veterinary & Agricultural University, Denmark
Johann Örlygsson, University of Akureyri, Iceland
Jaakko Puhakka, Tampere University of Technology, Finland
Jukka Rintala, University of Jyävskylä, Finland
Tiit Kallaste, SEI-Tallinn, Estonia
Bent Sørensen, Roskilde University, Denmark
Dagnija Blumberga, Riga Technical University, Latvia

PhD Candidates:
Åsa Agervald, Uppsala University, Sweden
Pernando Lope Pinto, Uppsala University, Sweden
Marie Holmqvist, Uppsala University, Sweden
Ellenor Devine, Uppsala University, Sweden
Kari Skjånes, University of Bergen, Norway
Johannes Sjöholm, Uppsala University, Sweden
Kajsa Havelius, Uppsala University, Sweden
Tanai Cardona, Uppsala University, Sweden
Åsa Söderberg, Uppsala University, Sweden
Shunmugam Sumathy, University of Turku, Finland
Arnheidur Almarsdottir, University of Akureyri, Iceland
Maney Seinsdottir, University of Akureyri, Iceland
Annaukka Mäkinen, TUT, Finland
Marika Nissilä, TUT, Finland
Hanne Tähti, University of Jyväskylä, Finland
Outi Pakarinen, University of Jyväskylä, Finland
Sylvestre Njakou Djomo, Riga Technical University, Latvia

PhD Degrees:
Åsa Agervald, Sweden, Uppsala University, Sweden
Fernando Lopes Pinto, Portugal, Uppsala University, Sweden
Sylvestre Njakuo Djomo, Senegal, Riga Technical University, Latvia

Kajsa Havelius, Sweden, Uppsala University, Sweden
Tanai cardona, Colombia, Uppsala University, Sweden
Margret Sigurbjörndottir, Iceland, University of Akurayri, Iceland
Hilma Eidsdottir, Iceland, Univsersity of Akureyri, Iceland
Sigridur Sigurdattori,Iceland, Univsersity of Akureyri, Iceland
Vallo Korgmaa, Estionia, Tallinn University of Technology, Estonia
Peep Pitk, Estonia, Tallinn University of Technology, Estonia
Merje Michelis, Estonia, Tallinn University of Technology, Estonia
Paulo Oliveria, Portugal, Uppsala University, Sweden

Post-docs:
Dr. Peter Kellers, Uppsala University, Sweden
Dr. Guiying Chen, Uppsala University, Sweden
PhD Allahverdiyeva Yagut, University of Turku, Finland
Dogan Karadag, Yildiz Technical University, Turkey
PhD Anne Menert, Tallinn University of Technology, Estonia

Other Participants:
Docent Ann Magnuson, Uppsala University, Sweden
Prof. Stenbjörn Styring, Uppsala University, Sweden
Docent Fikret Mamedov, Uppsala University, Sweden
Priit Kalleste, SEI-Tallinn, Estonia
Merje Michelis, Tallinn University of Technology, Estonia

Wind-packed Power Goodness

[Model Development for Power System Analysis with a substantial wind energy capacity installed in the Nordic grid]

Period: 2007-2010
Project Manager: Ola Carlson, Chalmers University, Sweden
Funding Nordic Energy Research/(Total): 5.0 (11.1) MNOK

Partners:
Technical University Of Denmark-Risø, Denmark
SINTEF, Norway
VTT Technical Research of Finland , Finland
Tallinn University of Technology, Estonia

Project Steering Group:
Jouko Niiranen, ABB, Finland
Urban Axelsson, Vattenfall, Sverige
Elisabet Norgren, Svenska Kraftnät, Sverige
Philip Carne Kjaer, Vestas, Denmark
Torsten Lund, Energinet.dk, Denmark
Martin Kruus, Nelja Energia LLC, Estonia

PhD Candidates:
Germán Tarnowski, MSc, Technical University of Denmark, Denmark
Oleg Tsernobrovkin, MSc, Tallinn University of Technolgy, Estonia

