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European Electricity Projects

2002 - 2006

PROJECT SYNOPSES

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European Electricity Projects

2002 - 2006

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FOREWORD

A major challenge for Europe is to ensure a supply of energy which is at the same time competitive, secure and sustainable. This is addressed in the comprehensive package of measures included in the European Council Action Plan (2007 – 2009) for an Energy Policy for Europe (2007 Spring European Council). In short, it translates to the realisation of a true liberalised European energy market, with increased efficiency, and with an increasing share of renewable and other low CO_2 emitting energy sources.

An integrated European electricity grid will be needed for the proper functioning of a European energy market. This integrated grid will have to be sufficiently intelligent and flexible to operate reliably with intermittent generation technologies such as wind power and with generation embedded in distribution grids, such as micro combined heat and power. A coordinated European approach, to overcome the technical and non-technical barriers to this advanced electricity grid, is needed.

EU research and innovation activities which address these barriers are carried out under the Framework Programmes for Research and Technological Development and under the Intelligent Energy Europe Programme. This brochure presents an overview of the EU funded projects (around 60 funded by the Sixth Framework Programme and 13 by the Intelligent Energy Europe Programme), giving a comprehensive view of European funded activities. The projects described in the brochure will hopefully give an insight into the present state of the technology and provide food for thought for the direction of future research. It also may be of interest for those thinking of proposing new actions or looking for new partners in the Seventh Framework Programme in the area of Smart Energy Networks.

Raffaele LIBERALI
Director

Section 1

Electricity Projects Funded by the Sixth Framework Programme

INTRODUCTION

This current brochure presents an overview of the most relevant European projects in the electricity field (around 60 funded by Sixth Framework Programme and 13 by the Intelligent Energy Europe Programme), giving a comprehensive view of European research activities in this area. This represents a research and development effort of about 190 Million € of which 110 Million € is public money. EC-funded research in the field of grid technologies is focused mainly on the development of distributed energy resources and the integration of renewables and other DG resources into the grid. The projects described in the brochure will hopefully provide guidance for future research activities. An electronic version of this brochure will be available on the web at: http://ec.europa.eu/research/energy/index_en.htm

Research objectives in FP6

Europe's energy supply is characterised today by structural weaknesses and geopolitical, social and environmental shortcomings, particularly as regards security of supply and combating climate change. Whilst energy remains a major component of economic growth, such deficiencies can have a direct impact on EU growth, stability and well being of Europe's citizens. These elements provide the main drivers for energy research, within the context of sustainable development, a high-level EU objective.

The **strategic and policy objectives** of the research on sustainable energy systems developed under the Sixth Framework Programme included reducing greenhouse gases and pollutant emissions, increasing the security of energy supplies, improving energy efficiency and increasing the use of renewable energy, as well as enhancing the competitiveness of European industry and improving quality of life both within the EU and globally.

Most of the research activities funded in the framework of 'Sustainable Energy Systems' are built upon previous and ongoing activities supported within the Energy part of the 'Energy, Environment and Sustainable Development' (EESD) Programme of the Fifth Framework Programme.

The EU Research Framework Programme

The main EU funding mechanism for research, technological development and demonstration (RTD) is the Framework Programme (FP).

Based on the Treaty establishing the European Union, the Framework Programme has to serve two main strategic objectives: strengthening the scientific and technological bases of industry and encouraging its international competitiveness while promoting research activities in support of other EU policies.

The Sixth Framework Programme (FP6) runs from 2002 to 2006, its main objective being to contribute to the creation of a true European Research Area (ERA). ERA is a vision for the future of research in Europe, an internal market for science and technology. It fosters scientific excellence, competitiveness and innovation through the promotion of better co-operation and coordination between relevant actors at all levels. The aim is to assemble a critical mass of resources, to integrate research and related efforts by pulling them together in larger, more strategic projects, and to make this research more coherent at a European scale.

Based on the above strategic objectives, FP6 has been structured into Thematic priorities (and sub-priorities) including 'Sustainable energy systems'.

The main instruments to implement FP6 were *Integrated Projects* (IP), and *Networks of Excellence* (NoE), which have been driven by the concept of the ERA and characterized by the structuring and integrating effect that they can have on European Research. There are also other instruments for multi-partner collaborative research activities, such as *Specific Targeted Research Projects* (STREP), *Coordination Actions* (CA) and *Specific support actions* (SSA), *Specific projects for SMEs*, etc.

FP6 project portfolio analysis in the area of electricity

In addressing the FP6 objectives through the 'Sustainable Energy Systems' Work Programme a clear differentiation was made between research activities expected to have an impact in the medium to longer term, and those having the potential for exploitation in the short to medium term.

For short to medium-term research, the projects in the **electricity** area had to address innovative technical approaches to the production, storage, integration and use of RES electricity, including the *integration of distributed electricity generation* at different network voltage levels; *electricity storage systems* for supplying short-term peak demands or for balancing variations in renewable electricity supply, as well as *innovative socio-economic approaches* to integrate energy planning, leading to local policies, codes, and regulations.

FP6 Research activities addressing **short–to–medium term** activities:

- deliver results, which will accelerate the market penetration of innovative energy technologies with a particular emphasis on 2010 energy policy objectives;
- consist mainly of integrated demonstration actions with a typical research component of up to about 20% and including, where appropriate, pre-normative research, energy technology integration, dissemination and technology transfer activities. The risks to be addressed are mainly technological and might include market related and financial issues;
- demonstrate reductions in the costs associated with implementation of new technologies and/or demonstrate how innovative technological solutions can be integrated under full-scale operating conditions;
- provide inputs for the future development of energy policy and legislation, including the improvement of existing regulatory measures, whilst serving EU research and related policies;

The research components of short to medium term projects should adopt a multidisciplinary approach, including, where appropriate, socio-economic research on the future policy, market and end user impacts of the innovative energy technologies involved, in addition to technology focused research.

The strategically important areas for medium-to-long term **electricity** research were:

- *New approach for large-scale implementation of Distributed Energy Resources (DER) in Europe*

  The main objectives of this research priority were to *design, develop and validate novel architectures, components and DER solutions needed for future interactive energy service networks*. Large IP projects – such as MORE-MICROGRIDS, FENIX and EU-DEEP – are examples of European efforts in this area.

- *Energy storage technologies and systems for grid-connected applications*

  The objective was focused on the development innovative energy storage concepts to facilitate the large penetration of DER. For electricity networks one NoE project (ALISTORE) was financed.

- *Development of key enabling technologies* for distributed energy networks with high power quality and security of service.

This research priority included a number of technology-driven projects on power electronic devices and cable systems and High Temperature Superconductors (components, devices and systems), such as SUPER3C, SLIM FORMER, UNIFLEX-PM.

FP6 Research activities having an impact in the **medium to long term**:

- deliver results which could be widely exploited commercially or otherwise, with a time horizon generally beyond 2010; further development and particularly demonstration type actions may be necessary before technologies are ready for full-scale commercial use;
- consist mainly of research and development activities (including pre-normative and socio-economic research and the validation of technical and economic feasibility in pilot plants and prototypes), research-related networking activities, training and dissemination activities. The main risks to be addressed are scientific and technological rather than market and financial;
- lead to the generation, exploitation and dissemination of new knowledge and contribute to the implementation of EU research policy, whilst also contributing to the development of energy and associated policies.

The research activities funded in the medium-to-long term should address not only the technological aspects, but also incorporate in a multidisciplinary approach the socio-economic research necessary to overcome the non-technical obstacles for the penetration into markets of the technologies concerned.

The coordination measures were established to ensure a coherent approach and manage any potential overlaps. These projects aimed at:

- removing all obstacles for the development of DG and RES;
- ensuring smooth functioning of the European electricity market, addressing the issues of security, reliability and quality of supply;
- providing appropriate knowledge for technical solutions and regulatory approaches.

The funding of electricity projects in FP6

Around 60% of Electricity research projects are funded under the Thematic Priority 6.1-**Sustainable Energy Systems** (both medium to long term and short-to medium term research).

Projects linked to Electricity research also exist under *Thematic Priority 2-Information society technologies*, and under other cross-cutting research activities such as *Scientific Support to Policies, SMEs Research Activities, Specific measures in support of international co-operation (INCO), Research and Innovation, and Marie Curie Host Fellowships*.

The following table gives an overview of the FP6 Electricity project portfolio, classified according to the FP6 areas.

FP6 Areas	Number of projects	Total budget in M€	EC funding in M€
Sustainable Energy Systems	33	137,5	78,3
Information Society Technologies	5	29,3	15,1
Scientific Support to Policies	5	4,1	3,5
SMEs Research Activities	1	2,4	1,4
International Cooperation (INCO)	8	10,7	8,1
Research and Innovation	2	2,9	1,9
Marie Curie Host Fellowships	1	1,6	1,6
Total Electricity	**55**	**188,5**	**109,9**

Within the 'Sustainable Energy Systems', the Electricity projects are classified in the following 'technology paths' (strategically research topics):

	Number of projects	Total budget in M€	EC funding in M€
Sustainable Energy Systems,	**33**	**137,5**	**78,3**
New Architectures and System Integration	27	115,8	63,8
Storage (for Electricity)	1	5,9	5,0
Enabling Technologies	**5**	**15,8**	**9,5**

Research objectives in FP7

The *Seventh Framework Programme for research and technological development* (FP7) is the European Unions main instrument for funding research in Europe. FP7, which applies to the years 2007-2013, is the successor to the Sixth Framework Programme (FP6), and is the result of years of consultation with the scientific community, research and policy making institutions, and other interested parties. Running from 2007 to 2013, the programme has a total budget of over 50 billion euros. This represents a substantial increase compared with the previous Framework Programme FP6 (41% at 2004 prices, 63% at current prices), a reflection of the high priority of research in Europe. Indeed, FP7 is a key tool to respond to Europe's needs in terms of jobs and competitiveness, and to maintain leadership in the global knowledge economy.

The **Seventh Framework Programme** (FP7) bundles all research-related EU initiatives together under a common roof playing a crucial role in reaching the goals of growth, competitiveness and employment; along with a new Competitiveness and Innovation Framework Programme (CIP), Education and Training programmes, and Structural and Cohesion Funds for regional convergence and competitiveness. It is also a key pillar for the European Research Area (ERA).

The broad objectives of FP7 have been grouped into four specific programmes: ***Cooperation, Ideas, People*** and ***Capacities***. For each type of objective, there is a specific programme corresponding to the main areas of EU research policy, all of them working together to promote and encourage the creation of European poles of (scientific) excellence.

The core of FP7 and its largest component by far – the ***Cooperation*** programme fosters collaborative research across Europe and other partner countries, according to several key thematic areas. These themes are: health; food, agriculture and fisheries, and biotechnology; information and communications technologies; nanosciences, nanotechnologies, materials and new production technologies; energy; environment (including climate change); transport (including aeronautics); socio-economic sciences and the humanities; space and security.

Cooperation theme 5: Energy

Energy is one of the **themes** of the *Cooperation* Programme, which includes several Research Activities. Among these – *the seventh - Smart Energy Networks* aims to **increase the efficiency, safety, reliability and quality of the European electricity and gas systems and networks in the context of a more integrated European energy market**.

For ***electricity*** networks, the goals of transforming the current electricity grids into a resilient and interactive (customers/operators) service network, controlling the real time flows and removing the obstacles to the large-scale deployment and effective integration of renewable energy sources and distributed generation (e.g. fuel cells, microturbines, reciprocating engines), will necessitate the research, development and demonstration of key enabling technologies (e.g. innovative ICT solutions, storage technologies for RES, power electronics and superconducting devices) including the development of new control and reliability tools for electricity systems.

EU-DEEP

The Birth of a European Distributed Energy Partnership that will help the Large-scale Implementation of Distributed Energy Resources in Europe

Overview

The main goal of the EU-DEEP project is to remove the main barriers that prevent large-scale deployment of Distributed Energy Resources (DER) by 2010.

Under the coordination of Gaz de France, the 39 partners' consortium will provide, by 2010:

- **new knowledge about European market opportunities for DER;**
- **a portfolio of technologies and business models based on extensive experimental evidence in promising market segments;**
- **a set of methodologies that can be replicated to study new promising market segments;**
- **training materials that will be delivered commercially before the end of the research project.**

Challenges

The widespread development of Distributed Energy Resources (DER) in Europe faces three major barriers:

- **technology barriers**: where significant penetration of small-sized generation impacts the planning and the operation of the distribution network and the system;
- **market barriers**: where new business models must be designed and validated to show that DER solutions can be profitable within acceptable return on investment figures;
- **regulatory barriers**: where new regulatory frameworks must be developed to allow for massive DER deployment by efficiently assessing and allocating costs and benefits to the system users in a sustainable way.

Technical Approach

The project structure aims to integrate research on several key aspects of DER to produce:

- **market assessment and energy demand modelling tools** to detect the segments with highest DER potential in Europe;
- **systemic grid simulation tools** to quantify the impacts of massive DER penetration onto the grid and to design efficient cost allocation schemes;
- **analysis of local dynamic energy management schemes** to measure the benefits of local electricity trading mechanisms;
- **full scale experiments**, one year in duration, to identify technical barriers that could not be addressed by simulation, and to pinpoint the remaining uncertainties;
- **innovative business models for the promising segments**, to be built by integrating all project findings. Real Option Theory is used to value the DER management flexibility;
- **training and dissemination tasks** to deliver usable knowledge to players in the energy sector that will face DER investment options in the very near future.

Expected Impact

Not available.

Progress to Date

The project will now address specific combinations of Local Trading Strategies and business modelling. One-year DER experiments will provide the real life experimental data to support the valuation of DER solutions connected to existing energy networks. This will illustrate the benefits and value of bi-directional flows of electric energy for all involved stakeholders.

The barrier addressed	How was it addressed?	What are the practical results?
Lack of a shared understanding of DER markets due to dispersed, fragmented knowledge	Sharing of commercial data between utilities; design of a common language to describe market features	• 4 segments identified with high DER potential in residential and commercial sector • A set of tools to detect further segments of interest for DER • Assessment of DER scenarios profitability for typical customers in the above 4 segments • User friendly tools for demand and DER response modelling • Quantification of the "Hosting capacity" or DER penetration ratio up to which the grid performs safely and reliably without major investment requirements • The technical impacts of connecting DER at low voltage are shown to be less severe than initially expected • Identification of innovative products and services linked to DER (the so-called Local Trading Strategies) • Description of the role of Aggregators in tomorrow's energy landscape • A set of trainings combining market description and simulation techniques enable trainees to make fair economic comparisons between several energy options in a given end-use segment.
Limited experience in evaluating new Demand Side Management schemes	Rely on physical descriptions of energy exchanges to model energy demand, generation, and end-use	
Reluctance of grid-operators to allow for massive DER deployment	Use systemic simulation tools to assess the impact of increasing DER penetration level on the system and the related costs or benefits	
Emerging energy liberalization process where market structures and DER regulation are still under construction	Use a systemic approach and simulation tools to understand the forms and functions of tomorrow's new players on the energy markets	
Excess number of opinions about DER impacts, lack of methodologies to evaluate their costs – benefits	Use change management approaches and adapt the project simulations tools to develop training sessions	

Project Information

Programme
Sustainable Energy Systems

Contract number
503516

Instrument
Integrated Project

Starting date
01/01/2004

Duration
66 months

Total cost
€ 28 899 568

EC funding
€ 15 000 000

Coordinator
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Anco - EL
Aristotle University of Thessaloniki - EL
Bowman Power Systems Limited - UK
Capitalia Gruppo Bancario - IT
CRES - EL
Centro de Nuevas Tecnologias Energeticas - ES
Electricity Authority of Cyprus - CY
Energoprojekt-Katowice - PL
EPA Attiki - EL
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Fondazione Eni Enrico Mattei - IT
Frederick Institute of Technology - CY
Fundación Labein - ES
Heletel - EL
Iberdrola - ES
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KAPE - PL
Katholieke Universiteit Leuven - BE
Laborelec - BE
Latvenergo - LV
Lodz Region Power - PL
MTU CFC Solutions - DE
Regulatory Authority for Energy - EL
Riga Technical University - LV
RWE Energy - DE
SAFT - FR
Siemens AG - DE
Siemens PSE - AT
STRI - SV
Suez-Tractebel - BE
Technof - FR
Tedom - CZ
Transénergie - FR
Tubitak - TR
Universidad Politécnica de Valencia - ES
University of Lund - SV
VEIKI - HU
VTT - FI

Website
http://www.eu-deep.com/

ALISTORE

Advanced Lithium Energy Storage System Based on the Use of Nano-powders and Nano-composites Electrodes/Electrolytes

Overview

ALISTORE's main objective is to integrate a significant proportion of the European Li-battery research within a Virtual Institute. This will create a 'network of excellence' in Li-battery research to reduce redundancy, ensure complementarity, share expensive facilities and resources, e.g. characterization platforms, pilot-plant battery fabrication, and optimise collaboration to achieve our research objectives.

Challenges

Global warming, finite fossil-fuel supplies and city pollution conspire to make renewable energy a European imperative. A future 'clean energy' economy must be based on small, distributed generators that exploit a diversity of technologies such as wind, wave, solar, fuel cells, etc.

A pressing need will therefore arise for *electrical energy storage systems* to balance supply with demand; the wind doesn't always blow when you want it to! With transportation accounting for 30% of CO_2 emissions, *hybrid electric vehicles* also have a well-defined part to play; hence rechargeable batteries. Furthermore, the pace of technological advance and mobility makes it inevitable for electricity providers to modify their present distributed electricity networks, and develop *grid-enhanced management architectures* combining renewable energy sources with batteries capable of meeting peak-power demands while providing high-power quality.

In these three applications (electrical energy storage systems, hybrid electric vehicles and grid-enhanced management architectures), it is essential that we achieve larger batteries using cheaper, less toxic materials, delivering higher energy densities at higher rates and with better charge/discharge cycling - but using which technology? Currently, no single technology, even Li-ion, is capable of fulfilling all the requirements for energy storage.

Aware of this limitation, 15 European Li-battery research groups have pooled their efforts through the creation of the ALISTORE network, in order to efficiently and aggressively pursue the positive attributes of **nano *vs.* bulk material electrodes with the hope** to lay the foundations for the next generation of energy-storage systems.

Technical Approach

To achieve our goals efficiently our scientific programme has been structured around six Thematic Groups. Tri-monthly brainstorming sessions for each thematic group helped maintaining excitement and enthusiasm in the programme. We also regrouped all partners biannually to ensure integration and cross-fertilization between the various interdependent thematic groups. Besides serving to assess current state-of-the-art battery research, these meetings also allowed us to discuss new opportunities/ideas that could fuel our long-term generic research programme.

Expected Impact

The project hopes to create the scientific knowledge-base needed to develop cost-efficient, long-life, and high- power advanced lithium energy storage systems based on the use of nano-powder and nano-composite electrodes and electrolytes. The developed technology will be capable of:

- facilitating the development of electric and hybrid vehicles;
- ensuring high quality electricity by enabling the development of grid-enhancement management architecture through the harmonious marriage of renewable energy sources and advanced battery systems;
- controlling overall air pollution and environment.

Besides securing a sound scientific platform for battery research and training programmes (in the form of a European Masters Degree, summer schools and workshops), another ALISTORE goal is to seek more powerful and focussed interaction mechanisms, such as the creation of a **European Research Institute** to liaise with European Industry, and to handle patent rights issues. Success in meeting the above challenges will serve to place Europe securely back at the international forefront of energy storage technologies, which is currently dominated by Japan, with the rising challenge coming from China.

Nano-materials can ultimately revolutionize the way the World stores and uses power, providing we are able to exploit nano-architectured electrodes/current collectors to inspire new advances in cell assembly, greatly lower production costs, and develop a better understanding of:

- how to synthesize, characterize, control and manipulate particles on a small scale;
- how to fabricate new nano-structured materials, electrodes and electrolyte membranes;
- how to master interface phenomena at the nanoscale, while preserving high ionic diffusion.

Progress to Date

ALISTORE is a fascinating and enriching adventure in both human and scientific terms, as the programme involved a group of very talented, dynamic and visionary researchers, always seeking innovation in their research, educational and business activities. On the scientific side, the use of **brainstorming sessions** with the creation of **state of the art analytical/benchmarking platforms** are serving the dual purpose of fostering research integration and provoking new ideas as witnessed by the number of **joined patents (5) and joined papers (46)**. Results have been achieved jointly that could never have been achieved by any of the partners working individually. Among them is the recent work published in ***Nature Materials (June 2006)*** that consists of the electrochemically assisted template growth of Cu nanorods onto a current collector, followed by its coverage with a low cost electrochemically active polycrystalline film based on Fe_3O_4 (e.g., rust). Using such a configuration, the feasibility of preparing conversion reaction electrodes with outstanding power rate capabilities (90% of the total capacity at 8°C) and sustained reversible capacities over a few hundreds cycles was achieved; the next step being the 3D micro battery.

The scientific results along with the success of the integration programme are proving a great asset to our partners when they approach **their national institutions** for extra funding. Besides Science, the accreditation of our European Master entitled '*Materials for energy storage and conversion*' as an **Erasmus Mundus** programme in 2006 constituted another ALISTORE highlight.

Finally, ALISTORE partners' eagerness towards turning our research advances into industrial exploitations remains unchanged, because of the positive feedback we are receiving from Industrial and National agencies ALISTORE is aiming for the creation of both an industrial club and a European research Institute in the near future.

Project Information

Programme
Sustainable Energy Systems

Contract number
503532

Instrument
Network of Excellence

Starting date
01/01/2004

Duration
60 months

Total cost
€ 5 868 641

EC funding
€ 5 000 000

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Max-Planck-Institut für Festkörperforschung - DE
National Institute of Chemistry Slovenia - SL
Paul Scherrer Institut - CH
Politechnika Warszawska - PL
Technische Universiteit Delft - NL
The University Court of the University of St Andrews - UK
Universidad de Cordoba - ES
Université de Montpellier II - FR
Université de Provence - FR
University of Kent - UK
Università di Roma 'La Sapienza' - IT
Uppsala Universitet - SV

Website
http://www.u-picardie.fr/alistore

Integration of Renewable Energy Sources and Distributed Generation into the European Electricity Grid

Overview

The increasing number of renewable energy sources and distributed generators requires new electricity grid structures and new strategies for their operation and management to ensure future power supply reliability and quality. The liberalisation of the grids leads to new management structures in which the trading of energy and power is becomingly increasingly important. This trend is accompanied by new structures for communication and trading, leading to digitally-controlled interactive electricity grids.

The preparation for the transition from conventional to future grid management requires an interdisciplinary approach between research, industry, utilities and consumers, taking into account technical as well as socio-economic and regulatory issues.

Objectives

The particular objectives of the project are:

- to make stakeholders aware of the increasing importance of RES and DG compared to conventional centralised systems;
- to contribute to the removal of technical, economic and regulatory barriers to grid connection of RES and DG;
- to create a favourable environment for socio-economic acceptance of intermittent RES and DG grid solutions without risks to quality or safety.

Challenges

There are four running projects (MORE MICROGRIDS, DER-LAB, SOLID DER, FENIX), and seven completed projects (DISPOWER, CRISP, SUSTELNET, DGNET, DGFACTS, INVESTIRE, MICROGRIDS) supported by the European Commission which deal with the integration of Renewable Energy Sources (RES) and Distributed Generation (DG). In order to concentrate efforts and maximise critical mass, these projects were bundled to create a research cluster in January 2002. This cluster represents more than 100 participating institutions from research, industry and utility sectors, all contributing to this common activity.

The objective of IRED is to promote change through coordinated action (CA). This CA will extend existing cluster activities in such a way as to achieve real added value by mobilising research which will be a major contribution to the ERA. The extension will be realised by the inclusion of forthcoming projects supported by FP7, national and regional activities.

The advantage of this Coordination Action (CA), in contrast to the creation of a Network of Excellence (NoE), is that research on the integration of RES and DG will be structured from the very beginning rather than fragmented. The most important elements of the CA will be the following:

- the systematic exchange of information and good practice by improving links to relevant research, regulatory bodies and policies and schemes on a European, national, regional and international level;
- the set-up of strategic actions such as transnational cooperation, the organisation and coordination of common initiatives on standards and testing procedures, and the establishment of common education and training;
- identification of the highest priority research topics in the field of integration and the formation of appropriate realisation schemes.

Technical Approach

The CA will be implemented through the following:

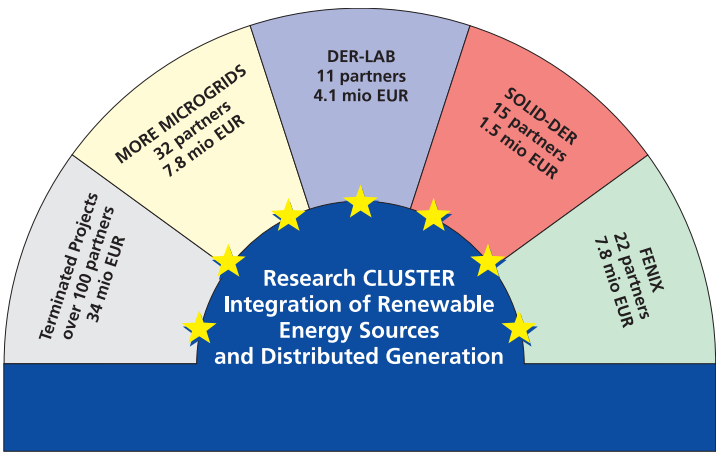
- establishment of an expert group covering important cross-cutting areas such as power quality etc.;
- formation of a group of contact persons for national, regional and international policy and programme makers and for programme managers;
- set-up of a comprehensive data and information exchange system including the realisation of links to relevant national, regional and international electronic information systems;
- organisation of conferences and workshops on an international and European level;
- exchange of personnel and joint supervision of theses and PhD-work by the participating institutions;
- production, exchange and dissemination of education material and good practice for higher education;
- organisation of regular cluster coordination meetings;
- identification and integration of forthcoming relevant projects and activities into the cluster.

Expected Impact

By increasing dynamic in research and the transformation of the current electricity grid into an interactive one, multiple benefits can be expected, such as, the creation of innovative products by European industry which in turn will lead to increased export. In addition, the realisation of an (electronic) e-energy market will allow greater flexibility in matching supply and demand and consequently ensure a higher integration rate of RES and DG into the electricity grid.

The coordinated action will also provide the infrastructure necessary for the realisation of the European Commission's target to substantially increase renewable energy supply as set out in the political papers.

Finally, increased economies in the production, transmission and distribution of electricity will lead to more attractive energy prices for the benefit of all, from industry to the private consumer.



Project Information

Programme
Sustainable Energy Systems

Contract number
503770

Instrument
Coordination Action

Starting date
01/01/2004

Duration
48 months

Total cost
€ 1 151 615

EC funding
€ 704 000

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Website
www.IRED-cluster.org

SUPER3C

Super Coated Conductor Cable

Overview

The Super3C project aims to establish the feasibility of a low-loss energy cable using the second generation of High Temperature Superconducting (HTS) tapes, the Coated Conductor (CC) tapes, as current carrying elements. It comprises the development, manufacturing and testing of a functional model consisting of a one-phase, 30-meter long, 10 kV, 1 kA CC cable with its terminations.

Challenges

Super3C is one of the two leading CC cable projects in the world. The only competing project world-wide is the one in Albany (New York state, USA) where a three-phase 30-meter CC cable is expected to be installed in 2007.

The main challenges faced by the current project are the modelling of a low-loss cable, the development and the manufacturing of 40-meter CC tapes with a satisfactory current transport capability, the CC tape stranding on industrial cabling machines and the development and assembling of specific cable terminations.

The most critical issue is the availability of the two kilometres of CC tape needed for manufacturing the functional cable model.

Technical Approach

The project is structured according to six work packages. It involves thirteen partners from six countries and is coordinated by NXF which is leading the *Project management* work package. TUT leads the *Cable modelling and system design* work package with the support of IEE, which is in charge of fabricating the short cable models, and ZFW for CC tape architecture and characterization. EHTS leads the *Long-length high critical current CC tapes* work package. Most of the HTS tapes will be fabricated by EHTS through Ion Beam Assisted Deposition (IBAD) and High Rate Pulsed Laser Deposition (HR-PLD); these are well established processes which provide the highest performances. Some of the CC tapes will incorporate a chemically deposited layer developed by NSC and ICMAB. The *CC cable prototype* work package is led by NDI. NXN will fabricate the cable core which will be inserted in the flexible cryogenic envelope supplied by NDI. NXF will provide the cable terminations. LABEIN leads the *Network integration and cable test* work package with the support of EEN for network integration and of ALF which will supply the liquid nitrogen cooling system allowing the CC tapes to reach their superconducting state around –200°C. The functional cable model will be tested by LABEIN in Bilbao. EON leads the *Technical, economical and social assessment* work package.

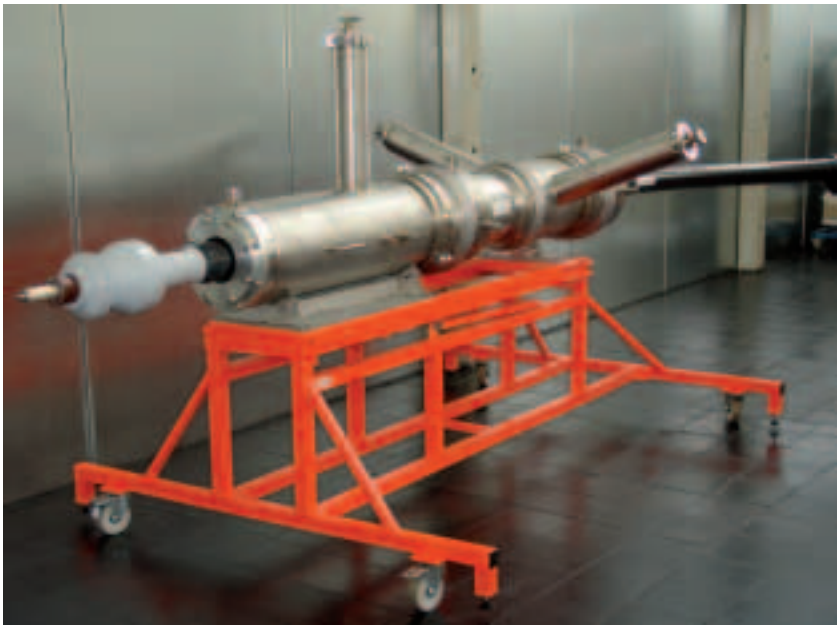
Expected Impact

The main deliverable will be a one-phase, 30-meter long, 10 kV, 1 kA functional CC cable model with its terminations. A successful Super3C project could possibly set the basis for a CC tape pilot production unit in Europe and for a CC cable demonstrator to be tested in the power grid of a major European utility.

Superconducting cables provide a new way to solve power transmission issues. They allow the enhancement of the transmitted power through a very high ampacity whereas the conventional technology typically relies on a voltage increase when the current exceeds 1500 A. With HTS cables, a lower voltage can be used for the transport of the same (or greater) amount of power compared to conventional technology. This will reduce the need for step-up and step-down transformations in the power transmission system. The introduction of low-loss HTS cables will also increase the efficiency of energy transmission through regional, national and international electricity grids. HTS cables are especially interesting in urban areas where the right-of-way constitutes a critical issue.

Progress to Date

The cable modelling is complete and validated through a cable model. The manufacturing feasibility of 40-meter homogeneous IBAD/PLD CC tapes with a satisfactory current transport capability has been demonstrated. CC tape stranding tests have been carried out successfully on industrial cabling machines. Specific cable terminations have been developed and assembled. The manufacturing of the 40-meter CC tapes has been delayed due to the relocation of the EHTS team from Göttingen to Alzenau but the equipment is now operational.



Project Information

Programme
Sustainable Energy Systems

Contract number
502615

Instrument
Specific Targeted Research Project

Starting date
01/06/2004

Duration
36 months

Total cost
€ 5 156 000

EC funding
€ 2 742 000

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Fundación Labein - ES
Nexans Deutschland Industries KG - DE
Nexans Norway - NO
Nexans SuperConductors - DE
Tampere University of Technology - FI
Zentrum für Funktionswerkstoffe - DE

DERLAB

Network of DER Laboratories and Pre-Standardisation

Overview

DERlab is the European Network of Excellence (NoE) of independent laboratories, working in the area of the integration of distributed energy resources (DER) into electricity grids and the preparation of related standards and test procedures.

The main objectives are to:

- **establish a distributed, independent world-class DER laboratory for Europe;**
- **support the development of European and international standards;**
- **achieve sustainable networking between European laboratories.**

Challenges

Sustainable Development requires the use of cleaner energy resources. The connection of new decentralised and clean energy resources to the grid can help to reduce the environmental impact of power production (CO_2 reduction in particular). Furthermore the introduction of new technologies can improve the performance of the network, improve the reliability and the quality of the supply and offer a more flexible and efficient service. However the integration of these new energy resources and technologies requires an important research, development and testing efforts in order to:

- make the most effective use of the new energy concepts including generation from renewables, "active" distribution networks and where appropriate use of energy storage;
- guarantee the highest level of reliability and quality of supply, essential in a critical infrastructure such as the power system.

As these new elements are integrated in the distribution network, it will be necessary to use laboratory tests to validate the new concepts for analysis, planning, control and supervision of the electricity supply and distribution in order take these new components into account in the performance optimisation of the whole system.

The integration of research and testing activities on DER across Europe, including its integration into the electricity grid, is particularly needed since:

- there are a large number of uncoordinated research and associated testing activities in this area, from national research programmes and standardisation activities;
- there is a clear need for European-wide solutions through the promotion of common standards for the integration of distributed energy resources (DER);
- the integration of the experience and facilities of a number of excellent laboratories with impressive activity profiles provides an opportunity to build a network that can claim world leadership in testing certification and pre-standardisation activities in the area DER technologies and their integration into networks.

The DERlab Network of Excellence (NoE) will provide critical support to the development of a common European research and development platform focusing on DER integration in the power system, taking into account the needs and concerns of the EU utilities and manufacturers. It will also strongly support the consistent development of DER technologies and contribute to the creation of a European competence through highly skilled human resources working at the leading edge of DER technology.

Technical Approach

The DERlab Joint Programme of Activities (JPA) consists of the following four parts, which are considered critical to the successful performance of the network:

Integration Activities

This concerns all activities aiming at integration of the partners.

