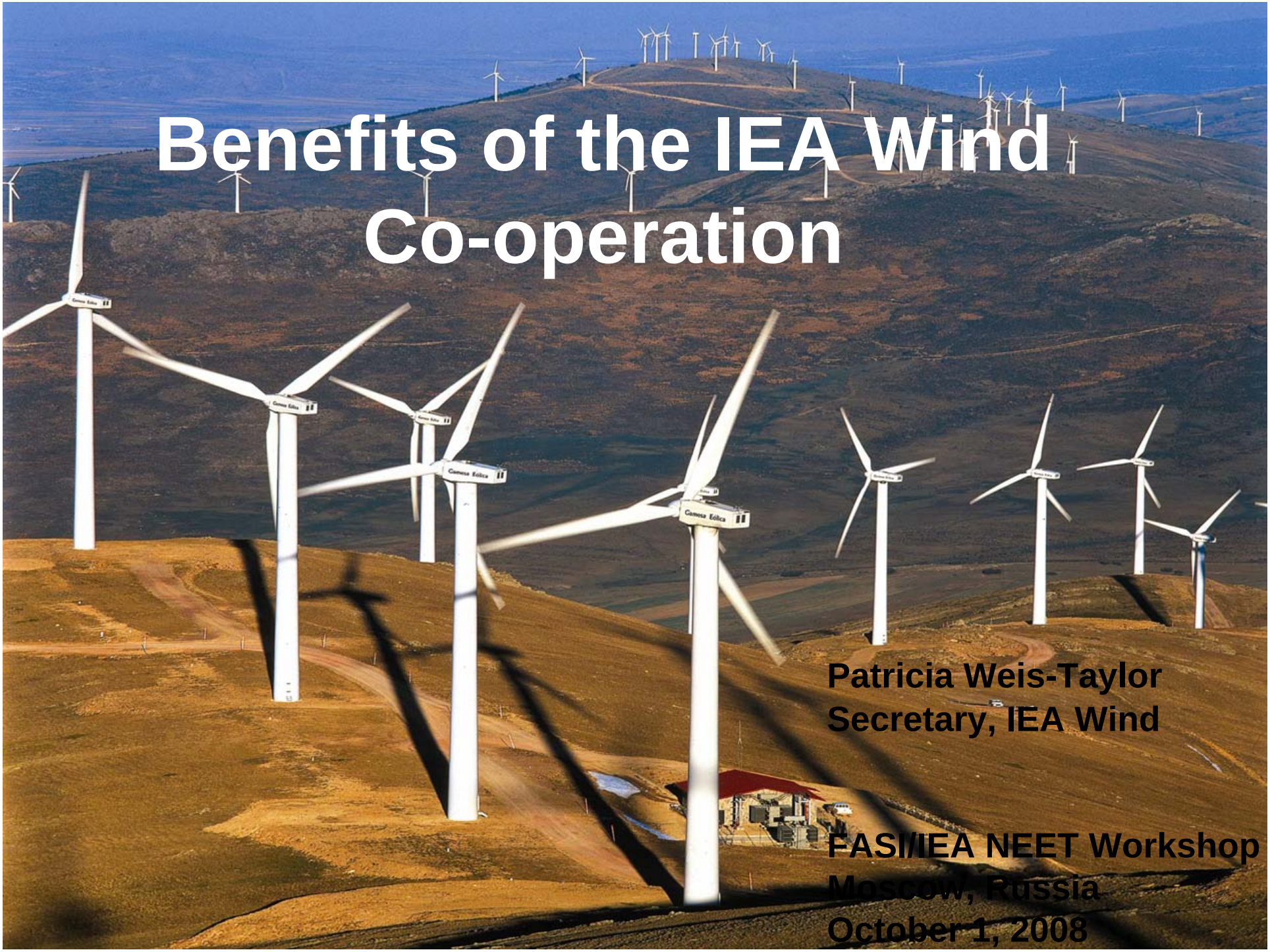

# Benefits of the IEA Wind Co-operation

**Patricia Weis-Taylor**
**Secretary, IEA Wind**

**FASI/IEA NEET Workshop**
**Moscow, Russia**
**October 1, 2008**

# Wind energy makes sense today

1. Wind energy is a significant source for new electrical generation capacity

2. Wind energy development brings national benefits

3. IEA Wind activities support national programs by sharing information and joint research results

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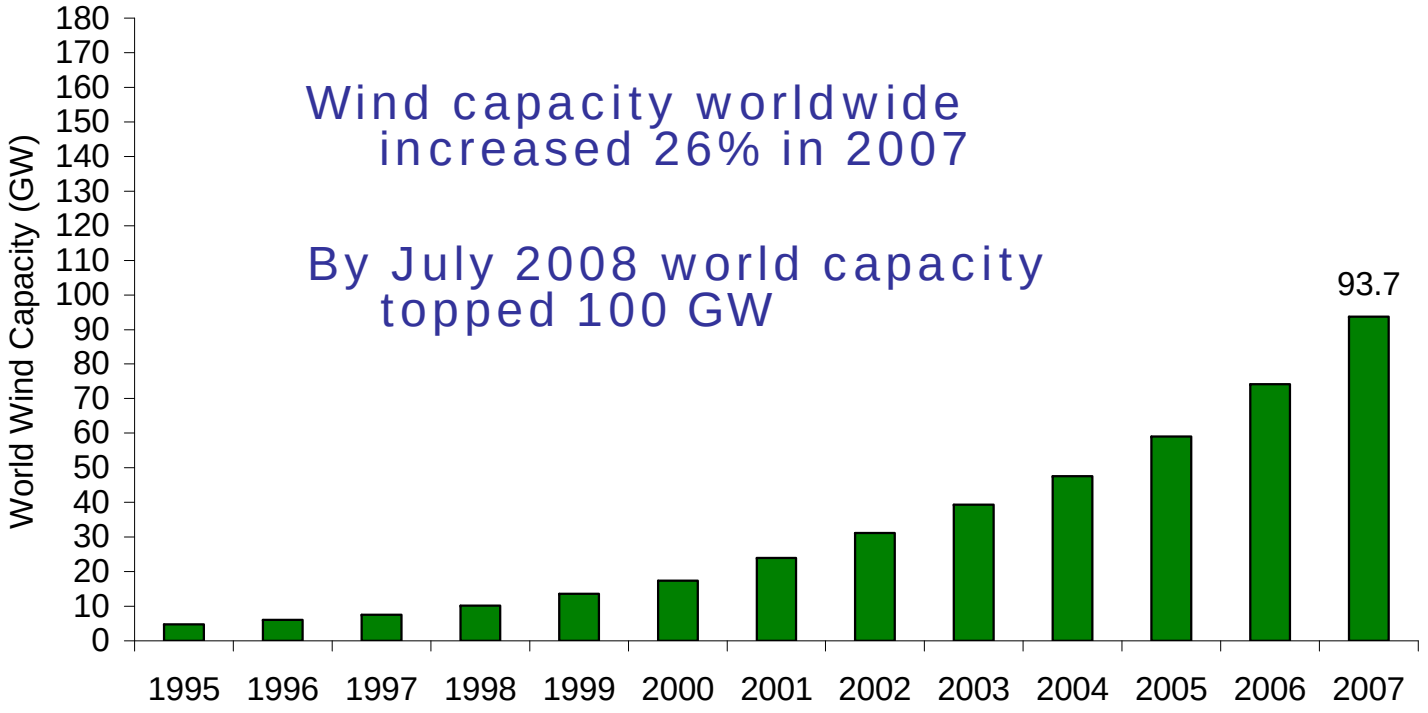
# 1. Wind generation is significant and growing

- In Europe, 40% of new power installations were wind power projects (Source: EWEA, 2007)
- In the U.S. 36% (Source: IEA Wind Annual Report 2007)

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# Wind generation is significant

In 2007 alone, new global wind power installations equaled the capacity of 20 large conventional power plants

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2007 New Global Wind Power Installations