PhD Degrees:
Torsten Lund, Denmark, Technical University of Denmark, Denmark
Abram Perdana, Indonesia, Chalmers University of Technology, Sweden
Hannes Agabus, Estonia, Tallinn University of Technology, Estonia
Ivo Palu, Estonia, Tallinn University of Technology, Estonia
Jarle Eek, Norway, Norwegian University of Science and Technology, Norway
German Tarnowski, Argentina, Technical University of Denmark, Denmark
Oleg Tsernobrovkin, Estonia, Tallinn University of Technology, Estonia

Post-docs:
Ivo Palu,PhD, Tallinn University of Technology, Estonia,
Hannes Agabus, PhD, Tallinn University of Technology, Estonia,
Peiyuan Chen, PhD, Chalmers University of Technology, Sweden,
Tuan Le, PhD, Chalmers University of Technology, Sweden

Other Participants:
Ass. Prof. Ola Carlson,Chalmers, Sweden
M.Sc. Sanna Uski-Joutsenvuo, VTT, Finland
Prof. Kjetil Uhlen, Norwegian University of Science and Technology, Norway
PhD Jarle EeK, Norwegian University of Science and Technology, Norway
PhD Leif Warland, SINTEF; Norge
Arne Hejde Nielsen, Technical University Of Denmark, Denmark
PhD Jacob Östergaard, Technical University Of Denmark, Denmark
PhD Anca D. Hansen, Risö, Denmark
PhD Rein Oidram, TUT, Estonia

#1 Cooking up Networks:

[Energy Foresight Forum]

Period: 2007-2009
Project Manager: Einar Hope, NHH, Norway
Funding Nordic Energy Research/(Total):
0.9 (1.2) MNOK

Partners:
University of Bergen, Norway
Stockholm School of Economics , Sweden
Copenhagen University , Denmark
University of Iceland , Iceland
Helsinki School of Economics, Finland

Project Steering Group:
J. S. Vaagen, University of Bergen, Norway
P.A Lindegaard, RISØ, Denmark
J. Keinonen, University of Helsinki, Finland
D. Ridikas, presently IAEA Vienna, Lithuania

PhD Candidates:
None listed

PhD Degrees:
None listed

Post-docs:
None listed

Other Participants:
None listed

#2 Cooking up Networks:

[Initiation of Nordic Automatic Meter Reading Forum]

Period: 2007-2008
Project Manager: Andrei Morch, SINTEF, Norway
Funding Nordic Energy Research/(Total):
1.4 (2.7) MNOK

Partners:
VTT Technical Research Centre of Finland, Finland,
Elforsk , Sweden
DEFU , Denmark
Ekodoma Ltd , Lithuania

Project Steering Group:
Andrei Z. Morch, SINTEF Energiforksning AS, Noway
Ingeborg Graabæk, SINTEF Energiforksning AS, Norway
Bernhard Haukland, Norwegian Electricity Industry Association, Norway
Seppo Måakkåainen, VTT Technical Research Centre of Finland, Finland
Kenneth Hänninen, Finnish Energy Industries, Finland
Åke Sjödin, Elforsk, Sweden
Anders Richert, Svensk Energi, Sweden
Henrik Weldingh, Dansih Energy Association, Denmark
Hans Jørgen Jørgensen, Danish Energy Association, Denmark
Mika Matikainen, Forum of Nordic Regulators (EMV), Finland

PhD Candidates:
None listed

PhD Degrees:
None listed

Post-docs:
None listed

Other Participants:
Ove S. Grande, SINTEF Energiforskning AS, Norway
Astrid Lundquist, SINTEF Energiforskning AS, Norway
Pekka Koponen, VTT Technical Research Centre of Finland, Finland
Claudio Rochas, Edodoma Ltd., Latvia
Äris Dandens, Latvenergo, Latvia
Ivo Grinbergs, Latvenergo adales Tikls, Latvia

#3 Cooking up Networks:

[Nordic Center of Excellence in Photovoltaics]

Period: 2007-2010
Project Manager: Arve Holt, Institute for Energy Technology, Norway
Funding Nordic Energy Research/(Total): 8.0 (12.8) MNOK

Partners:
University of Uppsala, Sweden
Helsinki University of Technology, Finland,
Danish Technology Inst., Denmark
Norwegian University Of Science And Technology, Norway,
Physico-Technical Inst. St. Petersburg, Russia
Tallinn University of Technology, Estonia

Project Steering Group:
Marika Edoff, Uppsala University, Sweden
Peter Lund, Helsinki University of Technology, Finland
Jens Christiansen, Danish Technological Institute, Denmark
Turid W. Reenaas, Norwegian Institute of Science and Tehcnology, Norway
Arve Holt, Institute for Energy Technology, Norway
Vladimir Khvostikov, Ioffe Physico-Tehnical Institute in St. Peterbrug, Russia
Enn Mellikov, Prof., Tallinn University of Technology, Estonia

PhD Candidates:
Jo Jessing, Institute for Energy Technology, Norway
Jonas Pettersson, Sweden
Kerttu Aitola, Finland
Anders Rand Andersen, Denmark
Nikolay A. Kalyuzhnyy, Russia
Kristi Timmo, Estonia
Tor Nordam, Norwegian University Of Science And Technology, Norway

PhD Degrees:
None listed

Post-docs:
None listed

Other Participants:
Dr. Erik Stensrud Marstein, Institute for Energy Technology, Norway
Prof. Aasmund Sudbø, Universtity Graduate Center (Kjeller), Norway
Prof. Mare Altosaar, Tallinn University ofTechnology, Estonia
Charlotte Platzer-Björkman, Uppsala University/ Institute for Energy Technology, Sweden/Norway

#4 Cooking up Networks:

[Nordic Center of Excellence in H2 storage]

Period: 2007-2010
Project Manager: Hannes Jonsson, University of Iceland , Iceland
Funding Nordic Energy Research/(Total): 8.0 (10.8) MNOK

Partners:
Institute for Energy Technology, Norway
University of Oslo, Norway
Stockholm University, Sweden
Uppsala University, Sweden,
Technical University Of Denmark, Denmark
Risø Technical University Of Denmark, Denmark
Helsinki University of Technology, Finland,
Lithuanian Energy Inst., Lithuania,
St. Petersburg State University, Russia

Project Steering Group:
Hannes Jónsson, Faculty of Science VR-II, Iceland
Sveinn Ólafsson, University of Iceland, Iceland
Bjørn Hauback, Institute for Energy Technology, Norway
Helmer Fjellvag, University of Oslo, Norway
Dag Noréus, Stockholm University, Sweden
Yvonne Andersson, Uppsala University, Sweden
Björgvin Hjörvarsson, Uppsala University, Sweden
Jens Oluf Jensen, Technical University of Denmark, Denmark
Tejs Vegge, Risoe National Laboratory and Technical University of Denmark, Denmark
Markku Lampinen, University of Technology, Finland
Darius Milcius,Lithuanian Energy Institute, Lithuania
Valery Uzdin, Professor, Saint-Petersburg State University, Saint-Petersburg, Russia

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Heidi Ostby, Institute for Energy Technology, Norway
Henrik Fahlquist, Stockholm University, Sweden
Martin Sahlberg, Uppsala University, Sweden
Hossein Raanaei, Uppsala University, Sweden
Nicolai Christian Bork, Risø, Denmark
Jon Bergmann Maronsson, Risø, Denmark
Jon Steinar Gardarsson Myrdal, Risø, Denmark
Steen Lysgaard, Risø, Denmark
Martynas Lelis, Lithuanian Energy Inst., Lithuania
Martin Sahlberg, Uppsala University, Sweden
Jan Prinz, Uppsala University, Sweden
Gunnar Palsson, Uppsala University, Sweden