Joint Research Programme

The objectives of the joint research programme are to contribute to the development of standards for DER, to develop common testing, certification and qualification

procedures, and to develop a pan-European laboratory infrastructure for the testing and qualification of DER components and systems.

Spreading of Excellence

Activities to spread excellence beyond the project consortium include interaction with standardisation bodies, organisation of workshops, training and education activities, organisation of national and international information exchange, as well as regular reporting.

Management Activities

This activity includes all activities concerning the management of the consortium, including operation of NoE executive management, NoE network coordination committee, NoE governing board and NoE advisory board.

Expected Impact

- **A distributed world-class DER laboratory for Europe:** the objective is to develop a Pan-European laboratory, which will be recognised as a leading laboratory in the field of Integration of DER. This will be achieved by mutual specialisation and systematic completion of the partners' laboratories and by developing a common test portfolio. The test capabilities together with the test facilities will establish a test environment for DER. This will enable the DERlab to provide European testing services for industry, utilities etc.
- **Support for the development of European and international standards:** this will be achieved through the exemplary execution of research activities on specific fields and by initiating new research activities, which aim to provide required technical information and input to the standards. The technical areas covered by DERlab are:
  - requirements concerning connection, safety, operation and communication of DER components;
  - requirements for the effective and economic operation of sustainable power systems;
  - quality criteria for DER components.
- **Sustainable networking between European laboratories:** DERlab aims to create long-lasting European competence through the establishment of a Pan-European expert group on "New DER technologies and their Integration into the Future Distribution Network". This will consist of highly skilled researchers working at the leading edge of DER technology.

Progress to Date

One of the first common activities was the elaboration of a proposal concerning the extension of the existing laboratory facilities. The proposed research infrastructure for DER integration into the European Grids will enable tests on component as well as on system level, and will be accessible for the European research community, industry and grid operators.

Secondly, DERlab internal working groups have been setup which work on the topic of interconnection requirements for DER.

Finally, a legal framework for the DERlab was drafted and is currently undergoing modification to meet the different partners' needs.

Project Information

Programme
Sustainable Energy Systems

Contract number
518299

Instrument
Network of Excellence

Starting date
01/11/2005

Duration
72 months

Total cost
€ 4 119 000

EC funding
€ 3 138 439

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Fundación Labein - ES
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Kema Nederland BV - NL
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Technical University of Sofia - BG
TU Lodz - PL
University of Manchester - UK

Website
http://www.der-lab.net

FENIX

Flexible Electricity Networks to Integrate the Expected "Energy Evolution"

Overview

The multiplicity of distributed energy resources within the distribution networks is beginning to create operational problems in many EU countries. Not big in size but potentially a great number, these sources are connected with a fit and forget policy in a very inefficient way, are not always visible and are very seldom dispatchable. They displace energy produced by conventional plants but don't displace capacity, flexibility and controllability. In addition, most of this production is considered to be intermittent, renewable and subject to market prices.
The continuation of this approach will reduce DER deployment rate, undermine security and increase cost.

But considering the proximity between these DERs and the load, they can also offer new services to the grid in addition to ecological benefits. Thus, a win-win approach can be defined. In this perspective, one of the advanced concepts consists of an aggregation of these small resources (combined if necessary with certain loads) in a virtual production unit.

Challenges

A technical architecture and commercial framework has been designed in the FENIX project for a 'Large Scale Virtual Power Plant' (LSVPP). The challenge is to facilitate direct access of DER to markets and, mass access to DER and demand from TSO/DSO. DER when integrated will provide the same flexibility and controllability as large conventional power plants and will become the solution for the future cost efficient, secure and sustainable EU electricity supply system.

To demonstrate this solution, selected network scenarios are being considered, starting with networks today, and increasing the penetration of DER/DSM. An economic evaluation of the future networks with and without FENIX will be performed (capital and Operation and Maintenance costs) advantageous in economic terms.

- Contracts, incentives, markets mechanisms are to be conceived, to support FENIX.
- Markets will not be *built*, but simulated when needed (FENIX access the markets).

Demonstrators will be a mix of real implementation and simulation.

Technical Approach

The project is organized in three phases:

- analysis of the DER contribution to the electrical system, evaluated in two future scenarios (Northern and Southern) with realistic DER penetration;
- development of a layered communication and control solution validated for a comprehensive set of network use cases, including normal and abnormal operation, as well as recommendations to adapt international power standards. It is envisioned as a threefold R&D effort:
  - the key component is the Large Scale Virtual Power Plant (LSVPP) which is an aggregation of DER taking into account the actual location of individual DERs in the network. LSVPPs will have flexibility and controllability to provide different services to energy and ancillary services markets;
  - the bottom level is the local solution at individual DER itself, responsible for managing the unit in connection with the LSVPP;
  - and finally the higher level, which consists of a new generation of EMS and DMS tools (to be developed) placed respectively at the TSO and the DSO, with the new ability to manage LSVPP capacities for network operation; and, the markets that will put a value on these capacities;
- validation through two large field deployments, one focused on domestic CHP aggregation, and the second aggregating large DER in LSVPPs (wind farms, industrial cogeneration), integrated with global network management and markets.

To achieve these multi-discipline objectives, the FENIX consortium incorporates: research centres and universities with high involvement in previous and current EU projects in this area (CRISP, DISPOWER, MICROGRIDS, EUDEEP); transmission and distribution utilities, which today hold the responsibility of the networks where DER are being integrated; equipment and ICT manufacturers, with large presence in the energy sector; DER owners, that bring to the project their business view; and finally organizations responsible for regulation, standardization, etc., that will be managed in the project through a Stakeholders Advisory Group which will be needed for the future effective widespread exploitation of the project results.

Expected Impact

The objective of FENIX is to boost DER (Distributed Energy Resources) by maximizing their contribution to the electric power system, through aggregation into Large Scale Virtual Power Plants (LSVPP) and decentralized management. The main expected outputs are:

- innovative solutions to enhance DER capabilities to support network operation;
- intelligent DER interfaces for commercial and grid integration;
- practical solutions for commercial and grid aggregation via LSVPP;
- novel network services and new DMS and EMS applications to include DER in system operation;
- new commercial and regulatory solutions to support LSVPP;
- quantified benefits of LSVPP;
- Southern and Northern demonstrators.

Overall view of the agents involved: DER (solar, wind, CHP...), network operators and markets, using more efficient control to maximize the value of DER

Project Information

Programme
Sustainable Energy Systems

Contract number
518272

Instrument
Integrated Project

Starting date
01/10/2005

Duration
48 months

Total cost
€ 14 760 830

EC funding
€ 7 799 986

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Fundación Labein - ES
IDEA - FR
ILEX - UK
Imperial College of Science, Technology and Medicine - UK
ISET - DE
Korona - SI
National Grid Transco - UK
Red Eléctrica de España - ES
ScalAgent - FR
Siemens PSE - AT
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W2M Gamesa - ES
ZIV - ES

Website
www.fenix-project.org

MORE MICROGRIDS

Advanced Architectures and Control Concepts for More Microgrids

Overview

Microgrids comprise Low Voltage distribution systems with distributed energy sources, storage devices and controllable loads, operated connected to the main power network or islanded, in a controlled, coordinated way.
The operation of Microgrids offers distinct advantages to customers and utilities, for example, improved energy efficiency, minimisation of overall energy consumption, reduced environmental impact, improvement of reliability and resilience, network operational benefits and more cost efficient electricity infrastructure replacement. Research within the earlier FP5 Project MICROGRIDS focused on the operation of a single Microgrid.
The aim of the project is to increase the penetration of microgeneration in electrical networks through the exploitation and extension of the Microgrids concept, involving the investigation of alternative microgenerator control strategies and alternative network designs, the development of new tools for Multi-Microgrids management operation (involving Distribution Management System architectures and new software adaptation) and the standardisation of technical and commercial protocols. The Microgrids concept plays a key role throughout these developments.

Main Objectives

- Investigation of new micro source, storage and load controllers to provide efficient operation of Microgrids.
- Development of alternative control strategies (centralised versus decentralised).
- Alternative Network designs.
- Technical and commercial integration of Multi-Microgrids.
- Field trials of alternative control and management strategies.
- Standardisation of technical and commercial protocols and hardware.
- Impact on power system operation.
- Impact on the development of electricity network infrastructures.

Challenges

- Quantification of the benefits Microgrids provide to power system operation and planning and, incorporation into an appropriate commercial and regulatory framework so that a level playing field for all energy technologies can be established.
- Coordinated control of a large number of distributed sources with potentially conflicting requirements and limited communication with the adoption of distributed intelligence techniques.
- Design of Micro-source Controllers enhanced with frequency and voltage control capabilities to face the specific Microgrids operating conditions, and possessing ride-through capabilities, especially in the islanded mode of operation.
- Design of smart Storage and Load Controllers able to face the stringent requirements posed by the islanded operation and especially during transition from interconnected to islanded mode.

Technical Approach

- WP1 Design of micro source and load controllers for efficient integration
- WP2 Development of Alternative Control Strategies (hierarchical vs. distributed)
- WP3 Alternative Microgrids Designs
- WP4 Technical and Commercial Integration of Multi-Microgrids
- WP5 Standardization of Technical and Commercial Protocols and Hardware
- WP6 Field trials on actual Microgrids
- WP7 Evaluation of the system performance on power system operation
- WP8 Impact on the Development of Electricity Infrastructures (expansion Planning)

Expected Impact

- Savings of Greenhouse Gases (GHG) emissions and mitigation of climate change.
- Exploiting the potential of new ICTs in energy RTD including e-science issues.
- Socio-economic research related to energy technologies and their impact.
- Reduced investment in reinforcement and replacement of generation transmission and distribution infrastructure.
- Reduced losses in transmission and distribution networks.
- Improvement of service quality and reliability.
- Environmental benefits.
- Contribution to the employment.

Project Information

Programme
Sustainable Energy Systems

Contract number
019864

Instrument
Specific Targeted Research Project

Starting date
01/01/2006

Duration
48 months

Total cost
€ 7 851 796

EC funding
€ 4 503 796

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SIEMENS AG - DE
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University of Manchester - UK
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Website
http://microgrids.power.ece.ntua.gr

NIGHT WIND

Grid Architecture for Wind Power Production with Energy Storage through Load Shifting in Refrigerated Warehouses

Overview

Night Wind project will demonstrate the storage of electrical energy, produced by wind turbines, in refrigerated warehouses. The storage considered is day/night storage, where the wind energy produced at night is stored and then released during the daytime when the demand for electricity is high, and thus the value of the energy greater than it was at the moment of production. The project will address economic, legal and technical issues.

Objectives

Night Wind addresses the following strategic objectives:

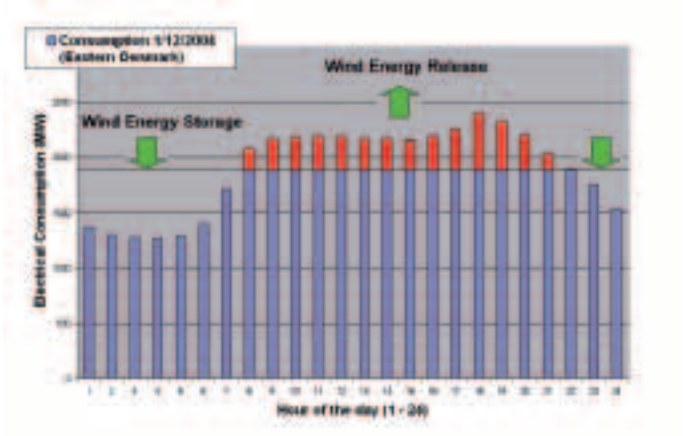
- integrating renewable energy resources into the European energy service network by providing new facilities for energy storage;
- increasing the economic value of wind energy by providing means to deliver the energy at peak demand hours;
- increasing the competitiveness of SME Cold Storage facilities by providing an 'energy storage' service to the European energy service network;
- the overall aim is that the project will offer a solution to integrate wind energy with energy storage in the European electrical grid, encouraging further growth in the use of wind energy worldwide and contributing to the Kyoto targets.

Challenges

The integration of wind power into national or EU energy supply systems is becoming more problematic due to increases in installed capacity and production, and, more importantly, the mismatch between energy supply and demand. Wind energy is produced at rather random times, whereas the energy use pattern shows distinct demand peaks during daytime and office hours, and low levels during the night.

The random production of wind energy cannot be easily accommodated on the grid by switching on and off conventional energy suppliers, like coal fired power plants, which would lead to an increase of CO_2 emissions, rather than the desired reduction of CO_2 emissions.

In order to accommodate the random production of wind energy in the grid, it would be most convenient if alternative (renewable and conventional) electricity producers could balance out the difference between production of wind energy and electricity demand. The Night Wind project aims to store wind energy produced at night in refrigerated warehouses, and to release this energy during daytime peak hours.



Optimum storage / release of wind energy in line with consumption pattern

Technical Approach

The 'Night Wind' concept makes use of existing technology, extended with novel control strategies. The new control strategies are needed to set the temperature level in refrigerated warehouses to a level that is derived from the actual balance between wind energy production and actual electricity demand. This is the case for 'island operation' with delivery of surplus energy to the grid, and also for the case of Distributed Energy Resources (DER), where windmills are physically located elsewhere than the (existing) cold stores, but controlled in an interdependent way to support the European energy service network. The design of control strategies, with the help of powerful simulation tools, will be the main task in the Night Wind project.

Project Structure

The research stage of the project includes the following topics:

- potential, economic & trade aspects of Wind Power DER + Cold Store DSM;
- design and modelling of infrastructures for island operation of Wind Energy + Cold Store DSM;
- control concepts and algorithms for Wind Energy + Cold Store DSM grid integration;
- quality preservation of frozen products during minor temperature fluctuations;
- legal issues;
- demonstration & introduction outline plan.

Expected Impact

The Night Wind Project intends to bring an idea into demonstration. It starts with a kick off meeting, followed by a phase in which literature will be surveyed and a technical specification will be set up. The benefits of the idea need to be detailed, both on a macroscopic scale from the European viewpoint of integrating RES with the energy network, and on a smaller scale to the energy distributors, warehouse owners and the end users. It is furthermore necessary to address a number of basic research topics – such as the effect of temperature fluctuations on the quality of stored refrigerated and frozen products – before the idea can be demonstrated with minimal risks.

The demonstration phase of the project should mark the start of a larger scale implementation. Therefore, the project will produce an implementation outline plan, which will be based on the preliminary experiences gained in the demonstration phase, and will include input from representatives within the sectors directly involved in the implementation, namely, the refrigerated warehouse sector and the energy distribution sector.

Project Information

Programme
Sustainable Energy Systems

Contract number
020045

Instrument
Specific Targeted Research Project

Starting date
01/07/2006

Duration
24 months

Total cost
€ 1 347 400

EC funding
€ 717 600

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RELIANCE

Coordination Perspectives of the European Transmission Network Research Activities to Optimise the Reliability of Power Supply, Using a Systemic Approach, Involving Growing Distributed Generation and Renewable Energy Markets

Overview

In line with the objectives of the EC Green Paper 'A European Strategy for Sustainable, Competitive and Secure Energy', COM(2006)105 8.3.2006, the RELIANCE project focuses on the ability of the electricity transmission system to meet three goals of crucial importance to European economic and social development: sustainability, competitiveness and security of supply. The key success factors to meeting these goals are: the creation of knowledge and innovative solutions to face electricity transmission challenges and the establishment of a regulatory environment that supports retention of experts and R&D.

The RELIANCE objectives are:

- **to remove most of the barriers which prevent today to perform joint RTD tasks of European added value;**
- **to design a vision for a European Transmission Network by 2030;**
- **to pinpoint the knowledge gaps that need to be filled to make that vision a reality;**
- **to propose configurations for a European Power System Research Organization together with its funding mechanisms.**

Challenges

The liberalization of power markets and the ongoing implementation of the European Electricity Market have led to power flows of a magnitude and direction that could not have been predicted at the time of the design of the European Transmission interconnected networks. The large scale capture of wind energy (as already implemented in several Member States) and its further development may expose interconnected transmission systems to major risks such as power imbalances and unpredicted flows. The expected growth of distributed generation, especially the deployment of renewable energy sources, and the expansion of the Internal Electricity Market, will further affect the effectiveness of the European Transmission Networks as well as the technical and economic performance of the whole electricity system. Recent blackouts have painfully demonstrated the strong interactions between the various national transmission systems and the need to approach the transmission activities as an integrated European Transmission Network rather than a set of interconnected national transmission networks. The necessary coordination and information exchange between the network operators extends beyond the operational level into the research and development work on transmission system design, operation and control.

Several side effects of the liberalization of the energy sector currently hamper the effectiveness and critical mass of the research and development on transmission systems. The unbundling of the incumbent monopolies has disbanded most of the in-house research teams into commercial or non-transmission system related work - the urgent priority of the transmission system operators today is to restructure their business models. At the same time, regulatory authorities are increasing their pressure for short term cost reductions and accountability.

Coordination at the European level already happens through CEER/ERGEG for regulation and within ETSO on technical and operational concerns. A European adequate structure should be created to expand and coordinate Research and Technological Development (RTD) efforts. The effort of all stakeholders coordinated by the TSOs is urgently needed and is expected to result in the creation of new knowledge leading to the implementation of new methods and the development of new facilities, hardware and software by the industry. The coordination of research efforts will also facilitate the attainment of the appropriate, critical size of expert groups, in a progressive manner, to address the issues that are relevant both at Member States and EU levels.

Technical Approach

The Consortium members have adopted the following approach:

- identify the challenges faced by the European transmission system up to 2030;
- identify and prioritize the research needs that require collaboration between European TSOs and other stakeholders;
- evaluate the potential impacts of the innovative solutions on all the electricity system stakeholders;
- design collectively a research roadmap and assess its implementation risks;
- quantify the research efforts that have a demonstrable European impact;
- propose an appropriate framework leading to an independent permanent European research organization for transmission networks;
- design funding schemes based on private-public partnerships;
- disseminate the project outputs through a European conference to be held around mid 2007;
- keep including other stakeholders in this process (TSOs, public authorities, users of the electrical system, manufacturers and other RTD providers).

Expected Impact

The RELIANCE project proposes the following strategic orientations in support of a European Transmission Network:

- optimize the reliability of electricity supply;
- increase the integration of the electricity market;
- support the massive penetration of RES and DER;
- improve the system robustness and resilience;
- achieve a sustainable grid development.

Progress to Date

The first main set of results is a portfolio of 130 RTD projects which have been clustered into a framework roadmap composed by nine key research areas. On the basis of the ranking criteria developed to measure the contribution of the RTD projects to the European strategic development orientations, a set of 80 critical projects are proposed for implementation over the next 10-20 years. They represent a funding requirement 0.5-1% of the TSOs estimated yearly turnover of 15 000 MEuros.

The second main set of results is a proposed management structure for the organization and a funding mechanism based on the flexibility, transparency and longevity principles and on the eligibility of the costs of the integration projects that represent the mission-critical core of the targeted Organization.

The second year of the project will be dedicated to the dissemination of the results towards the various transmission system stakeholders. A final conference will take place in Slovenia in September 2007.

Project Information

Programme
Sustainable Energy Systems

Contract number
020088

Instrument
Coordination Action

Starting date
01/10/2005

Duration
24 months

Total cost
€ 2 627 791

EC funding
€ 2 191 264

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ELES Elektro-Slovenia - SI
Elia System Operator - BE
Energinet - DK
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Red Eléctrica de España - ES
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Statnett - NO
Technofi - FR
Tennet – NL
TERNA - IT
University of Manchester - UK

Website
http://www.ca-reliance.org

SLIM FORMER

Multi-functional Self-limiting Superconducting Transformer

Overview

The SLIM FORMER project will develop and verify an innovative device to enable wide-spread introduction of HTS cable systems. The device integrates a HTS cable termination with a hybrid transformer, a fault current limiter and robust refrigeration.

The prime goal of SLIM FORMER is to develop a system design and component fabrication procedures to a point where a 100 kVA pilot plant can be constructed and critically assessed.

Challenges

The project covers HTS conductor winding and manufacturing technologies, design of the HTS device, cryogenic systems and testing of a pilot plant.

Technical Approach

The SLIM FORMER project brings together a consortium of six partners from four EU member states, each of which has a key expertise associated with the development, testing and exploitation of the SLIM FORMER device.

Working as a team, via parallel and interlaced Work packages, the partners are producing results that could not be otherwise achieved by the individual members working in isolation.

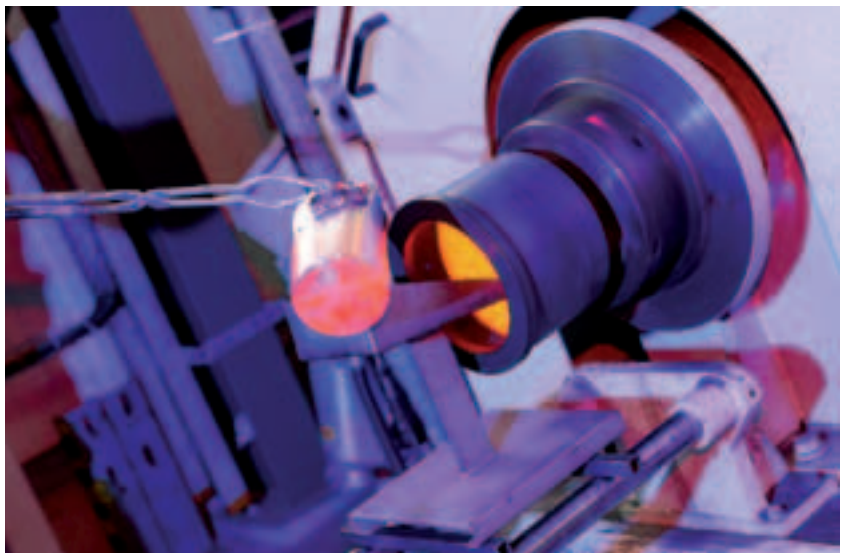
The first half of the project focuses on:

- researching critical features of the HTS design;
- developing preliminary system designs;
- evaluating methods for producing high performance HTS components.

The second half of the project includes:

- construction of pilot plant components (HTS, cryo, electrical and mechanical);
- assembly of the pilot plant;
- testing and critical analysis of the pilot plant.

All of the elements supporting a technological and economic breakthrough are present in the project consortium which is balanced to achieve a push of the underlying technology and pull through, such that it will significantly benefit the individual partners and the EU, in general.



Expected Impact

HTS cables are considered to be economically viable for immediate use in applications where bottlenecks exist, e.g. as high capacity bus lines for power plants and for retrofits within urban areas, thus providing up to three times higher power densities than conventional cables. However, the absence of affordable cable termination, fault current limitation and transformer technology prevents their implementation. SLIM FORMER integrates these functions into one affordable device thus allowing the establishment of HTS cable markets and providing increased transmission capacity and reduced transmission losses.

Progress to Date

Information on project progress can be obtained by visiting the project website.

Project Information

Programme
Sustainable Energy Systems

Contract number
518310

Instrument
Specific Targeted Research Project

Starting date
01/05/2006

Duration
36 months

Total cost
€ 2 615 512

EC funding
€ 1 500 000

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Budapest University of Technology and Economics - HU
European High Temperature Superconductors - DE
Ganz Transelektro Electric - HU
Nexans SuperConductors - DE

Website
http://www.slimformer.info/

SOLID-DER

Coordination Action to Consolidate RTD Activities for Large-scale Integration of DER into the European Electricity Market

Overview

The SOLID-DER project is specifically addressing the drivers and barriers towards the integration of Distributed Energy Resources (DER) in the electricity infrastructure of the new Member States and Candidate Countries of Central and Eastern Europe. DER, including both renewable electricity production (RES-E) as well as combined heat and power (CHP) has already been available in most of these countries in the form of CHP, mainly connected to district heating systems. Small to medium-scale renewable energy supply is, however, a relative newcomer to the electricity grids in the new Member States. These, often intermittent, energy sources have not yet reached such levels that it influences the electricity system in both technical (load balancing and supply) and economic (costs of network upgrades) terms.

Due to a number of recent developments, the integration of DER into the electricity infrastructure of these countries will become an important issue in the coming years for these countries also:

- the adoption of targets for renewable electricity production in the framework of the EU Renewables Directive (2001/77/EC) has led to the introduction of policy support for renewable electricity production. This will mainly concern small-scale dispersed power generation units that can potentially influence the management of the grid. Recent developments in a number of countries, e.g. Poland, Hungary, show that small-scale renewable energy production is at the brink of rapid increase;
- during the next decades the electricity generation capacity technology mix in the new MS will have to undergo a tremendous modernisation. Reasons are the phase-out of several nuclear power plants and the need to replace fossil fuel based power plants reaching the end of their lifetime in the coming years. Therefore it is of the greatest importance to make the decision makers and business community in the EU but particularly in the business community of the new Member States aware of the benefits and scope for DER as a better investment option for replacing today's non-sustainable electricity supply;
- the liberalisation of the electricity market and upcoming network regulation has led to easier access of DER to electricity markets. Nevertheless, the liberalisation process has also led to other developments, such as increasing market power of large power producers that may inhibit the increase of DER in the short- and mid-term future.

Challenges

SOLID-DER Coordination Action aims to unite RTD activities within the EU-25 countries aiming at large-scale integration of DER into the European electricity supply system. Thereby the project will:

- assess the critical developments, innovations and findings in EU RTD on large-scale integration of Distributed Energy Resources (DER) in the EU-25+[1];
- identify and assess costs and benefits of DER supply solutions, providing recommendations on applicable concepts for integrating increasing shares of DER;
- raise the awareness of DER benefits within the EU-25+ and organizing dissemination and transfer of knowledge to the new Member States.

Technical Approach

SOLID-DER project includes two thematic work packages and one aimed at dissemination of project results:

WP1

Economic, policy and regulatory constraints for DER integration
This work package includes tasks for detailed analysis of regulation, legislation and policy support for the integration of DER. It also reviews the costs and benefits of different DER options and applications. Finally, this WP will include recommendations for solutions and changes in policy and regulation to increased DER integration.

[1] By EU25+ we mean the 25 EU Member States and the Candidate Countries.

WP2 **Technical and system constraints for DER integration** This work package includes tasks for detailed analysis of DER and network technologies enabling new ways of improved DER connection. It aims at monitoring and assessment of innovations and latest findings facilitating large-scale DER integration in the next decades.

WP3 **Dissemination of project results, capacity building and awareness raising** This WP is aimed at setting up continuing informative dissemination tools expanding the dialogue with major European electricity stakeholders, especially those in the new Member States regarding DER aspects. Important tools for dissemination are a continuously updated project website used for dissemination of reports, newsletters and different articles. Most important tool is the organisation of national stakeholder seminars, organised in the New Member States (including the states acceding to the EU in 2007), as well as two International Conferences organised in Sofia in 2007 and in Warsaw in 2008.

Expected Impact

SOLID-DER has the aspiration to contribute to a larger penetration of DER in electricity supply and at the same time ensuring equal or even improved levels of reliability of network operation and power supply. Other expected outcomes are:

- enhancement of cooperation and support in the EU-25+ on DER integration among all EU-DER integration projects and within the research community;
- improving the dialogue and involvement of all stakeholders in both the 'old' and 'new' EU Member States;
- contribute to harmonisation of efficient system solutions, interconnection issues and grid regulation;
- overcome major barriers to a larger contribution of DER within the EU-25+ energy market.

Progress to Date

- A survey of market presence of DER (RES-E and CHP) in each of the new Member States, an overview of support mechanisms, a description of the national electricity market and of the regulatory framework towards DER operators and network operators. Furthermore, there will also work out a number of DER case studies to analyse the costs and benefits of DER. An example of a first outcome – Market presence of DER in the new Member States.
- Detailed analysis on interconnection requirements (such as national standards and guidelines for network operators). This research now continues with an overview of the state of the art in the field of Active Network management, Demand Response options and technical systems and solutions for DER market integration.

Project Information

Programme
Sustainable Energy Systems

Contract number
019938

Instrument
Coordination Action

Starting date
01/11/2005

Duration
36 months

Total cost
€ 1 875 259

EC funding
€ 1 499 478

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Elsam - DK
Enviros - CZ
Fundación Labein - ES
Iberdrola - ES
ISET - DE
KAPE - PL
Lithuanian Energy Institute - LT
MAKK - HU
Risø National Laboratory - DK
Siemens AG - DE
Universidad Pontificia Comillas - ES
University of Ljubljana - SI
Verbund - AT

Website
http://www.solid-der.org/

SOS-PVI

Security of Supply PhotoVoltaic Inverter: Combined UPS, Power Quality and Grid Support Function in a Photovoltaic Inverter for Weak Low Voltage Grids

Overview

The SOS-PVI project aims at developing an inverter, dedicated to the injection of photovoltaic energy into low voltage grids, with special features so that first, the impact on the grid of the very quick fluctuations of sun irradiation is minimised and even more, the PV system provides grid support on demand and secondly, the end user is protected against poor power quality and outages of the grid.

Challenges

The liberalisation of the electricity market, combined with international pressure to reduce CO_2 emissions, lead to new architectures of the future electricity networks with a large penetration of distributed energy resources, in particular from renewable sources.

But the current integration of distributed energy resources is performed in such a way that their intermittency impacts strongly on the grids, increasing concerns about power quality and the security of supply by the end users. Reciprocally, poor power quality from the grid impacts on the PV systems, reducing production, but moreover, it impacts on the end user, its production, services and comfort.

Therefore the project intends to:

- minimise the impact of PV systems on the grid operation and planning;
- ensure security and quality of electricity supply to houses and buildings with PV installations;
- increase performance ratio of PV systems;
- increase penetration of PV in the networks.

Technical Approach

In the project 6 partners join efforts for developing a Security of Supply PV Inverter of which, at the end of the project, 5 prototypes will have proved in field tests to provide both power quality and UPS function to the house grid and to support the external grid on demand. The energy supply will be ensured by storage systems for which the lithium-ion technology and a hybrid of lead-acid battery and supercapacitors will be compared in terms of performance and cost of ownership.

Expected Impact

The expected results of the project are:

- the development of the **SoS-PV inverter validated on 5 prototypes**, and available for demonstration systems;
- to validate that the SoS-PV inverter is **less than 30% more expensive than conventional PV inverters** (excepting storage components), has a **low environmental impact, high energy efficiency and maximises the PV production** in comparision to conventional PV inverters;
- to study the feasibility of **additional functionalities** e.g. for **integration in virtual power plants**;
- the identification of **barriers to the exploitation** of the full benefits of the SoS-PV inverter.

Progress to Date

A market study was performed with data on weak grids in Europe (load profiles, grid quality), the estimation of market potential for small scale distributed generation and grid stabilization systems in Europe, especially considering power and storage capacity provided. This also included the identification of possible impact and barriers for implementation of SOS-PV inverter, in particular regulation issues.

From the study of the national load profiles on the electricity network and of the irradiation curves, it was clear that to reach a high penetration of PV energy, it will be necessary to delay the injection to peak load periods. The next figure shows the profile of real consumption (data presented as % of simultaneity of the MV-LV transformer) as well as the simulation of the consumption with 10, 20 and 30% PV penetration and the average value of the daily consumption in the 3 scenarios. The load profile is representative of a mixed urban area with households and small businesses, during a winter day, in Spain.

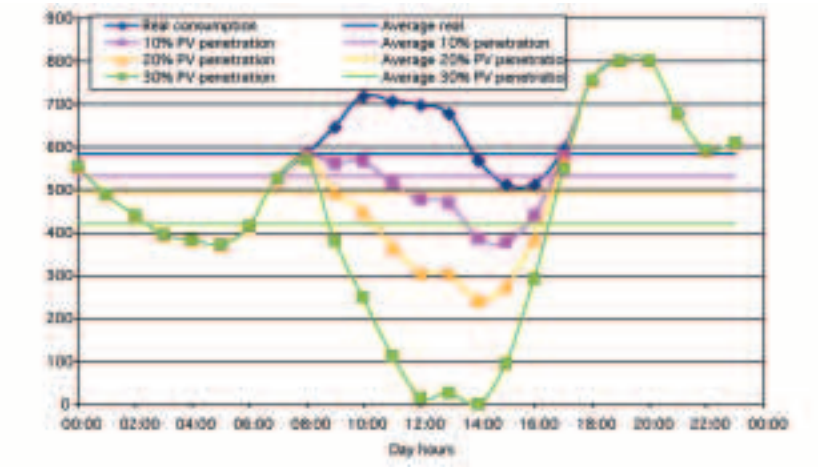
The main barriers to the full exploitation of the benefits by the PV owner were identified as:

- the possibility of injecting electricity to the network directly from a storage unit;
- retribution of the PV system owner via flexible feed-in tariff or an incentive from the utility to PV owners that install a SoS-PV system;
- the need for a sensor for the reactive power at the integration point.

The main barriers to the full exploitation of the benefits by the utility were identified as:

- standard for short-circuit should take into account the installed distributed generation (DG) when this DG can be controlled by the utility;
- the need for communication interfaces between the PV owner and the utility;
- in low quality grids, PV and especially a SoS-PV system has only a positive impact on the network stabilisation when injecting in the case of a low voltage. Therefore, the low voltage threshold should be decreased;
- the need for a deregulated market in order to be able to charge clients for higher power quality;
- the utility needs to be able to control the injection of the reactive power.

Storage system: the storage size was decided to be in the range of 15kWh with 4.5kWh emergency reserve. The first prototype of the lithium based storage system is in development and will have a design similar to the one in the following figure:



Project Information

Programme
Sustainable Energy Systems

Contract number
019883

Instrument
Specific Targeted Research Project

Starting date
01/10/2005

Duration
36 months

Total cost
€ 2 898 970

EC funding
€ 1 500 587

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Maxwell - CH
SAFT - FR
Skytron-Energy - DE
Trama TecnoAmbiental - ES

UNIFLEX-PM

Advanced Power Converters for Universal and Flexible Power Management in Future Electricity Networks

Overview

The goal of UNIFLEX-PM is to secure a clean, sustainable and economic energy supply for the EU through the development of intelligent, power-flow management systems. These will use Power Electronics based FACTS devices, which are being developed as part of UNIFLEX-PM, to transform electricity grids into a secure, stable, interactive and unified supply network.

