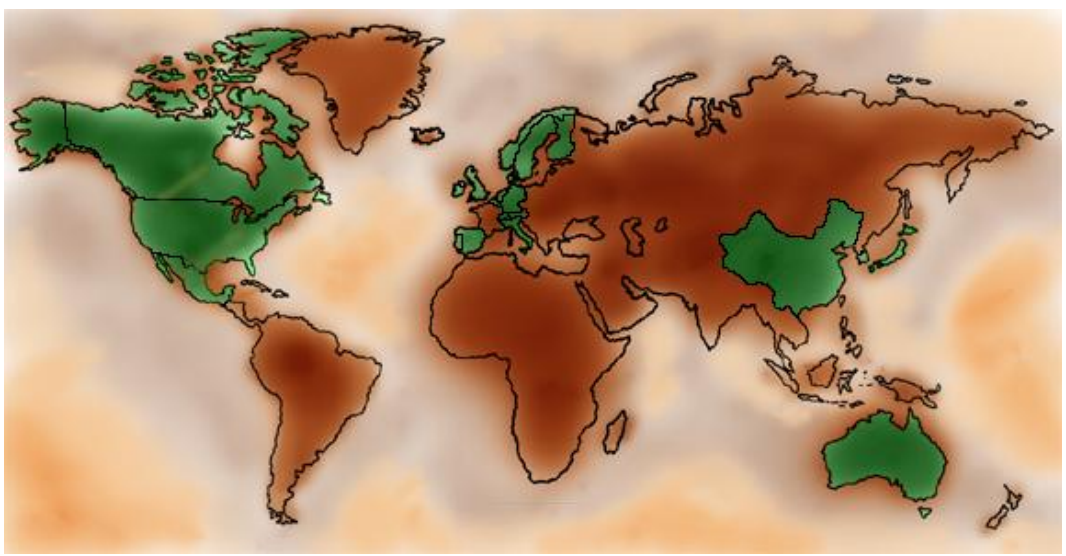
International Energy Agency Implementing Agreement for Co-operation in the Research, Development, and Deployment of Wind Energy Systems

Strategic Plan for 2009–2014



Update 2011

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PREFACE

The current Strategic Plan of the International Energy Agency Implementing Agreement for Co-operation in the Research, Development, and Deployment of Wind Energy Systems (IEA Wind) for the years 2009–2013 was accepted at the 51st IEA Committee on Energy Research and Technology (CERT) meeting on 7 October 2008 together with the report of the previous term and the extension of the IEA Wind Agreement through the end of 2013. The current term of IEA Wind ends 28 February 2014. The most recent extension of the Agreement was approved by the CERT meeting November 2010. The Agreement began in 1977.

The Strategic Plan is periodically updated to take account of movement on key issues. An important development since 2008 has been the publishing by IEA of the Technology Roadmap Wind Energy in 2009. This updated Strategic Plan for IEA Wind is the result of a review that adopted the main findings and strategies of the Technology Roadmap and reacts to the latest technological developments.

The IEA Technology Roadmap formulated the following key targets:

- Reduce the cost of wind energy use
- Increase the flexibility of transmission and power systems
- Increase of social acceptance of wind energy projects
- Increase the exchange of best practices.

These targets are explicitly reflected in the Updated Strategic Plan of IEA Wind. These key R,D&D themes for the wind energy sector were identified by the IEA Wind ExCo:

1. Wind technology research to improve performance and reliability at competitive costs
2. Research on power system operation and grid integration of high amounts of wind generation including development of fully controllable, grid-friendly wind power plants
3. Wind resource and performance assessment for large wind integration
4. Research on offshore wind in shallow to deep waters
5. Research on social, educational, and environmental issues that affect wind siting

1. INTRODUCTION TO STRATEGIC PLAN FOR 2009–2014

The purpose of this Strategic Plan for 2009–2014 is to provide direction and focus for the activities of IEA Wind over the five-year term ending in February 2014. It builds on the Strategic Plan developed for the prior five-year term (2003–2008), which is available at www.ieawind.org. In 2008, the IEA Wind Executive Committee (ExCo) generated a new Strategic Plan through a survey of IEA Wind Members and a consensus process. It was based on the recommendations of participants in the Task 11 Topical Experts Meeting (TEM) Long-Term Research Needs held on 6–7 December 2007 in Berlin, Germany. At the midpoint of the term in 2010, a Strategic Plan Working Group of the ExCo considered the findings of the IEA Technology Roadmap Wind Energy published in 2009. The Strategic Plan was reviewed by the ExCo in 2010 and adapted to new international developments and requirements in line with the IEA Technology Roadmap.