Anders Blomqvist, Uppsala University, Sweden
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Lene Mosegaard, Aarhus University, Denmark
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Adam Sobkowiak, Uppsala University, Sweden
Jonas Angstrom, Uppsala University, Sweden
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Andreas Pedersen, University of Iceland, Iceland
Andreas Vestbo, Danish Technical University, Denmark
Johannes Voss, Risø Danish Technical University, Denmark

Post-docs:
Ph.D. Nadir Aliouane, Institute for Energy Technology, Norway
Ph.D. Stefano Deledda, Institute for Energy Technology, Norway
Ph.D. Hilde Grove, Institute for Energy Technology, Norway
Ph.D. Isavel Llamas Jansa, Institute for Energy Technology, Norway
Ph.D. Sabrina Sartori, Institute for Energy Technology, Norway
Ph.D. Evangelos Papaioannou, Uppsala University, Sweden
Ph.D. Johannes Voss, Risø, Denmark
Ph.D. Didier Blanchard, Risø, Denmark
Ph.D. Adem Tekin, Risø, Denmark

Other Participants:
Prof. Torben Jensen, Aarhus University, Denmark
Prof. Rajeev Ahuja, Uppsala University, Sweden
Ponniah Vajeeston, Oslo University, Norway
Karim Kadir, Stockholm University, Sweden

#5 Cooking up Networks:

[Nordic Network for sustainable development in isolated. Areas]

Period: 2007-2010
Project Manager: David Pointing, Technical University Of Denmark-Risø, Denmark
Funding Nordic Energy Research/(Total): 4.0 (7.1) MNOK

Partners
Institute for Energy Technology, Norway
Technical University Of Denmark, Arctic Technology Centre, Denmark
Greenland Innovation Centre, Denmark
Danish Polar Centre, Denmark
GRID -Arendal, Norway
Nordic Council of Ministers "TBO" Task Force, Greenland
IRD Fuel Cells , Denmark
StatoilHydro New Energy, Norway
Pure project, United Kingdom
REEEP South East & Asia Pacific Secretariat, Australia

Project Steering Group:
David Pointing, Risø Center, Denmark
Gordon Mackenzie, UNEP Risø Centre, Denmark
Daniel Aklil, PURE Energy Energy Ltd., Shetland Islands
Kathrine Johnsen, UNEP GRID-Arendal, Norway
Elizabeth Johnsen, PURE Energy Energy Ltd., Shetland Islands
Arne Willumsen, Center for Arctic Technology (Technical University Of Denmark), Denmark
Margrethe Sørensen, Nordic Council's "TBO" Task Force, Greenland
Petre Vladykova, Danish Technical University, Denmark
Jens-Peter B. Henriksen, Nukissiorfilt, Greenland
Peter Kjeldmann, Nukissiorfilt, Greenland
Vilhjalmur Nielsen, Bitland, Faroe Islands

PhD Candidates:
Andreas Flensborg, UNEP Risø Centre, Denmark
Mette Annelie Rasmussen, UNEP Risø Centre, Denmark
Daniel Aklil, PURE Energy Energy Ltd., Shetland Islands
Anders Holm Foosnæs, DONG Energy, Denmark
Bill Semple, Canadian Mortgage Housing Corporation, Canada
Sigurdur Inge Fridleifsson, Energy Agency Iceland, Iceland
Walter Parson, Nalcor Energy, Canada
Leivur Hansen, SEV, Faroe Islands
Sten Dieden, Actualytics, Sweden
AnneSolgaard, UNEP GRID-Arendal, Norway
Ranneig Nielsen, UNEP GRID-Arendal, Norway

PhD Degrees:
None listed

Post-docs:
None listed

Other Participants:
None listed

#6 Cooking up Networks:

[Scandinavian Hydrogen Highway Partnership]

Period: 2007-2008
Project Manager: Ulf Hafseld, StatoilHydro, Norway
Funding Nordic Energy Research/(Total):
1.0 (2.2) MNOK