UNIFLEX-PM will enable the introduction of the concepts needed for the 'Future European Electricity Grid' through:

- **delivering a key enabling technology for EC Priority Thematic Area 1.1.6.1 'Sustainable Energy Systems';**
- **development of Power Electronic converters capable of balancing diverse energy sources and integrating RES DG into both existing and future electricity supply systems;**
- **establishing a new and affordable, modular power conversion architecture for universal application in the Future European Electricity Network. This will arise from the combination of new semiconductor devices with research in power converter topology and control.**

Challenges

- To determine performance requirements, electrical specifications and control requirements for power electronic converters in the future European Electricity Network, across the spectrum of applications.
- To develop power conversion architectures based on a modular approach to deliver the required performance specifications required by end-users within the Future European Electricity Network.
- To develop optimised power conversion modules incorporating advanced magnetic and insulating materials and advanced and emerging semiconductor devices.
- To develop advanced control strategies for local converter control and for controlling interactions with the grid.
- To determine the expected reliability of individual converter modules and to determine the expected reliability of various configurations of modular converters, including effects of redundancy.
- To determine the stochastic performances of modular converters at the system hierarchical level, and the economic impacts based on component/manufacturing cost and maintenance cost.
- To validate the approach through an experimental converter having a power rating of circa 500kVA and demonstrating advanced functionality and control capability.

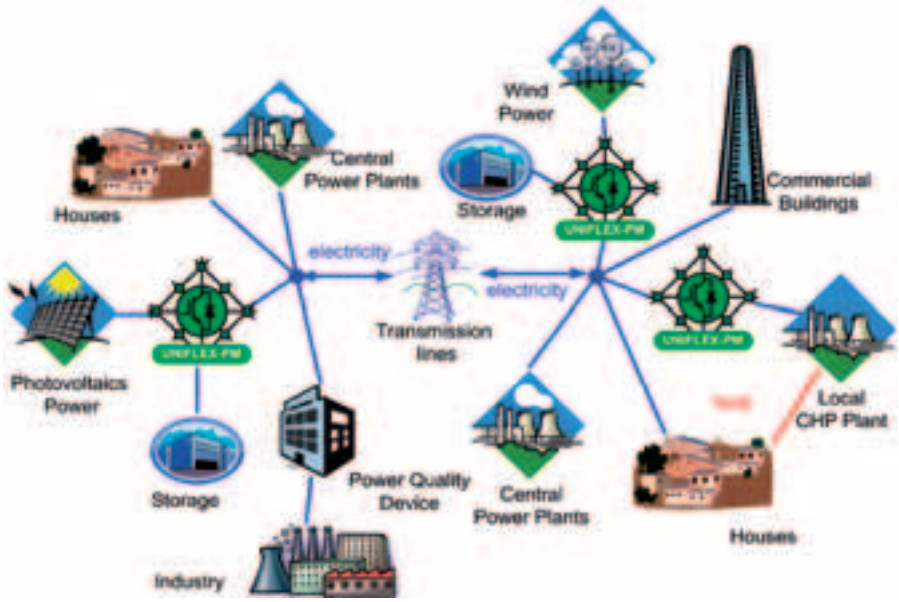
Technical Approach

- WP1 Project Management, Exploitation and Dissemination
- WP2 Characterisation of Applications
- WP3 Converter Structures
- WP4 Isolation Modules
- WP5 Control and Grid Interaction
- WP6 Reliability and Economics
- WP7 Hardware Evaluation

The approach will be validated through an experimental converter having a power rating of about 500kVA and demonstrating advanced functionality and control capability.

Expected Impact

UNIFLEX-PM will enable a transformation of electricity grids into an interactive and unified supply network.



Project Information

Programme
Sustainable Energy Systems

Contract number
019794

Instrument
Specific Targeted Research Project

Starting date
01/03/2006

Duration
36 months

Total cost
€ 2 354 300

EC funding
€ 1 902 684

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Dynex Semiconductor Limited - UK
Ecole Polytechnique Fédérale de Lausanne - CH
European Power Electronics Association - BE
Università degli Studi di Genova - IT
University of Nottingham - UK

Website
www.eee.nott.ac.uk/uniflex/index.html

SMARTGRIDS-TPS

Secretariat of the Technology Platform for the Electricity Networks of the Future

Overview

The objective of this project is to establish a secretariat to support the Technology Platform for the Electricity Networks of the Future - SMARTGRIDS - in terms of efficient, impartial and transparent management of platform activities, projects, results and communication strategy and contribute to achieving the statutory platform objectives and ensure their highest quality.

Objectives

The specific objectives of the secretariat are:

- to facilitate and coordinate the participation of the Community and Member State stakeholders at public and private level who are involved in the future electricity networks, in the formulation and implementation of an integrated research strategy for the Electricity Networks of the Future in Europe;
- to promote and drive the definition and design of new projects and activities directed towards achieving and furthering the specific objectives of the platform;
- to obtain high-quality results in terms of activities executed by the platform through the regular progress and quality reviews of both platform activities deliverables and results;
- to disseminate these results to the energy sector in general and particularly to involved actors.

Challenges

- To provide support to the Advisory Council, Executive Group and Member States Mirror Group: organise meetings, preparation of agendas, maintaining electronic diaries, review of executed tasks, working plan for the following months, minutes of the meeting, reception, editing and distribution of documents.
- Generation of quality results - implementing monitoring activities and quality control reviews of deliverables.
- To organise two General Assemblies of the platform in two annual technology platform conferences, where all the relevant actors from the electricity network sector will be invited, where the platform results and lighthouse projects will be presented.
- To create a continuous on-line assistance and information service for the general public to provide information and answer queries about the platform structure, procedural guidelines, activities, participation models, generated information and correspondingly, the access to this information.
- To prepare and distribute a periodic electronic newsletter with the main news on the platform developments.
- Info tool on the web for finding projects or new project proposals related to the European Electricity Grid, and also for posting and incorporating new project ideas.

Technical Approach

The three main pillars upon which the platform secretariat is to be maintained are the following:

- monitoring and organisational support to the platform groups;
- administration and quality of the reports and deliverables;
- information and communication functions.

The six work packages in which the project is structured are built on these three pillars and they are reflected in the following organisational diagram.

Expected Impact

The secretariat is to ensure and increase the impact and visibility of the European Technology Platform Electricity Networks of the Future in terms of:

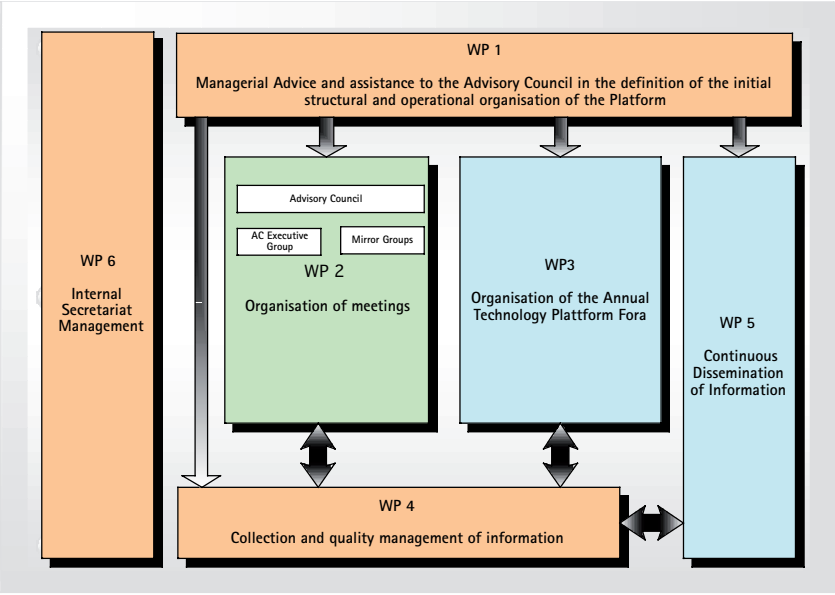
- generation of a research strategy for the European electricity networks community, integrating the points of view and opinions of all the actors and all current legislative situations;
- support to policy decisions, at European, national and regional levels;
- dissemination of results to all actors throughout Europe.

Progress to Date

The secretariat has been running so far as planned providing support to the Advisory Council and Mirror Group of the Platform. The official website was launched in September 2006. Works are being done to improve the capabilities of this site. The Strategic Research Agenda has been completed and published in the website. Organisation of next General Assembly has already started.

Highlights of Results

Main achievements are the creation of the website and the finalisation and publication of the Strategic Research Agenda in which the Secretariat has provided support.



Project Information

Programme
Sustainable Energy Systems

Contract number
038874

Instrument
Specific Support Action

Starting date
01/07/2006

Duration
30 months

Total cost
€ 628 047

EC funding
€ 492 047

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Partners
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Website
http://www.smartgrids.eu

EPS 2003 RES

Electric Power Supply Strategy in the 21st Century
The Renewable Energy Sources Option

Overview

The conference is designed to assist European countries, particularly the accession countries of Central and Eastern Europe, in developing their long-term electric power strategy. The essential part of its programme will focus on assessing the potential role of renewable energy sources (RES) and on the exchange of experiences between European countries in this area. The ongoing transition to a market economy in the accession countries and new developments influencing both the level of demand for electricity as well as the selection of energy sources to satisfy this demand will have to be recognized. The subject of the conference justifies its organization in Poland since like a number of countries in the region it is joining the European Union.

Objectives

The purpose of the conference is: to exchange creative information between the countries concerned, particularly the accession countries; to familiarize them with the relevant attitude of the EU (Green Paper "Towards a European strategy for the security of energy supply", Brussels, November 2000); and, to review the appropriate methods of comparing electric power options to achieve optimal power strategy. These issues under consideration will include technological progress, economic, ecological and sustainability aspects. RES will be closely reviewed and recommendations formulated for their potential use, particularly in the accession countries.

Challenges

- Technical and economic availability of the RES.
- National economic and social policy objectives in the area of sustainable development and the related legal regulations concerning the RES sector.
- Availability of modern technologies and financial means for research and implementation.
- Ways to solve the problem of integrating RES in the electric power system.
- Achieving competitiveness in the energy market.

The development of renewable energy sources should focus on the creation of market mechanisms to reduce the costs of producing energy with their use, in accordance with Directive No 2001/77/EC of 27 September 2001.

Technical Approach

All the thematic content of the conference was divided by the Programme Committee into 6 sessions, as follows:

- strategic issues;
- projections of technical progress in the electrical energy generation in the coal, gas and nuclear fuelled power plants;
- economic aspects of electricity generation and methods of comparing different generation options;
- liberalization and regulation of electric power system;
- projections of technical progress in the transmission of electricity and of the efficiency of its use;
- renewable energy supplied power plants.

The 6th session was specifically devoted entirely to the RES, discussed also in the other sessions. The Programme Committee and the Consortium of the conference (SEP) assessed that the RES accounted for about 40% of the entire thematic area.

Of the 29 papers presented during the conference (invited papers), 5 papers were devoted exclusively to RES while the remaining paper were related to RES. In addition two seminars on RES accompanied the conference:

- environment protection and RES – new challenges for the municipalities, 26 May 2004, Warsaw;
- renewable Energy Sources, ENEX, New Energy, 23 – 25 March 2004, Kielce.

Progress to Date

In the countries represented through this project the development of wind power plants has increased from 70 MW in 2003 to 120 MW in 2006. A further gain of approximately 1 GW is expected during the future 20 years. Considerable progress was also made in using biomass for co-combustion as well as combustion.

Highlights of Results

Optimization in the selection of electrical power engineering options taking into consideration RES, particularly biomass, water and wind.

The conference has highlighted the role that RES can play in the long-term energy future of the accession countries of Central and Eastern Europe. The conference has presented RES as an economic option for consideration alongside e.g. coal and nuclear energy.

Project Information

Programme
Sustainable Energy Systems

Contract number
500865

Instrument
Specific Support Actions

Starting date
01/08/2003

Duration
10 months

Total cost
€ 47 000

EC funding
€ 40 000

Coordinator
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CEERES

Large-scale Integration of Renewable Electricity and Co-generation into Energy Supplies in the EU New Member States

Overview

In 2004 eight countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia) from Central Europe (CE) joined the EU and thus became accountable for meeting the obligations set out under EU law. These include, amongst others, the requirements of Directive 2001/77/EC on the promotion of renewable electricity (RES-E Directive) and Directive 2004/8/EC on the promotion of high efficient cogeneration (CHP Directive).
The Accession Treaty specified the targets for all New Member States (NMS) regarding the share of the electricity which should come from renewables by 2010 (and thus complements the RES-E Directive). To achieve the EU goal presented in the RES-E Directive and to meet the requirements of the CHP Directive, the CE-NMS need to take action to develop renewables and the large-scale integration of RES-E and RES co-generation into energy supplies. This in itself presents a number of challenges given the transitional nature of their economies, in particular, in relation to the economic, environmental, technological, social and institutional aspects. Furthermore the CE-NMS face several hindrances similar to those faced by their EU-15 counterparts.

Main Objectives

- To facilitate the integration of large-scale electricity production from renewable energy sources (RES-E) and co-generation into energy supplies in the New Member States from Central Europe (NMS-CE), through:
  - the identification of barriers and drawbacks to the-large scale integration of renewable energies in Central European Countries;
  - the identification of areas for further research.
- To increase the participation of energy market participants (energy companies, authorities and researchers) from the NMS-CE in the future Framework Programme, by:
  - building consortia for further projects in EU Framework programmes;
  - providing feedback to the EU and the National Contact Points (NCP) on potential partners for future consortia and interesting research questions.

Challenges

The project faced a number of problems in the CEE New EU Member States:

- insufficient: development of renewables, large-scale integration of renewable energy sources and RES co-generation into energy supplies in the Central European EU Countries;
- inadequate participation of the Central European energy stakeholders in the EU Framework Programmes.

Technical Approach

The WPs covered the following activities:

- analytical activities including:
  - identification of the status quo of RES electricity production (including electricity from RES CHP) in participating countries;
  - identification of existing barriers to the RES-E development in the CE-NMS.
- activities to encourage information exchange including:
  - national workshops and seminars;
  - final international project conference.
- 'harvesting' activities, to integrate all project results and generate recommendations for future RES related research areas aimed at ensuring the efficient and effective development of RES in the CE-NMS.

Expected Impact

The long-term aims of the project are to contribute to sustainable energy consumption in the CEE region. The short-term aims are to encourage energy market stakeholders to participate in the Framework Programmes.

Progress to Date

The CEERES project identified numerous barriers to the development of RES-E and CHP in the CEE NM countries. These barriers were found to limit the effective implementation of RES. They included:

- institutional and legislative barriers;
- economic and Financial Barriers divided into:
  - contextual barriers, and;
  - local barriers.
- technology related barriers against large-scale integration of RES-E and CHP.

The project also identified best practices and lessons learned from the EU-15 and from the CEE NMS, with the aim of demonstrating and disseminating good practise.

In addition the project partners highlighted research topics to be addressed in future EU research framework programmes in order to overcome barriers to RES-E development. These included:

- research related to systemic issues;
- research related to technological aspects of large-scale integration of RES:
  - utilization of the potential of the renewable energy sources;
  - energy transformation technologies;
  - integration with electricity distribution system.
- other important topics regarding RES-e development in the region.

The project findings were widely disseminated among stakeholders of the RES-E production sector.

Highlights of Results

The project resulted in:

- identification of crucial economic, institutional and technological barriers to RES-E development in the CE-NMS;
- active exchange of ideas/information among the RES-E stakeholders in participating countries and internationally;
- development of information exchange media (website and database) to remain active post-project completion;
- a new, successful project initiative established by the CEERES team;
- numerous publications in national magazines and professional journals;
- recommendations to the European Commission for specific research into RES development in the region, to be conducted by future European research programmes.

Project Information

Programme
Sustainable Energy Systems

Contract number
510325

Instrument
Specific Support Action

Starting date
15/04/2005

Duration
15 months

Total cost
€ 308 819

EC funding
€ 229 991

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MICROCHEAP

The Integration of Micro-CHP and Renewable Energy Systems

Overview

Renewable micro-CHP systems are a combination of micro-CHP technology (which, at present, are mainly powered by non-renewable fossil fuels - e.g. natural gas) and renewable energy technology, such as biomass digestion systems or solar concentrators. The integration of renewable energy sources (RES) with micro-CHP allows for the development of sustainable energy systems with the potential for high market penetration; a cost-effective and reliable heat and electricity supply; and a highly beneficial environmental and economic impacts on a pan-European scale. The MicroCHeaP project intends to bring together industrial specialists and research experts to focus entirely on renewable micro-CHP technology. It will co-ordinate and steer research in this field and highlight the most promising technologies with the highest potential for market penetration in existing and future market conditions.

Objectives

Principal objectives are to:

- produce a comprehensive state of the art and market review;
- map the current research activities and centres of excellence, to help steer research;
- host expert group meetings to co-ordinate key areas of current research;
- produce a report recommending the future direction of European research;
- perform an analysis of potential links between micro-CHP and other RES;
- organise a technology transfer/training programme, to spread best practice;
- disseminate the project's results to stimulate commercialisation and further RTD.

MicroCheaP will stimulate further development in the field, focus research, minimise duplication of effort, and help to transfer cutting-edge technology from research institutions to industry. The global aim is to inspire the development of energy systems that can produce all the heat and electrical needs for a single dwelling. This will aid in the development of a sustainable energy infrastructure, reduce harmful environmental emissions, and allow natural resources to be used in a more economical and ecologically sound manner.

Challenges

The major challenges of the project are:

- to stimulate and facilitate technology transfer between cutting-edge researchers and industries in the renewable micro-CHP industry, with the view of optimising its efficiency, cost-effectiveness, and market size, and hence boost the development of a sustainable energy infrastructure;
- to evaluate technologies and research in the field of micro-CHP and renewable energy systems, with the aim of technological integration and the stimulation of research and development of new renewable micro-CHP technologies;
- to facilitate the Community's aims for the agrarian sector in favour of the use of biofuels and climate gas mitigations, especially in the light of enlargement;
- to disseminate the project's results directly to target clients, and also to a wider audience.

Expected Impact

The main achievements expected as a result of this project are:

- improved coordination of European research in the field of renewable micro-CHP;
- a state of the art review in the field of renewable micro-CHP, including a market analysis of the technologies reviewed in both present and predicted future market scenarios;
- a database mapping current research activities in renewable micro-CHP across Europe and beyond, enabling the identification of current centres of excellence;
- a report documenting the potential links between researched renewable energy systems and micro-CHP units, aimed at stimulating new research ideas throughout European industries and research centres. The report will include a technical and market analysis to aid in the steering and efficiency of research, and hence improve European industrial competitiveness;
- recommendations for suitable bioenergy and technical applications for the economically and socially crucial agrarian sector to facilitate favourable solutions for set-aside land, grant new profitable sources of income to farmers and the regional rural development.

The global innovative aim for the network will be the emergence of new renewable micro-CHP technologies among European industries, and the development of a sustainable energy infrastructure, leading to sustainable communities, and the reduction of environmentally damaging emissions during power generation.

Progress to Date

Literature and Patent Search: A literature and patent search was conducted at the start of the project. A range of renewable technologies and CHP systems were covered by the literature search and this formed the basis for the State of the Art Technology and Market Review, which was subsequently produced.

State of the Art and Market Review: A state of the art and market review was produced. This details the latest developments in the field of renewable micro-CHP and related subjects. It also presents an overview of the market conditions and trends in a number of European countries allowing market gaps and barriers to the implementation of renewable micro-CHP to be identified.

Coordination Seminars: The project holds annual coordination seminars to discuss the state of current research amongst the partners. All the research members present provide a brief overview of any projects with which they are currently involved, in order to make partners aware of other work being carried out in the field. The knowledge gained from this seminar has been valuable to partners and has allowed them to make inputs to other ongoing projects, which has hopefully helped to avoid the duplication of research efforts.

Expert Group Discussions: Three expert groups (Technologies, Integration and Fuels) have been set up. These meet at regular intervals with the aim of identifying gaps in current research, discussing and exchanging information and know-how on common themes of interest, and, hearing lectures from invited speakers.

Topical Seminars: The project has held two topical seminars. These were designed to raise awareness of new technologies and also to inform members of other partners' expertise. The titles of the two seminars were, 'Review of marketable, near-to-market and far-from-market RES-Micro-CHP' and 'Methodology of marketing RES-Micro-CHP'.

Database of Research Activities: A list of established industrial companies, university research groups, and public and private research organisations active in RTD relevant to renewable micro-CHP across the EU has been produced. The information has been compiled into an internet database which is accessible from the project website and includes the ability to rank the research groups and industrial companies based on the number of publications, patents and installed CHP units.

Technology Transfer Workshop: The first of two technology transfer workshops took place at ECN in Petten, Netherlands in April 2006. This event brought together participants from the MicroCHeaP project, as well as representatives from various industrial bodies, energy suppliers and DG TREN. The second technology transfer workshop is scheduled for March 2007.

Highlights of Results

- Online database of research activities containing over 300 organisations from across Europe, involved in renewable micro-CHP relevant RTD.
- State of the Art and Market review analysing the latest developments in the field of renewable micro-CHP.

Project Information

Programme
Sustainable Energy Systems

Contract number
503138

Instrument
Coordination Action

Starting date
01/10/2004

Duration
36 months

Total cost
€ 1 153 173

EC funding
€ 1 043 074

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Technology Codes - IE
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Website
www.microcheap.org

DIGENAS

Distributed Generation in the Associated States Research Priorities and Challenges on the Open Electricity Market

Overview

In the next few years distributed generation (DG) is expected to play an important role in the European electricity infrastructure and the common energy market. The technologies involved in DG can contribute to great savings in CO_2 emissions and energy consumption, enabling the EU to meet its Kyoto target for GHG emissions reduction and the 22% target for the share of electricity from RES in 2010. DG depends mainly on local market regulations and infrastructures but the rapid changes in the condition of the European electricity market provide both threats and opportunities in this field.

The main scope of DIGENAS project, which focuses in Romania and Bulgaria, is to strengthen the capacity of these two countries in the field of DG related research. The objectives of DIGENAS are to identify the success factors, barriers and research priorities for DG and RES integration in these countries and to analyse the policy implications for establishing the appropriate frameworks. The project also aims to promote and disseminate the DG concepts and, the outcomes of field research conducted by local scientific groups.

Challenges

The main challenge is to evaluate the technical issues, the socio-economic and policy aspects, and the market and end-user impacts related to DG research in Bulgaria and Romania, according to the country specific rules and policies and within the internal energy market. Other key issues addressed are the harmonisation of energy production standards at the national and international levels, and the opening of local power systems to competition to bring the benefits of small-scale power to the consumers.

The project will contribute to the emergence of new policy measures and legislation in Bulgaria and Romania, leading to an increase in the short to medium-term deployment of DG. In addition, the identified research priorities may lead to the opening of new research opportunities and the establishment of future integrated projects and joint actions related to DG and the large-scale integration of RES in these two Balkan countries.

Technical Approach

These targets will be met through the following activities:

- evaluation of the DG prospects in Bulgaria and Romania for definition of research priorities and challenges:
  - review of the actual status of DG in these countries; assessment of the opportunities and barriers in the context of the common European electricity market;
  - assessment of the existing potential for integrating DG and analysis of the short/medium-term socio-economic and institutional dynamics, according to European trends;
  - identification of the R&D priorities and quantifiable targets related to DG in both countries.
- enhancement of the research community capacity in Bulgaria and Romania in the field of DG by:
  - bringing together local scientists already working in research areas related to DG, by setting-up an on-line forum and through an international seminar;
  - providing information on the most recent developments in the field and opportunities for the of exchange ideas with experts from EU;
  - providing opportunities to collaborate in the preparation of complete action plans for the implementation of DG in their countries.
- promotion of the concepts and best practices of DG in the two countries.

Expected Impact

- Creation of new DG related research opportunities and of research priorities plans.
- Contributions to the economic and social uplift of remote communities by promoting innovative technology solutions, enhancing the security and diversity of energy systems, and creating new jobs.
- Initiation of future joint projects and actions related to distributed energy resources exploitation.
- Encourage a shift in investments from grids to efficient decentralised production without transmission and distribution losses.
- Increase the interest of local stakeholders, scientists and authorities in clean technologies for distributed energy production and storage.

- Contribution to the ERA's development by assessing the actual needs of the Associated and Candidate Countries in the field of DG related research.

Progress to Date

Within the first work package (WP) – "*Evaluation of the DG prospects in Bulgaria and Romania*", the activity has been focused to the review of the current status of DG, as well as to the assessment of the opportunities and barriers in Bulgaria and Romania. The existing potential of DG, and the short and medium-term socio-economic and institutional dynamics for the integration of DG according to European trends were analysed.

In the work package related to the "*Analysis and definition of the priorities and challenges for research on DG*", the key issues for DG research from the ERA perspective were reviewed. First, the existing research networks in the two countries were identified, and a questionnaire was distributed to institutes in the new EU Member States in order to obtain the status of DG and to identify fields of cooperation. Then, the R&D priorities and quantifiable targets related to DG and RES integration in Bulgaria and Romania were determined, together with the specific local priorities (regulatory, financing, promotional, etc).

To date activities under WP4 (*Dissemination of the DG concepts, best practices and lessons learned* in Bulgaria and Romania) have focused on setting-up the project's website. The site is available in English, Romanian and Bulgarian, and will be continually updated throughout the project's lifetime. It has been designed to include the latest developments on DG and RES integration in Europe, as well as all the available products of DIGENAS.

Highlights of Results

The evaluation studies on the integration of DG in Bulgaria and Romania have reviewed:

- the DG stakeholders
- the current DG policy
- the legislative and market environment
- the status of DG penetration

The main results for both countries were that DG has no significant contribution (less than 1% of the net electricity consumption). Legislation for assisting RES is in force, including financial support, but it is an unwieldy process. Market conditions for RES investments are still not very positive, but there are signals that the market is opening for wind, small hydro and efficient CHP plants.

A report on the dynamics and prospects for DG in Bulgaria and Romania was also prepared in WP1. The local studies reviewed:

- the DG potential
- the barriers to the development of DG
- the prospects and short and medium-term priorities and requirements for DG Development

The main findings were that the electricity potential from RES is important, but the target RES quotas for 2010 (33% including large hydro for Romania and 11% for Bulgaria) will be difficult to achieve without immediate efforts to stimulate the market through the provision of additional incentives.

Project Information

Programme
Sustainable Energy Systems

Contract number
513517

Instrument
Specific Support Action

Starting date
01/07/2005

Duration
24 months

Total cost
€ 245 000

EC funding
€ 217 680

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DESIRE

Dissemination Strategy on Electricity Balancing for Large-scale Integration of Renewable Energy

Overview

The European electricity market is facing upcoming problems. The proportion of renewable electricity in Europe is expected to rise, while local electricity systems are unable to absorb the excess capacity. Inter-connectors of electricity are blocked up by the need to transport excess supplies across the EU borders. At the same time, the competitiveness of the European electricity market is constrained. The DESIRE project aims to address these problems.

In line with the EU Directive 2003/54 of June 2003 and the Cogeneration Directive 52/2003, the project acknowledges the need for balancing various systems in the creation of a more competitive pan-European electricity market. Through case studies in Denmark, Germany, and the UK, the project demonstrates techniques of co-production of CHP (Combined Heat and Power) and wind power. These case studies are supplemented by studies in Spain, Poland, and Estonia. In this way, the project aims to promote the exchange of knowledge and experiences and the development of solutions at the European level.

Objectives

The main objective of DESIRE is to promote the integration of fluctuating renewable energy supplies into local and regional electricity systems by the use of CHP. In this project, the main focus is on wind power, but the same principles apply to other fluctuating renewable electricity sources. Various European countries are involved in the DESIRE project. In some countries, CHP is a well-known and used technology, while in others, CHP has not yet been integrated into the electricity supply. It is the aim of the project to draw on the experiences of the countries involved and to promote the integration of CHP and wind power in the European electricity supply as a whole. On the basis of the knowledge built and the experiences drawn, it will be possible to integrate balancing techniques on different scales in all European countries.

Technical Approach

The DESIRE project is organised into eight work packages (WPs). WP1 analyses the balancing problem of the European electricity system. WP2 proposes short-term and long-term solutions to these problems. WP3 analyses the barriers and opportunities for implementing the project solutions in the participating countries. WP4 develops the organisational set-ups, the optimising tools and the IT needed for demonstrating the project. WP5 demonstrates the project techniques at existing power plants in Denmark, Germany and the UK. WP6 evaluates the project results and presents recommendations. WP7 designs and operates the project web site and provides the demonstration of balancing techniques. WP8 is responsible for the dissemination of the project through the participation in conferences and the publication of results.

Expected Impact

Through the integration of fluctuating renewable supplies into local and regional electricity systems, the proportion of absorbable renewable electricity is expected to increase in Europe. The project will have an impact on the European electricity market as a whole and will contribute to achieving both national and European standards for deployment of renewable energy and CHP. Through the further development and implementation of these technologies in Europe, it will be possible to implement the EU Directives concerning the internal electricity market, the promotion of co-generation, and the promotion of electricity produced on renewable energy sources.

Progress to Date

During the first project period the theoretical and methodological basis for further implementation of the project has been created. Data from six regions have been collected, a database has been established, and reference calculations of electricity productions have been made for the years 2004 and 2020 of six regions in Europe. The software modelling and optimising tools EnergyPLAN and EnergyTRADE have been improved, which makes it possible to simulate the electricity production and feasibility of CHP plants in a very detailed way. A technical analysis of balancing problems and CHP plants has been conducted and electricity markets have been described. Detailed knowledge has been created on the conditions of the different markets for the combined use of wind and CHP. Knowledge of efficient plant design and methods for the comparison of the socio-economic effects of managing the electricity grids in different ways has been created. Relevant EU directives, country-specific regulatory conditions, and market actors' attitudes have been analysed. Potentials and problems related to the project have been identified. In addition, a practical toolbox has been introduced. The project web page has been established and online data from the production of a CHP plant in Denmark is now displayed and updated every minute. In the following project period, the techniques will be further developed and additional demonstrations of the project results will take place.

Project Information

Programme
Sustainable Energy Systems

Contract number
513473

Instrument
Specific Support Action

Starting date
01/06/2005

Duration
24 months

Total cost
€ 1 640 419

EC funding
€ 1 199 255

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Website
http://www.project-desire.org/

OPERA

Open PLC European Research Alliance

Overview

Power Line Communication (PLC) **is a technology which uses current electricity networks for data transmission purposes. It allows any user connected to the power grid to enjoy a number of services (for example the Internet, TV, etc) easily, without the need for expensive and polluting, new wiring. The main objective of the project was to perform the necessary *research, demonstration and dissemination at the European scale*, to overcome barriers towards the PLC technology, thereby allowing European citizens to enjoy its advantages.**

Challenges

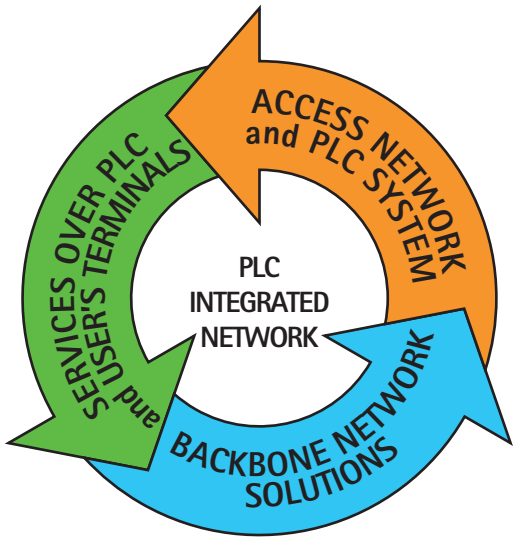
The scientific and technological objectives of the project are summarised hereafter:

- improvement of current Power Line Communication (PLC) systems – covering low voltage (LV) as well as medium voltage (MV) PLC system and looking at bandwidth, reach, ease of operation, EMC (electromagnetic compatibility), network management, channel modelling. Objectives relate to conditioning the power grid (using couplers and filters) and improving PLC equipment;
- development of optimal solutions for connection of the PLC access networks to the backbone networks;
- development of 'ready to sell services' over PLC technology.

Technical Approach

Our technical approach was based on three advance lines:

- power line communication (PLC) system;
- backbone network solutions;
- services over PLC and User's terminals.



Expected Impact

OPERA contributed to the development of the European Information Society, in accordance with the objectives of eEurope 2005, by:

- increasing the competition in access networks by using PLC networks as a real alternative 'last-mile' access network;
- fostering PLC based Broadband Access Mass Services availability;
- increasing European Industry Leadership: OPERA is now a real PLC technology, and its know-how is currently placed in Europe & Israel.

Progress to Date

The OPERA project was successfully completed in April 2006. The complete collection of public deliverables is available at the project webpage (see http://www.ist-opera.org/). Please contact the specific authors for restricted deliverables.

Highlights of Results

The OPERA Project brings out a **sensible advance in the applications of PLC to Broadband** access. The best technologies, from the leading technology suppliers across Europe, were made available to the project; and the most powerful features were selected and improved upon by the rest of the consortium. The OPERA project has created **sound progress both in the standardisation of PLC based Broadband access systems** and in the **development of tailored business models**. This progress will ensure the healthy future development of this technology across Europe.

Project Information

Programme
Information Society Technologies

Contract number
507667

Instrument
Integrated Project

Starting date
01/01/2004

Duration
25 months

Total cost
€ 20 180 473

EC funding
€ 8 998 554

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Website
http://www.ist-opera.org/

VIBES

Vibration Energy Scavenging

Overview

Over the years there has been a growing interest in the field of low power miniature sensors and wireless sensor networks. One specific topic that has received little attention is how to supply the required electrical power to such sensors. Conventional power supplies external to such sensors is one way. However, many applications do require such sensors to be completely embedded in the structure with no physical connection to the outside world. Supplying power to such systems is difficult and as a result they need to have their own power supply unit making them a self-powered microsystem. New possibilities offered by micro batteries can make them independent from an external power supply; however the device lifetime still depends on its energy storage capacity. Recent studies on micro generators offer the solution to this problem, by adding to microsystems the ability of recharging their energy storage by converting energy from the external environment to some form of useful power.