20 Large Conventional Power Plants

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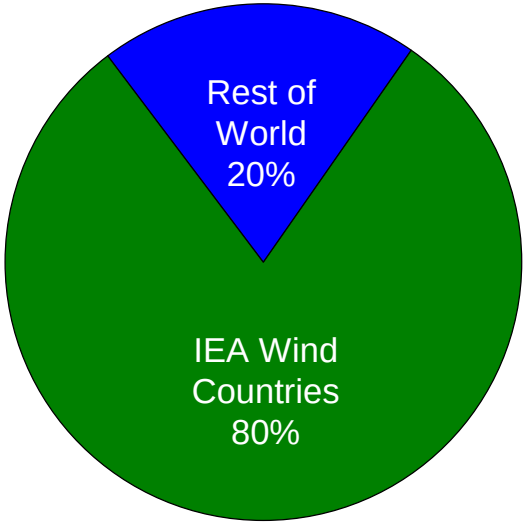
# 80% of the world wind capacity is in IEA Wind member countries


IEA Wind Countries




World Wind Capacity

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# IEA Wind has broad membership

## OECD Participating Countries:

**Europe:**

Austria, Denmark, Finland, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the European Commission

**North America:**

Canada, Mexico, and the United States

**Asia and Pacific:**

Australia, Japan, and South Korea

## International Organizations (sponsors):

European Wind Energy Association

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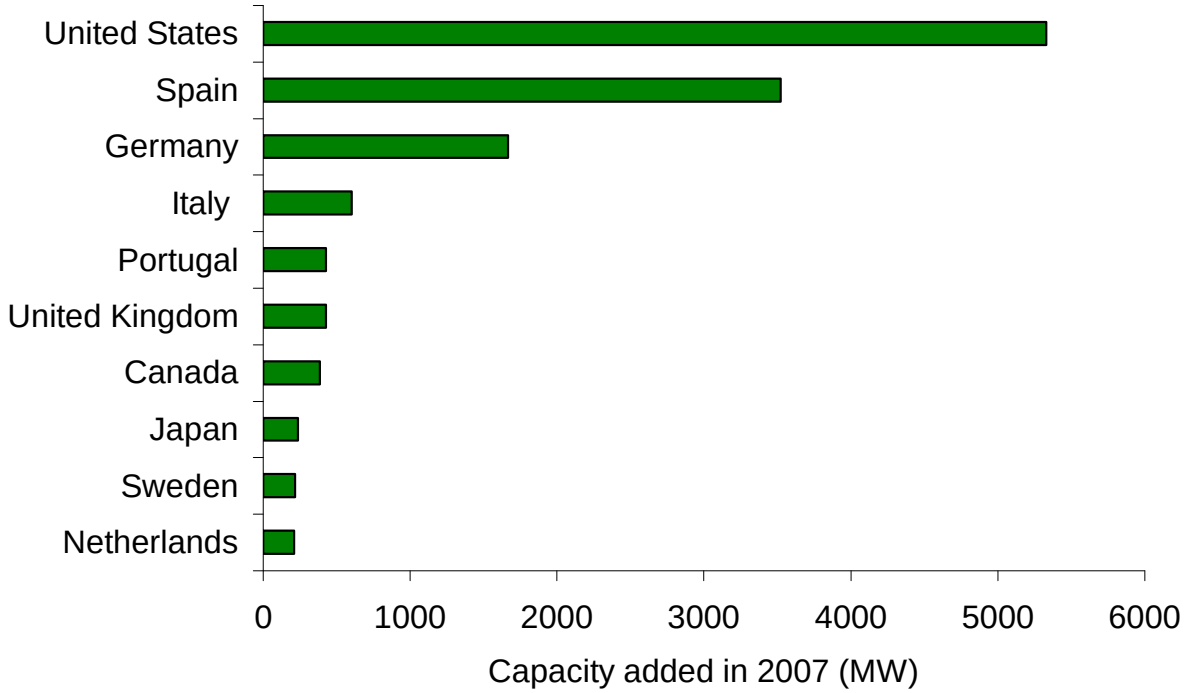
# IEA Wind participants added 13,300 MW of wind in 2007




Electrical output from wind in IEA Wind countries increased 31% in 2007 (while capacity increased 21%) due to better hardware and better development strategies (Source: IEA Wind 2007 Annual Report)

