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- **QUESTIONNAIRE** on the research/innovation programme of European Union
- **Second stage (2006):** Member States, Associated Candidate Countries and FP Associated States.
- **Objective:** Identification of complementarities and barriers for collaboration
- **Member State**

Associated State
Norway

- **Generalities about the General Framework Programme / Agency responsible for initiating, steering and financing Multiproject programmes¹:**

Complete name
Clean Energy for the Future
Short name
RENERGI
Web page address – in national language
www.renergi.com
Web page address – in English
http://www.forskningsradet.no/servlet/Satellite?cid=1088801905079&pagename=renergi%2FPage%2FHovedSideEng
Duration of the Programme
10 years
Global objective of the programme
<p>RENERGI is to develop knowledge and solutions as the basis for environment-friendly, efficient and effective management of the country's energy resources, security of supply and internationally competitive economic development related to the energy sector.</p> <ul style="list-style-type: none"> • New technologies, systems and solutions that facilitate energy restructuring by improving the efficiency of energy production, transmission and use, making more energy available and improving the security and flexibility of the system; • Environment-friendly energy systems by reducing emissions of greenhouse gases and other air pollution, improving land use, etc. • New internationally competitive goods and services related to the energy sector; • Knowledge and analysis as the basis of the long-term energy strategies of the authorities and industry, public debate and the design of public policy instruments;

¹ In case there is not a General Framework Programme but an Agency responsible for initiating, steering and financing Multiproject programmes

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- Internationally competitive research communities in high-priority fields with extensive collaboration with international research communities and different types of users

Structure / Organisation / Core activities (priority areas etc.)

The public financed energy research programmes in Norway are mainly the following three (figures given are public funding only, per year):

1. CLIMIT (CO2 sequestration from gas power plants, transport and storage of CO2): Approx. 6 mill. € for R&D and 12 mill. € for demo-projects.
2. Petromaks (offshore petroleum related activities): Approx 31 mill. €
3. RENERGI (Clean Energy for the Future): Approx 17,5 mill. €

All these programmes are mainly financed from the Ministry of Oil and Energy and all of them are managed by the Research Council of Norway. Out of these three, RENERGI is the programme related to Distributed Generation, DER and Renewable Energy.

1. Objectives for RENERGI

The main objectives specified by the authorities present a formidable challenge for the Research Council, since the research is to engender several types of results. Although priorities are different in research, energy, environmental and industrial policy, there is also a high degree of congruence and great expectations that the research will open new opportunities in the long term.

The efforts are aimed at research users. Long-term research generally targets other researchers as users, while applied research targets industry, public administration and the general public.

The following are the objectives for RENERGI, based on government policies and the Research Council's prospects:

Primary objective:

RENERGI is to develop knowledge and solutions as the basis for environment-friendly, efficient and effective management of the country's energy resources, security of supply and internationally competitive economic development related to the energy sector.

To make a clear distinction between the programme's two different time perspectives, the following clarifications are necessary:

Perspective for the next 5 to 10 years:

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

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Perspectives for the next 20 to 30 years

Such a long-term perspective generates considerable uncertainty about the possible results of the research, how the research might affect reality, and the reality in which the results will be used. The objectives will nevertheless contain the same elements as the perspective for the next 5 to 10 years. This entails, *inter alia*, that the research is to set the stage for social development featuring a high degree of innovation and where the energy sector's development is consistent with ambitious environmental goals.

Some of the goals of importance in this lengthy time span are:

- Energy systems and management that can accommodate the next generation of climate agreements and the EU's long-term objectives for security of supply, the environment, renewable energy, etc.
- Energy policy that paves the way for wealth creation in the energy sector and for the energy-related supplier industry to continue to play an important role in Norway's economy.

When the objectives are to be laid down and the strategy designed, the lengthy time perspective will be coloured by the fact that research efforts will have to be robust to changes in the needs of society and in framework conditions:

- Knowledge-building in fields of relevance for the exploitation of Norwegian energy resources and energy efficiency;
- Recruitment to research communities;
- Building up good co-operation between R&D communities and industry and other users;
- Broad participation in international research programmes;
- Encourage business and industry to innovate and take a long-term perspective;

RENERGI will feature a special systematised 'foresight process' that will run parallel to the Programme Committee's administrative activities. The goal is precisely to recognise new research needs and opportunities so that the programme can adapt to them.

▪ Sections / Programmes related to Distributed Generation, DER and Renewable Energy

RENERGI

The programme is divided in 6 main core activities:

1. Renewable energy production
2. Natural gas (use in industry and CHP)
3. Hydrogen (production, storage and use – mainly transport)
4. Energy systems
5. Energy market, - policies and international agreements.
6. Energy efficiency (industry and households)

The core activities 1, 4 and 5 are the ones which are most important for "SmartGrid", partly also 3. The contents of these sections are the following:

Renewable energy sources

- Large Hydro > 10 MW
- Small hydro < 10 MW
- Solar heating and cooling

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- Photovoltaics (from silicon via wafers to solar based energy plants)
- Wind energy incl. offshore wind parks
- Wind – hydrogen rural supply system (Utsira)
- Wave energy
- Salt power plants
- Bio-energy plants (electricity and heat)

Energy systems

- Energy system analysis (planning)
- Energy transmission and distribution (capacity utilisation, protection, lines/apparatus etc)
- Energy storage (hydro, hydrogen etc.)
- Electric power conversion

Energy market, - policies and international agreements.