Objectives

The aim of the project is the conception of a micro system containing all these elements, paving a promising and innovating road for future microelectronics applications. This project focuses upon the generation of electrical energy from mechanical vibrations and movements. The main goals of the project will be to use state of the art micro fabrication techniques to build millimetre scale micro power generators. The focus of the project's technical developments will be on two transduction principles: electromagnetism and piezoelectricity. An important part of the project will be dedicated to the design of specific power controllers that will manage the rough energy coming from the generators and send it either to some storage units or to the micro system to be powered.

Challenges

The amount of energy that can be scavenged from vibrations decreases with size and therefore a key challenge is to supply useable levels of electrical energy from small scale generators. The electrical energy must also be in a useable form, for example a DC supply with sufficient voltage, and therefore the system powered by such generators will require a power conditioning circuit, electrical energy storage and intelligence to switch on when sufficient power is available. Each aspect of the system must be highly efficient and consume low power.

Technical Approach

The project has been divided into 4 technical work packages. WP1 focused on characterising the vibration levels and energy available in typical application environments and identifying a demonstrator system specification. Data was collected from low frequency/high amplitude human movements and higher frequency lower amplitude machinery/automobile applications. WP2 is focused upon the fabrication of piezoelectric and electromagnetic generators designed to match the vibration characteristics identified in WP1. WP3 is concerned with exploring mechanisms for converting a range of external vibration frequencies to those useable by the generator and packaging the system. Finally, WP4 involves the design and fabrication of the system electronics with the objective of achieving a working self-powered wireless system that can be demonstrated in real application environments.

Expected Impact

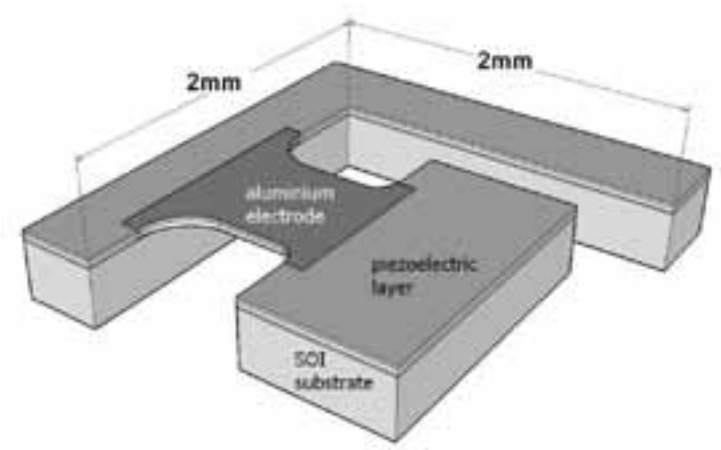
The project is expected to demonstrate the present state of the art in vibration powered wireless sensor systems. In particular, the generators will produce the highest levels of energy density achieved to date for their size. The project will also present comprehensive theoretical models for the types of generators enabling rapid design and optimisation. The system electronics aspect of the project will demonstrate what can be achieved with the current state of the art in low power sensing, micro-processing and wireless technologies. The final demonstrators will prove the feasibility of the approach and will have a major impact on the wireless sensor networking community.

Progress to Date

Both piezoelectric and electromagnetic generators have been successfully designed and fabricated. A micromachined silicon cantilever structure with an inertial mass on the end and employing an aluminium nitride piezoelectric thin film is shown in figure below. This has been fully characterised. More recently, generators employing a PZT thin film have been fabricated and are currently being tested. Two designs of the electromagnetic generator have been designed and fabricated. The first employed a moving coil / fixed magnet arrangement and devices employing both traditionally wound and integrated coils have been realised. The second design employs a cantilever structure with magnets moving relative to a fixed coil and additional micromachined tungsten masses to increase power output. These are shown in figures 2 and 3. The system electronics are currently under development and power condition circuits that convert the energy generated by the generators into a useable form have been achieved.

Highlights of Results

The VIBES generators developed to date have been compared with the state of the art and demonstrate a significant improvement. The micromachined piezoelectric generator is the only one of its kind that can operate at useful frequencies. The electromagnetic devices produce three orders of magnitude more power than competing devices for a given excitation vibration and volume.



First prototype piezoelectric generator design

Project Information

Programme
Information Society Technologies

Contract number
507911

Instrument
Specific Targeted Research Project

Starting date
01/01/2004

Duration
36 months

Total cost
€ 4 184 809

EC funding
€ 2 600 000

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Philips Applied Technologies - BE
Philips Research Eindhoven - NL
TIMA - FR
Tyndall National Institute - IE

Website
http://www.vibes.ecs.soton.ac.uk/index.html

CI²RCO

Critical Information Infrastructure Research Coordination

Overview

The Critical Information Infrastructure Research Coordination (CI²RCO) project is a coordination action co-funded under the Information Society Technologies (IST) Priority of the 6th Framework Programme by the European Commission. CI²RCO addresses the creation and coordination of a European taskforce to encourage a co-ordinated Europe-wide approach to research and development on Critical Information Infrastructure Protection (CIIP).

Challenges

While infrastructures critical to society have been protected by governments for a long time, a rapid change occurred due to the information and communication technology (ICT) paradigm shift and the liberalisation and privatisation of critical infrastructures (CIs). ICT creates dependencies between various CIs and has created a new CI: the critical information infrastructure (CII).

Modern society depends heavily on ICT. It has pervaded in all traditional infrastructures, rendering them more intelligent but more vulnerable at the same time. Our new economy is highly dependent on such information infrastructure services and their safe and reliable operation. A disruption or destruction of those infrastructures would have serious impact on the health, safety, security and/or economic well-being of citizens or the effective functioning of governments. Therefore, survivability and dependability of critical information infrastructures has to be considered on a level which goes beyond the local and national stakeholders and guarantees an acceptable level of performance for economy, society, and politics.

Thus, critical information infrastructure protection (CIIP) is crucial for the security of the citizens, the economy, ecology, and governments in the European Member States and in the Associated and Candidate Countries (ACC) and the EU as a whole. As the protection of CII is of utmost importance to nations and the EU, there is a pressing need for supporting R&D in CIIP.

Technical Approach

The CI²RCO project comprises a set of coordination activities and actions allocated to six work packages supporting the improvement of networking, partnership and coordination of national, regional and European research policies, programmes and funding schemes, namely:

- creation of a network of CIIP-related research and development organisations, agencies, initiatives, CIIP-research funding agencies, policy makers and CI/CII stakeholders;
- identification of completed, on-going and planned CIIP R&D programmes and projects on national and EU-level;
- analysis of European CIIP Research Area according to appropriate evaluation and assessment criteria;
- feedback loop with CI/CII stakeholders to identify gaps in the current and planned CIIP actions and activities;
- elaboration of a European CIIP research agenda to determine R&D priorities;
- provision of a common information platform to supply sustainable support for information and co-operation.

Expected Impact

Ensuring that the CII is protected remains a national responsibility across all Member States and ACC. However, as this protection is both difficult and expensive to implement and because of the multitude of cross-border issues, there is an obvious need for pan-European coordination of the various national activities.

Therefore, the European Commission decided to fund the **Critical Information Infrastructure Research Coordination** (CI²RCO) project with the objective to create and co-ordinate a European taskforce which:

- encourages a **co-ordinated Europe-wide approach** for research and development on Critical Information Infrastructure Protection;
- establishes a **European Research Area (ERA)** on CIIP as part of the larger EU IST strategic objective to integrate and strengthen the ERA on dependability and security.

In line with the EU IST strategic objective on dependability and security, the CI²RCO project further on aims at supporting CIIP awareness and actions in the EU-25 and ACC in order to:

- provide a forum and a platform to bring together the different key players to exchange experiences, share interests and define areas for joint activities;
- identify the key dependability and security CIIP challenges;
- foster truly multidisciplinary and innovative approaches to R&D that would build on the contributions provided by diverse scientific communities;
- encourage and support the national and international co-operation on key global CIIP research and development issues;
- develop recommendations and a roadmap for current and future CIIP R&D activities in the EU, Member States and ACC;
- support policy-makers in the EU, Member States and ACC in charge of financing or managing R&D programmes on CIP or CIIP.

Progress to Date

Meanwhile major progress towards the project objectives has been achieved, e.g.:

- the CI²RCO CIIP taskforce comprising of representatives from research organisations, policy makers, funding actors and CI/CII stakeholders has been built around representative European organisations representing large communities on the CIIP topic;
- national and Europe-wide CIIP-related R&D programmes have been identified and analysed in order to identify gaps and assess relationships;
- two CI/CII stakeholder workshops have been carried out to receive a feedback and validation of the analysis and findings by the CI²RCO taskforce on the gaps and prioritised need for CIIP R&D;
- a set of events (workshops and an international conference) as well as other dissemination activities addressing also the international CIIP community have been carried out in order to foster opportunities for collaboration, information exchange and awareness rising. In this regard especially also the meanwhile widely-accepted European CIIP Newsletter is to be mentioned. This newsletter is published at regular intervals by the project and is available via the CI²RCO website or a subscription list.

Project Information

Programme
Information Society Technologies

Contract number
0015818

Instrument
Coordination Action

Starting date
01/03/2005

Duration
24 months

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EC funding
€ 975 000

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G R I D

A Coordination Action on ICT Vulnerabilities of Power Systems and the Relevant Defence Methodologies

Overview

GRID **is a** ***Coordination Action*** **funded by the IST programme. It aims to achieve consensus at the European level on the** ***key issues involved by power systems' vulnerabilities and the relevant defence methodologies,*** **in view of the challenges driven by the transformation of the European power infrastructure. GRID seeks to establish consensus at the European level on the key issues involved by power systems' vulnerabilities, with a twofold objective:**

- **establish the more urgent and significant R&D challenges to be tackled at the EU level;**
- **raise awareness on the security concerns at the policy, industrial and academic level.**

Two main topics are proposed:

- **methods to assess reliability, security and risks affecting the power grid, especially concerning vulnerabilities arising from the increased control complexity and the openness of the supporting information and communication technologies;**
- **management, control and protection schemes and the relevant architectures and devices.**

In relation to this, GRID will assess the needs of the power sector and achieve consensus among stakeholders and R&D institutions, so as to establish a roadmap for collaborative R&D on innovative and/or advanced technologies pertaining to the two target areas. GRID will result in the strengthening of EU collaboration between R&D institutions and stakeholders.

Challenges

The vulnerability of the electrical infrastructure appears to be rising, due to growing demand, hectic transactions, the increasing number of stakeholders, and the complexity of controls. As evidenced by the recent, major blackouts over Europe and North America. Although these events don't appear to have been influenced by malicious acts, existing ICT vulnerabilities could be exploited by malicious threats in the future. In addition, the approaches and methodologies for designing the new, required, control, protection and monitoring systems, and those for the assessment of the security risks, seem to fall short of satisfying the current needs of power companies.

Technical Approach

Two workshops and two conferences will be organized during two years. These events will enable partners and stakeholders to discuss and contribute to the advancement of knowledge in the areas of risk assessment and power grid controls, so as to reach consensus on future research priorities. This will also be based on the exchange of information about national and European on-going research projects on related topics. The stakeholder consultation process will also be conducted through the compilation of questionnaires via web and direct interviews. The GRID work programme is organised into four work packages:

WP1 Management

WP2 Risk Assessment

WP3 Controls and

WP4 Strategies and dissemination

Expected Impact

GRID is to achieve consensus at the European level on the key issues involved by power systems' vulnerabilities and the relevant defence methodologies, in view of the challenges driven by the transformation of the European power infrastructure. GRID is to assess the needs of the EU power sector on these issues, so as to establish a Roadmap for collaborative research on the use of ICT in power grids and the related vulnerabilities, in view of the forthcoming 7th framework programme.

Progress to Date

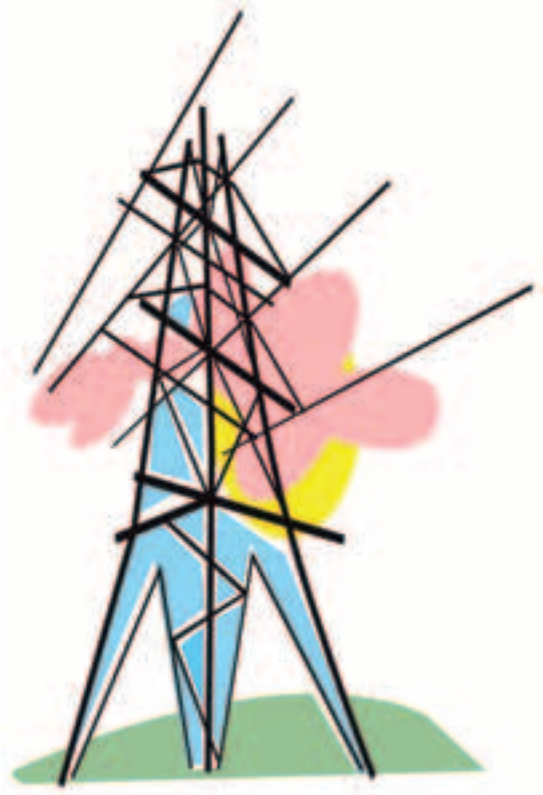
The GRID European Conference on 'Vulnerabilities of power system infrastructures – The role of ICT' was held on the 15th of June 2006 within ENERGEX 2006 at the Stavanger Forum, Norway. Twenty-nine participants attended the Conference, representing all the involved stakeholders, both in terms of categories (transmission system operators, academia and research organisations, authorities, utilities and manufacturers) and in terms of geographic coverage. The presentations gave rise to lively debates and contributed to the overall feeling of a successful event.

The project has adopted an appropriate road mapping methodology so as to establish the needs of the sectors and its main R&D requirements, through consultation with the stakeholders. The first phase of this consultation process now takes place via web questionnaires and interviews. The results of the consultation to date will be consolidated through a workshop to be held in Leuven, Belgium on November 14, 2006 and will be made available in December 2006.

Highlights of Results

The main outcomes from the discussions held during the Stavanger Conference relate to risk assessment, emerging control technologies, modelling and simulation and regulation, and policy risk scenarios. A full report on the Conference was released in September 2006, and can be downloaded from the project site.

The road mapping methodology identifies the key categories of stakeholders and R&D institutions of interest, which kind of questions to ask and how, etc. Seven different work categories and phases have been identified. The data collection is structured through a set of charts, designed in such a way as to achieve the required elicitation process.



Project Information

Programme
Information Society Technologies

Contract number
26923

Instrument
Coordination Action

Starting date
01/01/2006

Duration
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Total cost
€ 629 769

EC funding
€ 480 000

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Website
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CRUTIAL

Critical Utility Infrastructural Resilience

Overview

The CRUTIAL project addresses the security and resilience of new networked ICT systems for the management of the electric power grid. The project explores the control of physical electricity transportation and the connection of this process with information infrastructures, for example through corporate networks (intranets), which are in turn connected to the Internet.
CRUTIAL's innovative approach resides in modelling interdependent infrastructures taking into account the multiple dimensions of interdependencies, and attempting to cast them into new architectural patterns, resilient to both accidental failures and malicious attacks.

Objectives

- Investigation of models and architectures that cope with the scenario of openness, heterogeneity and evolvability exemplified by electrical utilities infrastructures.
- Analysis of critical scenarios in which faults in the information infrastructure provoke serious impacts on the controlled electric power infrastructure.
- Investigation of distributed architectures enabling dependable control and management of the power grid.

Challenges

The Electric Power community and Information Technology community need to take action to influence technological progress and effective deployment of commercial Intelligent Electronic Devices ; both for the protection of citizens and against cyber threats to electric power management and control systems.

A well-founded knowledge-base needs to be established within the industrial power sector to allow all the involved stakeholders to achieve their service objectives without compromising the resilience properties of the logical and physical assets that support electric power provision. This requirement is particularly stringent since the recent introduction of a competitive electric power market.

Technical Approach

The project integrates leading industrial persons and academic researchers from three critically important, but only weakly connected disciplines: a) electrical power generation, transportation and distribution; b) resilient (self-healing) distributed and secure real-time systems; c) modelling of complex systems. All three disciplines are necessary for the successful achievement of the project objective.

As far as analysis and modelling are concerned, the partners have considerable experience in qualitative and quantitative approaches, from both theoretic and experimental viewpoints:

- qualitative analysis, based on risk modelling and temporal logic analysis;
- quantitative evaluation, based on stochastic processes, using Markov chains, stochastic Petri nets under their various flavours, or models derived from Unified Modelling Language (UML) description, following formal and semi-formal model construction approaches (compositional and hierarchical);
- evaluation based on measurements performed on real-life systems;
- evaluation based on controlled experiments, either based on ad hoc approaches or following well-specified dependability benchmarking approaches.

Likewise, several partners have long-lasting track records in devising and/or building distributed system architectures of different kinds, providing the right portfolio for this multifaceted problem:

- large-scale Internet-based distributed systems;
- distributed real-time SCADA and control architectures;
- classical fault-tolerant systems;
- intrusion-tolerant (secure and dependable) architectures.

Both the (modelling and architectural) project activities are driven by the identification of *reference control system scenarios*. A control system scenario defines

a reference structure of the power grid, with Intelligent Electronic Devices at different levels of the power system (Control Centre level Station level, Bay level, Process level). It also defines the structure of the management information networks and their functional relationships with the process network, and the different threats that may challenge the operation of the power system services.

Expected Impact

The project will: a) identify and describe control system scenarios; b) provide modelling approaches for understanding and mastering the various interdependencies; c) develop a test bed integrating the electric power system and the information infrastructure; d) investigate fault-tolerant architectural configurations; e) provide qualitative and quantitative support for the identification, analysis and evaluation of the scenarios identified. The results will be validated against test beds of Electric Power Systems.

The results will help in designing and assessing new Electric Power systems and information infrastructures. They will help to reduce the current (unfortunately repetitive) blackouts, in terms of frequency, duration and extent, and provide insights to Electric Power companies and standardization bodies for exploiting resilience in critical utilities infrastructures.

Progress to Date

Considerable effort has been devoted in WP1 to collecting information from existing systems, on renewal plans and emerging evolutions from the scientific and technical literature. Considering the number (and complexity) of systems and devices falling under the umbrella of power system control, the acquired knowledge is certainly partial. The power system picture derived is only aimed at supporting the identification of sample control scenarios highlighting critical interdependencies among power and ICT (Information, Communication Technology) services. A set of control system scenarios have been described that cover emerging themes that involve ICT for power (bulk and distributed) generation, transmission and distribution infrastructures. These include:

- security of remote supervision and control functions for grid operator;
- security of supervision and control functions for generation companies;
- power System operators interactions in emergency conditions;
- integration of operation and maintenance functions;
- remote ICT maintenance for grid operators;
- interactions among Transmission and Generation ICT systems.

During its first phase, WP2 focussed on the modelling and analysis of interdependencies with the following objectives: 1) to investigate the main challenges to be addressed for the analysis and modelling of interdependencies, 2) to review the modelling methodologies and tools that can be used to address these challenges and support the evaluation of the impact of interdependencies on the dependability and resilience of the service delivered by power system infrastructures; and, 3) to present the preliminary options investigated to date for describing and modelling interdependencies.

The blueprint of a distributed system has been proposed in the first phase of WP4 as a reference for modern critical information infrastructures. It includes a set of classes of techniques and algorithms based on paradigms providing automatic resilience to faults and attacks.

Project Information

Programme
Information Society Technologies

Contract number
027513

Instrument
Specific Targeted Research Project

Starting date
01/01/2006

Duration
36 months

Total cost
€ 3 151 650

EC funding
€ 2 033 500

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CENCE

Connecting Energy Clusters Across Europe

Overview

The overall objective of CENCE is to promote cooperation between European Energy Clusters by establishing a cooperative learning platform that facilitates the promotion of entrepreneurial innovation. CENCE provides a new concept of clustering, building new collaborative relationships between the most promising and developed EU Energy Clusters. The project consists of 3 stages: Learning – Networking – Cooperation.

Challenges

- **Learning:** the goal of CENCE is the creation and development of a learning platform for the European Energy Clusters. Learning processes will be enhanced from a double approach: cluster organisations – as management structures – and their associated firms and intermediate organisations from the energy sector.
- **Networking:** clustering has been a useful instrument to improve development in several industrial sectors and European regions, by making the most of networking and relationships' potential. Focused on the European energy sector, a network of clusters (Mega-Cluster) will be designed based on a development model agreed by all the partners.
- **Cooperation:** the European Energy Mega-Cluster will be established as a tool to foster existent synergies among participant clusters. Joint projects will be developed in different common areas: product, market, R&D, training, marketing, etc. The cooperative approach will include European New Member States.

Technical Approach

The CENCE learning platform will focus on both technical and non-technical aspects, as these are key factors for sustainable organisational growth. This objective will be achieved through a work-plan with the following work packages (WP1 is dedicated to project management): WP2 will establish the basis of the research work, providing a SWOT analysis, Best Practices and a Regional Competences Map. WP3 will be based on enhancing learning processes and the creation of a European platform. This platform will be an instrument to increase economic and social growth, by means of: exploiting synergies and fostering joint projects, paving the way to an Energy Mega-Cluster and providing recommendations to encourage clustering processes in Europe, especially in the New Member States (WP4). The intention is to achieve a durable structure of exchange beyond the horizon of CENCE. WP5 will ensure the awareness, dissemination and exploitation of the project activities and results.

Expected Impact

Taking into account the three key issues, CENCE will encourage energy clusters to adopt an "outward looking" approach. It will establish a cooperative learning platform for the exchange of experiences, best practices and knowledge which will be transferred to the New Member States and which will be the basis for the exploitation of synergies and collaborative projects.

Progress to Date

The main progress has been achieved in the project management, by partners agreement in how to work together, communication procedures, rules and responsibilities. The 11 partners have shared information, shown how they operate and proposed ways of collaboration.

Project Information

Programme
Research and Innovation

Contract number
022511

Instrument
Coordination Action

Starting date
25/10/2005

Duration
30 months

Total cost
€ 894 025

EC funding
€ 894 025

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G E N D I S

Distributed Generation: its Impact on Electricity Networks from an SME Perspective

Overview

European society is overly reliant on non-renewable fuel sources: oil, natural gas and coal. Fossil fuels are currently used to generate 80% of the European Union's energy demands, with increasing dependence on imported oil and gas (currently 50% and estimated to rise to 70% by 2030). This situation is unsustainable and is not compatible with the EU's commitment to reducing greenhouse gas emissions.

It is clear that the current dependency on non-renewable fuels must be lessened, both for environmental and economic reasons. If the targets accepted by governments for 2050 are to be met, then clearer alternative strategies are needed, including a significant role to be played by SMEs.

Distributed generation (DG) involving the connection of small-scale, usually renewable energy, generators to distribution networks, is likely to become increasingly common, as the European Union's member states strive to reduce their dependence on fossil fuels and tackle issues of climate change. Generation in the 100kW range should be attractive to SMEs in particular but current uptake is small.

Challenges

Although DG can be found in some locations, notably Combined Heat and Power (CHP) units, its uptake has been hindered by several key problems. First, buildings with DG installed have to be able to export energy to the distribution network operator (DNO) as well as import. Distribution networks were not designed for two-way flow and the performance of these networks with bi-directional energy flow is not well understood. Secondly, due to problems with metering these flows, it is often not economically viable to install DG.

DG (being produced at or near the point of consumption) is able to improve the efficiency of power distribution by minimising distribution losses, and also facilitates the exploitation of small-scale (often renewable) generation sources. This will be of considerable commercial interest to companies, as on-site power production can reduce energy costs by 30%, by reducing transmission and distribution costs. Many of the electrical generators in the future are likely to be small-scale plants, constructed at a residential or industrial unit (e.g. CHP in a block of flats or a factory) or in rural areas with weak distribution networks (e.g. wind farms, small scale hydroelectric). These generators connect directly to the local distribution network, rather than to a high voltage transmission network, to which conventional central generating plants are normally connected.

DG is becoming an increasingly important part of national planning for future electricity supplies. The EU has set an indicative target of 22% of electricity in the EU15 to come from renewable sources by 2010 (compared to 14% in 2000). In order to meet their commitments to reducing greenhouse gas emissions over the next decade, EU governments will need to encourage the development of DG and meet the challenges this will impose on distribution networks. Therefore, opportunities for SMEs will be created in the coming years for appropriate components and technical services in the field of DG. It will also be important to encourage more SMEs to install DG.

The benefits for Europe of increasing DG are clear. Installing a DG energy source can reduce electricity costs by up to 30%. The total EU electricity requirements in 2010 are predicted to be 3.18 PWh per annum. If this project can contribute to a 0.1 % increase in the uptake of DG between now and 2010 (a conservative target), this would correlate to an annual energy saving of 9.54 GWh per annum. Enabling SMEs to participate in this new market is thus important for European competitiveness as well as the environment.

Expected Impact

- To identify and map current distributed generators in Europe.
- To determine the size and characteristics of the potential market and identify legislative obstacles to greater uptake of DG, especially by SMEs.
- To test the effects of DG on components of European distribution networks by undertaking laboratory testing and evaluation and by drawing on available data.
- To investigate the current problems of metering for DG, propose solutions and recommend best practice.
- To assess the impact of DG on model national networks (specifically Denmark, Italy and the UK).
- To construct a prototype network model to determine the optimum design for the distribution network of the future.
- To train SME staff in the new technology and to disseminate the results throughout Europe.

Progress to Date

These initial stages have delivered constructive results, and progress has been made towards planning the next phase of the project with the collaborative strength of the partners continuing to develop and strengthen.

- **A report describing a roadmap to facilitate the integration of DG within European networks:** this report is a road map of the actions needed to achieve widespread use of Distributed Generation (DG) by Small and Medium Sized Enterprises in the EU over the next 15 years.
- **Technical Issues study related to SMEs and the use of Distributed Generation:** this purpose of this work was to help address the current understanding of these implications for connection of DG within distribution networks.
- **Identification and Evaluation of technical solutions to implement large scale use of small scale distributed generation:** the first part of the report compares the architectures of different distribution networks in Europe and concludes that apart from different medium voltage levels and earthing systems that the basic design is very similar.
- **State of the art metering technology:** this report Describes the arrangements for import and export of electrical energy from small embedded generators in European Countries.
- **Website development:** the project website http://www.gendis.org/ was constructed and became operational on schedule in month 1 of the project, and is a key communication tool for the project. It contains all of the information related to the project including links to external events and related activities. One of the aims for the website is for it to act as a dissemination tool which is a developing activity. The website has received ongoing enhancements, and is registered with relevant search engines.

Project Information

Programme
Collective Research Projects for SMEs

Contract number
500351

Instrument
Specific actions for SMEs

Starting date
01/05/2005

Duration
36 months

Total cost
€ 2 374 883

EC funding
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Website
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SESSA

Sustainable Energy Specific Support Assessment
European Regulation Forum on Electricity Reforms

Overview

SESSA pursued the following objectives:

- **It assessed policies and identified the actual best practices in the EU and abroad in regulating sustainable energy.**
- **It defined the appropriate tools contributing to the corresponding benchmarking, and initiated this benchmarking, notably through the definition, measurement and monitoring of the critical factors in European electricity sustainability.**
- **It delineated the key issues and recommended timetable for reproducing best practices both at the EU and at the Member State level in harmonizing national rules, behaviours, and policies for deepening energy sustainability and preparing the needed European policy integration.**
- **By doing so SESSA contributed to the 2006 European review of internal energy market, as defined by the Copenhagen summit.**
- **SESSA involved both high level scientists and decision-makers by building a European task force of international experts (more than twenty research teams – i.e. 9 participants and 13 external experts – in economics, business administration and engineering) and of European energy decision-makers (around forty Stakeholders from EU 15 and New Member States: energy companies, network operators, public authorities, consumers groups and non governmental associations).**

Challenges

SESSA Specific Support Action aimed at contributing, through research in economics and economic engineering, to the development of a sustainable European energy system and of an appropriate regulatory framework for the EU. In addressing this topic SESSA put electricity at the core of European energy sustainability. In relation to this, all relevant regulations, including RTD energy policies, were addressed from the perspective of making the energy internal market a success and a cornerstone of sustainability.

A key goal for SESSA was to integrate energy RTD and engineering into the economic frame of a reliable and competitive European internal market. As defined by the Lisbon summit, the European Union aims at becoming one of the first areas for both economic and scientific competitiveness for the well being of its citizens. It implies that RTD and engineering have to interact with the market economy, and that market compatibility and robustness is an important criterion in the achievement of effective regulations and policies. In this respect, electricity RTD cover the upgrading of generation by renewable and new technologies, the access and uses of primary fuel, as well as the definition of new grid concepts and new grid operation systems corresponding to the new generation technologies and new consumption sets (like 'distributed generation').

SESSA brought together the top-level European economists and economic engineering research centers involved in the area. In fact, mainly national issues have been dealt with until now. Constructing a sustainable European energy system is not the same as dealing with each country apart. The focus is quite different. Interactions between European countries are at the very core of European sustainability and only at the margin for each of the European Member States. What looks like a 'border or cross countries issue', is rather marginal from a national viewpoint yet lies at the heart of the European Union as a whole. Consequently, addressing energy systems problems and policies country by country will not build the skills, knowledge and tools needed at the European Union level. The pioneering example provided in gas and electricity regulation by the Madrid and Florence processes had to be followed by a concerted European Energy technology Regulation Forum, like the one SESSA prepared.

The core objective of priority 8.1.3.2 in the 'Policy-orientated Research' area of the 6th Framework Programme was to provide analytical instruments, models, and data to identify how to implement sustainable energy procurement that ensures European economic growth, and is environment friendly while avoiding congestions, accidents, energy supply rises, and disruption of flows in the energy supply chain. SESSA aimed at contributing to this objective by assembling the best experts in the field and by assessing what are the main issues and main tools available.

Technical Approach

SESSA organized five conferences, each addressing a specific issue in regulating for a European sustainable energy supply system:

- refining market design;
- addressing market power and industry restructuring for Consumers Benefits;
- ensuring EU Energy Enlargement to New Member States;
- harmonizing Effective Regulation;
- investing for Sustainability.

Each conference provided both a research forum and a stakeholder forum. Its recommendations and main findings were presented to decision-makers in a final meeting in Brussels.

Expected Impact

SESSA generated seven reports in total: five on these specific issues, plus a specific report on benchmarking and best practices, and a general report. Its recommendations and main findings were disseminated throughout Europe, notably by making them available to the public on a web site and by publishing them.

Highlights of Results

The main outcome of the project was a final SESSA report that recommended 20 priority and secondary actions:

Priority Actions

- Facilitating access to, and improvement of balancing services.
- Ensuring access to competitive gas long term contracts.
- Improving the efficiency of the management of interconnections.
- Setting a European Market Surveillance Committee Network.
- Encouraging the negotiation of reinforced regional cooperation agreements between TSOs.
- Seeking objective criteria for evaluating Europe's interest in grid interconnections.
- Encouraging bilateral and regional harmonisation agreements between regulators.
- Developing a pan-European regulatory knowledge and training in the EU.

Secondary Actions

- Terminating vesting contracts.
- Improving the link between the operation of PXs and grids.
- Setting incentive pricing of domestic congestion.
- Facilitating regional harmonisation to open a European bilateral market.
- Facilitating regional harmonisation for reciprocated opening of PXs.
- Facilitating regional harmonisation for reciprocated opening of balancing mechanisms.
- Facilitating regional harmonisation of the collection of, and access to, TSOs. databases on markets, grids and interconnections.
- Extending the independence of TSOs to include ownership of transmission assets.
- Encouraging regional harmonisation of grid access and connection fees.
- Encouraging TSOs to develop joint regional reference scenario, forecast and planning.
- Associating NRAs with the Commission's evaluation activities.

Project Information

Programme
Scientific Support to Policies

Contract number
502479

Instrument
Specific Support Actions

Starting date
01/04/2004

Duration
18 months

Total cost
€ 523 123

EC funding
€ 472 000

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MAXIMA

Dissemination of External Costs of Electricity Supply
Making Electricity External Costs Known to Policy-makers

Overview

The quantification of externalities from electricity production has made considerable progress; however, internalisation of external costs has not been implemented broadly. This is due to a lack of information on the concept and its application as an aid to policy. Even though the Impact Pathway Approach (IPA) developed in ExternE (Externalities of Energy) is accepted as the best way to calculate energy external costs, results show considerable uncertainties and variations with different basic assumptions in certain areas.

The scientific task of reducing uncertainties is currently addressed in several projects; identifying the assumptions to be used for decisions however requires consensus with stakeholders. The main objective of this project was to translate and present the concept of externalities, the quantification approach and results outside the scientific community. Furthermore, it was the aim to initiate a discussion of the pros and cons between representatives from the energy industry, policy and NGOs with the aim of reaching a consensus on methodology and values.

Challenges

The overall objectives of the MAXIMA project were to translate and present the ExternE (Externalities of Energy) quantification approach and ExternE estimates for power sector externalities outside the scientific community, and to improve the applicability and acceptance of the ExternE methodology and results.

Technical Approach

In the first step a concept for internalisation of external costs of electricity production was developed, identifying optimal internalisation strategies. External cost values as required by the internalisation instruments were calculated with the Impact Pathway Approach, based on the latest scientific knowledge. This included the synthesis and comparison of existing results on the external costs of energy in the European Union, both in EU15 and new member states.

The principal means for disseminating and discussing the ExternE methodology and results, was the hosting of a number of workshops at which representatives of the energy industry, NGOs and the policymaking community could meet with the ExternE team to express reservations and make suggestions regarding methodology, values and potential internalisation instruments. The discussions centred on three stakeholder workshops arranged progressively. Workshop discussions were documented, with efforts to identify areas of consensus as well as those where agreement could not be reached or where issues were open-ended. The first workshop took place in Krakow on 28th February to 1st March 2005, with participants predominantly from the new member states of the European Union. The second workshop, held in Paris on 10th to 11th May 2005, brought together participants from industry and NGOs, predominantly from Western Europe. The third workshop, held in Brussels on 14th September 2005, was oriented towards participants who had attended one of the previous workshops, in order to build on previous discussions. A final symposium summarising results for policy makers as well as other stakeholders was held on 9th December 2005 in Brussels, and was attended by more than 130 people from all relevant stakeholder groups.