This updated Strategic Plan incorporates views of the IEA Wind ExCo recorded in the last ExCo meetings as well as results and views and recommendations of recent TEMs. Based on this review, conclusions were drawn about the research needed to increase the penetration of wind energy in the world's energy mix, while reducing cost and enhancing performance. IEA Wind will use this Strategic Plan to guide its activities during the second half of the five-year term and beyond.

The Plan addresses research in three ways.

First, the Plan presents the research needs identified by IEA Wind as strategic in the medium to long term to develop the full potential of the wind sector.

Second, the Plan presents activities to meet the needs in strategic areas. IEA Wind will organize R&D activities in these areas through February 2014. Some activities will continue into the next term or will be initiated during the next term.

Third, the Plan describes a strategy for communication of R&D results to the audiences that will use these results to reduce the cost of wind energy use, increase the flexibility of transmission and power systems, increase social acceptance of wind energy projects, and increase the exchange of best practices.

The successful formula of the preceding terms will remain the cornerstone of future activities. In the years ahead, IEA Wind will draw from the list of long-term research needs to initiate new research tasks and continue those under way. The IEA Wind Implementing Agreement will continue collaborative R&D on technological and practical matters supporting the development of wind energy in the Member countries and worldwide.

2. VISION AND MISSION

The IEA Wind Implementing Agreement aims to contribute to the vision of the IEA CERT to become the pre-eminent player in clean energy technologies. It will do this by strengthening its current position as an authoritative organization, providing technology and policy support to its members' governments and to the wind energy sector.

IEA Wind's mission is to stimulate co-operation on wind energy research, development, and deployment (R,D&D). It will provide high quality information and analysis to member governments and commercial sector leaders by addressing technology development and deployment and its benefits, markets, and policy options. At the same time IEA Wind's activities are an important instrument to implement the IEA Technology Roadmap Wind Energy.

3. MEDIUM-TO-LONG-TERM STRATEGIC RESEARCH NEEDS

The key R, D&D themes for the wind energy sector were identified by the IEA Wind ExCo as follows:

1. Wind technology research to improve performance and reliability at competitive costs
2. Research on power system operation and grid integration of high amounts of wind generation including development of fully-controllable, grid-friendly "wind power plants"
3. Wind resource and performance assessment methods for large wind integration
4. Research on offshore wind in shallow to deep waters
5. Research on social, educational, and environmental issues

Theme 1, Wind technology research to improve performance and reliability at competitive costs

IEA Wind work will develop new methods and components for wind turbines to improve performance and reliability at competitive costs. Work is under way in Task 19, Wind Energy in Cold Climates; Task 27, Consumer Labeling of Small Wind Turbines; Task 29, MexNex(t) Aerodynamic Models and Wind Tunnel Data, and new initiatives.

Theme 2 Power system operation and grid integration of high amounts of wind generation including development of fully-controllable, grid-friendly Wind Power Plants

IEA Wind work will address this theme within Task 25, Power Systems with Large Amounts of Wind Power and new initiatives.

Theme 3 Wind resource and performance assessment for large wind integration

IEA Wind will address this theme within Task 29, MexNex(t) Aerodynamic Models and Wind Tunnel Data and new initiatives to assess performance of large wind parks in complex and forested terrains. To advance methods for assessing performance, a new Task on Benchmarking of Wind Farm Flow Models—WAKEBENCH / Task 31, was approved by the ExCo in autumn 2010.

Theme 4 Offshore wind in shallow to deep waters

IEA Wind will address this topic with the conclusions of Task 23, Offshore Wind Technology Deployment and the eventual results of the recently approved Task 30, Offshore Code Comparison Collaboration Continuation (OC4).

Theme 5 Social, educational, and environmental issues

IEA Wind will address this topic by the ongoing Task 28, Social Acceptance of Wind Energy Projects, through continuing communication efforts (outlined below), and by potential new initiatives to increase the educational capacity of wind energy institutions.

Through February 2013, the IEA Wind Agreement will focus on the completion of the R,D&D work already initiated related to the five themes listed above. Task 11, Base Technology Information Exchange, will contribute to each theme by calling Topical Experts Meetings (TEMs) as requested by the Members and by coordinating development of Recommended

Practices stemming from completed work of the research tasks. In 2010 a new procedure to select TEM topics was adopted by the Members, making it possible for TEMs to be focused still more consistently on the five R,D&D themes.

The core activity of the Wind Implementing Agreement continues to be collaboration on technology R,D&D to

- Reduce investment and life-cycle costs
- Improve performance
- Ensure that wind energy deployment is consistent with the environment
- Increase the deployment of wind energy systems.

