European Wind Energy Technology Platform

Strategic Research Agenda
Market Deployment Strategy

From 2008 to 2030

Annex C:

Current research programmes and networks

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Introduction

This annex contains background information which was necessary to build the TPWind Strategic Research Agenda (SRA) and Market Deployment Strategy (MDS) documents.

Implementing the SRA priorities, in particular, will require fostering energies and a strong coordination at all levels. TPWind conducted an internal survey amongst its members, in order to identify on-going initiatives. The following sections provide a review of the identified research programmes and networks at the International, European and national levels.

If your network does not appear here, please contact: secretariat@windplatform.eu

A The main EU-funded projects

In 2006 more than 20 R&D projects were running with the support of FP6 and FP7 (the Framework Programmes are the main EU-wide tool to support strategic research areas).

The management and monitoring of projects is divided between two European Commission Directorate-Generals: the Directorate-General for Research (DG Research) for projects with medium- to long-term impact, and the Directorate-General for Transport and Energy (DG TREN) for demonstration projects with short- to medium-term impact on the market.

B Private initiatives

B.1 EOLIA (Spain)

The government-funded programme CENIT (the National Strategic Consortia for Technological Research)[1] is focused on research activities. The target of the CENIT funding programme is to support large private-public consortiums aimed at overcoming strategic issues. In this framework, the private action EOLIA was launched in 2007.

The purpose of EOLIA is to carry out the research needed for the new technologies for offshore wind in deep waters. This covers a broad range of topics from support structures, cables and moorings to project development (Environmental Impact Assessment, wind resource and planning), and includes future applications and synergies (desalination and aquiculture).

The project's total budget of €34 million is being supported with €17 million from CDTI. EOLIA started in 2007 and will be completed in 2010.

Several companies from the Acciona Group are participating in EOLIA (Energy, Wind Turbines, Desalination, Infrastructure, Engineering), together with major partners such as ABB, Construcciones Navales del Norte Shipyard, General Cable, Ingeteam Group, Ormazabal and Vicinay, smaller partners such as Tinamenor and IMATIA, and the participation of research centres such as CENER.

[1] http://www.cdti.es/index.asp?MP=7&MS=23&MN=3

C International networks

C.1 The European Academy of Wind Energy (EAWE)[2]

The EAWE is a network on wind energy R&D made up of research institutes and universities in seven countries: Germany, Denmark, Greece, Netherlands, Spain, the UK and Norway. The Academy was founded to formulate and execute shared R&D projects and to coordinate high-quality scientific research and education on wind energy at a European level. The core group is made up of 25 bodies, representing seven EU countries and more than 80% of long-term research activity in the field of wind energy.

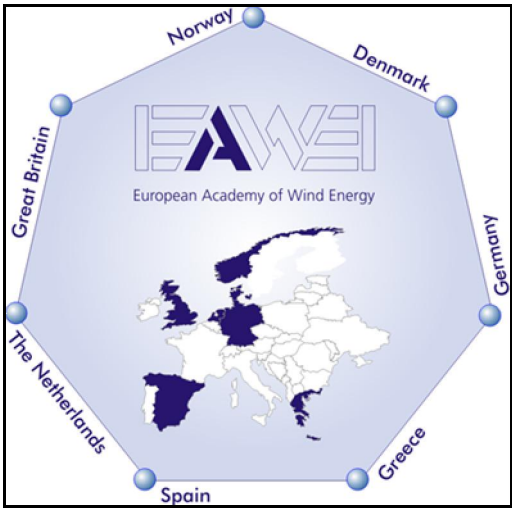

Figure 1: Structure of the European Academy of Wind Energy (2007).