Expected Impact

Questions, concerns and comments received at the workshops and associated exchanges with stakeholders were compiled, summarised and analysed, together with responses from the ExternE team. The overall impression was that those who attended the workshops valued the ExternE method, and had already found it or its results useful or, especially for participants from new member states, were very interested in using ExternE or its results. The concerns and reservations expressed were less about faults of the method and disputes about assumptions made, although there were some of these. Rather, questions were instead raised about the practical applicability of the method and results in policymaking, and, the representativeness of the results. Reservations were also expressed about uncertainty, monetisation, and completeness relative to what information was considered important to the environmental policy-making process.

Many of the comments and questions expressed by stakeholders during the workshops related to the use and interpretation of ExternE results in a real-world policy context, as opposed to the more technical aspects of the ExternE method and results. The translation between the ExternE method and results 'in the laboratory' and policy implementation is, not surprisingly, an area of intense interest to stakeholders. Applied policy interpretation, and policy analysis in general, is outside the classic methodology purview of the ExternE team, but clearly important to the project's ultimate goals.

The discussions helped to reveal a few areas where ExternE's role could be clarified; highlighted some points on which the ExternE method or results drew controversy or discomfort; and, identified some topics in which participants thought more research or effort would be useful.

It can be concluded that MAXIMA provided a better accepted scientific methodology for implementing electricity external costs into European policy, as well as a set of external cost estimates which is broadly accepted. The results of the project are documented on the website of the ExternE project series (www.externe.info).

Project Information

Programme
Scientific Support to Policies

Contract number
502480

Instrument
Coordination Action

Starting date
01/05/2004

Duration
18 months

Total cost
€ 585 909

EC funding
€ 585 909

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ENCOURAGED

Coordination Action on Energy Corridors Optimisation for European Markets of Gas, Electricity and Hydrogen

Overview

In several publications [1, 2], the EU emphasizes its role as a force for stability and sustainable development within the European Continent. Extending the benefits of the Internal Market would help to encourage the stability of the surrounding countries. In fact, the neighbouring countries play a vital role in the development of the EU, as they are the main suppliers and transit countries of oil and natural gas. This role is expected to grow significantly in the coming decades, in particular in relation to ensuring energy supply security, and the supply and trade of electricity and later hydrogen from neighbouring countries.

[1] Communication on a Wider Europe (COM(2003) 104 final, 11.3.2003

[2] On the development of energy policy for the enlarged European Union, its neighbours and partner countries (COM(2003) 262 final)

Objectives

In view of this, the EC has formulated several objectives to facilitate the integration of energy systems and the improvement of energy connections with its neighbouring countries:

- enhance security of energy supplies of the European Continent;
- strengthen the Internal Energy Market (IEM) of the enlarged EU;
- support the modernisation of energy systems in partner countries;
- facilitate the realisation of crucial major new infrastructure projects.

Main Objectives

- To assess the economically optimum energy interconnections and network infrastructures for electricity, gas and hydrogen in the EU, with and through the neighbouring regions (North Africa, Middle East and Turkey, Central and Eastern Europe, Russia and Iceland). Thereby, connecting the EU with key producers in the coming decades.
- To identify, quantify and evaluate the barriers and potential benefits of a large European "energy connected area".
- To recommend the necessary measures to be adopted to ensure, realize and implement an optimisation of energy corridors and realise a high level of network security.
- Organise workshops and a final stakeholder conference in order to attain consensus among scientists, stakeholders and NGOs and, to validate the results.

Technical Approach

The project focuses on three types of energy corridor: electricity, natural gas and hydrogen. For each type of energy carrier, there is a review and assessment/projection of demand and supply in Europe and the surrounding regions, in both the medium and long term, on a similar scenario basis. This reveals the gaps in demand and supply, and the required infrastructure capacity needs for connecting demand and supply regions. The technical and economic issues of the supply grids and transmission costs are analysed and assessed.

Finally, the economic optimal routing of the different options for transit/transport, through the different corridors/connections, and their implications for transport capacity of pipeline, LNG and other infrastructure facilities, are analysed in an integrated way, from the sources in the neighbouring countries of production to the centres of consumption. Based on the results of this model analysis for finding the optimal corridors per energy carrier, final assessment of the economic optimal and sustainable network configurations in Europe is conducted. Recommendations for the realisation of new optimal electricity, gas and hydrogen corridors are formulated. To promote implementation of these corridors, the geo-political dimension and the investment conditions are analysed.

Technical Approach

WP1

Assessment of optimal Electricity Corridors between EU and neighbouring countries. This involves an analysis of the long-term requirements for interconnections, based on forecasted scenarios of demand, generation, and fuel prices in the European and neighbouring countries. Using cost-benefit analysis, the optimal expansion of the interconnections are identified and recommended.

WP2 **Assessment of optimal Gas Corridors between EU and neighbouring countries.** This focuses on an analysis of the long-term requirements for gas routes, connections, and other infrastructure to supply EU markets. Based on scenarios for gas demand, resources and supply, and energy and gas prices in all European countries, including our EU-neighbours, the need for transport infrastructure capacity is identified. The optimal expansion of the gas infrastructure between key suppliers and the EU markets is identified, by means of cost-benefit analysis and an assessment of the scope and barriers of the different routes and options.

WP3 **Assessment of need and feasibility of Hydrogen Corridors for the long term.** After identifying the development in time of potential consumer markets and production centres of hydrogen in Europe, the costs of production and supply per technology and country are assessed. These are compared with the supply costs of other competing alternatives, e.g. electricity supply, and the markets. Finally, the need and feasibility of hydrogen corridors is reviewed.

WP4 **Integration and implementation of corridors by assessment of investment and geopolitical conditions.** The final conclusions and recommendations of the project are formulated using two studies: one on the economic investment and the other on the international conditions, for implementing the recommended building of new energy corridors.

Expected Impact

ENCOURAGED seeks to contribute to European wide dialogue between policy makers, regulators, and companies, interested in collaborating to further extend energy connections between EU and its neighbouring countries.

To this end, the implementation and dissemination of the report, findings, knowledge and conclusions will be promoted by organising a number of regional seminars for countries neighbouring the EU (East, South and South-East) and a final conference in the EU. All relevant stakeholders, such as international associations (Eurelectric, Eurogas ETSO, UCTE, etc), gas and power companies, NGO's, policy makers, regulators, transmission system operators, manufacturers and energy producers from both EU and neighbouring countries, will be invited.

Progress to Date

So far the following results have been achieved under WP1 (Encouraged in the Electricity field):

- elaborated long term projections (till 2030) of electricity demand, generation capacity for each country in the 'wider Europe' and forecasts about the possible electricity transmission capacity at the main 'EU borders';
- projections of costs of electricity production and estimation of investments for the new interconnection corridors;
- review of drivers, barriers and regulatory issues influencing the realisation of interconnections between electricity systems in the 'wider Europe';
- pan-Europe-wide model based analysis to understand how much EU and the neighbouring regions can profit from increased electricity exchanges;
- cost-benefit assessment for the realisation of new interconnection links for seventeen corridors within the European Union and between the EU and the neighbouring barriers.

Project Information

Programme
Scientific Support to Policies

Contract number
006588

Instrument
Coordination Action

Starting date
01/01/2005

Duration
24 months

Total cost
€ 899 675

EC funding
€ 899 675

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Website
http://www.encouraged.info/

EUSUSTEL

European Sustainable Electricity – Comprehensive Analysis of Future European Demand and Generation of European Electricity and its Security of Supply

Overview

The main objective of the project EUSUSTEL is to provide the EU Commission and the Member States with coherent guidelines and recommendations to optimise the future nature of electricity provision and the electricity generation mix in Europe so as to guarantee an affordable, clean and reliable , i.e., 'sustainable', electricity supply system.

Challenges

To a large extent, the work effectively consists of a major critical review and evaluation exercise of existing studies, published papers, reports, policy documents, scenarios, etc., whereby those are held against the light of coherence, and expertise and experience of the scientists and electric industry. Much has been published in recent years on the energy issue in general and electricity provision in particular, but regrettably, very few critical reviews of the published material have been undertaken. Often, there is plenty of inconsistency in the material published within a particular country, let alone that the material is consistent for whole regions. Assuming that the presentation of the data is not manipulated, the discrepancy often lies in the definitions and conventions behind the numbers. Moreover, for future projections, many (often hidden) boundary conditions and hypotheses are imposed and assumed, which then lead to a variety of conclusions that may lead to very unrealistic scenarios, which are often insufficiently checked with regard to full consistency. In addition, policy documents often reflect a short-sided approach or undertake project attractive visions, which may turn out to be very 'undesirable' in the long run. The current project intends to 'set the record straight' and to deliver a fully consistent picture of future electricity provision by means of an extensive 'reviewing exercise', complemented with individual insights.

Technical Approach

The project is performed by a group of high-level energy scientists, supported by their laboratories or research groups, in close collaboration with the electric industry. Attempts have been made to gather a consortium that relies on rational reasoning and common sense, rather than to choose *a priori*, 'ideologically-coloured', advocates of a particular energy vision. Nevertheless, it is the case that the group covers a variety of insights, approaches and viewpoints, reflecting the differing existing policy orientations in Europe. The combination of the rational approach, with different "beliefs" with regard to future technology breakthroughs and public acceptance of particular technologies, should guarantee a well-balanced outcome for the project.

To help guarantee that the views of the scientists are not too different from what real life shows, there is an intensive interaction with the electric industry, especially via its umbrella organisation, Eurelectric. Hereby, Eurelectric act as a *'Special-Focus Industrial Advisor'*. The interests of the other major stakeholders are voiced through a Consultative Committee established for this purpose.

Thus, the project entails a major review and evaluation of existing studies and publications, carefully complemented with the project participants' own expertise and views. It will cover studies referring to *countries or regions*, and studies referring to the state of the art, the future projections, and the likelihood of penetration and/or renaissance, of particular energy-conversion technologies (both on the end-use side as on the supply side). *The future demand for electricity* is also analysed. Furthermore, the study will take into account policy trends such as the drive towards a liberalised and fully integrated European electricity (and gas) market, the consequence of climate-change abatement measures, and the promotion of renewable sources and Combined Heat and Power (CHP) (*work package 4*).

The review and evaluation exercise consists of a major effort of sifting through the documents, verifying and crosschecking the results and conclusions, and of confronting the different viewpoints so as to try to detect the underlying assumptions and boundary conditions. The review performed by one particular project partner will effectively be "verified" as the whole group has a chance to comment on the conclusions of the reviews. It is the goal that the whole group reaches a consensus on the treated subjects.

Following the completion of all technology-related and country-oriented reviews, and the achievement of a consensus on the technical, economic, and environmental data of the technologies, their evolution, and their degree of implantation in particular countries, a limited number of well defined scenario runs are performed with the model(s) chosen from an analysis exercise of simulation codes. The boundary conditions and hypotheses of these scenarios are to a large extent determined by the so-called context issues such as liberalised markets, climate change and other specific policy trends (such as renewables, CHP, energy efficiency, etc). In this last work package, a framework for *sustainability* is also developed.

The work deals with the entire EU i.e. the EU-25. However, because of expected difficulties with the availability of 'good' documentation on the most recently acceded 10 member states, some analysis is more detailed for the EU-15 than for the EU-25.

The objective of the project is certainly relevant to the support of the European Union's policy in the energy field, as policy recommendations on the EU-level are to be expected. As another EU added value, information amongst organisations from 10 different member states is exchanged. The project will automatically be faced with the consequences and boundary conditions of several EU directives, regulations and guidelines on, for example, the liberalisation of the electricity and gas markets, cogeneration, emission trading, renewable electricity generation, cross border transmission, energy efficiency, and so on.

In addition, the study will scrutinise earlier EU policy studies such as the Green Paper and other documents, including Commission Communications. Furthermore, the study will be able to draw conclusions on the possible future of nuclear power in Europe (especially given the fact that some countries have opted for a phase out, while in other countries there seems to be a renaissance). A scientific consensus on very uncertain issues and on the possible contribution of various energy technologies in the medium to long-term future may also be reached. The study will furthermore permit conclusions to be drawn concerning a properly functioning liberalised electricity market, thereby providing recommendations so as to minimise the risks of black outs as happened in the summer/fall of 2003.

Expected Impact

In order to provide the EU-25 with coherent guidelines and recommendations for a 'sustainable', electricity supply system, some objectives are defined, with 2030 as the scope:

- establishment of a framework for the concept 'sustainability';
- analysis of the electricity provision in the EU-25 countries;
- provide projections for reasonable evolution of demand for energy services and determine the relationship with electricity demand;
- analysis of the electricity generation technologies and their integration into the overall generation system;
- analysis of the current regulatory framework and its technical and economic consequences concerning the liberalisation of the electricity market. Reflect on an "ideal" fully consistent framework for a fully integrated European electricity market;
- determination of the total social cost for electricity generation, both with and without taking into account system interaction. Perform scenarios to determine the 'most optimal solution' for electricity provision in the EU;
- screening of the results of the project with respect to the degree of realism, compatibility with liberalised markets, and the 'desire' for security of supply.

Project Information

Programme
Scientific Support to Policies

Contract number
006602

Instrument
Specific Support Action

Starting date
01/01/2005

Duration
24 months

Total cost
€ 749 340

EC funding
€ 749 340

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ECRIN - FR
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NTUA - EL
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ERMINE

Electricity Research Road Map in Europe

Overview

The objective of the project is to help the EU authorities to get a view of the recent, present and future scenario of the Research and Technology Development (RTD) efforts in the EU electricity sector. With regard to the recent and present scenario, the project intends to reach a complete and systematic understanding of RTD expenditures and strategies of the main actors of the European electricity sector. In terms of the future scenario, the project intends to highlight the specific RTD needs of the European utilities and plant/equipment manufacturers and to develop a Road-Map of RTD to be undertaken in all sectors of the electrical power system in the next 25 years.

Challenges

The electricity sector in Europe is experiencing a very strong evolution, due to several factors including the liberalisation of the electricity market, the strong dependence of European energy consumption on foreign importation, the growing focus on the environment and the enlargement of Europe. RTD programmes are facing a general trend of reduction of available funds and the electricity operators are focusing their research efforts on short term objectives. This calls for appropriate strategies and policies in the planning, selection and prioritisation of research needs and funding.

The ERMInE project intends to contribute to the definition of European RTD strategies by providing a view of the recent and present scenario of the electricity RTD efforts and the specific needs of the European electricity sector in the next 20-25 years, in the following areas: generation, transmission, distribution, and end-use. Common to all these areas, RTD activities related to the actions to be undertaken to limit the environmental burden and the activities linked with the setting up of the electricity markets and the relevant regulations, are also included.

Technical Approach

WP1 **Project management:** dealing with all management aspects.

WP2 **Data mining:** to map the present scenario of electricity RTD in the EU countries and to define the present distribution of electricity RTD funding to public and private entities.

WP3 **Road map development:** this WP aims at preparing a Road Map for the next 25 years in the EU electricity sector, including: technology development of the electricity sector; R&D initiatives to reach major objectives of generation efficiency, secure energy supply, electric system reliability, respect of the environment; and proposals on how to improve the efficiency of electricity RTD.

WP4 **Logistics and event organisation:** for the organisation of Workshops and Final Conference.

WP5 **Dissemination** of the results of area workshops among major European electricity utilities and manufacturers and of the project results through an International Symposium.

To match the project objectives, the following tools are implemented.

- **Questionnaire:** a data collection tool addressed to subjects acting as RTD funders and performers.
- **Workshops:** in different EU areas. Utilities, manufacturers and other entities are invited to describe their present RTD point of view, as well as research needs and priorities in the mid and long term.
- **Focused meeting:** with a reduced number of participants are intended to discuss specific topics not completely dealt with, during workshops.
- **Digital databank:** based on the results of the questionnaires and workshops, and organised to provide information about the Map and the Roadmap.

Expected Impact

The outcome of the project consists of two major deliverables: a *Map* of the recent and present RTD efforts in the EU electricity sector and a *Road Map* with indications of the possible evolution and of the future needs of RTD efforts, specifically tailored to the EU context. They are expected to support the definition of long term research programmes aimed at providing secure electrical services, cost-effective and high quality power supply, in the frame of sustainable development. The ERMInE project intends to outline RTD policies, strategies, priorities, qualified centres of competence in the electrical sector at a real European level, in order to overcome the weakness of national policies, which are liable to follow individual paths and approaches in RTD funding.

Progress to Date

The activity carried out in the first six months consists of all background and preparatory work for the data collection in view of the setting up of the Map and the Road Map.

An extensive literature search and analysis was carried out to review the publicly available information about RTD&D funding in the energy and electricity sectors.

Background data collection and elaboration was carried out to understand the evolution of the European society, economy and electro-energetic system in the last 20 years.

The data-collection questionnaire has been designed to gather quantitative information about the evolution of the private and public funding of RTD&D activities starting from the mid '80s.

The database to relate the RTD&D expenditures to the main actors in the field and to the background information has been designed.

Four workshops have been scheduled
- Brussels, 11-12 October 2006
- Oslo, 1 November 2006
- Warsaw, 31 November 1 December 2006
- Rome, 1-2 February 2007

As for the organisation of the data collection at national level, for most of the countries, a National Data Manager was appointed, with the role of pointing out potential recipients of the questionnaire, sponsoring the data collection and validating the data collected by the consortium.

Project Information

Programme
Scientific Support to Policies

Contract number
022825

Instrument
Coordination Action

Starting date
01/01/2006

Duration
24 months

Total cost
€ 1 301 090

EC funding
€ 790 560

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SYNERGY+

Expanding the Competitive Intelligence in the European Distributed Energy Resources Sector

Overview

Distributed Energy Resources (DER) refer to the decentralised production of electricity and very often heat, either in isolated areas (such as islands) or connected to electricity grids. It includes the use of renewables (solar, hydro, wind, biomass, geothermal) which will contribute to meeting the Kyoto protocol targets and some of the European energy challenges of the 21st century.

Distributed Energy Resources will surely open new business opportunities where innovative SMEs can be involved at the generation, distribution and end use level.

SYNERGY+ aims to support the development of innovative solutions by SMEs in the DER sector. Its activities include raising awareness, providing training and providing support for the preparation of Research and Development proposals to be submitted for selection in 2006 and 2007 by the 6th and 7th Framework Programmes of the EC.

Challenges

There are several barriers that deter SMEs from submitting RTD proposals in response to EC calls. SYNERGY+ has devised a set of complementary approaches to reduce or overcome such barriers.

Technical Approach

First, detecting new SMEs having RTD capabilities and a real ability to innovate are identified through training sessions held all over Europe. SME players that are willing to enter EC-funded projects are then supported through an in-depth audit to identify, under appropriate non-disclosure agreements, the most promising ideas ready for public support at EC level. Finally, support is given to the research consortia to prepare proposals in line with EC selection requirements. All the trained SMEs are invited to register on the developed Web Market Place, where they can network, meet in Forums, access expert knowledge and ask for support from SYNERGY+ technological or business partners at any time.

RTD providers
Universities
Research centres

Industry
Energy Utilities
Engineering companies
Equipment manufacturers

Public authorities
Agencies
Local Authorities
Ministries
(Energy, Environment, Research)

Groupings
Professional Associations
Clusters of enterprises
Networks of Excellence
Incubators

Barriers as perceived by SMEs	SYNERGY+ actions
Anxiety regarding the complexity of European support measures and the various research agendas regarding DER technologies	**Connections have been established with DER-related Platforms,** with direct connections to their web sites
Need for coherence between National and European funding schemes	The **energy agencies** of the participating countries **are partners** of SYNERGY +
Readiness to **participate in research actions** especially in SMEs that need outside RTD support	**150 SMEs are to be included in research project proposals,** as an outcome of training on FP7 participation performed in each of the participating Member States
Need for integration of all the key players of the innovation chain, especially when **funding the prototype industrialization phase**	**Private Investors have joined** the consortium to bring their expertise at funding the costs of producing market applications of innovative technologies
Too much information about DER, but no packaged knowledge ready for use	A portal is designed to become a **Market Place** delivering relevant knowledge for the use of European SMEs (technology, markets, competition,...)

Expected Impact

WP1 Seven hundred and twenty SMEs will be trained at understanding DER business opportunities in tomorrow's energy landscape throughout Europe: they will become knowledgeable in the technological expectations of the European Commission and the demands of local energy markets involved in DER solutions.

WP2 Four hundred SMEs will be audited in depth to better understand their willingness to enter European projects within FP6 and FP7.

WP3 One hundred and fifty SMEs will be connected to FP6 and FP7 RTD project proposals, based on the support of their professional associations and the technology expert group of the SYNERGY+ consortium.

WP4 The SYNERGY website will become a real Market Place for SMEs linked to the DER-relevant European Technology Platforms.

WP5 To continuously disseminate the SYNERGY+ activities in order to secure the sustainability of the Market Place beyond project completionn.

Progress to Date

Close to the mid-term of the project, nearly 300 SMEs have been trained. Phone audits have been performed with trained and non-trained SMEs, so that between 10 and 20 project proposals are expected for submission at the first Call of FP7.

The Web Market Place is fully operational. Links have been established with the 6 European Technology Platforms of relevance in the DER sector ('Smartgrids', Photovoltaic ETP, Solar Thermal ETP, The Biofuels ETP, Hydrogen and Fuel Cells ETP, Zero emission fossil fuel power plants ETP), to which SMEs can make inputs through SYNERGY+.

Technology roadmaps, using the vision papers of the different ETPs, will be made accessible from the Market Place in the next 6 months to make SMEs aware of the expected markets and innovation needs for DER technologies.

Highlights of Results

Twenty-four SMEs have been included in nine project proposals (STREP, IP) submitted in the last two FP6 Calls, in the scope of the Distributed Energy Resources (FP6-2005-TREN-4 and FP6-2006-Energy-4).

One hundred and seventy SMEs have already joined the Web Market Place. They can access 2200 'Knowledge Pills' and can network through the contact database.

Project Information

Programme
Research and Innovation

Contract number
023395

Instrument
Specific Support Action

Starting date
17/10/2005

Duration
24 months

Total cost
€ 2 006 320

EC funding
€ 1 307 020

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Website
www.synergy-project.org

A D E G

Advanced Decentralised Energy Generation Systems in Western Balkans

Overview

The main objectives of the project are:

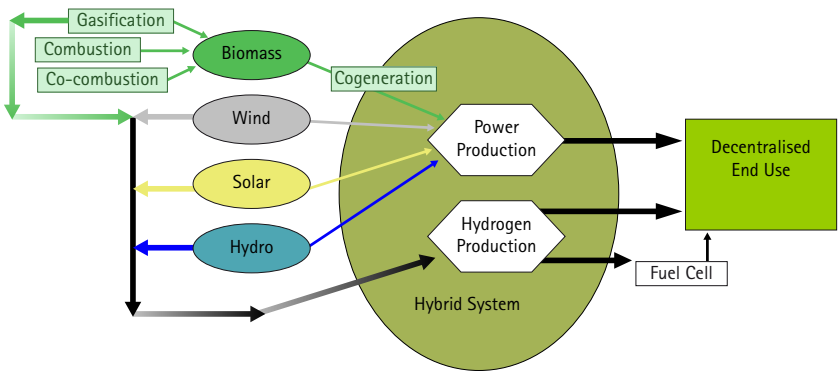
- **to map the potential for Renewable Energy Sources (RES) exploitation in Decentralised Energy Generation (DEG) in Western Balkan (WB) countries;**
- **to create a standard modelling procedure for decentralised system selection by investors in WB;**
- **to identify specific concepts for DEG in Bosnia-Herzegovina, Croatia, Serbia and Montenegro;**
- **to integrate these concepts into multi-technology systems for the achievement of stable and high efficiency power production;**
- **to increase efficiency and competitiveness of Renewable Energy and hybrid stand alone power supply in decentralised areas in WB;**
- **to improve the environmental performance of reconstruction work linked to energy generation.**

Challenges

The main goal is the prevention and management of environmental problems in Bosnia-Herzegovina, Croatia, Serbia and Montenegro. In that perspective the work deals with decentralised energy generation including grid-connected or stand-alone electricity generation and the significant potential in the Western Balkans in the fields of: biomass gasification, hydrogen production and utilisation, solar energy, wind energy, co-generation technologies, small hydro plants, fuel cell applications and hybrid systems.

Technical approach

The work is divided into five work packages. In the first one, the potential for RES is examined in terms of its availability and the specific characteristics of each type taking into account biomass, wind, hydro and solar for the development of regional maps of power production sources, and technologies focusing on decentralised energy systems. In the second work package, technological concepts are investigated to identify the opportunities and barriers with each technology according to the local particularities. Moreover, experimental work involves biomass combustion, co-combustion and gasification. The third work package deals with the identification of the most promising configurations for the advanced utilisation of renewable energy in decentralised systems. It aims to: increase the efficiency of decentralised systems for power production; to explore the opportunities for hydrogen as an energy carrier; to establish reliable and low cost energy generation for stand alone grids and develop applications with advanced security of supply characteristics. In the forth work package, the most promising concepts will be optimised based on the specific characteristics of the selected areas and the assessment of the relevant economic and environmental aspects. Finally, the last work package involves Management and Dissemination activities.



Expected impact

- Specific technological concepts suitable for DEG in the Western Balkans.
- Assessment of hybrid configurations of energy systems on technical, economic and environmental terms.
- Standard procedure for applications of decentralised energy generation systems – Standard regional considerations.
- Dissemination of results and identification of future research needs.

Progress to Date

An extensive survey was conducted focusing on the availability and potential of decentralised concept products in Bosnia-Herzegovina, Croatia and Serbia and Montenegro. The assessment of the suitability of each technology was based on the evaluation of the key parameters, namely: technical, environmental, economic and financial, social, market, and regulatory, as well as on the background information and selected test cases under investigation.

Highlights of Results

The regional characteristics were identified in terms of the current technical and economic aspects of the energy systems and market, and the regulatory and energy policy background. RES utilisation was assessed, including an overview of RES technologies applied at the country level and available RES applications within country's regions and the respective RES potential. The development of secondary legislation, mainly tariff methodologies for power generation, transmission and distribution is an important issue for DEG market development. For wind-based energy systems the most promising areas are in Croatia, the islands and the coastal area of the Adriatic Sea, in the mountainous areas in Bosnia-Herzegovina (in Sarajevo Canton and in the South) and in FYROM. Currently, local companies and representatives of EU manufacturers are active in the WB region. The further investigation of wind potential and the adoption of financial support schemes are expected to facilitate the penetration of this technology to the WB energy market. For solar-based systems the islands and Coastal Area in the Adriatic Sea of Croatia as well as Albania are promising. Photovoltaics and solar thermal technologies are available to the WB area and there are companies active in the field of solar and PV manufacturing and system design services. For Biomass systems, promising areas are Bosnia-Herzegovina for its wood residues, and Serbia and Montenegro for agricultural residues. Biomass combustion is already quite developed in the WB region. There are commercialised concepts that are mainly focused on conventional industrial and residential applications. Two representative fuels (soya straw from Serbia and Montenegro and pine wood chippings from Bosnia-Herzegovina) were investigated in combustion and gasification mode. The results are promising for the further utilisation of biomass in WB with enhanced energy schemes. For hydro energy Bosnia-Herzegovina seems to have significant potential.

Project Information

Programme
Specific Measures in Support of International Cooperation

Contract number
509187

Instrument
Specific Targeted Research Project

Starting date
01/05/2004

Duration
36 months

Total cost
€ 1 189 802

EC funding
€ 1 189 802

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RES INTEGRATION

Rural Sustainable Development through Integration of Renewable Energy Technologies in Poor European Regions

Overview

The project has two main objectives:

- **to significantly increase the share of local renewable energy sources in specific regions of the participating countries; thus providing benefits such as reduced emissions and job creation;**
- **to develop cost effective local renewable energy solutions integrated in areas with significant social and environmental dimensions, within selected, poor regions.**

Challenges

The main challenge is the development of a model for defining the optimum local combination (integration at regional level) of renewable energy technologies according to the specific conditions, needs, and particularities of the selected regions. An expert system-model is being developed for defining the **optimum** local combination of renewable energy technologies. The collected data is used as an input to the model. During the model implementation, particular emphasis is given to: the local environmental and socio-economic conditions; the recorded RES potential; the regional environmental restrictions; energy demands and agricultural activities; and, national policy priorities for energy, agriculture and environment.

Technical Approach

WP1 Selection of target regions – data collection and processing.

WP2 Identification of schemes for IRES implementation.

WP3 Model development and application for determining optimum IRES schemes in the selected regions.

WP4 Cost benefit analyses and socio-economic impact assessment of the defined IRESs for each region.

WP5 Environmental and ecological impact assessment of the defined IRESs for each region.

WP6 Integration of project results into the existing and planned international aid and development schemes of each region.

Expected Impact

The project results will provide local governments in each region with plans for future sustainable development. The overall project results will provide guidelines and tools for promoting sustainable development in other poor European regions, especially in the West Balkan countries.

Progress to Date

A review has been conducted of the potential RES (detailed data) for the selected regions and the RES technologies to be employed in the Integrated Renewable Energy Systems. A common methodology for the implementation of Integrated Renewable Energy Systems has been developed and the software (expert system-model) for the definition of the optimum combination of IRES is currently under development.

Highlights of Results

The main achievements will be the definition of the optimum combination of IRES for each of the selected regions using the developed model – these results will be available in April 2007.

Project Information

Programme
Specific Measures in Support of International Cooperation

Contract number
Specific Targeted Research Project

Instrument
STREP

Starting date
01/11/2004

Duration
36 months

Total cost
€ 1 150 000

EC funding
€ 900 000

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V B P C - R E S

Virtual Balkan Power Centre for Advance of Renewable Energy Sources in Western Balkans

Overview

There is considerable underexploited potential for the development of renewable energy sources (RES) in the countries of the Western Balkans (WB) region. Efficient use of this potential could significantly contribute to security of energy supply within the region and its wider neighbourhood. Special care has to be devoted to sound solutions for electricity supply of undeveloped and regions, isolated due to war damage.

The main objectives of the Virtual Balkan Power Centre (VBPC) are:

- **transfer of know-how in RES technology and their implementation for isolated regions;**
- **identification of the main economic and legislative factors influencing investment decisions in RES including barriers and local specifics, and identification of options to improve penetration of RES;**
- **awareness building and education on modes, means and benefits of RES.**

Challenges

The VBPC-RES Project is focusing on the region of Western Balkans where the economic situation is improving only slowly due to the lack of sufficient funds and the general socio-economic conditions. By providing a high-profile project which maintains a strong professional focus, prominent local institutions have been encouraged to take part in the project and contribute to results dissemination.

The key challenges of the Project are:

- building of awareness about RES in a region with severe economical problems, just emerging from a long period of ethnic strife and war;
- defining key technical and regulatory steps, for the countries in the region to help themselves in fostering efficient use of RES for energy supply;
- ensuring the knowledge transfer from EU amongst diverse beneficiaries in the Western Balkans despite ethnic tensions, historic background and different economic priorities necessary for survival.

Technical Approach

The VBPC-RES Consortium is set up to provide knowledge transfer and capacity building. Of 17 project partners from 11 countries, 9 are from EU Member States, 2 from accession countries and 6 representing all Western Balkans countries.

The work within the VBPC is organized in 4 work packages (WP).

WP1 This WP deals with transfer of best practice and best technologies in RES for isolated regions. This is comprised of: energy transformation, distribution, operation and control, connection to the local network, energy storage and organizational as also other implementation issues.

WP2 The regulatory framework of each WB country is analysed to identify barriers to deployment of RES and other local specifics. This WP will share experiences from the EU, associated states and the WB countries regarding establishing incentives for promotion of RES and experiences with harmonisation to EU legislation.

WP3 The objective is communication and dissemination with key stakeholder groups (policy makers, utilities and SMEs, higher education system). For each key stakeholder group of actors important for RES implementation in the region a special dissemination programme will be carried out. This will comprise of targeted workshops, conferences, public reports and summer schools.

WP4 Will be devoted to project management issues and to support actions and activities in the first three work packages.

The coordinated action VBPC-RES will provide a number of innovations and improvements, which will facilitate the achievement of project objectives; namely:

- provision of critical insight into present development of RES in WB countries and selection of the most relevant good practice and lessons learned in EU and AC countries for efficient transfer of these achievements to the Balkan Countries;

- finding optimal solutions for smoother implementation of RES in WB isolated regions;
- strengthening the link between the scientific community and decision makers. Focusing the discussion to crucial points for RES implementation, and enhancing means and methods to prepare sound solutions as support to decision-making processes;
- bringing together institutions involved in preparation of regulation for energy sector restructuring and institutions involved in renewable energy research, thus facilitating the exchange of experiences and setting the foundations for future common projects;
- organisation of seven knowledge generation workshops mainly involving experts in the field and six knowledge dissemination workshops with high involvement of decision makers. The project will disseminate results to actors responsible for national energy policy and business development.

VBPC-RES offers a unique opportunity for networking between research institutions, industrial partners and utilities within the region, which will contribute to reinforce WB research potential. Cooperation with research institutions from EU member states will also allow positioning and integration of individual research activities from the WB region into the common European Research Area.

Expected Impact

As the main impact, the project aims to raise RES awareness by establishing high status project activities, by producing high quality informational material, and by disseminating the proceedings to the decision makers and the relevant professional public through project activities. The following goals are set in the project:

- a series of four expert workshops on RES technologies and three expert workshops on RES policy;
- special RES seminars on priority areas of VBPC-RES topics at two scientific conferences;
- one regional decision makers conference on RES technologies, and one on RES policy;
- five local decision makers conferences, one in each WB country;
- preparation of two brochures in national languages of the WB countries;
- two summer schools for students;
- preparation of learning materials for higher education students on RES technologies;
- organization of exchange of personnel within the region;
- provision of support for development of further cooperation projects;
- web portal and pages will be prepared and information for media.

Project Information

Programme
Specific Measures in Support of International Cooperation

Contract number
509205

Instrument
Coordination Action

Starting date
01/01/2005

Duration
36 months

Total cost
€ 597 397

EC funding
€ 597 397

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Joanneum Research - AT
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NTUA - EL
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University of Maribor - SL
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Website
www.vbpc-res.org

CRESMED

Cost Efficient and Reliable Rural Electrification Schemes for South Mediterranean Countries Based on Multi Solar Hybrid Grids

Overview

Rural electrification in South Mediterranean countries is mostly done with solar home systems, which only provide service for a very limited number of appliances (lights). This service gives an image that 'PV is for the poor', and is not sufficient for the stimulation of economic activities in rural areas. Fuel generators are also used and provide more electrical power, but suffer high maintenance costs, irregular availability of fuel, and are mostly used to give a limited energy service during 6 to 14 hours per day only. The solution is the employment of hybrid systems using a mix of renewable energies and fossil fuel, and the provision of energy services to the wider rural community via a micro grid.