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# Wind contributes to national electrical demand

| IEA Wind Country | National electricity demand (TWh/yr) | Percent of national electricity demand from wind* |
|---|---|---|
| Denmark | 36.0 | 19.9% |
| Spain | 276.8 | 9.8% |
| Portugal | 50.0 | 8.1% |
| Ireland | 26.0 | 6.9% |
| Germany | 617.2 | 6.4% |
| Greece | 51.0 | 4.6% |
| Netherlands | 115.6 | 2.9% |
| United Kingdom | 406.0 | 1.3% |
| Italy | 340.0 | 1.2% |
| Australia | 220.0 | 1.1% |

* % of national electricity demand from wind = (wind generated electricity/ national electricity demand)

Source: IEA Wind 2007 Annual Report

- The EU overall has moved from .09% wind contribution in 2000 to 3.7% in 2007
- In Spain on certain days, wind has covered 30% of hourly demand and up to 20% of daily electrical demand.

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# 2. Wind energy development brings national benefits

| IEA Wind Country | Total Capacity (MW) | Estimated jobs | Economic impact (Million euro) |
|---|---|---|---|
| **Germany** | **22,247** | **84,300*** | **11,729*** |
| **United States** | **16,904** | **17,000** | **6,165** |
| **Spain** | **15,145** | **45,000** | **5,000** |
| **Denmark** | **3,124** | **28,000** | **4,690** |
| **Italy** | **2,726** | **10,600** | **1,000** |
| **Canada** | **1,845** | **3,340*** | **1,490*** |
| **Australia** | **824** | **978** | **180** |

* Numbers from 2006

Source: IEA Wind 2007 Annual Report

- Avoided $CO_2$ emissions:
  - Spain 18 million tons
  - U.S. 30 million tons

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# 3. IEA Wind supports national programs with information exchange and joint R&D

- Information Exchange: Sharing experience
  - the planning and execution of large-scale wind energy deployment
  - tariffs, permits, credits, certificates, mandates, and other incentive and regulatory environments
  - experiences with national technology research projects

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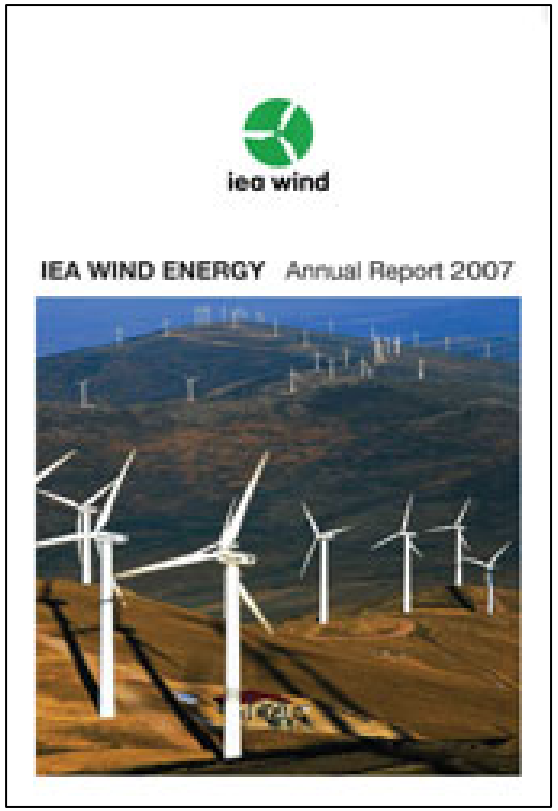
# Information Exchange:

- Country and Task reports at meetings of the IEA Wind Executive Committee (2 times per year, 20 countries, the European Commission, and the European Wind Energy Association)
- IEA Wind Annual Report (280 pages) containing country and Task chapters and Executive Summary is distributed to all participating organisations
- Public Web site: www.ieawind.org
- Members-only Web pages

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# Information Exchange:
## Experts address challenges

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# Topical Experts Meetings:

- Smart structures for blades (22 people from 7 countries)
- Gear boxes and drive train dynamics (47 people from 9 countries) Proposal for joint research task being prepared
- Forecasting remote wind speed sensing techniques using sodar, lidar, and satellites (24 people from 10 countries)
- Wind and wave measurements at offshore locations
- Radar, radio, and wind turbines
- Social acceptance of wind energy projects
- Long-term research needs for wind energy
- Periodic symposia on aerodynamics, fatigue, wind characteristics, and forecasting

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# IEA Wind Joint R&D Tasks:

- Task 20 HAWT aerodynamics and models from wind tunnel measurements.
  - Contribution per participant: $9,375 plus in-kind effort
  - **Total value of shared labor: $2,036,300 USD**
  - Access to the NASA wind tunnel data

- Task 21 Dynamic models of wind farms for power system studies
  - Contribution per participant: 15,500 Euro plus in-kind effort
  - **Total value of shared labor: 4,760,000 Euro**

- Task 24 Integration of wind and hydropower systems
  - Contribution per participant: $16,430 USD plus in-kind effort
  - **Total value of shared labor: $6,237,000 USD**

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# IEA Wind R&D continues to reduce costs

- Grid integration tools
- Designs to increase performance/value
  - Forecasting
  - Aerodynamics
  - Structural dynamics
  - Electrical systems
- Designs for specific locations
  - Cold climate
  - Offshore
  - High wind/turbulence
- Impact assessment
  - Cost assessment tools
  - Social impacts
  - Environmental impacts

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# Task 19 addresses cold climate issues for wind energy

- Establishes a site classification scheme
- Explores technologies to increase productivity
- Develops tools to predict performance

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# Task 23 explores issues of offshore wind development

- Workshops on regulation, grid connection, and ecological issues
- Technical research for deeper water
  - Benchmarks structural dynamics models for estimating offshore dynamic loads
  - Identifies and verifies model capabilities and limitations


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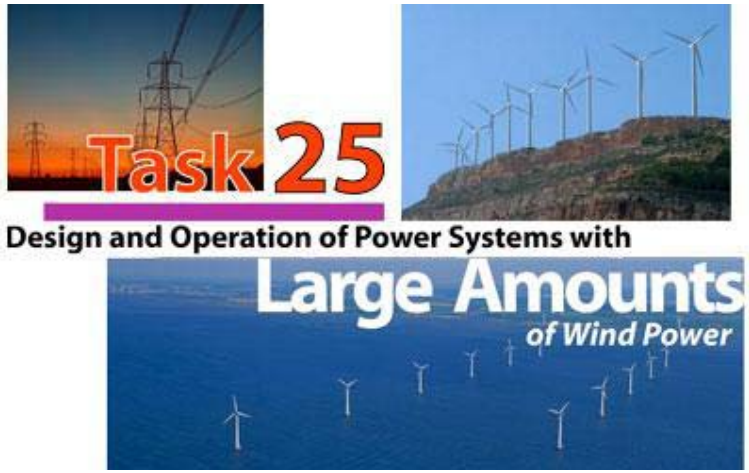
# Transmission system operators and wind developers benefit from IEA Wind Tasks

- Dynamic models of wind farms for power system studies (Task 21)
- Integration of wind and hydropower systems (Task 24)
- Design and operation of power systems with large amounts of wind power (Task 25)