- Incentives for renewable energy (regulator framework/tariffs etc.), bottlenecks in transmission grid, price of reserve power etc.,

Web page address – in national language

www.renergi.com

Web page address – in English

<http://www.forskningsradet.no/servlet/Satellite?cid=1088801905123&pageid=1088801905123&pagename=renergi%2FPage%2FhovedSideEng&site=renergi>

Objectives of the section

Renewable energy sources

Goal 1: Norway will continue to be a world leader in hydropower competence.

Goal 2: Norway should have strong competence that can support several industrial clusters featuring products aimed at the growing international market.

Goal 3: Commercial availability of renewable energy technology adapted to Norway's climate and market conditions.

Possible target areas for achieving the above-mentioned goals may be:

- The optimisation and environment-friendly development of hydropower installations.
- The use of solar heating in buildings.
- Biofuel production and exploitation, based on wood and waste.
- Offshore wind power and other wind power adapted to conditions in Norway.
- The exploitation of energy from the ocean in areas of technology in which Norway is especially well qualified.

Energy systems

The goals for the efforts in this area will be:

Goal 1: For Norway to maintain leading, international-calibre competence in the analysis and planning of a market-based energy system.

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Goal 2: To deal with electricity, natural gas and heat together in models for system analysis.

Goal 3: A competitive Norwegian supplier industry to provide equipment and services for an efficient, environment-friendly and secure energy supply, concentrating on the electricity supply, gas distribution and the integration of distributed production.

Possible target areas for achieving the above-mentioned goals may be:

- System analysis;
- Efficiency improvement, security of supply/emergency preparedness and the environment;
- Public planning and social governance at the municipal and regional levels;
- Systems integration of distributed power generation;
- LNG technology, with emphasis on small-scale solutions;
- Power transmission;
- Small-scale district heating systems.

Energy market, - policies and international agreements.

Goal 1: Norwegian expertise is to occupy a leading international position when it comes to market trends, market schemes and regulation mechanisms as the basis for further developing energy markets to achieve the efficient use of resources, security of supply and environmental goals.

Goal 2: Norwegian expertise on market and regulation concepts is to help promote the internationalisation of the energy markets and market integration, and provide a platform for the commercial exploitation of Norwegian expertise so that the country maintains a leading international position.

Goal 3: Strong specialist groups which, based on interdisciplinary competence, can establish a framework for the energy policy debate.

Goal 4: Publicly available, strong expertise on the framing of international agreements, the negotiating process and the consequences of agreements.

Possible areas for achieving the above-mentioned goals may be:

- Market integration: spatial and between energy carriers;
- Competition and sector regulation and the harmonisation of regulatory measures;
- Market regulation with a view to capacity and security of supply;
- Market schemes for environmental regulation and the valuation of environmental considerations;
- Technological change and the introduction of new technologies;
- Innovation and economic development;
- Public instruments and their effects.
- Knowledge about the development of international energy markets;

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Research Priorities

Some interesting ongoing projects funded by RENERGI:

Energy systems: Grid stability and control

Key achievement	Level of development	Project
Introduced Wide Area Control in the Norwegian main grid (PMUs for phasor- and VIP for voltage instability measurements. Increase the capacity utilization of long lines. Supervision from Statnett's National Control Centre.	New MMI in National Control Centre under development/testing. Measurements are compared with calculations from the State Estimator.	WAN – Statnett, ABB and SINTEF.

Energy systems: Security of supply

Key achievement	Level of development	Project
Transformer winding ageing, condition control and condition assessment of power transformers	Maintenance must consider both water and acid content of cellulose.	"Transformer winding ageing" – SINTEF, ABB, EDF, Hydro Quebec etc.

Energy systems: ICT in grid operation

Key achievement	Level of development	Project
Different technologies for 2-way communication tested. Automatic centralised load control of low prioritised household-load, based on flexible tariffs (spot-market price high: load control is effectuated).	2-way communication to 10.000 households tested for more than one year. The project has been of interest to EU project EFFLOCOM and IEA DRR. This project is (load control) is now connected to the TSO considering system operation.	Buskerud-Skagerak project.

Energy systems: Bottle neck handling

Key achievement	Level of development	Project
In a Nordic project, a software model to reduce the risk of bottlenecks in the main grid, is developed.	The model is influencing the market price to "limit the power flow" when the bottleneck arises. EDF is involved in the further development of the model.	"Flow based market coupling"

Pilot-installations

Key achievement	Level of development	Project
Wind-Hydrogen based electricity supply of isolated island. 300 kW wind mill, electrolyser, hydrogen storage, fuel cell and hydrogen motor as alternatives for generation. Supply of 10 households.	System control developed. System in operation for nearly two years. Power quality ok. Main problem: fuel cell. The motor/generator has been main generating source.	"Production and storage, Norsk Hydro – Utsira"

Budget

The public finance through RENERGI is 17,5 mill. € per year, financed through different ministries. The main part, approx. 80 % from the Ministry of Oil and Energy, approx 15% from the Ministry of Transport and the rest The Ministry of Finance and others. A rough estimate is that the total budget of the concerned R&D projects is 35 mill. €, i.e.