The integrated approach for rural electrification using such multi user hybrid grids has been tested for electrification in Europe, but still has to be adapted to the different social, economic and environmental context in the South Mediterranean countries.

Objectives

The main strategic objectives of the project are:

- RE electricity produced from multi user solar hybrid systems (MSGs) combining solar and other locally available energy sources on local micro grids;
- management tools to operate rationally a larger number of MSGs in a region by satellite and other communication technologies.

Technical Approach

The project follows a clear set of work packages (WP), which can be grouped into research, technology development, field-testing and dissemination.

WP1 Deals with research studies on the needs for energy services in the Mediterranean partner countries. This WP gives partners in the Mediterranean countries the opportunity to investigate the energy needs in the field in terms of hybrid systems.

WP2 The results are used to define a strategy for rural electrification programmes in each of the participating Mediterranean partner countries, addressing all non technical issues requiring research activities.
There are two work packages dealing with research and appropriate technology development.

WP3 Covers the further development of system components (power conditioner, water and wind turbine) to suit the social and environmental conditions in the target countries.

WP4 Involves the development of an advanced control system, which is based on a unified communication bus for system components and is used for the monitoring system, which allows for remote control.

WP5 Covers research on general technical aspects for the implementation of hybrid systems with high renewable energy content in the target countries. Outcomes of this WP are gathered into a design manual for such systems, which may be further used for the development of standards.

The results of the work done so far are tested in a field test system, which will be set up in a real village in Morocco. All steps of the implementation of such a system will be followed, and any necessary improvements to the procedures will be made. After implementation, the system will be monitored technically, socially, and economically for at least 6 months.

The results of this project will be disseminated among decision-makers and stakeholders of Mediterranean partner countries.

Expected Impact

The results of the study on the need for rural electrification in Mediterranean countries will be used for the development of a rural electrification strategy, where strategic targets are set. Financing schemes and models will be developed in order to achieve a service scheme, which is socially and economically sustainable in the Mediterranean countries. Close co-operation between the European and the Partner Countries' research centres will ensure that further Mediterranean Partner Countries related INCO objectives are met. This will boost the RTD capability of the Mediterranean Partner Countries and establish links between research centres.

These results will be used to research and develop components for the specific operation conditions present within the Mediterranean countries, such as high temperatures and high dust content in the ambient atmosphere. The close co-operation of all participants will help to strengthen the links between research centres, businesses and other stakeholders in society, and the links between research institutions in the European Union and Mediterranean partner countries.

Project Information

Programme
Specific Measures in Support of International Cooperation

Contract number
015286

Instrument
Specific Targeted Research Project

Starting date
01/02/2006

Duration
42 months

Total cost
€ 1 800 000

EC funding
€ 900 000

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Website
http://project.cresmed.org/

DISTRES

Promotion and Consolidation of all RTD Activities for Renewable Distributed Generation Technologies in the Mediterranean Region

Overview

Recent concerns on environmental protection and sustainable development have led to recognition of the critical need for cleaner energy technology. A number of potential solutions have evolved including energy conservation through improved energy efficiency, a reduction in the use of fossil fuels, and an increase in the utilisation of environmentally friendly energy forms. This is expected to lead to the increased use of renewable energy sources (RES), and distributed generation (DG) technologies, as an alternative to large scale sources of energy production.

Objectives

The overall goal of DISTRES is to exchange and disseminate good practice within the field of RES-DG technologies. This will be achieved through isolated research activities, studies, and/or analyses of the needs of the Mediterranean region. Several promising RES-DG technologies have been already identified as having the potential to significantly contribute to the reduction of primary emissions (e.g. SO_2, NO_x, and dust) and CO_2 emissions.

Solar potential is an abundant commodity in the Mediterranean region. Thus the primary area of interest of DISTRES is electricity produced from solar energy (photovoltaic and/or solar thermal concentrating systems) from DG systems. The main scientific and technological objectives of DISTRES may be summarised as follows:

- to co-ordinate RTD projects in RES-DG technologies;
- to promote electricity generation from solar energy, photovoltaic systems and solar thermal systems, paving the way for pilot systems and products;
- to produce capacity building methodologies;
- to disseminate the results as widely as possible within the Mediterranean countries and the EU.

Challenges

DISTRES will contribute to the EU objective of establishing a Euro-Mediterranean Research and Innovation Area as a component of the opening of European Research Area within this region. DISTRESS seeks to encourage the long-term sustainable development of the Mediterranean in the context of transboundary economic, environmental and socio-political problems. This includes promoting the production and the exchange of knowledge, technological know-how, innovation, and investment in people and institutions, in order to foster socio-economic progress throughout the Euro-Mediterranean area.

DISTRES aims to boost the R&D capabilities of the Mediterranean countries and to encourage links between research centres, businesses and other stakeholders in society. In particular, the results from DISTRES will pave the way for pilot systems and products which meet the specific needs, climates and socio-economic conditions of the Mediterranean countries, and will contribute to the development of appropriate RES-DG policies. To that end, DISTRES will also reinforce the creation of new jobs in advanced engineering fields.

Technical Approach

DISTRES is organised into five work packages (WPs) with a total duration of 36 months. WP1 involves various studies concerning RES-DG policies including the status of green hydrogen and socio-environmental benefits for the EU and the Mediterranean countries. WP2 focuses on the identification of various successful RES-DG business models. WP3 reviews the various studies the concerning regulatory regimes of the EU and Mediterranean countries. WP4 aims to provide building capacity methodologies for the promotion of RES-DG technologies in the Mediterranean region. Finally, WP5 concerns the project management and the coordination of DISTRES.

It is intended that the results of DISTRES will be made widely available, both during and after completion of the coordination action. The work programme includes the organisation of three workshops, a Conference, the development of capacity building methodologies, and the creation of a website, newsletters, and a press release.

Expected Impact

To date, RES-DG (solar thermal systems and photovoltaic systems) is not considered commercially viable nor profitable unless strong subsidies are available within the Mediterranean countries. However, the conclusion from concerted European research is that solar thermal systems and photovoltaic systems are reliable and technically feasible for installation and operation in the Mediterranean region. Strong financial incentives have yet to be developed to enable RES-DG to become viable in technical and economic terms. Persistent obstacles are the technology cost, the stability issue for isolated power systems and the energy policies of the Mediterranean countries.

DISTRES contributes to the promotion of RES-DG technologies and policies, while safeguarding the environment, and thus has application at a pan-European level. In particular DISTRES responds to EU policies at a number of different levels, by:

- promoting the use of solar thermal and photovoltaic systems;
- promoting RES-DG technologies including green hydrogen based systems (hydrogen as an energy carrier is one of the key technology sectors identified by the EU to ensure the long-term competitiveness and strength of the European economy and the goal of providing Europe with a realistic and economically viable route to a green hydrogen economy);
- encouraging the development of a European hydrogen economy, this work will help to maintain the ability of Europe's energy supply infrastructure to smooth the increasingly fluctuating supply/demand balance inherent in an increasing dependence on renewable energy sources, and;
- contributing to the efforts of the EU to reduce its greenhouse gas emissions and thus towards global climate change issues.

Project Information

Programme
Specific Measures in Support of International Cooperation

Contract number
031569

Instrument
Coordination Action

Starting date
01/01/2007

Duration
36 months

Total cost
€ 1 075 484

EC funding
€ 999 832

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National Agency for the Promotion and Rational Utilisation of Energy - DZ
New and Renewable Energy Authority - EG
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Palestinian Energy and Environment Research Center - PS
Renewable Energy Development Centre - DZ
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MEDRES

Cost-effective Renewable Energy for Rural Areas in the Mediterranean Region

Overview

The objectives of the MEDRES research proposal – starting from the analysis of the present situation and announced objectives by the countries with a special focus on the rural and peri-urban areas – are to assess the opportunities for cost-effective renewable energies for rural areas and villages (by selection and analysis of pilot projects), to assess the real effectiveness of new technologies through better knowledge of end user acceptability for energy efficient technologies and practices, and to measure the impact of electrification on socio-economic development in rural areas.

The main results of the project will be elaborated in a set of recommendations and proposed adapted strategies to be largely disseminated in the Mediterranean region.

Objectives

The Southern Mediterranean countries will be studied in order to promote cost-effective renewable energy for rural areas in the Mediterranean region and best practices identified in order to enhance the sustainable development in these regions. This is consistent with the Development Millennium Goals, the outcome of the International Conference on Renewable Energies in Bonn 2004 and its follow up initiatives, the Mediterranean Renewable Energy Programme (MEDREP) the Type II Initiative, the newly adopted Mediterranean Strategy for Sustainable Development and the EU strategy within its neighbouring countries and especially the Mediterranean Partner Countries.

Challenges

Important actions in different fields of renewable energy and energy efficiency are needed in order to widely develop and in an efficient manner in the Mediterranean Partner countries. Particularly, for the rural and peri-urban areas which are largely under-endowed with energy services: in such areas energy efficiency and renewable energy are very important to have access to energy services.

In order for renewable energy sources to achieve their market potential, policy frameworks and financial instruments will be required that give financiers the necessary assurance and incentives to shift investment away from carbon-emitting conventional technologies to cleaner energy systems. In addition transfers of technology and know-how and capacity building will also be required.

In this context, regional cooperation is necessary and will significantly benefit the sustainable development of the region, and the MEDRES research project could play an important role in this regard.

Technical Approach

The MEDRES project is structured along five main work packages:

WP1 Analysis of the current and future renewable energy context in the Southern Mediterranean countries to identify the real need for renewable energy in these regions. Specific attention will be given to rural areas, villages and also peri-urban areas. Indeed, these areas often lack energy services and in many cases have no access at all.

WP2 Research on sustainable power for rural areas and villages. Specific attention will be given to: diesel mini-grid retrofit using renewable energy sources; distributed generation in rural weak grids; and, distributed generation in LV grids, using the concept of Microgrid. Studies of selected projects identified by the partners as being strategic and of priority will be performed in each country.

WP3 Analysis of energy efficient use in peri-urban and rural areas, technologies and practices using surveys, selection of local initiatives, implementation of surveys, and, analysis of results and lessons learned. The purpose will be to assess the real effectiveness of such solutions, through better knowledge of end-user acceptability for energy efficient technologies and practices.

WP4 Measuring the impact of electrification on socio-economic development in rural areas. A selection of internationally recognised indicators (on social, sanitary, educational and economic aspects) will be chosen from those used by UNDP, World Bank, EU etc.. Measurement methods will be developed and tested. 'Before-and-After' comparisons will be conducted on selected villages to be electrified during the project. The indicators, measurement methods, and results will be assessed, and strategies will be developed for successful implementation.

WP5 Management, exploitation and dissemination: in addition to the general coordination of the project and management activities, a Steering Committee with representatives from European and Mediterranean associations, international organisations, public authorities, industry and so on will be set up in order to support the dissemination of the results and to promote analysed projects in the selected countries. In addition, a high level Conference will be organised towards the end of the project in order to disseminate the results. This will involve major stakeholders (for example, equipment suppliers, utilities, Ministries for Energy) in the European countries and Southern and Eastern Mediterranean countries.

Expected Impact

The MEDRES research project will have a large impact on the sustainable development of selected Mediterranean Partner Countries. It will provide support to decision makers in these countries for the improved identification of best practices of sustainable energy in rural and peri-urban areas, particularly in relation to renewable energy and energy efficient technologies.

The project will also serve to support the European Commission with respect to the formulation of future International Cooperation programmes focussing on the thematic issue of Sustainable Energy as well as to elaborate draft concepts for Renewable Energy projects which may be supported by the EC and the Mediterranean Countries. Thereby, this project will also help to achieve the objectives of the Type II energy Initiative launched at the WSSD in Johannesburg: the Mediterranean Renewable Energy Programme (MEDREP) and the newly adopted Mediterranean Strategy for Sustainable Development.

Project Information

Programme
Specific Measures in Support of International Cooperation

Contract number
032020

Instrument
Specific Targeted Research Project

Starting date
01/01/2007

Duration
36 months

Total cost
€ 2 037 129

EC funding
€ 1 159 782

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Office National d'Electricité - MA
SMA Technologie - DE
Société Tunisienne d'Electricité et du Gaz - TU
Sonelgaz - DZ
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www.medres.org

OPEN-GAIN

Optimal Engineering Design for Dependable Water and Power Generation in Remote Areas Using Renewable Energies and Intelligent Automation

Overview

To combat water scarcity and desertification, intensive desalination activities have been carried out in remote arid regions: Very large desalination plants at coast are inadequate for remote areas because of an expensive infrastructure and high distribution costs including important pipe losses; de-centralised solutions offer advantages over large central production sites.

In addition, desalting is resources and energy intensive. Thus water production must be increased while keeping the consumption of resources affordable. Because energy has to be generated to supply the desalination plant it is logical to think in a co-generating system for water and electricity.

Challenges

The global objective of this project is to co-ordinate R&TD joint efforts to produce sustainable essential life-resources, water and energy, at minimum environment loads in Mediterranean Partner Countries (MPC) by introducing high technology and automation. A review of the standard plant construction and design techniques will lead to a new model-based optimal system design approach, which will economically improve the overall perform¬ance, dependability, reliability and availability of these co-generating water-electricity plants. Besides by diesel generators the plants, located in remote arid areas, are powered by renewable energy and utilize a high level of automation. This is because of the need to increase reliability, to adapt the working conditions to the strongly varying renewable energy supply, for remote maintenance, and to meet specific cost requirements.

The approach adopted in this project is based on thorough modelling of the processes and offers a large degree of flexibility in the design to meet different production requirements.

Finally, the new technology will be disseminated in MPC and MENA-wide.

Technical Approach

In the above mentioned context, reverse osmosis emerges as a feasible desalination technology, renewable energy sources as a necessary complement and decentralized water-electricity supplies as a solution for this particular problem. A recent study has confirmed the convenience of this combination, where it was shown that RO desalination properly integrated with a renewable energy production system considerably reduced the environmental loads and the airborne emis¬sions associated with desalination and power production. However, water desalting in remote areas requires a high level of plant reliability as well as a dependable system.

Finally, cost reduction and energy saving have been undertaken until now almost exclusively from the point of view of technological improvements to the most important components of the plant (i.e. membranes and high-pressure pumps). Although plants are getting more and more complex, they have not been considered as complete integrated systems at the design stage and automation is not considered as a relevant issue. This lack of system design and full control are found not only in the desalination industry but also in research. However, it is well known that component approaches lead to oversized plants because an optimal system is normally less than the simple sum of the parts, and very often, the misconception "the best system is made from the best components" is used as a design approach. In the future, technological advances in the plant components should be accompanied by a sophisticated system design, for which design tools should exist at that time.

Expected Impact

Water scarcity is a very serious problem that is being attacked from several sides. Nevertheless, the state of the art indicates that plants are not thought to be tolerant in the presence of failures, malfunctioning and operator mistakes. This is however of crucial importance in remote areas where the plant cannot fail without causing severe difficulties to the people who depend on it.

The transfer of technology from RTD to the industrial world will lead to a new line of products with an incremental benefit compared with current products. Companies can reduce costs by means of an optimal engineering design. Furthermore, they can also offer better maintenance services based on remote monitoring. Potential employment in the local manufacturing of system components may open up; reliable water and power supply can create opportunities for small local business and tourism. On the other hand, the new products will improve the quality of life in the regions for which the system was designed.

Apart from supporting the water authorities in offering reliable water supply with a minimum standard of quality, women's responsibility for water in homes will be alleviated. Likewise it can contribute to reduce the interest in migrating, avoiding so a painful uprooting.

In addition, the transfer of technology and expertise can help to reduce energy imports in general, resulting in a reduction of foreign currency expenditure.

The environmental load is the lowest that can be expected for this kind of plant, as a secondary effect, real local water and power costs will be uncovered.

Project Information

Programme
Specific Measures in Support of International Cooperation

Contract number
032535

Instrument
Specific Targeted Research Project

Starting date
01/01/2007

Duration
36 months

Total cost
€ 1 416 345

EC funding
€ 1 299 985

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NTUA – EL
Universidad de Valladolid – ES

POWERSOL

Mechanical Power Generation Based on Solar Thermodynamic Engines

Overview

The main project objective is the development of an environmentally-friendly improved-cost shaft power generation technology, based on solar thermal energy, optimized for supplying the basic needs of rural communities. The proposal focuses on the technological development of solar thermal-driven mechanical power generation based on a solar-heated thermodynamic cycle (POWERSOL system). This technological development consists in optimizing a solar-assisted thermodynamic cycle that generates mechanical power from low to medium temperature range. The optimization is performed by means of experimental testing of the thermodynamic cycle with selected working fluids and of three solar collector prototypes. Mechanical energy could be either used to direct electricity generation (using a generator) or for brackish or seawater desalination by coupling the output to a high-pressure pump connected to a conventional reverse osmosis system.

Challenges

The lack of an electricity grid and/or the shortage of drinking water limit the socioeconomic development of many Mediterranean areas where solar resources are abundant. The use of solar technologies offers an opportunity for supplying basic needs, thus promoting the development of such communities. Solar thermal power generation has been developed in order to produce electricity in the range of tens of MW (SEGS plants, USA). Nevertheless many applications in remote areas only require tens of kW, for example, for pumping for irrigation, cooling, rural electrification for basic needs, economic development through tourism, and so on. Even some intensive energy processes, such as the reverse osmosis seawater desalination process with 100 m3/d of nominal production, consumes only around 20 kW. In addition, remote areas require simple and robust systems, easy to control and operate and with no requirement for skilled workers. Thus, it is clear that an optimized technology for applications in remote areas should be quite different from conventional solar electricity generation plants. This has led to the promotion of solar photovoltaic systems as the main source of electricity for satisfying basic needs in small communities, in remote areas. However, such systems have a number of drawbacks such as high cost and low efficiency. Further, they normally use batteries as energy storage which can result in high maintenance and replacement costs, as well as toxic wastes and operational problems due to the hot climate.

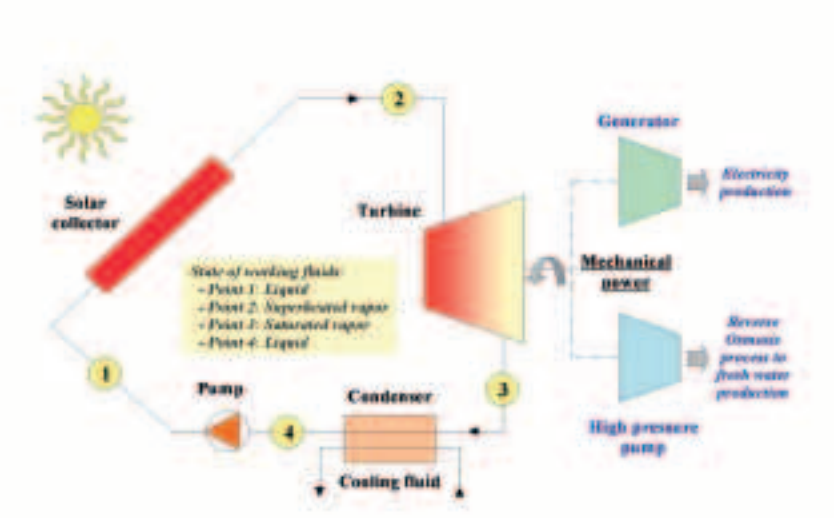
Technical Approach

- Selection of the most suitable working fluid and thermodynamic boundary conditions for three different, top temperature ranges – 80ºC, 100ºC-150ºC and 200ºC-250ºC – by means of modelling the solar-driven thermodynamic cycles which provide the shaft power production.
- Optimisation under thermodynamic and economic points of view of such solar-powered systems for shaft power generation. This includes, not only the analysis of the system as a whole, but also the optimisation of every subsystem.
- Development of three modified-design solar collector prototypes optimised for respective selected working fluid and boundary conditions of thermodynamic power cycles and the optimised design of different subsystems to be coupled to close the thermodynamic power cycle. Two of the prototypes are stationary collectors, a flat plate collector and a compound parabolic concentrator, and the last one will be a one-axis sun tracking parabolic trough collector.
- Experimental testing of the solar collector prototypes.
- Final test of solar-thermal driven thermodynamic cycles by connecting it to two existing solar collector fields.
- Technical evaluation of the developed solar-driven shaft power generation systems: availability, requirements of operation and maintenance, requirement of skilled workers, preliminary design of process control, auxiliary energy consumption, and suitability of stand-alone design or requirement of energy back-up.

Expected Impact

POWERSOL technology will permit the use of thermal energy storage between the solar collector field and the thermodynamic cycle thus avoiding the disadvantages of operational and environmental problems caused by batteries in solar photovoltaic (PV) systems. Also, it will permit the use of a conventional thermal energy resource as backup if a continuous shaft power production is necessary. Nevertheless, photovoltaic systems require grid backup if a continuous electricity demand is required. Moreover, POWERSOL technology is more energy efficient than solar photovoltaic cells and preliminary assessment shows that it is also more cost-effective. Finally, the heat rejection of all thermodynamic power cycles offers the possibility of its use in water or space heating. In summary:

- POWERSOL is an environmental-friendly technology, and can be installed anywhere with solar energy availability;
- POWERSOL could provide sustainable development by providing a shaft power supply for basic needs such as electricity, desalination, pumping or cooling. In addition the heat rejected in the thermodynamic power cycle may provide water and space heating or cooling;
- a POWERSOL plant could accommodate present and future energy demand because it is a modular technology;
- POWERSOL technology offers various advantages as opposed to solar PV systems since:
  - it is more energy-efficient and seems to be more cost-effective than photovoltaic systems;
  - it permits the use of a thermal storage instead of batteries, thus avoiding their environmental impacts and operational troubles;
  - it does not require electricity as an energy backup but a thermal energy resource. Thus it is possible to use POWERSOL technology for a given application, even if continuous operation is required, by means of a thermal energy backup.



Project Information

Programme
Specific Measures in Support of International Cooperation

Contract number
032344

Instrument
Specific Targeted Research Project

Starting date
01/01/2007

Duration
36 months

Total cost
€ 1 456 539

EC funding
€ 1 050 000

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Partners
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Alternative Energy Systems - TN
AOSOL-Energias Renováveis - PT
Ecole Nationale d'Ingénieurs de Tunis - TN
Ecosystem Environmental Services - ES
Instituto Nacional de Engenharia, Tecnologia e Inovação - PT
LOTUS Solar Technolgies - EG
Suez Canal University - EG
Swiss Federal Institute of Technology - CH
Universidad de la Laguna - ES
Universidad de Porto - PT
University of Ouargla - DZ

Website
https://www.psa.es/webeng/projects/joomla/powersol/

E C O N 2

Electrical Energy Conversion and Conditioning

Overview

ECON2 is 5-partner Early Stage Training programme in the field of Electrical Energy Conversion and Conditioning. The aim is to establish a group framework for the coordinated doctoral training in a core technology underlying a number of Framework Programme thematic priority areas. It represents continuity and consolidation of previous FP5 Marie Curie Training Activities and allows for the development of coordinated research and training strategies as well as providing for future organic growth of the network. The programme involves a total recruitment of 30 Fellow-years over a 4-year period and comprises five partners from five EU States.

Challenges and Key Issues

Electrical energy conversion and conditioning is a core technology addressing the environmental concerns of energy efficiency whilst providing the required technological interface between electrical generation and the energy requirements of industry, transport and the community at large. The technology is core to many fields: renewable energy sources, electric and hybrid vehicles, the more-electric aircraft and all-electric ship; and the enhanced efficiency and optimality of industrial and domestic energy use. The training project is set within the context of a European-wide shortage of doctoral research engineers within this field. In the developed states, this is in part due to the low number of graduates entering the field. It is also recognised that there is an abundance of under-utilised natural graduate talent, especially in the Eastern European and Mediterranean regions, and it is important that this talent is also developed to its full potential. The project addresses these issues.

Technical Approach

Fellows are recruited into the training area for periods between 6 months and 3 years, either from within a partner's pre-registered, pre-funded PhD researchers, or from outside the network. Fellows on 2 or 3 year programmes are expected to undertake mobility studies within the network as part of a growing programme of joint research between partners.

The programme provides training in a number of specific areas across the network: converter construction and experimental techniques, high frequency construction techniques, FPGA programming, prototype development, analytical methods, industrial placements and postgraduate technical courses. An annual Easter School provides an intensive week of research support courses, whilst the Fellows' work is presented at the ECON2 mini-conference held annually at the European Power Electronics conference.

Expected Impact

The main achievement will be the enhanced research training of PhD students through the provision of focussed training and mobility, whilst also engendering inter-university awareness and collaboration, both in research and training methods. ECON2 will also contribute to the overall aim of increasing the numbers of research trainees in Electrical Energy Conversion. It will raise the profile of research training in this area through its excellence of provision, its publicity and the positive experience of its Fellows. It will also contribute to redressing the shortage of engineers in the field and will meet the need for researchers, not only for universities and industry in general, but also for future EU Framework Programmes in which Electrical Energy Conversion will continue to play an important role.

Progress to Date

Recruitment has been good with quotas for all partners being filled. This has meant the recruitment of 17 Fellows and 14.5 Fellow-years in the first two years. Of the 17 Fellows recruited, 8 have come from inside the Training Area and 9 outside, of which two were from a non-EU state. Each year, Fellows have met at the annual ECON2 conference and the annual ECON2 Easter School focussing on research and career support activities.

Highlights of Results

There is excellent feedback from the Fellows who report a substantial enhancement in the quality of their research experience. The sense of community engendered by the Easter School and the ECON2 conference is particularly appreciated. Technically, the research programme has already resulted in 8 paper publications, which is very good considering that training is at an early stage, and given the challenges inherent in the subject.

In addition to existing collaboration between the network partners, new partnerships with universities outside the network are beginning to emerge. These include the Universities of Catalonia (Spain), Aalborg (Denmark) and Zagreb (Croatia). Particularly noticeable is the extent to which Malta and Zilina, universities in new EC states, are becoming integrated into the European research community.

Project Information

Programme
Specific Measures in Support of International Mobility

Contract number
504243

Instrument
Marie Curie Actions

Starting date
01/09/2004

Duration
48 months

Total cost
€ 1 558 846

EC funding
€ 1 558 846

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Partners
Politecnico di Bari - IT
University College Cork - IE
University of Malta - MT
University of Zilina - SK

Website
http://hermes.eee.nott.ac.uk/mcf/index.htm

VITA

Vital Infrastructures Threats and Assurance

Overview

Project VITA studied the threats to assurance and protection of highly networked infrastructures, most of which are operating trans-nationally. The reliable performance of which is critical to Europe's security, the well being of its citizens and to the functioning of its economy. The project focused mainly on the electric power infrastructure.

Technical Approach

The project aimed to provide:

- methods to raise awareness and the sense of urgency on the need for international critical infrastructure protection at both the European and national levels. Carried out by developing, executing and analysing a scenario at the level of European Directorates with national stakeholder participation;
- a vision on methods, tools and technologies required for the protection (pro-action, prevention, preparation, incident response, and recovery) of critical infrastructures as preparation for the forthcoming European Security Research programme (ESRP) agenda;
- a demonstrator experiment of tools and technologies in a selected set of end-user applications for proving the feasibility and efficiency of the approach.

A gaming exercise with simulation of a cross-border emergency due to many threats (including a regional power blackout) was conducted in May 2006, and a final conference showing the results was organised in July 2006.

Highlights of Results

Project partner, JRC developed a methodology for the assessment of the security of industrial systems (called Industrial Security Assessment Workbench - INSAW), primarily focusing on cyber risks. The methodology has been implemented in a software tool, which will be available by late 2006.

The methodology was applied to two industrial cases in the electric power sector: a power generation station and a primary substation. For confidentiality reasons and due to the sensitivity of the results, the detailed information on these cases is not yet available.

The methodology has been the object of several papers and presentations in international conferences and workshops.

The project also initiated the European SCADA and Control systems Information Exchange (E-SCSIE). This is a stakeholder working group for the exchange of information on cyber-security aspects of control systems. The electricity field is a key topic within the group. Participants in the working group include governmental agencies, users, academics and researchers, and vendors. Due to the sensitive nature of many of the topics discussed, participation in specific meetings and the distribution of information is strictly controlled.

The ultimate aim of VITA is to enable a pan-European distribution of information on cyber vulnerabilities, threats, countermeasures and incidents related to industrial control and communication systems. The benefit for the electric power industry will be to have access to relevant security information, both generated within their sector and exchanged across sectors, across the whole EU.

Project Information

Programme
Preparatory Action
for Security Research 2004

Contract number
SEC4-PR-004400

Starting date
01/01/2005

Duration
20 months

Total cost
€ 1 364 944

EC funding
€ 1 023 248

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Biomedical - PL
PM Projektmanagement - DE
QinetiQ - UK
Red Eléctrica de España - ES
Swedish Defense Research Agency - SE
TNO - NL

Website
http://vita.iabg.eu/

REF-REE

Scientific Technical Reference System for Renewable Energies and Energy End-Use Efficiency

Overview

The aim of the project is to provide decision makers with relevant, validated and independent information on renewable energy and the efficient use of electricity. The specific objectives are:

- **assessment and comparison of national and regional policy measures, tools and incentives (e.g. feed-in tariffs, green certificate(s) and green generation obligations, carbon-taxes, direct investment subsidies, tax-reductions, etc.), in view of the planned introduction of minimum shares of renewable energy into Europe's generation mix and the achievement of end-use energy efficiency goals;**
- **monitoring of EU strategy and legislation fulfilment, implementation, and research progress on renewables and energy efficiency;**
- **assessment of the saving potentials in electricity end-use and renewable energy resources, and related development in the new Member States, including analysis of the knowledge base and specific technical and non-technical barriers;**
- **scientific and technical support to political activities at the EU-level, e.g. standardisation policies for the reduction of stand-by losses, electricity consumption and the Environmental Technology Action Plan;**
- **strengthening of Europe's portfolio on Scientific Technical Reference Systems in terms of the filling the gap for Renewable Energies and Energy End-Use Efficiency, thus becoming the clearing-house and scientific reference centre for data on Renewable Energy and Energy End- Use Efficiency, and soundly supporting all sustainability related policies.**

Challenges

The European Union is implementing challenging commitments to reduce carbon dioxide emissions in accordance with the Kyoto protocol. It has established ambitious targets for renewable energy sources and energy end-use efficiency in its Green Paper "Towards a European strategy for the security of energy supply", as well as through different directives, for example, Directive 2001/77/EC on the promotion of electricity produced from renewable energy, Directive 2003/30/EC on biofuels, and Directive 2002/91/EC on Energy performance of Buildings. In the past decade, renewable energy technologies have made significant progress in terms of performance, cost and reliability, thanks to vigorous research, development, demonstration and market introduction programmes at European, national and also regional levels. Developments primarily rooted in environmental concerns are now penetrating all societal decision-making and have led to a new, dynamic, and exponentially growing industry.

Three major drivers are determining today's socio-economic framework for the impressive renewables' industrial and market developments:

- the successful application of legally binding feed-in tariffs;
- the liberalisation of the electricity market, and thus new possibilities for decentralisation of power generation;
- the undisputed need for massive re-powering of the larger part of Europe's energy generation capacity. The later will result in generally higher electricity costs, which will more accurately reflect the real costs (incl. externalities) of all the different energy technologies. Thus, a more favourable market situation for sustainable technology choices will evolve, for example, for massive renewable power generation. While technological development has been a key driver in the progress of renewables, the first examples of significant penetration would have been impossible without appropriate supporting policies including instruments such as introduction targets, carbon taxes, elimination of non-technical barriers, internalisation of external costs of energy, and harmonisation of market rules.

The efficient end-use of energy is a parallel area where modern technology, policies, better public awareness of the issues, and market forces (for example utilities' interest in exploiting the potential avoidance of new transmission and generation capacity) have combined to achieve significant results. New integrated marketing concepts, like energy service companies, have recently been very successful. Organisationally they have led the way for the implementation of sharper physical efficiency concepts. This is of particular strategic importance for the New Member States of the EU, as the use of energy in these countries, including electricity, is still significantly less efficient than in the old Member States.

Technical Approach

The Action has set up the Core Group of the Scientific Reference System on Renewable Energy and Energy End-use Efficiency, which consists of key scientists and sector-responsible public administrators. In addition, Action 2312 will set up a network of similar expert centres to access information on vertical technologies, such as biomass, wind and solar thermal. Action 2312 defines and uses quality criteria for the assessment of technologies, implementation actions and incentives schemes, delivering at 6-month intervals indicators on the progress of development and implementation.

Progress to Date

The Core Group of this Action met regularly twice a year to discuss and validate data and published various reports.

Action 2312 organised a number of specific conferences and enlargement workshops targeted towards the enhancement of data collection in the New member States, Candidate Countries and the Western Balkans.

Highlight of Results

Action 2312 set up a web site to disseminate information, including the project results, published reports and the proceedings of the various conferences and workshops. (See http://streference.jrc.cec.eu.int/).

A number of key reports were produced:

- photovoltaic Status Reports 2003, 2004, 2005, 2006;
- status Report 2004 – Energy End-Use Efficiency and Electricity from Biomass, Wind and Photovoltaics in the European Union, P. Beroldi, E. Dunlop, T. Huld, A. Jäger-Waldau, N. Kautto, A. Machirant, H. Scholz, M. ·úri, Editor: A. Jäger-Waldau; Euro-Report EUR 21297 EN, 2004, 131 pages; Luxembourg: Office for Official Publications of the European Communities, 2004; ISBN 92-894-8193-5.

Project Information

Joint Research Centre
Institute for Environment and Sustainability

Core Area
Environment and Sustainability

Priority
Energy [FP6 - WP2005- Action 2312]

Integrated Scientific Area
Sustainable Energy Technologies Reference and Information System

Starting date – End date
01/01/2003

Duration
48 months

Website
http://ies.jrc.ec.europa.eu/refree.html

DEMO-RESTORE

Electricity Storage and Demonstration of Renewable Energy Systems

Overview

The ambitious EU target of doubling the penetration of renewable energy in the European energy mix by 2010 requires the introduction of electricity storage devices. Electricity storage provides on one hand continuity of supply from an inherent intermittent energy source (i.e. wind, sun) and on the other it enables electricity power levelling over time.