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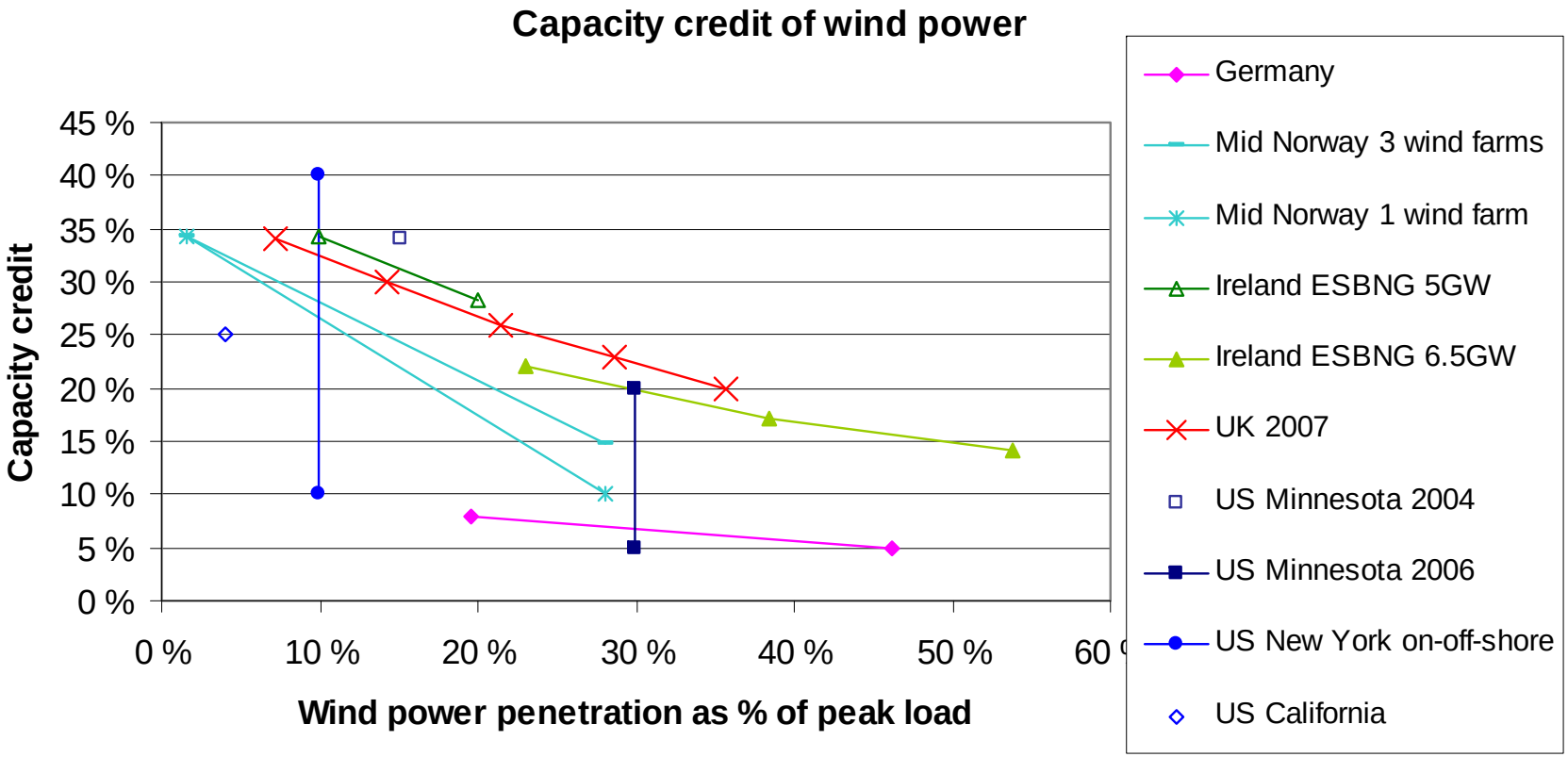
# State-of-the-art report on integration