3.1. Wind technology research to improve performance and reliability at competitive costs

Experts and the IEA Wind ExCo identified six research areas to reduce costs and improve performance.

1. Increase component and sub-system performance and reliability.

New and improved components for wind power plants should be incorporated by

- Adding intelligence to get smart rotors and flexible drive trains
- Developing new bearing structures including magnetic bearings
- Developing advanced multi-megawatt, low-speed generators; improving generators through characterization of problems and better understanding of transient behavior for power system simulation
- Developing basics for superconducting generators to reduce weight, decrease size, and avoid damages to gearboxes
- Developing better understanding of reasons for gearbox failures
- Improving test methods for sub-systems
- Achieving better communication between wind turbine systems, components, and the electric grid.

2. Reduce costs of turbine and component production by using new and recycled materials, new manufacturing techniques, and new methods for transport and installation.

The wind turbine industry employs materials and components that use large amounts of energy during manufacture. The costs of these components are rising, driving up the overall price of wind technology. Work is needed to transition from single unit manufacturing to automated serial production and to provide cost reduction through economies of scale (turbine, blade, foundation). Costs may be reduced by using new materials such as thermoplastics, permanent magnets, and superconductors. When older turbines are exchanged for newer ones, recycling materials can reduce costs. The "cradle to cradle" concept for recycling needs to be fully applied in the wind sector. Supply chains should be made stronger and more cost effective.

A significant part of the cost of today's wind power plants comes from the transport of components and commitment of heavy infrastructures for installation. This is especially true for offshore wind energy development. Work is needed to develop

- Sustainable, intelligent, and low-cost transport means (boat, train, and truck)
- Innovative marine installation equipment and concepts designed especially for large offshore wind turbines, foundations, and whole power plants
- Implementation of modular concepts in the construction of large and heavy elements
- Procedures for commissioning on quay, transport, and assembly.

3. Reduce costs of wind turbine towers and foundations.

Wind plants use large amounts of steel, and developers must compete with rising world demand for this material. Decreasing the amount of steel needed for wind turbine towers offers a valuable opportunity to reduce costs. With this in mind, some manufacturers are developing and producing towers of concrete and composite material. In the coming years, an enormous impact on the overall cost of wind energy could be achieved by research to identify processes, materials, and strategies that minimize loads on towers.

Research to explore alternative tower materials will also be important both for land-based and offshore applications. Costs of offshore foundations have a strong influence on wind power deployment at sea. Optimization of such structures concerning steel or concrete, effort, environmental impact, logistics, and reliability are of high concern. As discussed in the IEA Wind Roadmap, metrics should be developed for quantifying technology improvements.

4. Reduce operations and maintenance costs that are driven by subcomponent characteristics.

To reduce O&M costs, research is needed to

- Study component reliability by comparing the rates and types of failures to design life
- Develop condition-monitoring O&M (learn from best practices in industries such as oil and gas)
- Increase availability (a function of reliability and accessibility)
- Improve the reliability of small turbines
- Improve security of operation and, for offshore wind, ship safety
- Develop reliable sensing devices (learn best practices from other industries such as aircraft, oil, and gas)
- Develop remote sensors with intelligent software (the use of redundant sensors and measuring devices is common in other energy sectors, but not for wind turbines)
- Develop internationally harmonized health, safety, and labor standards for offshore personnel

- Develop design tools for the optimization of offshore foundations regarding wind and wave loads and geological seabed conditions.

5. Explore advanced design concepts with the potential to reduce costs.

Experts agree that research is needed to produce new design concepts in both the short and long term. Some ideas worth exploring are

- New rotor concepts—achieve larger-diameter rotors without increasing structural loads at the same extend and develop more efficient and reliable drive trains
- Lighter structural design—this element is not necessarily a design driver, but it is a sub-ordinate cost driver
- New drive train concepts—increase efficiency and reliability, reduce weight, and improve ease of installation and maintenance
- Combine built-in passive control methods with multi-variable control;
- Fast up-scaling: "skip" the first half of the blade, make it a "truss"
- Applied research on aerodynamics and wakes
- Control strategies for load reduction—adapt turbines to anticipated loads in various situations
- Design validation—current design standards are considered to be not conservative enough in certain areas but too conservative in other areas; e.g., loads and load transmission in drive trains for static and dynamic situations
- Develop advanced design tools for modeling drive trains and whole wind turbines.