Furthermore, nearly half of the world population still does not have access to electricity and is unlikely to get it in the near future as the creation of a centralised electricity distribution (electrical grid) is beyond the budgetary capabilities of developing countries. Photovoltaics have the capability of bringing electricity to this population by the use of stand-alone systems, the so-called Solar Home Systems (SHS). The core of a SHS is the battery that allows to delay the use of the electricity from the production period (over daylight hours) to the consumption period (normally during the evening). Today, SHS is the world's most widespread photovoltaic application and the battery their weakest component. Electricity storage will become a bigger proportion of the cost of photovoltaic systems as the modules get cheaper. Therefore, to reduce the cost impact of the electricity storage, a longer lifetime and improved quality is needed.

Summary of the Project

This action addresses both the short-term storage and the mid- to long-term storage of electricity. The first goal addresses mainly grid-connected applications to increase the quality and availability of the grid power, as well as to smooth the fluctuation of renewable energy systems in a distributed electricity generation system. The second goal targets off-grid electrification applications (urban or rural) and seasonal storage. The present action also focuses on:

- stand-alone Systems. It aims to increase the quality and reliability of Solar Home Systems to match the already very high ones of the photovoltaic modules as a means to increase customer acceptance and in turn renewable energy penetration;
- renewable Energy Systems Demonstration. Aims at demonstrating the viability of renewable energy, above all in arid zones and remote islands where basic energy and water needs remain largely unfulfilled;
- analytical monitoring of photovoltaic installations: Continuation of our support role in the market penetration of photovoltaic systems by performing the analytical monitoring of DG TREN demonstration projects.

Specific Objectives

- Battery Performance, Testing and Standards: verification of proposed drafts on test performance and test procedures for lead-acid batteries used in stand alone PV systems (solar home systems) as a pre-condition for their acceptance as international standards.
- Solar Home Systems: Methods and Standards: confirmation of the System Balance Point as a parameter to measure the energy rating of SHSs by comparing the indoor and outdoor test performance.
- Renewable Energy Systems Demonstration: construction of small demonstrator using RE and reverse-osmosis for drinking water production. This objective supports the development of arid areas in Member States and Candidate Countries.
- Analytical monitoring of PV-installations: continuation of our support role in the market penetration of PV systems by performing the analytical monitoring of DG TREN PV demonstration projects. Extension of this activity by proposing new/alternative means of monitoring. This objective also supports the penetration of PV in Member States and Candidate Countries.

Project Information

Joint Research Centre
Institute for Environment and Sustainability

Core Area
Environment and Sustainability

Priority
Energy [FP6 - WP2003 – Action 2325]

Integrated Scientific Area
Renewable energies and advanced energy conversion technologies

Website
http://projects-2003.jrc.ec.europa.eu.

SARES

Security and Reliability of Energy Supplies

Overview

Europe is undergoing a radical conversion of the operability of its energy infrastructure systems. This is being driven by market deregulation and unbundling of the European energy sector utilities promoted by a suite of policies and Directives and, in tandem, by concerns regarding the vulnerabilities associated with the increasing dependency of the EU on imported hydrocarbons (particularly gas for power generation), the infrastructures for transportation and, in view of major blackout events, the electricity grid systems.
The geographic dimension of these critical infrastructures ranges from western Siberia and Central Asia to the western fringe of the EU, and from northern Europe and adjacent Arctic regions southwards to North Africa and the Middle East.

The vulnerabilities include: supply side geo-politics and market instability; malicious acts (crime, terrorism); natural events (landslides, seismic activity, flooding, permafrost, impacts of climate change); technological factors (ageing infrastructures, particularly outside of the EU, that have reduced capacity due to old equipment and pipe corrosion; accidental interference with buried pipelines and control cables; accidents and disasters on land and sea that cost lives, threaten the environment and local economies; electricity blackouts). ●●●

●●● The rationale for action at the EU level is rooted in the analyses provided in the Green Paper (2000) and subsequent Commission Communications, policies and Directives. The expressed need to improve co-operation with major energy suppliers gave birth to the EU-Russia Energy Dialogue that identifies in a list of priorities the safety of the energy transport infrastructures (need for risk-based monitoring) and maritime safety (environmentally-safe transport of oil). Most recently, the Commission issued a Communication on Critical Infrastructure Protection in the Fight Against Terrorism.

Such concerns transcend the interests of individual Member States. The importance of secure, reliable and competitively-priced energy supplies must be increasingly addressed from the EU level. Indeed, there are recommendations that energy security should become a key foreign policy issue of the EU. This would strengthen the roles of relevant DGs and the JRC in their relations with the European Council and European Parliament.

At present, there is lacking a global knowledge and understanding of the critical energy transport infrastructures, their interdependencies, the key vulnerabilities and of the consequences of a major disruption in some critical node of the infrastructures. This system-wide approach, involving co- operations with Russia, the NIS (New Independent States) and other key supplier and transit countries should be addressed internationally from the EU level. ●

Summary of the project

Given the broad scope of the Energy Security area as described above, the management approach was to plan feasible medium-term strategic objectives (for end of 7th FP) that would provide a framework in which to progressively build up a suite of activities towards, and during, the 7th FP.

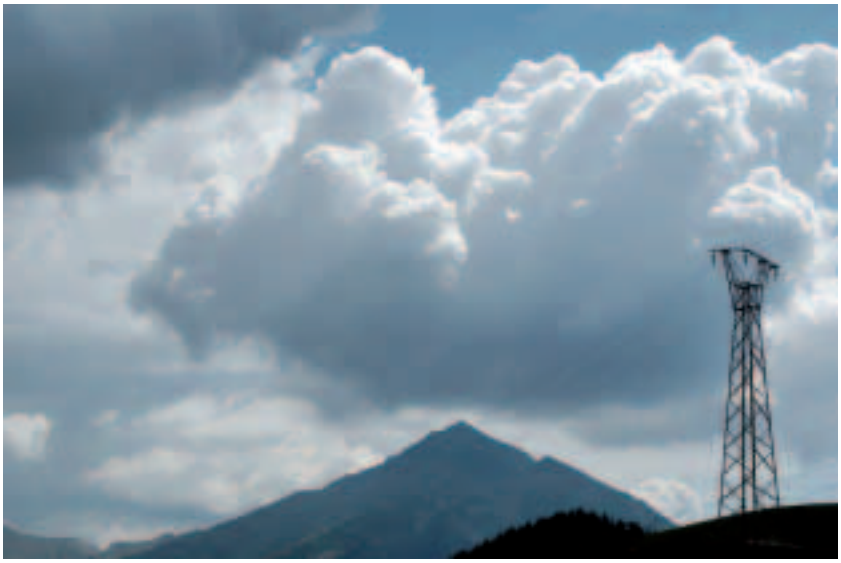
Since a requirement of Europe's energy security is the security and reliability of the energy transport infrastructures (gas. oil, electricity) both inside and outside of the EU, the medium-term strategic objectives are planned around this requirement as follows:

- establish an extensive knowledge base of the sources of energy supply and their capacities (present and future), and of the energy transport infrastructures from source to user;
- identify, assess, prioritize and map the key vulnerabilities (natural, technological and malicious) of the energy sources and transport infrastructures, the interdependences including also with other critical infrastructures (e.g. telecommunications, water, sewage);
- develop a solid understanding of the overall, system-wide consequences of major disruptions to energy supplies by conducting studies of hypothetical incidents, building on existing expertise and knowledge base of past accidents and disasters;
- demonstration of techniques and technologies to mitigate against the key vulnerabilities, e.g. by information products, systems analysis, analysis, design and selected field testing of integrated diagnostic and monitoring systems (satellite, airborne and ground-based inspections) for early warning and prognosis of problems, improved maintenance scheduling and crisis management;

- establish JRC as an international point of reference on security and reliability of energy supplies This medium-term strategy, being aligned with EU energy policy objectives, facilitates a logical approach to setting the shorter-term annual objectives.

In this regard, the main tasks selected to achieve the objectives for 2005 are:

- continue/expand consultations with relevant DGs (TREN, RELEX, AIDCO, JAI), representative organisations of the gas, oil and electricity industries (Marcogaz, Eurogas, GERG, UCTE), individual energy companies and research organisations to consolidate interest, co-operation and support in the following activities:
  - forming an international technical network to co-operate on vulnerability assessment and monitoring of the energy transport infrastructures,
  - mapping of the infrastructures and vulnerabilities,
  - defining pilot-scale projects for monitoring of pipelines and electricity grids,
  - defining the JRC contribution to the COM Communication on Security of Energy Installations and Infrastructures,
  - defining scope of an energy security workshop (end 2005);
- writing of proposals (network, mapping, pilot projects), preparation of contribution to COM Communication and organisation of workshop;
- contribute as requested to the work of DG TREN's Working Group on energy pipeline accidents;
- form an internal JRC group for information exchange and co-operation on key energy security issues.



Project Information

Joint Research Centre
Institute for the Protection and Security of the Citizen

Core Area
Environment and Sustainability

Priority
Energy [FP6 - WP2005 – Action 4318]

Integrated Scientific Area
Sustainable Energy Technologies
Reference and Information System

Website
http://projects-2005.jrc.ec.europa.eu

COMPASS

Vulnerability and Integrated Risk Assessment

Overview

COMPASS will focus on the development of pragmatic, effective methods and tools, substantiated by case-studies, validation exercises and involvement of all interested stakeholders, to assess and manage the vulnerabilities of infrastructures, technological systems, societal assets, or of any other potential targets in the society against terrorist and intentional acts, and other man-made, technological and natural hazards.

With a view to systemic risk, specific attention will be given to the following two complex and distributed infrastructures and their interactions with the societal systems:

- the transport infrastructure
- the production and distribution of energy

COMPASS will develop, in co-operation with MS organizations, of a comprehensive method for in depth assessment of vulnerabilities of critical infrastructures and assessment of the impact of their disruption on society. This development will start with a critical review of the existing practices and tools currently in use in Europe and in the World.

SCNI

Security of Critical Networked Infrastructures

The Action Security of critical Networked Infrastraucture (SCNI) aims at facilitating the description, assessment and governance from the security point of view of networked infrastructures, including information systems, communication networks, electricity and other energy networks and water networks. The main interest is in cross-border and European-wide issues.

This action will cover five main axes of activities:

- policy support: Support actions directly developed as a service to a customer DG (e.g. organisation of workshops, information systems, etc.). The work will also comprise the support to standardisation activities;
- modelling and simulation: Research will focus on the further development and application of methodologies for the modelling of the infrastructures and of their vulnerabilities and threats, and of potential attacks, disruptions and their effects. The focus will be on those threats and the vulnerabilities that are assessed to have the most damaging effects with respect to the integrity and availability of extensive, cross-border networked infrastructures. The sectors selected for research will primarily include electric power, gas and oil systems;
- security risk assessment: Research will focus on the development and applications of methodologies for the assessment of the likelihood and potential severity of security risks of networked architectures;
- security risk management: Research will focus on methods and tools for the observation of security- relevant events in information networks, and the synthesis of assurance case techniques (mainly in light of risk communication). This will include the application of honeypots, telescopes, and other technologies, and in particular their application to industrial network systems;

A specific case-study will be carried out on the **qualitative modelling of the European energy system** (i.e. high-voltage power lines and trunk pipelines), of the inter-play with other critical infrastructures and societal systems, its vulnerability against different types of man-made and natural threat, and the consequences of energy system disruption upon the identified interconnected infrastructures and societal systems.

The methodological activity will be complemented by the development of **software tools** to prototype and verify on case-studies the use of specific modelling techniques, scenarios definition, and decision support systems for the vulnerability analysis and protection of critical infrastructure.

Lessons learnt from these prototyping works ands case-studies will support the identification of the **User Requirements** required for the classical risk management life-cycle to address the new internal security challenges of the Union.

Project Information

Joint Research Centre
Institute for the Protection and Security of the Citizen

Core Area
Horizontal Activity

Priority
Public Security and Antifraud
[FP6 - WP2005 – Action 4335]

Integrated Scientific Area
Technological and natural risks

Website
http://projects-2005.jrc.cec.eu.int/

- security risk governance: Research will further progress in the definition of a Governance process for decision-making with respect to the security risks of international networked infrastructures.

This action includes policy support, research (e.g. modelling and simulation, situation awareness, security risk assessment, management and governance), hands-on laboratory work as well as applications development. It will cover four main axes of RTD activities and also contributions to wider policy support and complementary activities.

The goal is to support the definition of the governance framework for European-wide problems, in light of the future European Programme on CIP.

Joint Research Centre
Institute for the Protection and Security of the Citizen

Core Area
Horizontal Activity

Priority
Public Security and Antifraud,
[FP6 - WP2006 – Action 4321]

Integrated Scientific Area
Support to cybersecurity

Coordinator
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JRC - Institute for the Protection and Security of Citizen

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Scni.jrc.it/

Section 2

Electricity Projects Funded by the "Intelligent Energy - Europe" Programme

INTRODUCTION

In Brief: The Intelligent Energy Europe Programme

The European Union's instrument Intelligent Energy – Europe is a programme in the energy field to support an increase of renewable energies and energy efficiency by overcoming non-technological barriers. Its main mission is to turn policy into action – which means to help achieving real market changes on the ground. It supports 'soft' actions through the dissemination of information, education, training, strategic analysis at local and regional level, and the development of better policies and regulations. It gives market stakeholders such as cities, regions, municipalities, industry, chambers of commerce, networks, NGOs additional financial resources to share experience across Europe, to test pioneer actions and to take up best practices from other countries. The first IEE-Programme has come to an end in 2006; IEE II will be one pillar of the Framework Programme on Competitiveness and Innovation (2007-2013) and will have a budget of approximately € 730 Million.

The **Intelligent Energy – Europe (IEE) Programme** is one of the responses to the continued challenges Europe is facing in the energy field: Climate change, import dependency, high energy prices and the competitiveness of our economies. It is the main Community instrument for **non-technological** support in the field of sustainable energy.

It addresses the market barriers that still exist today to the efficient use of energy and increased use of new and renewable energies. On renewable energy, Europe has set targets: to double the share of renewable energy in national gross energy consumption from 6% to 12% by 2010 and to increase the share of green electricity in total electricity consumption from 14% to 21% by 2010. We also have a target of 5.75% of biofuels in the transport market by 2010. The Renewable Energy Road Map, which was adopted on 10 January 2007, proposes an overall 20% target of renewable energy in primary energy consumption by 2020. Moreover, it announces a Framework Directive, which is supposed to cover the three different sectors renewable electricity, renewable heating and cooling and transport.

Turning policy into action: These ambitious targets need to be implemented by the Member States – a process which requires the matching of those inspiring ambitions which exist on many levels (businesses, local and regional actors, utilities etc.) with practices that are needed to develop and bring efficient and clean technologies and systems to their users. Many parallel courses of action are needed to achieve real changes on the ground: analysis of market needs, analysis of the impact of changes in policy on the market, training of people at all the right levels, share skills and best-practices from one country to another, change administrative and regulatory environments.

This is how the Intelligent Energy – Europe programme works, together with partners from 31 European Countries. The main aim is to support those actions to which will help to overcome legal, financial, institutional, cultural and social barriers.

The future: IEE II and the CIP

The follow-up programme IEE II will be one of three pillars of the future 'Framework Programme on Competitiveness and Innovation' (CIP), which will provide a budget of € 3,6 billion over a 7 years period (2007-2013). € 730 Million are allocated to the Intelligent Energy for Europe II. The IEE II will continue to cover the three areas: SAVE – energy efficiency in buildings and industry; ALTENER – renewable energy for electricity, heating and cooling, and transport fuels; STEER – energy efficiency in transport.

There will be a new element of so-called 'market replication projects', which aim to replicate technologies, processes, products or practices, which have been successfully tested but which haven't so far fully entered the market. However, this new type of projects will not be subject to the call for proposals in 2007.

Electricity from Renewable Energy Sources: Projects 2003–2006

Electricity from renewable energy sources is focused on the promotion and implementation of the Directive 77/2001. Typical activities in this area include monitoring of the development of renewable electricity, looking at potentials and targets, analysing support mechanisms, identifying non-technological market barriers, assessing the regulatory framework for distributed generation, grid connection and grid integration, and promoting the use of green electricity.

Renewable electricity is the most advanced of the renewable energy sectors with already reasonably developed market and business structures in some Member States. This explains why most of the RES-e activities in the IEE-programme reach beyond general awareness raising and promotion. In fact, they have quite a strong strategic dimension and cover activities and assessments with mainly European and national but also local impact. They address both, technology-specific and horizontal questions related to the current and future use of renewable electricity.

Target Areas and Priorities

Renewable electricity activities in the IEE-programme 2003-2006 address five 'Target Areas'.

1. National indicative targets: Actions to increase the future share of RES electricity (e.g. through benchmarking and new approaches to use/interpret data).
2. Support schemes: Actions to add value to existing support schemes to improve their operational efficiency and market impact.
3. Grid system issues (in first instance large-scale integration): Addressing potential impacts on RES markets following from changes in the distribution/transmission networks.
4. Green electricity: Actions to foster marketing of green electricity, including information campaigns, to improve measures or to help new actors to participate in RES markets.
5. Distributed electricity generation: Actions to address policy, legislative or standardisation issues related to distributed generation from RES (including CHP based on biomass), effects of intermittency, potential benefits of intelligent grid control, demand management and storage systems.

Renewable electricity projects in the IEE-programme started partly at the beginning of 2005, partly towards the end of 2006. Some of the most relevant ongoing projects are going to be presented on the following pages.

OPTRES

Assessment and Optimisation of Renewable Energy Support Schemes in the European Electricity Market

Overview

The effectiveness and the efficiency of current and future RES-E support schemes is analysed with specific focus on a single European market for renewable electricity products. Current best practices are identified, and (future) costs of RES-E and the corresponding support necessary to initiate stable growth have been assessed. Main barriers to a higher RES-E deployment as perceived by market actors and stakeholders have been assessed. The central questions of this project are the following:

- **Which of the currently implemented support schemes (feed-in law, quota obligation, tender procedure, investment incentive) are most effective and which are most efficient?**
- **Are these support schemes compatible with the principles of the internal electricity market?**
- **Which innovative policies and regulatory frameworks might be alternatives to the currently existing ones?**
- **Is a coordination of RES-E support in Europe preferable with respect to effectiveness and to efficiency in the future and which instruments are optimal in such a scenario?**

Challenges

- Clear empirical insights into the present success and failures to support RES-E in Europe on Member State level.
- Quantitative results on the costs and benefits of future policy options such optimised national and coordinated policy options based on the techno-economic model Green-X.
- Detailed definition of best practice criteria for renewable electricity support schemes and barrier mitigation.
- Stakeholder involvement through in-depth interviews and an internet based questionnaire.
- Recommendations and an action plan on optimisation of RES-E policy measures to support policy makers on European and national level.

Technical Approach

To answer the central questions addressed by this project a work phase of extensive data gathering and fact finding on current policies, green electricity prices, market barriers, costs and potentials of RES-E has been followed up by an in depth assessment of the impact of different policy schemes and their mutual interactions based on historical data. The next and central step of the project was a comprehensive modelling of future policies (efficiency, effectiveness, risk assessment, sensitivity of costs on parameters like interest rates) based on the model Green-X.

Expected Impact

The main outcome of OPTRES is an independent and comprehensive analysis of current and future support schemes for renewable electricity in Europe. Furthermore a detailed assessment of RES-E markets in Europe considering present and future costs and prices of green electricity with particular emphasis on biomass will be delivered.

OPTRES will also provide a detailed action plan for policy makers finding a set of efficient and sustainable policies to integrate RES-E with other EU-related objectives, such as rational electricity use and GHG reduction over time. Recommendations will be given both for individual countries and for the EU as a whole and will consider harmonised and non-harmonised strategies.

In addition essential information for the derivation of economically efficient portfolio strategies for utilities, investors, producer of RES-E technologies, manufacturers, and end-user will be published. Comprehensive dissemination activities complement the work in this project including two thematic workshops, three dissemination seminars as well as a printed brochure containing the main results and recommendations from the project.

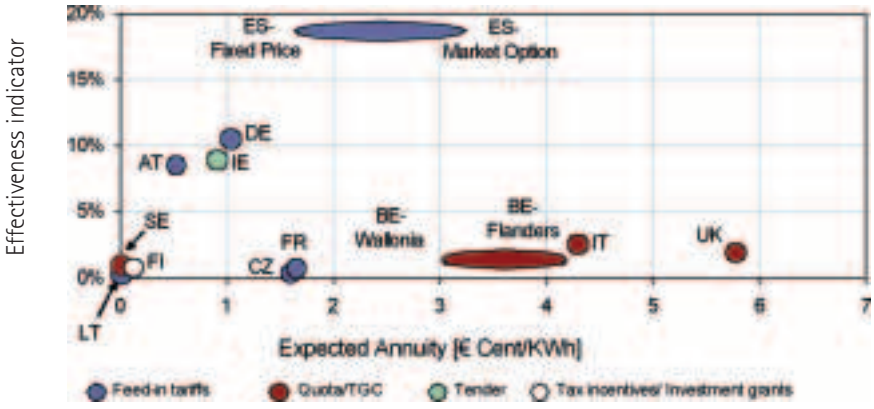
Progress to Date

The project is almost completed. Missing parts comprise final dissemination events and the derivation of a final report.

Highlight of Results

Although the project has not been completed it is possible to draw the following preliminary conclusions:

- the effectiveness as well as the economic efficiency of support measures for RES-E in Europe is very heterogeneous across Member States as illustrated in the figure below for the case of onshore wind energy. The most effective instruments often tend to be very successful with respect to their economic efficiency as well;
- among the key barriers hampering a faster development of RES-E in Europe, the administrative and regulative obstacles as well as grid connection barriers are most relevant;
- in the short to mid term the highest efficiency gains with respect to RES-E support can be achieved through optimisation and regional coordination of national policy measures.



Historically observed efficiency of support for wind onshore: effectiveness indicator in relation to the annuity of expected profit for the year 2004

Project Information

Programme
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RES Electricity

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FUTURES-E

Deriving a Future European Policy for Renewable Electricity

Overview

The core objective of this action is to better involve Member State stakeholders in the debate on policy optimisation and coordination for renewable electricity and the process of post 2010 target discussion. In the long-term this will enable a successful and stable deployment of electricity from renewable energy sources (RES-E) in Europe.

Objectives

To achieve this overall target derived objectives are to:

- establish a lively information exchange among the major market actors on experiences gained at national level;
- discuss consequences of possible policy decisions with respect to the future of support schemes for RES-E from a national viewpoint;
- facilitate the establishment of a common European vision on the long-term future of renewable energy as proposed in a top down manner by setting bottom-up activities at national level;
- elaborate on best practices of the main policy instruments, i.e. feed-in tariffs, premium systems, quota obligations based on tradable green certificates – suitable for policy coordination between Member States or even coordination at European level;
- assess national costs and benefits of RES-E and derive a methodology to share them under a future coordinated European policy.

The work will be based on outcomes of previous activities (e.g. IEEA project 'OPTRES' and FP5-project 'Green-X'). It will initiate an in-depth discussion process on support schemes for renewable electricity (RES-E), focussing on aspects of optimisation and coordination, and post 2010 national targets.

To analyse the effectiveness and efficiency of support schemes, the well established modelling and analysis tool Green-X will be applied. This software tool allows conducting in-depth analyses of RES deployment and accompanying transfer costs due to the promotion of RES on country, sectoral and technology level in a real-world energy policy context.

Challenges

At present, it is the responsibility of Member States to establish effective and efficient RES support schemes. The successful long-term deployment of RES-E depends largely on the active involvement of stakeholders across Europe. Consequently, the success of any European policy initiative is dependent on the acceptance and active participation of stakeholders on Member State level. Additionally, innovation envisaged within this action contributes also to solve its key challenges:

- the derivation of a methodology to share costs and benefits under a European RES-E policy among the individual Member States or;
- the integration of RES-E policies with other key EU objectives, such as rational energy use and GHG reduction.

Technical Approach

Based on outcomes of previous activities (e.g. IEEA project OPTRES, DG TREN-tender FORRES 2020, FP5-project Green-X) an in-depth discussion process in the topical areas of support schemes for RES-E, focussing on aspects of optimisation and coordination, and post 2010 national targets will be initiated at the start of this action.

Proposed work includes to:

- elaborate optimisation and coordination of support schemes, including deriving a methodology to share cost and benefits of a future European policy among Member States;
- undertake at the national level one international mid-term event and six regional workshops) a critical reflection of derived scenarios on future RES-E deployment as calculated for (at European level) coordinated and uncoordinated support policies;
- reconsider and improve proposed scenarios and recommendations taking into account identified specific issues of the Member States;
- analyse trade-offs between RES-E policies and other markets, policies and energy sectors and formulate recommendations for policy integration.

Expected Impact

The FUTURES-e project will develop the key elements of a post-2010 RES-E policy in Europe. At the present stage three main directions with respect to the evolution of the RES-E policy at Member State and EU level aim at optimisation and regional coordination of national policies as well as an EU wide harmonisation of basic principles.

The effect of implementing these policy options shall be analysed in an interactive approach with the key stakeholders in various Member States.

It is envisaged that this proactive stakeholder based approach in the debate will contribute to successful and stable deployment of electricity from renewable energy sources (RES-E) in Europe.

Project Information

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Website
www.futures-e.org

E-TRACK

A European Tracking System for Electricity

Overview

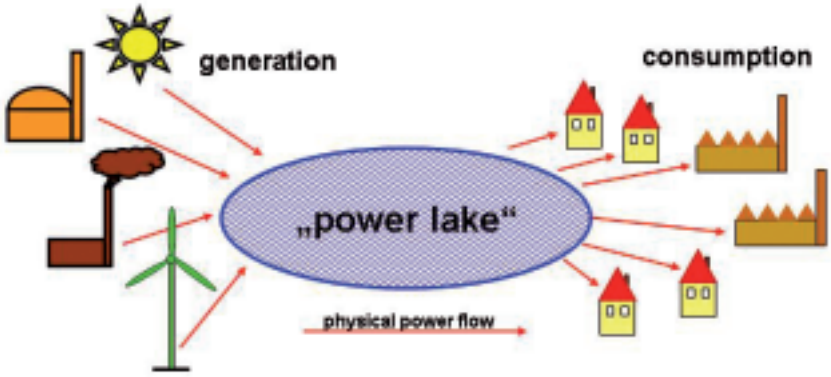
The objective of E-TRACK is to draft a harmonised standard for tracking of electricity generation attributes in Europe.

Challenges

- Increase of market transparency for consumers, governments and regulators.
- Reduction of current multiple counting of electricity generation attributes.
- Generation of adequate solutions for complex framework conditions in the electricity market.
- Avoiding a loss of liquidity in the electricity market due to tracking of attributes.
- Development of a well balanced cost-benefit ratio for tracking systems.

Technical Approach

E-TRACK analyses the requirements for tracking information on electricity generation in 31 mainly European countries. The project follows a co-ordinated European approach by taking into account the electricity market and policies which require tracking. The current situation is used to develop possible future scenarios and a blueprint for a tracking system by the end of 2006. Governments and market players in the electricity sector can use this standard for implementing the electricity labelling (disclosure) provision contained in the European Electricity Directive as well as other policies. Tracked information encompasses energy source used, emissions and support granted for electricity production.



Physical flow of electricity: Electrons can not be traced back from consumption to supply.

The proposed standard will support a variety of European and Member State policies such as electricity disclosure, Guarantees of Origin for electricity from renewable energy sources and high-efficient cogeneration, support schemes for certain types of electricity generation etc. E-TRACK addresses the different aspects of the design of a European tracking system and gives specific attention to the cost and benefits of such a scheme. The project features intensive consultations at both the European and National level.

Expected Impact

- An analysis of existing schemes for the allocation of electricity generation attributes and a detailed insight into the policy and market requirements for the design and operation of tracking systems.
- A draft blueprint for a co-ordinated standard for tracking electricity in Europe, including technical and non-technical aspects.
- A detailed assessment of the cost and benefits of tracking systems.
- Results from intensive consultations with stakeholders on the European and national level.
- A revised blueprint for the tracking standard.

Progress to Date

Project progress to date has revealed the following preliminary conclusions:

- current national systems for tracking electricity are mainly focused on national markets, they vary considerably among countries and their design and interaction with related policies lead to a significant amount of double-counting and loss of information;
- the design of a tracking system for electricity is a delicate issue for market participants and should be developed carefully in order to produce useful results, e.g. for electricity disclosure, but at the same time to avoid negative impacts on the liquidity of electricity markets;
- the preferred tracking system should feature an efficient mechanism for explicit tracking, preferably based on certificates, combined with an option to use a residual mix, which consists of statistical generation data which is corrected by those attributes which have been tracked explicitly.

Project Information

Programme
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RES Electricity

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Website
http://www.e-track-project.org

D G - G R I D

Enhancement of Sustainable Electricity Supply Through Improvements of the Regulatory Framework of the Distribution Network for DG

Overview

The DG-GRID project aims to achieve better deployment of distributed generation (RES, CHP and other small generation) by improving the coordination between distributed generation (DG) and the electricity distribution network. Improved coordination can be realised by a framework that regulates the distribution network operators' business and determines regulatory arrangements between DG and electricity distribution networks. New and innovative approaches in network planning and operations will provide opportunities for higher levels of DG deployment at relatively low costs. Based on several existing studies, the DG-GRID project will develop guidelines for improved regulation, network planning and the enhancement of integration of DG in the electricity supply system in both the short and long term.

Challenges

The DG-GRID project will:

- review the current EU Member States economic regulatory framework for electricity networks and markets and identify short term options that remove barriers for cost-efficient RES and CHP deployment;
- analyse the interaction between the economic regulatory framework, the increasing volume share of RES and CHP and innovative network concepts in the long term;
- assess the effects of large-scale penetration of CHP and RES by analysing changes in revenue and expenditure flows for different market actors in a liberalised electricity market, in particular DSOs by (1) a cost/benefit analysis of different regulatory designs and (2) developing several business models for economically viable grid system operation;
- develop guidelines for network planning, regulation and the enhancement of integration of DG in the short term, whilst including the opportunity for new innovative changes in networks in the long term.

Technical Approach

WP1 **Regulatory review**
Workpackage one analyses current regulation and identifies barriers for DG deployment.

WP2 **Network innovation**
Workpackage two identifies new and innovative concepts are that create the possibility for large-scale electricity supply at the distribution level of the network and investigates regulatory incentives for distribution system operators (DSOs) to innovate their business.

WP3 **Costs and benefits of high DG penetration**
Workpackage three analyses the cost and benefits of high levels of DG penetration for distribution networks. Distribution system operators (DSOs) are exposed to economic regulation that provides strong cost reduction incentives, but they are also responsible for necessary investments for integration of DG into the electricity network. This 'conflict' will be assessed by analysing the revenues and expenditures of DSOs. Regulatory improvements and market developments are assessed based on current and new DSO business models.

WP4 **Guidelines for improved regulation**
Based on the reviews, analyses and assessments in the previous work packages, the final workpackage develops guidelines for improvement of electricity network regulation.

Expected Impact

The DG-GRID project will deliver guidelines for improvement of electricity network regulation that, when implemented, will enhance the electricity supply from renewable sources and other types of distributed generation. The guidelines aim at regulatory improvements in the short term, taking a review of the current electricity network regulation in 15 EU Member States as starting point. The guidelines will also

recognise the long term development of electricity grids and the necessity to innovate these grids in order to integrate renewable and distributed power generators. Based on assessment of the costs and benefits for the electricity network in the case of large-scale penetration of DG, the guidelines will recommend new regulatory arrangements for economically viable grid system operations by the distribution system operators.

Progress to Date

By the end of 2006 the work packages that deliver the information required for development of the guidelines were completed. Namely, the current regulatory framework has been reviewed, the effect of a high levels of DG penetration on operational and capital expenditures has been studied as well as its impact on the revenues of distributed system operators. Furthermore, options have been identified for regulatory improvements to handle distributed generation integration costs and to provide incentives for electricity network innovations.

Highlights of Results

- The review of the current regulation has identified a number of barriers. Barriers reported in more than half of the member states investigated are: lack of incentive for distribution system operators (DSOs) to integrate DG, high and opaque connection charges, procedural barriers to network access, difficulties in market access and physical network constraints.
- Model analyses of large DG penetration in distribution grids indicated that:
  - large DG penetration requires reinforcement of the distribution network. At low DG penetration reinforcement costs are zero, but they will increase progressively with higher DG penetration. A high "DG density" on the grid causes increases of reinforcement costs. Reinforcement costs can be reduced with 'active network management'. However, in some high DG-penetration cases costs will be higher than with conventional passive network management;
  - DG may initially reduce energy losses within the distribution network, but with higher DG penetration losses will increase;
  - with active network management operational costs (i.e. energy losses, curtailment compensation, labour costs) will increase. In some cases this would result in higher total costs;
  - DG can replace distribution assets because the net (peak) load of the network is set to decrease with increasing DG penetration. The replacement value decreases in case of high DG penetration in combination with high "DG density".
- Network innovation is necessary to accommodate a rising DG share in a more cost efficient way. DSOs play a role in developing network innovations, but have mainly been risk averse resulting in low-innovation businesses. The regulator should provide incentives for innovations, i.e. allow DSOs to take certain risks and to invest in innovative technologies or reward the innovative aspects in performance regulation.

Project Information

Programme
IEE - ALTENER
RES Electricity

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Website
www.dg-grid.org

ELEP

European Local Electricity Production

Overview

The ultimate objective of the project is the removal of a number of the policy, commercial and regulatory barriers that are currently restricting the uptake of distributed generation (DG) and renewable energy systems (RES) in Europe. To contribute to the removal of these barriers, the project consortium is developing a series of policy recommendations relating to DG and RES for consideration by the European Commission, Member States, and other policy making bodies within the EU. These recommendations are been disseminated in a series of reports and position papers, and through a series of dissemination events. Copies of the project documentation and details of the dissemination events can be found on the project website (www.elep.net).