The activities of the EAWE are split into:

- Integration activities such as PhD exchanges, exchange of scientists and the exploitation of existing research infrastructures
- Activities for the spreading of excellence, through the development of international training courses, dissemination of knowledge, support to SMEs and standardisation
- Long-term research activities (see below)

The following thematic areas and topics have been identified as first-priority long-term RTD issues for EAWE's joint programme of activities:

Long-term wind forecast	• Wind resources • Micro-siting in complex terrain • Annual energy yield • Design wind conditions (turbulence, shear, gusts, extreme winds) offshore, onshore and in complex terrain
Wind turbine external conditions	• Characteristics of wind regime and waves • Atmospheric flow and turbulence • Interaction of boundary layer and large wind farms • Prediction of exceptional events
Wind turbine technology	• Aerodynamics, aeroelasticity and aeroacoustics • Electrical generators, power electronics and control • Loads, safety and reliability • Materials, structural design and composite structures • Fracture mechanisms • Material characterisation and Life Cycle Analysis

[2] http://www.eawe.org

	• New wind turbine concepts
System integration	• Grid-connection and power-quality issues • Short-term power prediction • Wind farm and cluster management and control • Condition monitoring, maintenance on demand • New storage, transmission and power-compensation systems
Integration into energy economy	• Integration of wind power into power-plant scheduling and electricity trading • Profile-based power output, Virtual power plants • Trans-national and trans –continental supply structures • Control of distributed-energy systems

C.2 European Renewable Energy Centres Agency (EUREC)[3]

The European Renewable Energy Centres Agency was established as a European Economic Interest Grouping in 1991 to strengthen and rationalise the European research, demonstration and development efforts in all renewable energy technologies. As an independent, member-based association, it incorporates 48 prominent research groups from all over Europe.

EUREC members' research fields include solar buildings, wind, photovoltaics, biomass, small hydro, solar-thermal power stations, ocean energy, solar chemistry and solar materials, hybrid systems, developing countries and the integration of renewable energy into the energy infrastructure.

C.3 GEO - Wind Energy Community of Practice

The Wind Energy Working Group is part of the Energy Community of Practice[4], which is a section of the Group on Earth Observation[5] (GEO). Under the auspices of G8, GEO is an international initiative, aiming to establish the Global Earth Observation System of Systems (GEOSS) within the next 10 years. The Wind Energy Working Group directly contributes to the goals of one of the nine societal benefit areas of GEOSS, the Energy area, for the improved management of energy resources. Specifically, *"GEOSS outcomes in the energy area will support: environmentally responsible and equitable energy management; better matching of supply and demand of energy; reduction of risks to energy infrastructure; more accurate inventories of greenhouse gases and pollutants; and a better understanding of renewable energy potential. "*

C.4 International Electrotechnical Commission (IEC)[6]

IEC, through its Technical Committee 88, is responsible for the development of standards relevant to wind turbine generator systems. It has produced standards for design requirements, power-curve measurement, power-quality control, rotor blade testing, lightning protection, acoustic noise measurement techniques, measurement of mechanical loads and communications for monitoring and control of wind power plants. Its current work

[3] http://www.eurec.be
[4] http://www.geoss-ecp.org
[5] http://www.earthobservations.org
[6] http://www.iec.ch/zone/renergy/ren_wind.htm

programme includes both standards and design requirements for offshore wind turbines, for gearboxes and for wind farm power performance testing.

C.5 International Measuring Network of Wind Energy Institutes (MEASNET)[7]

MEASNET is a network of institutes which are engaged in the field of wind energy and want to ensure high-quality measurements, the uniform interpretation of standards and recommendations as well as to obtain interchangeable results. The members have established an organisational structure for MEASNET, and they periodically perform mutual quality assessments of their harmonised measurements and evaluations. This network was founded in 1997. Today, it has 10 full members and five associate members.

C.6 European Committee for Electrotechnical Standardisation (CENELEC)[8]

CENELEC was created in 1973 as a result of the merging of two previous European organisations: CENELCOM and CENEL. Nowadays, CENELEC is composed of the National Electrotechnical Committees of 30 European countries. In addition, eight National Committees from neighbouring countries participate in CENELEC's work with an affiliate status.

CENELEC's mission is to prepare voluntary electrotechnical standards that help develop the Single European Market/European Economic Area for electrical and electronic goods and services, removing barriers to trade, creating new markets and cutting compliance costs.