6. Develop test facilities to demonstrate cost-reducing concepts and improve reliability.

Today's test facilities must be adapted and new facilities developed to

- Test larger blades, innovative drive trains, and new materials to verify design models and performance characteristics
- Test wind turbines for research purposes as well as turbines designed to operate in cold climates
- Test offshore foundations and their components under conditions close to reality (wave canal, soil mechanical test pit)
- Assess the dynamic interferences between the wind turbine's natural frequencies and the effects of wind, waves, and currents for floating systems for deep offshore applications
- Test and validate the ride-through-fault capability of individual wind turbines and of wind farms.
- Develop effective time-saving test methods (blade, drive train).

3.2. Power system operation and grid integration of high amounts of wind generation

Power sources with variable output, such as wind, need to cope with and respond to the power system's transient events and quality of service. However, grid systems must also change to accommodate the variability of demand and variability from the generation sources. They will need to focus on renewable sources, if we are to build an energetically sustainable future.

1. Improving grid integration and system operation

Research should provide

- New concepts to address grid integration and power quality issues
- Smart control of turbines (power control)
- Operation of power system with high wind penetration—system operation and balancing of the power system
- Development and validation of dynamic models of wind power plants and aggregation of multiple wind power plants for assessment of the power transient behavior
- Security of supply

2. Developing new integrated power system applications

The “smart grids” of the 21st century will be characterized by the distributed contribution of all energy sources, not only in terms of generation, but also in terms of what relates to production regulation and to the contribution to the control and stability of the power system.

Research (partly by IEA Wind in co-operation with other Implementing Agreements) should explore advanced energy storage solutions, plug-in vehicles (benefits: energy storage and transportation), integrated demand-side and wind generation management, wind power plant in combination with reversible hydropower station (with pumped storage), and new applications for production regulation such as water desalinization, clean water, and hydrogen production.

3. Developing fully controllable, grid-friendly wind power plants

Research should

- Improve energy production forecasting for system operation
- Provide for regulation and control of wind generation: wind power as a dispatchable, ride-through-fault power source
- Develop control models and systems to optimize the output of wind farms as power plants
- Assess the feasible wind contribution for voltage and frequency regulation
- Improve communication among system operators, transmission system operators, distribution system operators, wind power plants, and wind turbines
- Provide monitoring and central control systems for aggregates of wind power plants.

3.3. Wind resources and planning assessment for large wind integration

Integration of large amounts of wind generation requires good understanding of the wind resource and good planning assessment tools.

1. Increasing knowledge of the wind field

Research is needed to

- Improve resource assessment and forecasting—develop forecasting tools with increased accuracy
- Explore methods to recover the kinetic energy in the wake of wind turbines and arrays to optimize the energy production of wind power plants
- Increase knowledge of wind field in front of the turbine for improved control strategies
- Develop remote sensing techniques to measure wind speed and wind field patterns in front of and behind turbines.

2. Understanding wind power plant performance in complex conditions

Deployment of large wind power plants in complex (mountainous or forested) terrain introduces added challenges in the characterization of the wind behavior inside the plant, the development of wakes, and the operation of wind turbines in highly turbulent fields. Simple wind models currently in use are inaccurate and introduce difficult financial and operational problems.

Research is needed to develop

- Reliable tools (computational fluid dynamics, wind tunnel, and field tests)
- Accurate energy production assessment for wind power plants, with special focus on complex terrain
- Accurate wake models for large wind power plants
- Methods to optimize and smooth the power output of large wind power plants
- Methods to determine the interference of wind turbines (aerodynamic and electric) and the interference of wind farms
- Models to determine noise propagation for medium to very complex terrain
- Prediction tools for deployment in cold climate areas (e.g., forecasting rime ice, icing events, and the effects of turbulence and snow-covered blades)
- Objective methods for siting risk assessment.

3. Providing a publicly accessible wind database

Resource information should be readily available to planners and developers to promote effective wind plant operation. A publicly accessible database with the greatest possible coverage, taking into account commercial sensitivities, is needed of onshore and offshore wind resources and conditions.

3.4. Offshore wind in shallow to deep waters

Offshore wind energy is important in countries with restricted land locations and a large offshore resource or with a large offshore resource conveniently close to large loads. Offshore wind deployment in 2010 had costs ranging from 150% to 200% higher than for installations onshore.

However, offshore wind is a potentially unlimited energy source, if the deep offshore waters are conquered.

IEA Wind has organized workshops outlining issues and has coordinated modeling work on offshore foundations. Developing offshore wind energy presents design challenges including predicting loads from the combined forces of wind, waves, and ice; designing support structures for shallow to deep waters (>30 m); developing systems for transportation, installation, and maintenance of turbines; and developing larger machines to take advantage of the wind resource. To further reduce the cost of offshore wind energy, special wind turbine designs are needed for shallow to deep waters. Although offshore wind is more mature than the sea/ocean energy technologies, there are common constraints and deployment steps. Co-operation with IEA Ocean Energy Systems (OES) and IEA Renewable Energy Technology Deployment (RETD) Implementing Agreements is therefore meaningful.