Challenges

The challenges and key issues being addressed by the project relate to policy and legislative barriers that can be experienced by DG and RES schemes within EU energy markets. These were identified by the previous EU-funded project DG-FER (IEE – ALTENER project 4.1030/Z/01-141/2001, www.dgfer.org). The specific barriers under investigation within the ELEP programme include grid interconnection, certification and authorisation of new schemes, connection charging mechanisms, utility planning approaches, metering and tariff structures. The project also intends to analyse the overall impact and value of increasing levels of DG and RES to Europe as a whole, in terms of economic value and also societal benefits such as emissions reductions.

Technical Approach

The project is broken down into five technical work packages, each addressing a major policy or legislative barrier that currently limits the uptake of DG and RES in Europe, and three further work packages dedicated to programme management, dissemination and education activities. The technical approach varies between the work packages. However, in general each series of policy recommendations has been developed following a review of current practice across EU Member States, the identification of best practice and shortfalls from these reviews, and the development of policy recommendations that include the identified best practice and other proposals developed by the ELEP team.

Expected Impact

These include:

- detailed recommendations for the definition of an EU interconnection standard for DG and RES (focussing on policy and procedural aspects);
- detailed EU policy guidelines on connection charging, ownership and control of DG/RES equipment, and net metering and feed-in tariffs;
- recommendations for new commercial mechanisms reflecting the total value of DG and RES, particularly in relation to overall system reliability and emissions;
- detailed recommendations for a generic EU certification and authorisation procedure applicable to DG and RES of different kinds (i.e. conventional fossil-fuel based systems as well as renewable energy sources).

Progress to Date

The project is around 3/4 complete, with a number of policy recommendations already published.

Highlights of Results

Although the project has not been completed, some preliminary conclusions can be drawn. For example EU Member States apply very different and inconsistent rules and procedures for the interconnection and connection charging of new DG and RES market entrants, and in terms of the way that that DG and RES is considered by utilities in their planning processes. Furthermore these rules and procedures are often not transparent, creating unnecessary risk and uncertainty to project developers, which in turn lead to market distortion. As a result of this there is an urgent need for novel, consistent and pan-European approaches to DG interconnection rules and connection charging, and a requirement for utilities to actively consider DG and RES as alternatives to network reinforcement in their network planning processes. More detail can be found via www.elep.net.

Project Information

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Website
http://www.elep.net

GREENNET-EU27

Guiding a Least Cost Grid Integration of RES-Electricity in an Extended Europe

Overview

The core objective of the project GreenNet-EU27 is to derive least cost strategies for integration of RES-Electricity into the European electricity grids. Based on comparative empirical case studies, application of existing software models (e.g. GreenNet) and comprehensive involvement of key stakeholders in the consortium still existing barriers for large-scale RES-E grid integration are identified – taking into account a variety of different constraints (e.g. different system configurations of the UCTE-, Nordel-, UK-region) – and best-practice concepts to overcome these barriers are derived.

An equally important objective of this project is to disseminate several project outcomes and practical guidelines to a broad audience, especially to key stakeholders as there are decision makers, regulators, grid operators and RES-E generators.

Challenges

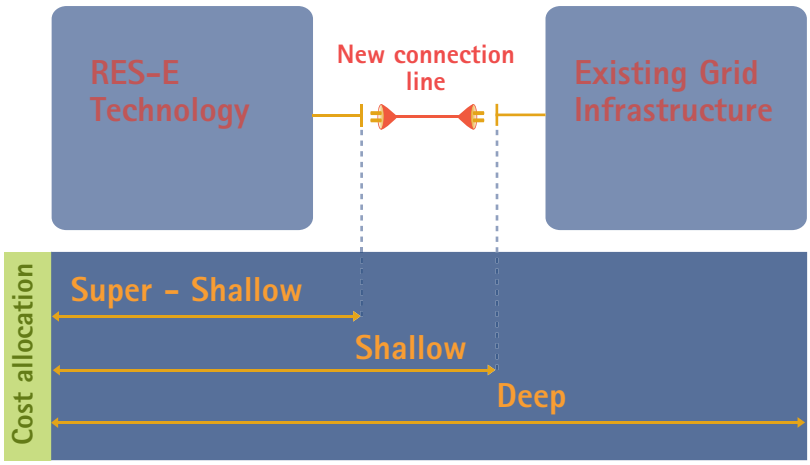
One of the major challenges in the project GreenNet-EU27 has been the collection of empirical data on disaggregated grid integration costs of RES-E generation technologies (i.e. grid connection, grid reinforcement/upgrading and system operation costs) in selected EU Member States.

Based on these empirical case study analyses, subsequently, the corresponding separated cost elements have been implemented into the simulation software GreenNet in order to enable model runs on RES-E deployment on EU-27 Member States' level for different cost allocation policies of RES-E grid integration: "deep" versus 'shallow' versus 'super-shallow' charging.

Whereas in the "deep" charging approach the RES-E developer has to pay several extra grid-related costs (grid connection, grid reinforcement/upgrading) and system-related costs upfront (i.e. cover these costs in the RES-E generation costs), the "super-shallow" approach represents the other extreme (the end-user pays several extra costs in the grid tariffs). In the 'shallow' charging approach only the grid connection costs are allocated to the RES-E developer, remaining cost elements have to be paid also by the end-user in the grid tariffs.

The simulation software GreenNet can be purchased free of charge at the project website www.greennet-europe.org

The bandwidth of RES-E deployment for different cost allocation policies of RES-E grid integration on EU-27 Member States' level up to the year 2020 is presented below based on model runs of the simulation software GreenNet. Note that in this analysis the currently implemented RES-E promotion instruments in each of the EU Member States are assumed to be unchanged until the year 2020.



Highlights of Results

The most important final results and major products of the project Green*Net*-EU27 are:

- tailor-made practical guidelines and action plans for decision makers and stakeholders in order to establish a common understanding on least cost RES-E grid integration strategies in an extended Europe under different constraints;
- the simulation software Green*Net*-EU27 modelling least cost RES-E grid integration strategies under a variety of different constraints and energy policy settings up to the year 2020 for the EU27-region;
- comprehensive and consistent empirical data on cost-resource curves for RES-E generation as well as extra system operation costs and extra grid reinforcement/upgrading costs caused by large-scale (intermittent) RES-E grid integration in different European system configurations;
- a set of comprehensive dissemination activities – incl. the project website www.greennet-europe.org – guaranteeing know-how transfer of several project outcomes (and its applications) in several European countries and regions.

Based on the final results achieved in the project Green*Net*-EU27 the following major conclusions can be drawn:

- in different EU Member States there still exist a variety of different, non-transparent cost allocation and cost reimbursement principles for RES-E grid integration and system operation. Practical guidelines to harmonise existing legislation in this context are presented in the recommendation report of the project Green*Net*-EU27 (available on the project website for download);
- from the grid-operator's perspective, at present there are no incentives for large-scale RES-E grid integration, since the corresponding grid-related costs are hardly eligible in the grid regulation and grid tariff determination procedures. Practical guidelines to overcome these disincentives are also outlined in the recommendation report of the project Green*Net*-EU27;
- comprehensive quantitative analyses (RES-E modelling, empirical RES-E case studies) provide evidence that the "overall costs" of large-scale intermittent RES-E grid integration (including system operation costs and grid reinforcement/upgrading costs) are still below 10% of the long-run marginal costs of the RES-E generation technology itself.

Project Information

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University of Manchester - UK
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Website
http://www.greennet-europe.org

GREEN*NET*-INCENTIVES

Promoting Grid-related Incentives for Large-scale RES-E Integration into the Different European Electricity Systems

Overview

The core objectives of this project are:

- **to promote grid-related incentives for large-scale RES-E integration into different European electricity systems;**
- **to identify existing non-technical barriers for RES-E grid integration;**
- **to actively involve key European market actors (grid companies, RES-E generators, regulators, decision makers) in the discussion process towards 'green' electricity grids.**

These objectives will be achieved by organising expert platforms, stakeholder consultations, training/education workshops and summer schools. The major products of this project are tailor-made recommendations and actions plans for several key market actors to establish a common European vision on the implementation of grid-related policies favouring "green" electricity networks. Comprehensive ongoing/final dissemination activities/events through a portfolio of dissemination channels guarantee know-how transfer of several project outcomes to several European countries/regions.

Challenges

The major challenges of the Green*Net*-Incentives project comprise the identification of existing disincentives of large-scale RES-E integration and the preparation of guidelines on how to overcome non-technical barriers. To address this, respective market actors must be engaged in an active discussion of possible improvements. Therefore, different approaches for the involvement of experts are incorporated into the project's working plan.

Finally, derived results must be elaborated and included in dissemination material and communicated appropriately for different target groups; in order to impact the future efficient deployment of large-scale RES-E in Europe.

A further challenge of this project is to integrate data and improve data quality for New Member States and Western Balkan countries into the simulation model Green*Net*-Europe; Additional to this rather technical issue, stakeholders from the respective regions shall be actively involved into the experts-discussion.

Technical Approach

In order to meet these ambitious challenges the working plan consists of:

- extension of the empirical data base of the simulation model Green*Net*-Europe (RES-E potentials/costs, RES-E related grid connection and grid reinforcement/extension cost, RES-E related system balancing/capacity cost) on a consistent basis to new Candidate Countries (Turkey, Macedonia, Croatia) and remaining Western Balkan countries;
- derivation of economic incentives (from the grid operators' perspective) to improve policies and legislation in the grid-regulation and grid-tariff determination process for large-scale decentralised RES-E grid integration;
- organising expert discussion platforms on case studies on successful RES-E grid integration projects and stable system operation (including cases with intelligent grid management systems) and derivation of best practise criteria;
- stakeholder consultation, addressing primarily distribution grid operators and Regulatory Authorities (including the evaluation of results) to identify several existing non-technological barriers and information deficits on RES-E grid integration from different market actors' perspectives;
- training and education events on strategies and sustainable policies for large-scale RES-E grid integration in summer schools and training workshops, mainly addressing participants from New Member States and Western Balkan Countries;
- derivation of recommendations and action plans (tailor-made for several important market actors) to establish a common European vision on the implementation of sustainable policies favouring 'green' electricity grids.

Expected Impact

The major achievements and products of this project consist of tailor-made guidelines and practical action plans for several key European market actors and decision makers in order to accelerate the implementation of sustainable grid-related policies favouring "green" electricity grids.

Most important related direct project achievements will include:

- a comprehensive network of key European experts and market actors (due to five expert discussion platforms being organised on different grid-related and system related topics of RES-E integration in different European regions; hosted by a market actors (full partner of the consortium or subcontractor) exchanging experience on best-practise of RES-E grid integration and stable system operation;
- stakeholder consultation and evaluation of results to identify non-technical barriers and information deficits on RES-E grid integration. These will be tailor-made primarily for distribution grid operators and regulating authorities;
- training and education events on strategies and sustainable policies for large-scale RES-E grid integration promoting the concept of least-cost RES-E grid integration and incentives in grid regulation (especially from the grid operator's perspective) as well as several other highlights of the project outcomes (e.g. the socio-economic aspects/barriers derived from the stakeholder consultation to a selected audience (students, young professionals, PhDs, etc.). This will strengthen the cooperation between specialist institutes in education and training;
- the training software Green*Net*-Europe (available free of charge at the project website www.greennet-europe.org) modelling least cost RES-E grid integration (and taking into account also several system-related aspects of intermittent RES-E generation), covering finally several major 35 European countries on a consistent basis (comprehensive, comparable and consistent empirical data (per country, per technology, over time, etc.) on RES-E potentials and cost, RES-E related grid connection/reinforcement/ extension cost, RES-E related system operation cost as well as also Energy Efficiency potentials and cost);
- finally, a set of comprehensive ongoing as well as final dissemination activities and events within the European Union as well as globally (incl. the project website www.greennet-europe.org) guarantee know-how transfer of several project outcomes (and their applications) to several key market actors, decision makers and stakeholders on international, national regional and local level.

Project Information

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RES Electricity

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RESPOND

Renewable Electricity Supply – Interactions with Conventional Power Generation, Networks and Demand

Overview

The growing amount of RES-E (renewable electricity) and DG (distributed generation) supply affects the electricity system and can only be economically efficiently integrated if it provokes economically efficient, market-based responses by different stakeholders. In practice, however, current electricity market regulation does not always give sufficient incentives to market participants for the optimal support of integration of RES-E and DG. The RESPOND project specifically considers the interactions between different segments of the electricity system (generation, demand, trading, and the network) and the challenge of increasing penetration of RES-E generation and DG. Governments should support and stimulate the development of efficient responses that arise from the market, recognising the electricity system as a "complex network" in which the constituent segments (generation, demand, trading and networks) dynamically interact with each other.

Challenges

The RESPOND project aims at identifying efficient market response options that actively contribute to an efficient integration of (intermittent) RES-E and DG in the European electricity system. It also recommends effective policy and regulatory framework improvements that support these market response options. Other objectives of the RESPOND project are:

- evaluation of the impacts of increasing penetration of RES-E and DG on the integral electricity system;
- identification and analysis of efficient response options from market participants that actively support an efficient integration of RES-E and DG in the electricity system;
- identification of barriers and failures in market competition and regulation that hinder the response options to be developed and implemented by market participants.

Technical Approach

The RESPOND project aims at identifying efficient market response options that actively contribute to an efficient integration of (intermittent) RES-E and DG in the European electricity system and it recommends policy and regulation framework improvements that effectively support these market response options. To perform the RESPOND project, the following Work Packages are defined:

WP1	Management
WP2	Impact analysis of increasing RES-E and DG penetration
WP3	Identification of optimal market response options
WP4	Barriers to optimal market response
WP5	Recommendation of policy and regulatory response
WP6	Communication and dissemination
WP7	Common dissemination activities

WP2 identifies the impacts of RES-E and DG on the different segments of the electricity system and sketches the possible European development of RES-E and DG penetration. WP3 identifies and analyses possible response options of market participants actively supporting an efficient integration of RES-E and DG in the electricity system. WP4 identifies barriers and failures in market competition and regulation preventing the uptake of these efficient market response options. Finally, WP5 recommends policy responses and regulatory framework improvements summarised in a policy and regulatory roadmap. The workpackages are composed of tasks that focus on a different segment of the electricity system. The integral view of the electricity system (including the interactions between the segments) is represented in each workpackage. Figure 1 shows a workpackage flow scheme that reflects this approach.

By identifying options and solutions that improve the electricity system's ability to integrate efficiently a high penetration of RES-E and DG the RESPOND project directly addresses the following target groups:

- the European Commission - DG TREN;
- national governments;
- national energy regulators.

In addition, market actors such as (large and DG) electricity producers, network operators and energy suppliers are directly addressed in the RESPOND project; an "Advisory Committee" consisting of these market actors will be established to give feedback on the project results.

Expected Impact

The main outcomes expected from the RESPOND project are:

- an evaluation of the impacts that an increasing penetration of RES-E and DG have on the integral electricity system;
- the creation of efficient response options that key market participants may develop (in response to and) in support of an increasing penetration of (intermittent) RES-E and DG;
- the creation of awareness in the market of these efficient response options;
- the identification of market failures and regulatory failures that hinder the electricity market to respond to the increase of RES-E and DG supply;
- an extensive overview of policy and regulatory options prioritised in a regulatory roadmap, that governments might use for supporting RES-E and DG;
- a proposed, clear responsibility allocation to market participants and governments that makes policy makers as well as market players aware of their responsibilities.

In the longer term, the achievements and impact expected from the RESPOND project are:

- an improvement of the electricity system's ability to efficiently integrate high penetrations of RES-E and DG;
- an effective regulatory framework with a clear allocation of responsibility between market and government;
- finally together these will lead to the optimal and increased penetration of RES-E and DG in the European electricity system in the medium and long-term future.

Project Information

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RES Electricity

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TRADEWIND

Wind Power Integration and Exchange in the Trans-European Power Markets

Overview

TradeWind aims to facilitate the removal of barriers to the large-scale integration of wind energy in European power systems, on a trans-national and European level. The project will formulate recommendations for policy development, market rules and interconnector allocation methods to support wind power integration.

These recommendations will be based on a detailed analysis of the interaction of foreseen developments in wind power capacity, power system upgrades and international power market mechanisms.

The project scope covers the EU-25, including the synchronous zones UCTE, Nordel, GB and Ireland. The study will build on the results of national and supra-national wind integration studies and will seek to answer the questions these studies have raised. The supply of Europe's islands will also be addressed.

Challenges

The European power transmission system has been developed in conditions in which the contribution of decentralised generation was very limited. As a result it is not optimally suited for an economic integration of renewables, which are inherently distributed in their nature. The specific characteristics of wind power which require a shift in attitude relate to the size and location of the plants (often remote from demand) and their variable output characteristics. Studies have shown that in order to reap the maximum benefits of wind power, taking this variability into account, it is important to make use of the "smoothing" effect of geographical aggregation on this variability, and this requires a fluid and well interconnected power system. Such a system allows smoothing of wind power variations, improves the predictability of wind power, and increases its capacity credit, its contribution to system adequacy and to supply security.

With ever increasing amounts of wind energy in the system, new requirements are appearing for balancing, transmission and interconnection, and market structures are changing. A considerable amount is added to the cost of wind power because it is more difficult to predict than conventional power output. On the European level, the uncertainty in estimates of cross-border power flows corresponding to the accuracy of wind power forecasts has as yet been insufficiently investigated.

TradeWind specifically addresses the market mechanisms underpinning the exchange of power among Member States and their effectiveness in dealing with an increasing amount of wind power in the system. Many European electricity markets still have structural deficiencies and inefficiencies in their balancing and settlement procedures that discriminate against variable-output wind power.

Market rules not only impact the costs of integrating wind power, but also influence how power systems are developed, with regard to interconnection, regulatory capabilities and back-up systems. Specific concerns addressed by TradeWind include the consequences of "gate closure time" and interconnector capacity allocation. These have significant influence on how wind power is integrated into the power systems, and how unfulfilled bids are penalised by the power market, which could add a considerable amount to the cost of wind power as it is more difficult to predict than conventional power generation.

Technical Approach

Future wind power scenarios will be developed, and market mechanisms studied, to quantify the effect of increasing wind power penetration on power flows in European grids. Realistic wind power expansion scenarios up to 2030 will be used. Regional and European state-of-the-art grid and market models will be used for simulations of cross-border power flows and the effect of the market parameters.

There will be three main project phases: first, a six-month preparatory phase, in which the wind power scenarios will be outlined, the models will be prepared and the market parameters will be inventoried. Then follows a one-year simulation and analysis phase in which power flows will be analysed for the defined wind power scenarios and the technical and economic consequences of grid upgrade solutions and in which improved market mechanisms will be analysed. Finally, the last project phase will concentrate on the final analysis and the formulation of recommendations for European policies. These include conclusions with respect to infrastructural needs (input for TEN-E), recommendations for improved power market rules and recommendations as to optimisation of wind power generation.

Expected Impact

TradeWind will produce technical and economic justification for strategic decision making on the development of EU grid and generation infrastructure. The findings will be targeted at national public authorities, EU institutions, Transmission System Operators (TSO), wind farm developers and operators, turbine manufacturers, and other wind energy sector actors.

Beside the recommendations the following outcomes are expected:

- quantified effects of increasing wind power capacity and its regional distribution – both onshore and offshore - on continental power flows and cross-border connection, in well defined time steps up to 2030, including uncertainties related to short-term forecast accuracy and estimations of Europe wide capacity credit of wind power for the time steps considered;
- qualified indications for offshore and onshore grid upgrade measures to accommodate the growing amount of wind power for the identified time steps up to 2030 based on the assessment of increasing the capacity of selected transmission corridors and the investigation of various grid scenarios;
- survey of power exchange market rules and constraints (continental and on the islands), including the analysis of the economic consequences of gate closure time and the insufficiencies in allocation of interconnector capacity;
- proposal of solutions to facilitate a maximum exchange of electricity from wind energy via markets.

Moreover the project will have the following outcomes, as a consequence of the development of the methodology to investigate the effects of increasing wind power capacity on power system and markets:

- wind power scenarios for selected target years up to 2030;
- improved methodologies and tools for simulating the impact of wind power on the trans-European power system, including equivalent models to quantify the effects of wind power on cross border flows.

TradeWind is expected to have a significant impact on future policies and developments of wind power integration in Europe, which will result in substantial economic benefits for the EU and the Member States. These impacts are discussed below:

- implementation of the study results into concrete national and European measures will facilitate the large scale introduction of wind power. The macro- economic benefits (in terms of overall system benefits) of having significant amounts of wind power in the system will be substantial – and will provide Europe with a more secure, sustainable energy supply, enhancing the continent's competitiveness. In the long term the consumer electricity price will decrease with increasing wind power penetrations;
- improved power exchange procedures will be identified throughout the EU-25. These procedures will be based, inter alia, on improved quantification of the uncertainty of forecast and resulting quantified uncertainties on cross-border flows;
- the amount of balancing power required for wind power and curtailment of wind power will also be diminished as a result of a more fluid interconnected system. This will further reduce wind power costs. This can be realised by the allocation of cross-border capacity for wind power at particular interconnectors;
- the study will result in qualified estimations of grid upgrade measures corresponding to various wind power scenarios;
- tradeWind addresses issues relevant to a very large number of power market stakeholders. Furthermore, its recommendations will address European policy frameworks and it is hoped that they will provide useful input to the legislative process;
- it is intended to establish close co-operation between TradeWind and the EWIS project, carried out by a collaboration of major European TSOs. TradeWind is complementary to the scope of the EWIS study, in as much as it mainly focuses on the relations between wind power integration and European market mechanisms, while the EWIS study would be more technical in approach. A close co-operation between the wind industry sector and TSOs is expected to be beneficial for wind power integration in Europe.

Project Information

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RES Electricity

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Website
www.trade-wind.eu

WINEUR

Wind Energy in Urban Areas

Overview

The European Commission has set a target of doubling the use of renewable energy to 12% of total consumption by 2010. Accordingly, European governments have set national targets to increase electricity generation from renewable energy sources (RES). Cities and towns across Europe are willing and able to contribute to achieving these targets. Suitable technologies and new initiatives at national, regional and local levels will be required to enable urban areas to contribute to these goals.

Until now, the main small-scale renewable energy technologies used in an urban environment have been solar thermal, solar photovoltaic (PV) and heat pumps. Recently, a number of manufacturers have introduced new small wind turbine products, especially designed for the installation in urban surroundings. Similarly to PV, these 'urban' wind turbines can generate electricity on-site where it is needed, preventing transport losses and contributing to CO_2 emission reductions in urban centres.

However, urban wind turbines are a fairly new product, the market for them is underdeveloped and there is a lack of familiarity with these products. Consequently, the awareness of the potential that these wind turbines present for small scale electricity generation in an urban environment is low. This is where the WINEUR project aims to assist by carrying out research and making information available to all the actors involved in the development of the market for small-scale urban wind turbines.

Challenges

- To identify the conditions required to enable the integration of small wind turbines in an urban environment.
- To promote the use of this technology as a real option for electricity supply in towns and cities across Europe.
- To raise awareness amongst key actors of project development, including local authorities, town planners, architects, energy and agenda 21 agencies, electricity utilities and others with regard to the benefits of small wind energy systems and their potential role in economic targets.

Technical Approach

The project runs over 26 months and is split into 5 operational work packages plus one management work package and one 'Common dissemination activities work package'. Each work package is led by one of the project partners, but in most work packages all partners make some contribution.

WP1	State of art and Experiences gained
WP2	Techno-economic and grid connection aspects
WP3	Legal aspects and administrative constraints
WP4	Socio-economic and non-technical issues related to Urban Turbine (UT) implementation
WP5	Potential projects identification

Expected Impact

- A comprehensive typology of wind machines that are potentially appropriate for the use in cities.
- Identification of technical barriers, including clarification of the conditions for connection to the network.
- Identification of the principal regulatory barriers, including the requirements for defining specific town planning rules dedicated to these new technologies.
- Identification of the principal economic barriers, including the need to define a specific feed in tariff dedicated to Urban Turbines (as for other RE technologies).
- Mobilisation of key actors (municipalities, urban planners, administrations).
- Identification of potential projects in cities.
- Build up a National and European 'UT cities network'.
- Publishing and communications activities including awareness raising workshops and national and European 'UT cities network', dissemination of the results of the project and presenting ideas on the way forward for development of wind energy in the city.

Progress to Date

To date, the following activities have been completed:

- technology inventory
- information on the economic costs and benefits of small wind turbines
- a report on grid connection issues
- a study on spatial and architectural integration of small wind turbines
- a report on administrative and planning issues
- country reports on the UK, France and the Netherlands
- workshop summaries

Highlights of Results

The project raised considerable interest for this new RES technology on behalf of the local communities. The successful identification of sites on numerous urban locations shows that this technology could become an important option in the future in the context of decentralised energy generation.

However, before the market introduction of Urban Turbines can really start it is fundamental to define clear rules regarding the physical and electrical integration and the value of generated electricity.

Project Information

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RES Electricity

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Website
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PV Policy Group

Overview

PV POLICY GROUP aims to overcome the current political-legal barriers that are preventing investment in the majority of European PV markets: namely, lack of political commitment and effective incentive schemes, insufficient and disparate monitoring systems and lack of co-operation between key actors in the definition of political action, especially on the trans-national level.
Eight national energy agencies of key "solar nations" (DE, FR, NL, AT, SL, PT, EL, ES) have formed the "PV Policy Core Group" to define common action for the improvement and alignment of national support systems for PV. Two countries informally joined the Core Group later on: Italy and Sweden. The Core Group focuses on policy issues and closely interacts with existing, more technology-oriented networks and complementary IEE - ALTENER projects in the PV area.

Challenges

Against the background of an overall PV strategy the PV Policy Group deals with the three political sub-areas:

- regulatory and administrative frameworks;
- financial support schemes;
- PV market and policy monitoring systems.

The project consortium wants to achieve:

- a shared assessment of the current market situation in eight countries with a focus on national PV policies and strategic options for improvement;
- a clear commitment to national PV targets (National Action Plans);
- a Joint Action Plan to improve and align activities for PV promotion in the partner countries;
- a Joint Position Paper to political decision-makers on both Community and national level on how to improve the current support framework for PV investments.

Technical Approach

In line with the aforementioned objectives, shows the policy group's work programme, me follows four overall steps:

- comparative assessment of national policy frameworks in 12 countries published in a European Best Practice Report;
- mutual exchange and knowledge transfer between project participants on lessons learned and ways of improvement, in particular:
  - on the cross-national level, by means of the European Core Group and three Thematic Working Groups;
  - on the country level, via eight National Core Groups in roundtable discussions with key actors;
- development of policy proposals for improvement to politicians (key results: position papers, both on national and European level);
- definition of own activities to contribute to implementation of proposals (key results: action plans, both on national and European level).

Expected Impact

The first major outcome, the European Best Practice Report, was published in May 2006 by the PV Policy Group. It shows which political-legal barriers exist prevent market deployment of photovoltaics (PV) in most EU countries. The report also presents a benchmark analysis of best practice in the fields of regulatory and administrative frameworks, financial support schemes and monitoring systems that could be transferred into practice in countries that want to further develop their PV sector.

During the project the Best Practice Report served as important basis for the development of recommendations and action plans for both the national and European level.

National Position Papers and Action Plans for each of the partner countries Germany, France, The Netherlands, Austria, Slovenia, Portugal, Greece and Spain as well as a Joint European Position Paper and Action Plan shared by all partners are currently under preparation. These documents address both national governments and the European Commission and aim to stimulate political action for the implementation of effective and efficient policies supporting PV. They will be published by the end of 2006 and beginning of 2007 respectively. The dissemination phase of the project begins in January 2007, during this time and beyond all project partners of the PV Policy Group have committed themselves to the implementation of the best practice recommendations and proposed actions.

Highlights of Results

The European Best Practice Report and the consultations to date within the PV Policy Group have shown:

- in most European countries the barriers are still too high for the development of activities in the PV sector. This is mainly due to not existing or ineffective PV strategies and/or policy measures;
- there is good practice and experience in all PV related policy fields;
- the starting position regarding PV is very diverse from country to country.

Best Practice Report
(free download: www.pvpolicy.org)

Project Information

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RES Electricity

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P V U P S C A L E

PV in Urban Policies: a Strategic and Comprehensive Approach for Long-term Expansion

Overview

For a sustainable electricity supply in Europe, large-scale implementation of PhotoVoltaics (PV) in our cities and villages is a necessity. Successful implementation of PV on a large scale depends on the technology being:

- **part of the urban planning process of city districts building or renovating, including the energy infrastructure planning;**
- **available as accepted building product;**
- **attractive for the electricity sector, for investors, utilities and/or end-users.**

PV as a building product has been the subject of many projects and will not be addressed directly. In the planning process however, it is crucial that the decision makers are aware of the possibilities of PV being an electricity producing building product and that implications on an urban-scale are clear.

Challenges

The objective of PV-UP-SCALE is to bring the drivers and barriers for implementation of urban PV to the attention of the stakeholders in the urban planning process. The project will highlight the do and don'ts within the PV-urban planning process including electricity grid factors. To reach the relevant decision makers workshops will be organised and a quality handbook will be written using gained experience with PV-Urban projects in the Netherlands, Germany, France, Spain and the United Kingdom. PV-UP-SCALE has a dynamic interaction with the IEA PVPS Task 10 'Urban-Scale Photovoltaic Applications'.

Expected Impact

The expected results and activities within the project concentrate on:

- organisation of national and international Urban PV workshops and distribution of questionnaires. to collect and disseminate information, involving all relevant stakeholders (e.g. developers and construction consortia, builders and trades-people, urban planners, residential and commercial building owners, architects, engineers, financiers, utilities, grid operators and private costumers). The topics of the workshops are related to PV architecture, education, impact of PV on the grid, economical drivers and the urban planning process;

- development of a database to present Urban PV issues regarding all relevant projects in Europe between 1998 – 2005. The resulting 'EU Urban PV database' will be available on CD-ROM and online; preliminary results are already available at: www.pvdatabase.com;
- documentation on planning our cities. This will address planning and architectural awareness of PV's added value; community engagement; heritage; aesthetics and street character issues; best practice integration with local development plans; simple and uniform engineering and building codes and standards; input to construction planning and scheduling; and effective and efficient building integration;
- documentation on connection to the grid. This will address interconnection guidelines and metering; maximizing network and supply value; understanding network risks; and required inputs to network planning. The crucial question is whether PV electricity can actually add value for the utilities;
- documentation on economical drivers. This will address innovative financing and investment; best practice market transformation approaches; risks and exposures for local government; role of portfolio standards, feed-in tariffs and other mandated approaches and network regulation from the economic perspective.

Project Information

Programme
IEE - ALTENER
Small scale Applications

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http://www.pvupscale.org

PERCH

Production of Electricity with RES and CHP for Homeowners

Overview

The PERCH project deals with interconnection issues (technical, contractual, tariff rates and metering issues) for electricity generation using small RES and micro CHP.

The project focuses on applications for home and small business power solutions in EU and candidate countries. It aims to introduce guidelines for homeowners for small RES and CHP applications regarding selection, dimensioning, interconnection, power quality and safety issues. Considerable dissemination activies will be undertaken through PERCH including establishing a European web portal for homeowners and organisation of information exchange and best practice workshops/events involving market actors and policy makers from participating countries.

Challenges

- to exchange information about the interconnection issues for electricity generation using small RES applications for home and small business power solutions with RES and CHP applications in EU;
- to map the existing information in European countries (member states and candidate countries) regarding interconnection issues and supporting schemes and to communicate this information in an efficient and interactive way;
- to disseminate practical guidelines to homeowners and potential users regarding system selection, dimensioning criteria together with safety and power quality issues;
- to present existing home power projects using RES and CHP applications in EU and exhibit specific supporting tools and grid connecting policies for the EU member states;
- to exchange the experiences between regulators, policy makers, utility authors and other relevant professionals in a European level;
- to contribute to the national sustainable energy policies;
- to increase the co-operation and exchange of experience between partners with different status within the home power market.

Technical Approach

Through the initial phase of the design of this project proposal, it was evident that there was a lack of information regarding the interconnection issues of small RES-e and micro CHP at a European level.

Based on this fact, the work programme was initiated by the collection of data from the EU member states and candidate countries, processing of this information into databases and guides and finally promoting this through a series of dissemination actions like workshops, web sites, interactive tools and general dissemination actions.

Expected Impact

As a result of this project, a broad group of homeowners and other potential users will be informed about the current conditions and requirements for the interconnection of their potential RES-E installation. The target group of regulators, utility engineers, policy makers, project developers and other relevant professionals will be informed about the interconnection issues raised by small scale RES-E and micro CHP. In addition, this group will be able to compare the benefits for the various regulatory and supporting schemes and assess the numerous safety and power quality codes. Stakeholders will also be able to exchange their experiences through dedicated workshops and a pan-European event and even to propose and adopt new future policies in order to overcome local barriers.

Project Information

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RES Electricity

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LIST OF COUNTRY CODES

Code	Country	Code	Country
DZ	Algeria	LV	Latvia
AT	Austria	LI	Liechtenstein
BY	Belarus	LT	Lithuania
BE	Belgium	LU	Luxembourg
BG	Bulgaria	MT	Malta
CA	Canada	MA	Morocco
CL	Chile	NL	The Netherlands
CN	China	NO	Norway
CY	Cyprus	PS	Palestinian territory
CZ	Czech Republic	PY	Paraguay
DK	Denmark	PL	Poland
EG	Egypt	PT	Portugal
EE	Estonia	RO	Romania
FI	Finland	RU	Russia
FR	France	SK	Slovakia
DE	Germany	SI	Slovenia
EL	Greece	ZA	South Afrika
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IS	Iceland	SE	Sweden
IN	India	CH	Switzerland
IE	Ireland	TH	Thailand
IL	Israel	TN	Tunesia
IT	Italy	TR	Turkey
JO	Jordan	UA	Ukraina
KE	Kenia	UK	United Kingdom
LB	Lebanon	US	United States

European Commission

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This publication is a compilation of synopses of the most relevant European projects in the electricity field (around 60 funded by the Sixth Framework Programme and 13 by the Intelligent Energy Europe Programme), giving a comprehensive view of European funded activities in this area. For each project, basic information is provided with regard to the scientific and technical scope, expected impact, the participating organisations and contact points.

The projects described in the brochure will hopefully provide guidance for future European research particularly that carried out under the Seventh Framework Programme on Smart Energy Networks.

Publications Office
Publications.europa.eu