Partners:
Zero, Norway
ETC Batteries and Fuel Cells Sweden AB, Sweden
Region Midtjylland, Denmark
H2 Logic , Denmark

Project Steering Group:
Ulf Hafseld, StatoilHydro, Norway
Jostein Pettersen, Rogaland Fylkeskommune, Norway
Sven Wolf, Vätgas Sverige, Sweden
Hanna Jönsson, Vätgas Sverige, Sweden
Mikael Sloth, H2 Logic, Denmark
Flemming Wnnike, Region Midtjylland, Denmark

PhD Candidates:
None listed

PhD Degrees:
None listed

Post-docs:
None listed

Other Participants:
None listed

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2009

International w/peer review (referee system)

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Other international

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- Liski, M. (2009b): Paper presented at: Gothenburg 2008, HECER-Helsinki 2009, Econometric Society meeting Barcelona 2009, the meeting of the Finnish economic association 2009. By co-author presented at: Columbia, Ecole Polytecnique, MIT, Bocconi, and Econometric Society Meeting Rio 2008, and EAERE 2008.

- Liski, M. (2009c):Paper presented at: HECER-Helsinki 2008, University of Heidelberg 2008, and Centre for Advanced Studies (CAS) Oslo 2008. By co-author: Toulouse School of Economics 2008, UC Berkeley 2008, and University of Montevideo 2008.

- Liski, M. (2009d): Paper presented at: EAERE 2007 Thessaloniki, University of Stirling 2007, Toulouse (LERNA) 2007, NEMIEC-Island 2007, HECER-Helsinki 2007. By co-author: Centre for Advanced Studies (CAS) Oslo 2008.

- Liski, M. (2009e): Paper presented at: Harvard University, Helsinki School of Economics, MIT, PUC Chile, Stanford University, UC Berkeley, Universidade de Vigo, Universite Catholique of Louvain-CORE, University of CEMA, University of Paris 1 and Yale University.

- Liski, M. (2009f): Paper presented at: Catholic University of Chile, Catholic University of Leuven, EAERE-2008, EEA-ESEM 2008, HECER-Helsinki, IIOC-2008, Research Institute of Industrial Economics in Stockholm, Toulouse School of Economics and University of Manchester.

- Liski, M and P. Murto (2009): Energy saving investments: simple analytics and an application to electricity, HECER-Working paper.

- Storrøsten (2009a): Research seminar, May 13, 2009, Oslo (Holmsbu): "Incentives to invest in abatement technology: A tax versus emissions trading under imperfect competition".

- Storrøsten (2009b): ECT (energy, climate, technology) 2009, Grieghallen, Bergen, 24 September: "Incentives to invest in abatement technology: A tax versus emissions trading under imperfect competition". Received "Best student paper award" in competition arranged by the Energiforum for this paper.

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- Tangerås, Thomas (2009) Nuclear market power presented at Energy Day, Stockholm School of Economics, November 9, 2009.

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- Von der Fehr, Nils-Henrik M.(2009a): Price Volatility and Risk Exposure: On the Interaction of Quota and Product markets, Seminar, Department of Economics, University of Oslo, Geilo, January 7-9, 2009

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- Von der Fehr, Nils-Henrik M. (2009d): Price Volatility and Risk Exposure: On the Interaction of Quota and Product markets, Invited seminar, Bocconi University, Milano, March 17,

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- Von der Fehr, Nils-Henrik M. (2009h): Market Design and Investment Incentives, Workshop on Designing Electricity Auctions, Stockholm, September 15-16, 2009

- Von der Fehr, Nils-Henrik M. (2009i): The Nordic Market Design – A Model For Others?, Market Design 2009, Saltsjöbaden, September 17-18, 2009

- Von der Fehr, Nils-Henrik M. (2009j): Investment Incentives and Market Design, Workshop on Inequalities in Contests, ESOP, University of Oslo, October 24, 2009

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- Von der Fehr, Nils-Henrik M. (2009m): Investment Incentives and Market Design, NEECI Workshop, University of Reykjavik, December 1-2, 2009

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Mixed Green Policies

[Distibuted generation integration in Nordic Energy Market]

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Raw Energy

[Primary energy efficiency (PEE)]

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Softwood Sugar

[New innovative pretreatment of Nordic wood for cost-effective fuel-ethanol production]

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Presentations - international:

- K.Øyaas: "From the Nordic forests to the fuel tank – a search for cost-effective pretreatment processes". Presentation given at the 6th European Motor BioFuels Forum 2008, Rotterdam, January 9–10, 2008.