1. Research supporting offshore wind power plants in coastal waters (<50 m)

Research is needed to achieve

- Offshore wind and ocean measurements and resource assessment—today, insufficient data is available for siting offshore wind plants
- Sustainable, intelligent, and low-cost transport means (boat, train, etc.) and installation equipment and concepts dedicated for offshore wind development
- Improved access to offshore structures
- New foundation design concepts for shallow waters—reduce cost of structures and installation, considering environmental aspects as well
- Remote and satellite measuring systems
- Offshore applications—optimize traditional structures and develop new low-cost, easy-to-install structures
- Environmental impact assessments for offshore wind development
- Integrated wind and wave energy conversion technologies for shallow water
- Optimized design for offshore wind.

2. Research supporting offshore wind power plants in deep waters

Research is needed to contribute to

- Offshore planning, measuring, and monitoring methods for deep waters
- New foundation design concepts for deep waters – floating technologies for wind turbines and power plants
- New concepts for large multi-megawatt wind technologies for deep waters
- Offshore infrastructures and construction development (rigs, mooring, and anchoring).

3.5. Social, educational, and environmental issues

Even where the economics of wind energy are favorable, deployment can only occur when the public and the planning authorities accept the technology. This requires an appreciation of the benefits of wind energy that weigh against any local visual and environmental effects. The evaluation of this balance is often complicated by its subjective nature and by the circulation of misinformation.

1. Social acceptance of wind energy projects

Local resistance to new wind energy projects is becoming more commonplace as the number of installed wind turbines increases, in spite of public surveys that have revealed very high levels of support for renewable energy technology, and wind energy in particular.

Activities are needed to

- Establish an international forum for exchange of knowledge and experiences related to social acceptance and other societal issues
- Document the state of the art on current knowledge and results regarding social acceptance of wind power installations; provide a relevant library
- Establish best practices and tools for policy makers and planners to reduce project risks, accelerate time of project development, and accelerate development of the full potential of wind energy to meet regional and national targets
- Establish strategies and communication activities to improve or maintain the acceptance of wind power;
- Develop an internationally accepted method for calculating the cost of energy for wind systems and the resulting cost of energy from wind energy projects
- Determine the learning curve for wind energy to allow governments and the research community to anticipate the future trends of wind generation costs
- Compare the cost of wind energy with the costs of other electricity generation technologies
- Determine the value of wind energy in terms of its contribution to reducing greenhouse gas emissions, to decreasing electricity prices, and to decreasing the overall risk of the energy system.

2. Education and training for the wind industry

International collaboration between national programs and industry experts is essential to providing the necessary education and training for the global wind industry.

Work is needed to

- Establish an international academic network among leading national universities and laboratories to educate students, transfer knowledge, and provide research opportunities for postgraduates and professors
- Establish co-operative research and development agreements between national state-of-the-art test facilities and field demonstration facilities
- Expand the participation of the commercial sector in developing an international academic network and co-operative R&D agreements between national programs and seek opportunities for industry co-funding.

3. Assessing environmental impacts

Wind energy offers many benefits to the environment, especially compared with other forms of electricity production. Wind energy production can also negatively affect local ecology and communities and may require methods to mitigate risks and uncertainties.

Work is needed to

- Organize international workshops relating to critical environmental research issues for onshore and offshore wind power projects to identify R,D&D gaps that are of national interest and identify specific areas requiring further investigation
- Exchange baseline environmental data and research methods for pre- and post-construction studies
- Establish criteria for comparing environmental impact assessments among nations for onshore and offshore wind developments
- Develop comparative methodologies to assess the impact on birds and mammals; develop methodologies to assess potential cumulative effects to the land and marine ecosystems
- Establish best practices for planning and approval procedures related to the permitting and monitoring of wind power projects
- Improve knowledge of acoustical influence of offshore construction activities on marine mammals
- Develop physically and economically effective methods to mitigate intensive sound emission during offshore construction.

4. Interference with the radar systems and air space operations

Among the military and civilian aviation communities there is a serious concern about the impact of wind turbines on airspace and radar operations as wells as surveillance.