C.7 International Energy Agency

In its report, *Long-Term Research and Development Needs for Wind Energy for the Time Frame 2000 to 2020*, the Executive Committee of the IEA's Implementing Agreement for Wind Energy[9] stated that continued R&D is essential for providing the reductions in cost and uncertainty necessary for reaching the anticipated deployment levels of wind energy.

In the mid-term, the report describes the R&D areas of major importance for the future deployment of wind energy as related to forecasting techniques, grid integration, public attitudes and visual impact.

In the long term, the Implementing Agreement sees R&D focusing on making the wind turbine and its infrastructure interact more closely.

Since its inception, the Implementing Agreement has been involved in a wide range of R&D activities. The current research and development activities of the Implementing Agreement itself are organised into seven tasks (referred to as "annexes"), giving an insight into its perceptions of current R&D priorities.

Task II: "Base technology information exchange." This refers to coordinated activities and information exchange in two areas: i) the development of recommended practices for wind

[7] http://www.measnet.com
[8] http://www.cenelec.org
[9] http://ww.ieawind.org

turbine testing and evaluation, including noise emissions and cup anemometry, and ii) joint actions in specific research areas such as turbine aerodynamics, turbine fatigue, wind characteristics, offshore wind systems and forecasting techniques.

Task XIX: "Wind energy in cold climates. "The objectives here include i) gathering and sharing information on wind turbines operating in cold climates, ii) establishing a formula for site-classification, aligning meteorological conditions with local needs, and iii) monitoring the reliability and availability of standard and adapted turbine technology, as well as the development of guidelines.

Task XX: HAWT[10] aerodynamics and models from wind tunnel tests and measurements. The main objective is to gather high-quality data on aerodynamic and structural loads for HAWTs, to model their causes and to predict their occurrence in full-scale machines.

Task XXI: Building dynamic models of wind farms for power-system studies whose main objective is to assist in the planning and design of wind farms through the development of models for use in combination with software packages for the simulation and analysis of power-system stability.

Task XXIII: Offshore wind energy technology development. The aim is to identify and conduct R&D activities towards the reduction of costs and uncertainties and to identify and organise joint research tasks between interested countries.

Task XXIV: Integration of wind and hydropower systems into the electricity grid. The goal is to identify feasible wind/hydro system configurations, limitations and opportunities, involving an analysis of the integration of wind energy into grids fed by a significant proportion of hydropower, and opportunities for pumped hydro storage.

Task XXV: The "design and operation of power systems with large amounts of wind-power production" has recently been added as an additional task.

C.8 Offshore Wind Energy Network (OWE)[11]

OWE is an independent source of information for professionals working in the field of offshore wind energy. It is also a gateway to several research projects on offshore wind energy. It provides a survey of the existing offshore wind farms, and information on existing offshore-related research projects and networks (CA-OWEE, COD, WE@SEA).

[10] Horizontal Axis Wind Turbine
[11] http://www.offshorewindenergy.org

D National networks

D.1 Denmark

D.1.1 Megavind[12]

The partnership Megavind is the result of a government initiative for the development of environmentally-effective wind technology. It addresses the challenges Denmark is facing in order to maintain its position as an internationally leading centre of competence within the field of wind power. The partnership is the catalyst and initiator of a strengthened testing, demonstration and research strategy within the field of wind power in Denmark. It aims to think innovatively in regard to validation, testing and demonstration within wind power technology and the integration of wind power into the entire energy system. It therefore recommends creating an accumulated strategy for testing and demonstrating:

- Components and turbine parts
- Wind turbines and wind farms
- Wind power plants in the energy system

Long-term university research and education in general should make the fundamental or generic technologies that are part of the development of wind turbines and wind power plants a priority. These include:

- Turbine design and construction
- Blades –aerodynamics, structural design and materials
- Wind loads and siting
- The integration of wind power into the energy system
- Offshore technology

Megavind ś recommendations will function as a reference for strategic research within wind power in the coming years, thus becoming the valid research strategy for wind power in Denmark.