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averagely 50% financed from the RENERGI programme.

▪ **Administrative and financial issues**

Institution responsible for the Programme
The Research Council of Norway
Web page address – in national language
www.forskningsradet.no
Web page address – in English
http://www.forskningsradet.no/servlet/Satellite?c=Page&cid=1138785830860&pagename=ForskningsradetEngelsk%2Fpage%2FStandardSidemal
Institution responsible for the Management of the Programme
The Research Council of Norway
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Line Amlund Hagen and Frank Nilsen (Smart-Grid) lah@forskningsradet.no frank.nilsen@energiconsult.com
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http://www.forskningsradet.no/servlet/Satellite?c=Page&cid=1138785830860&pagename=ForskningsradetEngelsk%2Fpage%2FStandardSidemal
Cost models and type of participants
For definitions of the project type see next paragraph. 1. Researcher projects (FP). Financed from Research Council up to 100%. Application comes from university or research institute. 2. Competence projects with user participation (KMB). Financed from Research Council max. 80%. Min. 20% cash from user. Application comes from university or research institute. 3. User-driven projects with user subsidies (BIP). Financed from Research Council max. 50%. Min. 50% (cash plus cost of own participation) from user. Application comes from user. User could be energy company, supply industry, consulting etc.
Call
June: FP + KMB, October: BIP

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▪ **Type of financed projects / Programme implementation instruments**

Researcher projects. This policy instrument is well-proven and offers ample opportunities to support projects, judged mainly on the basis of scientific merit.

Competence projects with user participation. This policy instrument offers an opportunity to encourage long-term collaboration between research groups and users, but with limited requirements for co-funding on the part of the users.

User-driven projects with user subsidies. This policy instrument attaches importance to users' management and co-funding so that the results can be adopted quickly, for example, through user-driven innovation projects.

Independent funding distributed to projects regardless of field priority, with the main emphasis on merit, to interdisciplinary projects or for other proposals not covered by the targeted calls for proposals.

Strategic knowledge-building programmes aimed at research groups. So-called SIP/SUP (strategic institute and strategic university programmes) will be dealt with outside RENERGI, but will be co-ordinated by the Research Council.

Supplementary instruments will also be used to the extent they are required. Examples of these are:

- Support for network building at the national and international levels alike.
- Support for the development of international projects.
- Support for the demonstration of new technology expected to have market potential.
- Interaction between the strategies for Enova, Innovation Norway and the Research Council.

Establish an arena for the framing of Norway's national energy strategy with participation by the authorities, research and industry.

▪ **Cooperation with other Member States and Regions and third countries**

Some important projects with Norwegian participation:

- RELIANCE
CA: Roadmap for TSO's RTD needs
- GRID
CA: Roadmap for RTD in "ICT vulnerabilities of power systems"
- ERMInE
CA: Roadmap for European Electrical System RTD needs
- IEA Implementing Agreement: "Transmission and Distribution".
- Nordic Energy Perspectives (Further development of the Nordic Energy Market) – Sweden/Norway
- Market Design III (Further development of the Nordic Energy Market) – Sweden/Norway

▪ **Other interesting Programmes**

Some interesting R&D ongoing outside RENERGI:

Power Quality and Safety

Key achievement	Level of development	Project
National power quality database	Database established with measurements from approx 1000 sites.	National power quality programme

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	Some analyses performed	
Reliability driven maintenance and development of distributions systems	Life cycle cost models and software that includes outage costs are implemented	National power quality programme
Voltage quality measurements	Contributions to specifications of eight power quality instruments and associated software. Instruments are in commercial use	National power quality programme
Power quality standards	Utilize knowledge base and measurement base to improve national codes and international standards (especially EN 50160)	National power quality programme
New power quality measurement	Development of a new low cost single phase instrument (household affordable) – prototype established	SINTEF project

Regulatory framework

Key achievement	Level of development	Project
Power system reliability as part of utility regulatory framework	Development of methodology on how to include reliability and power quality aspects in utility income cap or price cap regulation (CENS arrangement) Methods, software and premises is presently a part of the Norwegian grid code	National power quality programme
Benchmarking and grid regulation improvement	Establishment of norm models in combination with DEA models for utility benchmarking and utility regulation. Improved methodology established, but not implemented yet by the authorities	Several national projects

ICT for reliability and quality management

Key achievement	Level of development	Project
Reliability and voltage quality management system	Further develop NetBas to integrate moduls for asset management including reliability, power quality and fault statistics management covering all voltage levels from EHV to LV. NetBas is today a integrated transmission and distribution system documentation and management system including power system simulation tools. More than 100 international users.....	NetBas project

Other interesting links