To help remove this barrier to wind energy development, work is needed to

- Determine the minimum noninterference flow fields of flying devices and wind turbines to assess the safety of flights under these conditions;
- Determine the interference of wind turbines on communications and radio links or the effect of wind turbines on radar systems.
- Develop radar technologies that mitigate the effect of wind turbines on radar; develop rotor blades with reduced backscattering of radar electromagnetic waves.

4. MEETING STRATEGIC RESEARCH NEEDS

Through 2013, the IEA Wind Implementing Agreement will conduct research tasks addressing the five key research themes identified by IEA Wind. The specific R&D tasks in place and potential activities for the new term are presented below.

4.1. Wind technology research to improve performance and reliability at competitive costs

Activities in place in 2010

Task 11, Base Technology Information Exchange
Task 19, Wind Energy in Cold Climates
Task 26, Cost of Wind Energy
Task 27, Consumer Labeling of Small Wind Turbines
Task 29, MexNex(t) Aerodynamics
Task 30, Offshore Code Comparison Collaboration Continuation (OC4)

Possible future activities through 2013

- Work on new materials
- Work on automated manufacturing
- Work on improving methods of transport and installation
- Work on drivetrain (gearbox) reliability
- Work on tower designs and materials
- Support increased availability and effectiveness of testing facilities and methods for cold climate and offshore wind
- Conduct international statistical analysis on wind turbine failures
- Work on smart wind turbine rotor blade techniques

4.2. Power system operation and grid integration of high amounts of wind generation and the development of fully controllable system-friendly wind power plants

Activities in place 2010

Task 11, Base Technology Information Exchange
Task 25, Power Systems with Large Amounts of Wind Power

Possible future activities through February 2014

In the power system integration area, close co-operation with other IEA Implementing Agreements can increase the effectiveness of the results. Of special note is the intended co-operative research regarding “New integrated power system applications with high wind penetration” conducted with the Demand-Side Management and the Energy Storage Agreements.

- Work to address grid integration and power quality
- Develop smart controls
- Work on methods to balance the power system

- Improve and validate dynamic models that aggregate wind power plants to assess transient behavior
- Demonstrate security of supply through capacity credit and power system flexibility
- Enhance regulation and control of wind generation as a dispatchable power source that can ride through faults
- Develop control models and systems to optimize the output of wind farms as power plants
- Assess the feasible contribution of wind power for voltage and frequency regulation
- Explore advanced energy storage solutions for high wind penetration (Energy Storage Agreement)
- Evaluate plug-in electric vehicles for energy storage and transportation (Hybrid and Electric Vehicles Agreement)
- Explore integrated demand-side management and wind generation management (Demand-Side Management Agreement)
- Evaluate wind power plants in combination with reversible hydro power station (with pumped storage). (Hydropower Agreement)
- Assess new applications for the regulation of wind generation such as production of desalinated and clean water, hydrogen, and others.
- Work on internal grids and grid connection for offshore wind farms.

4.3. Wind resources and performance assessment for large wind integration

Activities in place 2010

Task 11, Base Technology Information Exchange
Task 19, Wind Energy in Cold Climates
Task 25, Power Systems with Large Amounts of Wind Power
Task 26, Cost of Wind Energy
Task 28, Social Acceptance of Wind Energy Projects
Task 31, Benchmarking of Wind Farm Flow Models, WAKEBENCH

Possible future activities through February 2014

- Improve resource assessment and forecasting tools
- Develop recommended practices
- Develop and validate performance assessment tools (computational fluid dynamics, wind tunnel, and field tests)
- Develop methods for energy production assessment, with special focus on complex and densely forested terrains
- Create a new task on development of recommended practices for Lidar and Sodar
- Design applied research on aerodynamics and wakes
- Develop advanced numerical flow models (numerical site calibration) techniques for power performance procedure of wind turbines at complex terrain sites, etc.

4.4. Offshore wind in shallow to deep waters

Activities in place 2010

Task 11, Base Technology Information Exchange
Task 25, Power Systems with Large Amounts of Wind Power
Task 30, Offshore Code Comparison Collaboration Continuation (OC4)

Possible future activities through 2013

- Research to improve wind and ocean measurements for resource assessment
- Research on offshore infrastructures and construction such as transport, rigs, mooring, and anchoring
- Research to optimize traditional structures and develop new low-cost, easy-to-install structures
- Research and modeling to validate floating technologies for wind turbines in deep water
- Promotion of test facilities for offshore wind turbines in water
- Co-operation with IEA Ocean Energy Systems and IEA Renewable Energy Technology Deployment (RETD) Implementing Agreements on common constraints and deployment steps.
- Increase of offshore foundation technology and knowledge for shallow, middle, and deep waters
- Optimization of offshore logistics.