D.2 Germany

D.2.1 Centre of Excellence for Wind Energy (CE Wind)[13]

The research network CE Wind, founded in 2005, includes the universities of Schleswig-Holstein. Through scientific research, CE Wind deals with fundamental questions relating to the wind turbines of the future, wind parks and the corresponding infrastructure.

CE Wind looks at the main issues regarding grid connection and integration, the design of rotor blades, generators, towers and foundations, operation monitoring and maintenance and impact on the environment in the multi-megawatt class and in extreme local conditions.

[12] http://www.windpower.org/megavind
[13] http://www.cewind.de

D.2.2 ForWind[14]

ForWind was founded in August 2003. It combines the interdisciplinary competencies of the universities of Oldenburg and Hanover and of its associated members, the universities of Stuttgart and Essen, in the field of wind power utilisation.

ForWind bridges basic research at the universities over applied demands from the industry for innovative wind-energy conversion techniques. The research performed ranges from estimation of the wind resource to the grid integration of the wind power. The research priorities are:

- Wind resources and offshore meteorology
- Aerodynamics of rotor blades
- Turbulence and gusts
- Wave and wake loads
- Analysis of Scour Automatic System and load identification
- Material fatigue and lifetime analysis
- Material models for composite rotor blades
- Structural health monitoring for blades, tower and the converting system
- Hydro-noise reduction
- Interaction of ground and foundation structure
- Grouted joints for offshore constructions
- Electrical generator power system simulation and analysis of power quality
- Grid connection of large scale wind farms

D.2.3 Research at Alpha VEntus (RAVE)[15]

To help launch the deployment of offshore wind in German waters, the German Federal Ministry for the Environment (BMU) will support the offshore test wind farm Alpha Ventus in the North Sea with a research budget of about €50 million in the next few years. This research initiative was named RAVE – Research at Alpha VEntus – and consists of a variety of projects connected with the installation and operation of Alpha Ventus. The different project consortiums in RAVE are made up of most of the offshore research groups in Germany. RAVE is represented and coordinated by the ISET institute in Kassel.

In order to provide all participating research projects with detailed data, the test site will be equipped with extensive measurement instrumentation. The overall objective of the research initiative is to reduce the costs of offshore wind energy deployment in deep water. The institutes and companies participating in the RAVE initiative have prepared projects on the following topics so far:

- Obtaining joint measurements and data management

[14] http://www.forwind.de
[15] http://www.rave-offshore.de

- Analysis of loads and modelling, and further development of the different components of offshore wind turbines
- Loads at offshore foundations and structures
- Monitoring of the offshore wind energy deployment in Germany –Offshore WMEP
- Grid integration of offshore wind energy
- Further development of LIDAR wind-measuring techniques, analysis of external conditions and wakes
- Measurement of the operating noises and modelling of the sound propagation between tower and water
- Environmental research

D.3 Spain

D.3.1 Spanish wind energy technology platform (REOLTEC)[16]

REOLTEC (Techno-Scientific Wind Energy Network) was created in July 2005 with the aim of integrating and coordinating actions focused on research, development and innovation activities in the field of wind energy in Spain. In the last two years, the network has created working groups focused on different topics related to wind energy: wind turbines, applications, resource and siting, offshore, grid integration, certification and social impact.

REOLTEC has the full support of AEE (the Spanish Wind Energy Business Association) and it is made up of the main players within the wind energy companies, research centres, universities and government agencies in Spain. This gives the network a wide-ranging point of view on the best path to follow in the coming years.

D.4 The Netherlands

D.4.1 INNWIND[17]

The long term R&D programme of the INNWIND consortium is funded by the government of the Netherlands. The budget is €1.5 million per year. The consortium partners are:

- The Energy Research Centre of the Netherlands
- Delft University of Technology
- The Knowledge Centre on Wind turbine Materials and Constructions

The aim of the programme is to develop expertise, concepts, computer models and material databases that will be made available and applicable through a new generation of software tools. This is to enable the construction of large, robust, reliable, low-maintenance and cost-effective offshore wind turbines which are readily available for developers.