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- K.Øyaas (2009): “Pretreatment of wood for biofuels/biorefinery”. Oral presentation, Nordisk treforedlingssymposium, Trondheim, October 8-9.
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Presentations - national:

- K.Øyaas: “New, innovative pretreatment of Nordic wood for cost-effective fuel-ethanol production”. Presentation given at the Nordic project manager workshop “Creating knowledge for the future”, Oslo, March 8-9, 2007.
- K.Øyaas: ”Pretreatment”. Presentation given in meeting on 2nd generation biofuels, The Research Council of Norway, Oslo, September 5th 2007.
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- K.Øyaas: “Biodrivstoffets dilemma og utviklingen av andre generasjons biodrivstoff”. Presentation given at the seminar ”Mer miljøvennlig transport i nord”, Alta, Nov 21-22, 2007.
- K.Øyaas: ”Biodrivstoff – en fremtidig løsning i transportsektoren”, Presentation given to Norsk veg og Trafikkfaglig forening, Trondheim, February 28th, 2008.
- K. Øyaas: “Fremtidens treforedlingsbedrift – et bioraffineri?” ”Fremtidens produkter og produksjonsprosesser for norsk treforedlingsindustri – refleksjon om fremtid, utvikling og lønnsomhet”, Seminar, PFI 31.08.2010.

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- S.T.Moe: ”Pretreatment of wood for bioethanol production – a literature review”. PFI-report 10/2007, August 2007. (R&D report)
- L.Olm and D.Tormund: “Wood raw materials and wood handling”. Memo, May 2008. (Technical report)
- M.Jansson and A.von Schenck: “Memo – Simulation for ethanol production using alkaline pretreatment”. STFI-Packforsk report 0608, June 2008. (R&D report)
- L.Olm, D.Tormund and F.Lundqvist: “Alkaline pre-treatments of Nordic wood for fuel-ethanol production. Hardwood and softwood species.” STFI-Packforsk rapport nr. 488, February 2009. (R&D report)
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- N.Dyrset: “Fermentation study of Thermoanaerobacter islandicum AK17 strains”. SINTEF-memo 2010-06-04. (Technical report)
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- K. Toven: “Pretreatment technologies for bioethanol production from Scandinavian wood feedstocks”. PFI report 3/2011, January 2011 (R&D report)

Sunny Side Up Climate

[Climate and energy systems: Risks, Potential and Adaption]

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- Bergström, S. Presentation on Climate change and hydropower production at an Internal Climate change workshop at Vattenfall, Stockholm May 21, 2010.
- Bergström, S. Lecture on climate and hydropower at the Nordic energy days, Arranged by Montel, Stockholm June 4, 2010.
- Bergström, S. Presentation for the Swedish Advisory board on dam safety, Lossen. September 2, 2010.
- Bergström, S. HUVA training course for the hydropower industry. Lecture on climate change and hydropower. Stockholm, December 2, 2010.
- Bergström, S. Presentation on Nordic-Baltic hydropower in a new climate. IMO 90 years celebration, Reykjavik. December 14, 2010.
- Bergström, S. Presentation on climate and the energy sector. Point Carbon's customer's day. Oslo, Norway. January 8, 2009.
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- Bergström, S. Presentation on climate and hydropower at "Energitinget". Stockholm, March 12, 2009.
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- Bergström, S. Presentation on climate change and hydropower at Swedenergy's Hydropower day in Stockholm. May 27, 2009.
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