4.5. Social, educational, and environmental issues

Activities in place 2010

Task 11, Base Technology Information Exchange
Task 19, Wind Energy in Cold Climates
Task 25, Cost of Wind Energy
Task 27, Consumer Labeling of Small Wind Turbines
Task 28, Social Acceptance of Wind Energy Projects

Possible future activities through 2013

- Establish an IEA Wind Network of Training Institutions with links for wind energy employment entities, within the IEA wind web site
- Establish a network among test facilities and field demonstration sites
- Develop methodologies to compare environmental impact studies
- Facilitate exchange of information on radar and radio effects of turbines.

5. COMMUNICATION STRATEGY FOR IEA WIND 2011–2014

IEA Wind participants collaborate on technology R&D both to improve cost and performance and to increase the deployment of wind energy systems. The communication strategy presented here supports this activity by developing and distributing information from this research to the key audiences that can use it to affect the cost, performance, and deployment of wind energy systems.

5.1. Goals and objectives

Goal 1. Increase the influence of results from IEA Wind–sponsored research

IEA Wind exists in a complex world of information developed and published by many sources. Given the limited resources of a government-funded activity, the communication strategy works to

1) Deliver the results of successful research activities to key audiences
2) Meet information needs of these audiences that are not being addressed by other wind energy publications
3) Produce and distribute information to the key audiences in a cost-effective way.

Goal 2. Increase quality participation in IEA Wind–sponsored activities

IEA Wind competes for funds with other research activities of the member national governments. To attract new participants and to ensure that sponsors understand the value of the collaborative research, the objectives of this communication strategy are to

1) Produce and distribute specific information on the benefits of collaboration
2) Facilitate communication among participants to enhance the research efforts
3) Enhance the credibility and visibility of IEA wind as a reliable source of research and development information.

5.2. Target audiences

The overall goal of the communication effort is to affect the behavior of the target audiences. The simple decision model in Table 1 shows the flow of information content, format, and distribution of materials from IEA Wind to these target audiences. As each audience moves through these decision steps, it becomes clear that different information products are appropriate for different audiences in the decision process. The communication strategy will help IEA Wind reach more audiences with balanced information appropriate to each audience's role in deploying wind energy. Concurrently, properly targeted information will reach more people within each audience.

Table 1: Decision Model

Steps toward action	Types of information
Step 1 Awareness of wind energy and IEA Wind	Awareness: Eye catching, encountered in daily activity. Lay groundwork for positive attitude, establish credibility of source.
Step 2 Motivation to seek further information	Promotion: Promotional, encountered in daily activity, Illustrates the role the reader can play to promote wind energy. Includes references to decision information.
Step 3 Evaluation of information to make decision	Decision: Decision oriented, includes data and tools to evaluate the data.
Step 4 Positive action	Action: Resources or data required for action.

For the purposes of this communication strategy, deciding how to best deliver information materials to the following audience categories is important for achieving the overall goals of IEA Wind.

Researchers

- **Task participants: Includes operating agents, contributors to work plan activities, meeting observers, and funding agencies.**

  Objectives: Facilitate information exchange about active research.

- **Non-task participants in research institutes, universities, and industry; those in related research fields (offshore oil, aeronautics, etc.).**

  Objectives: Promote awareness of completed research, research in progress, experts meetings, proposals for potential research, and benefits of co-operative research.

Developers: Includes project designers, manufacturers, sales force, installation and maintenance personnel.

Objective: Reduce the cost of finding relevant information resulting from IEA Wind activities (databases, recommended practices, state-of-the-art reports, etc.).

Influencers: Includes regulators, educators, elected officials, environmentalists, professional/business groups, media, citizen interest groups, IEA Wind ExCo members, members of other IEA implementing agreements, and funding sources for participation in IEA wind activities.

Objective: Supply information to aid in decisions to approve wind energy projects (results of tasks on cost, public acceptance, labeling, etc.) and support wind energy research (including IEA Wind activities).

Users: Includes utilities, developers, communities as owners, or individuals who may become financially involved with wind energy projects.

Objective: Provide positive information on deployment of wind energy and information to aid in the decision to deploy.

5.3. Communication strategy

The communication activities of IEA Wind are directed by the ExCo and managed by the Planning Committee and the Communication Committee. Activities are carried out by the Secretary, operating agents, and ExCo members. New activities achievable within the approved Secretary's budget can be instigated by the Planning Committee. Major cost items will be included in the annual Common Fund budget proposal presented at the second meeting of the year.