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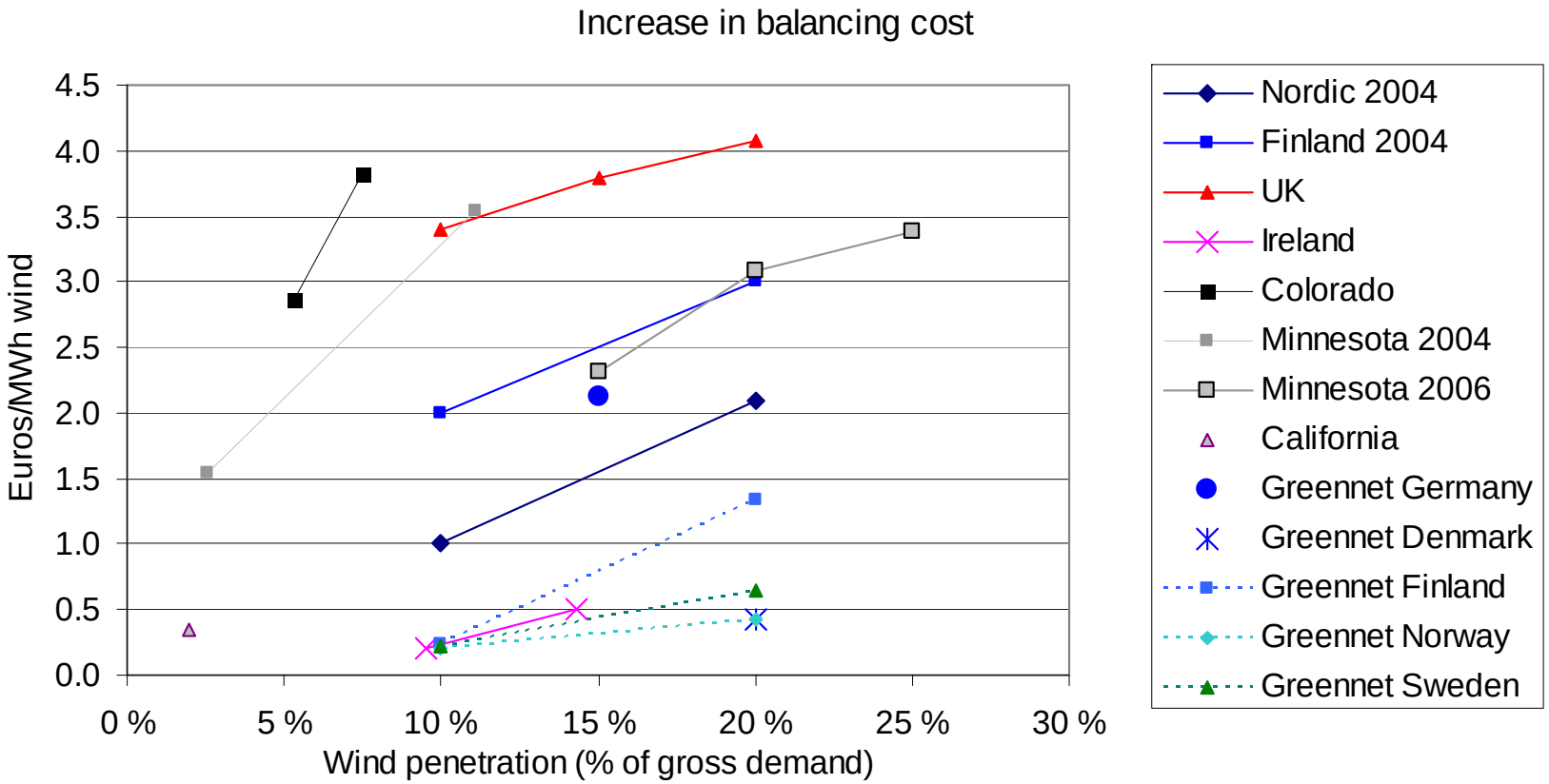
# More state-of-the-art report

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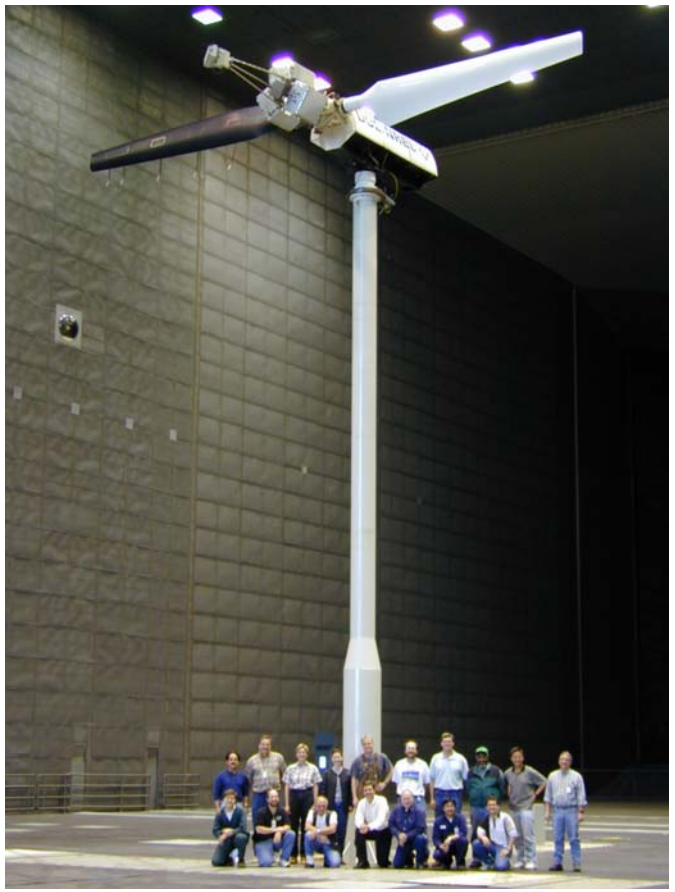
# Aerodynamic research