The INNWIND R&D priority areas are:

- Concepts and components

[16] http://www.reoltec.net
[17] http://www.innwind.nl

- Aeroelasticity
- Materials and constructions
- Model development and realisation of an integrated modular design tool
- Design guidelines

D.4.2 We@Sea[18]

We@Sea is a body funded by the government of the Netherlands. It is focused on the national 6 GW offshore target for 2020. The total budget is €26 million for five years. The We@Sea research priorities are:

- Integration of wind power, and scenarios for its development
- Offshore wind-power generation
- Spatial planning and environment
- Energy transportation and distribution
- The energy market and financing
- Installation, exploitation, maintenance and dismantling
- Training, education and dissemination of knowledge

D.5 The UK

D.5.1 Collaborative Offshore Wind farm Research Into the Environment (COWRIE)[19]

COWRIE is an independent company set up to raise awareness and understanding of the potential environmental impacts of the UK's offshore wind farm programme. Identified research areas are:

- Birds and benthos
- Electromagnetic fields
- Marine bird survey methodology
- Remote techniques
- Underwater noise and vibration

D.5.2 Offshore Wind Energy Network (OWEN)[20]

OWEN is a joint collaboration between industry and researchers. It promotes research on all issues connected with the development of the UK offshore wind energy resource (e.g. shallow water foundation design, submarine cabling, power systems, product reliability and impacts on the coastal zone).

[18] http://www.we-at-sea.org
[19] http://www.offshorewindfarms.co.uk
[20] http://www.owen.eru.rl.ac.uk

The main aims of the OWEN are:

- To identify, in detail, the research required by the UK wind-energy industry so that the offshore wind-energy resource can be developed quickly, effectively and efficiently
- To provide a forum where specific research or development issues can be discussed
- To ensure that regular reports of on-going research projects are disseminated to relevant academic and industrial partners
- To ensure that the final results of any research project are widely publicised through tools such as conferences, newsletters and journals, while remaining aware of the need to preserve commercial confidentiality in the relevant cases

D.5.3 The UK Energy Research Centre (UKERC)[21]

The UK Energy Research Centre's mission is to be the UK's pre-eminent centre of research and source of authoritative information and leadership on sustainable-energy systems.

UKERC undertakes world-class research addressing whole-system aspects of energy supply and use, while developing and maintaining ways of enabling cohesive research on energy. Research themes include:

- Demand reduction
- Future sources of energy
- Energy infrastructure and supply
- Energy systems and modelling
- Environmental sustainability
- Materials for advanced energy systems

D.5.4 ITI Energy[22]

ITI Energy is a private company, part of ITI Scotland Ltd. It is aimed at the funding and managing of early-stage technology development. It benefits from a long-term direct funding commitment from the Scottish Government through Scottish Enterprise. The available budget is £150 million over 10 years. The IT Energy programme includes:

- Battery-management systems
- Composite pipeline structure
- Hydrogen-handling materials
- Interior surface coating
- Large-scale power storage,
- Rechargeable batteries
- Wind-turbine access systems
- Active-power networks

[21] http://www.ukerc.ac.uk
[22] http://www.itienergy.com

- Offshore renewables programmes

D.5.5 Energy Technologies Institute (ETI)[23]

The Energy Technologies Institute (ETI) is an energy, research and development institute that is planned to begin operating in the UK in 2008. It is being set up by the UK government to "accelerate the development of secure, reliable and cost-effective low-carbon energy technologies towards commercial deployment. "This new institute is supported by a number of companies as a 50:50 public-private partnership. The institute is expected to work with a range of academic and commercial organisations.

E Conclusion

This large number of networks shows the willingness of the research sector to coordinate its efforts. It demonstrates the need for research, and the quest for improved efficiency through knowledge-sharing.

Building a research network is a way to strengthen the entire wind energy community, and to improve its attractiveness for the private sector, which can take advantage of a high level of expertise and information.

The European Wind Energy Technology Platform is the instrument that brings together institutes, research networks and private companies in order to set the research and market-development priorities for the wind energy sector up to 2030.

[23] http://www.berr.gov.uk/files/file34010.pdf