6. STRATEGIC OBJECTIVES AND ACTION PLAN

Table 2: Summary of the IEA Wind Action Plan to Meet Objectives 2009–2014

Strategic objective	Key issues	Forward plan	Action path
1. Wind technology research to improve performance and reliability at competitive costs	➢Basic R&D: Improve performance, reliability, and innovation ➢Optimized manufacturing and supply chains ➢Bringing the test site to the lab (test facilities and methods)	➢Continue core technology R&D activities ➢Increase engagement with the commercial sector ➢Bring advanced research and industry together	➢Exploit existing mechanisms to continue to identify and advance the state of the art across R&D topics ➢Convene experts meetings and new tasks on offshore issues
2. Power system operation and grid integration of high amounts of wind generation	➢Systematization and development of methods to assess the impact of wind generation on power system design and regulation ➢Making the wind turbine grid-friendly to increase acceptance by grid operators	➢Continue core R&D activities ➢Assess balance costs depending on the structure of the energy mix ➢Assess capacity credit and flexibility of representative power systems	➢Continue to advance the state of the art in the area of power system operation with large wind penetration ➢Convene experts meetings and new tasks on grid integration issues ➢Increase engagement with the power system operation sector ➢Co-operate with other Implementing Agreements (e.g., IEA Storage)
3. Wind resource and performance assessment for large wind integration	➢Need for dynamic models, performance assessment methods, and improved methods to estimate production in complex terrain and under offshore conditions ➢Need for improved forecasting	➢Expand on existing grid integration and power quality work, resource assessment, and forecasting ➢Develop new computational fluid dynamics and energy balance methods with special focus on complex and densely forested terrains ➢Initiate a publicly accessible wind database	➢Consider additional experts meetings to complement the work under Task 25 ➢Consider new tasks on performance assessment ➢Integrate Task 25 seminars in programs of international conferences

4. Offshore wind development	➢Need to model loads and design support structures for deep water (>30 m) and floating structures ➢Need for better transport, installation, and maintenance ➢Need for new and optimized support structures as integrated concepts concerning production, installation, operation, and environmental impact	➢Increase emphasis on offshore technology and environmental issues ➢Conduct periodic review of long-term R&D needs ➢Gain increased input from industry ➢Gain publicly available information on experience in offshore wind farm operation	➢Extend foundation design work of Task 30 ➢ Develop new task proposals on offshore aspects based on final reports of Task 23, work of Task 30 and findings of experts meetings, ➢Hold experts meeting on long-term R&D needs toward the end of this term ➢Review strategy document and generate annual work plan ➢Support the exchange of operation experiences of wind farms taking into account commercial sensitivities
5. Social, educational, and environmental issues	➢Increase relevance of IEA activities for member countries ➢Explore wind within future energy supply systems ➢Conduct energy systems modeling ➢Assess support mechanisms and markets for wind in the context of all renewables ➢ Increase the visibility and quality of information generated ➢Assess environmental and social issues such as effects on flora and fauna, visual influence, and noise emission	➢Gain more active involvement of the commercial sector ➢Gain participation of planning and policy stakeholders ➢ Increase membership and information dissemination activities	➢Continue Task 28 work to address societal issues ➢National representatives continue to liaise with relevant commercial-sector organisations ➢Hold dedicated events with the commercial sector ➢Collaborate with other implementing agreements ➢Continue presentations at targeted events ➢Exploit appropriate IEA dissemination channels ➢Continue to produce and distribute the annual report ➢Update the strategy annually

Strategic objective	Key issues	Forward plan	Action path
6. Communication strategy	➢Increase the influence of results from IEA Wind–sponsored research ➢Increase quality participation in IEA Wind–sponsored activities	➢Support information dissemination needed by objectives 1–5 ➢ Deliver the results of successful research activities to key audiences ➢Enhance the credibility and visibility of IEA wind as a reliable source of research and development information	➢Continue refinements to web site to serve the members, the research tasks, and publication of research reports ➢Continue improvements to the Annual Report to increase visibility of IEA Wind accomplishments within member countries ➢Increase use of newsletters such as the IEA OPEN Bulletin to announce IEA Wind accomplishments ➢Devise publicity strategy based on target audiences for each IEA Wind publication ➢Develop new brochures and Web content to publicise the work of IEA Wind

7. STRATEGY AND PERFORMANCE REVIEW

This latest Strategic Plan and the Action Plan shown in Table 2 is for use as a guiding reference document and not as a rigid commitment to a course of action. Therefore there will be periodic reviews to take proper account of changes in circumstance in light of the thinking behind the existing strategy.

The next review is scheduled for 2013 while preparing a new Strategic Plan for extension of the IEA Wind Agreement for another five-year period beyond 28 February 2014.