- Task 29 will analyse wind tunnel measurements and improve aerodynamic models
  - Using measurements of a wind turbine in the large German Dutch Wind Tunnel, DNW
  - Measurements are available from EU-funded project *Measurements and Experiments in Controlled Conditions, MEXICO*



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# Three new tasks will address key issues

- Cost of wind energy (Task 26)
  - Bring economists and engineers together on the issue
- Quality labeling of small wind turbines (Task 27)
  - Bring standards and test practices together
  - Produce a recommended practice for quality labeling of small wind systems
- Social impacts of wind power projects (Task 28)
  - Bring social scientists, planners, and project developers together

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# Russia could benefit from IEA Wind information exchange and joint R&D tasks

1. Wind energy could add significant electrical generation capacity now, not in 20 or 30 years.

2. Wind energy development could bring economic (often rural) development, exports, and reduced carbon emissions in the near term.

3. To support national development, IEA Wind would provide technical and policy support including
   - strategies for extreme environments
   - integrating large amounts of wind power into the electricity grid, and
   - perfecting incentive programs.

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For more information, visit www.ieawind.org
or email the Secretary ieawind@comcast.net.

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# References


- *End-of-term Report for IEA Wind*, July 2008.
- *Windpower Monthly*, April 2008.
- *IEA Wind Energy, 2007 Annual Report*, July 2008.
- IEA Wind task reports posted to www.ieawind.org
- *The Difference Wind Makes*. American Wind Energy Association, 2008.
- *Clean Energy Trends 2008*. Clean Energy, 2008.


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# Supplemental information about the IEA Wind co-operation


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# Mission of IEA Wind

"…to stimulate co-operation on wind energy research and development and to 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 instruments**." – IEA Wind Strategic Plan

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# IEA Wind organisational details

- IEA Wind is one of the more than 40 Implementing Agreements under International Energy Agency (IEA) Organization for Economic Co-operation and Development (OECD). It is attached to the Renewable Energy Working Party (REWP).
- The full, legal name of the activity is the IEA Implementing Agreement for Co-operation in the Research, Development, and Deployment of Wind Energy Systems.
- Benefits include:Guide national governmental programmes and policies through information exchange
- Develop skills, knowledge and improve wind R&D cost effectiveness and minise environmental effects
- Provide information and technology to reduce costs and increase the value of wind energy
- Identify and publicise societal, economical and governmental benefits

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# IEA Wind operational details (1)

- The IEA Wind Executive Committee (ExCo) organises the overall information exchange and the R,D&D tasks
- The ExCo consists of a Member and an Alternate Member from each contracting party in the Implementing Agreement
- Most countries are represented by one contracting party such as a government department or agency
- The ExCo meets twice a year to discuss the R&D programs of the member countries, to report work progress on the various Tasks, and to plan future activities

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# IEA Wind operational details (2)

- Most decisions are reached by majority vote with one vote per member country. Change to members rights and contractual obligations require unanimity
- Members share the cost of administration for the ExCo through annual contributions (based on the size of the nation's economy) to a Common Fund
- Each research task has its own budget and fees based on the work and number of participants
- Each member country must participate in at least one research task

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# IEA Wind active research tasks

Task 29 Aerodynamic Analysis of the EU MEXICO Project

Task 28 Social Impacts of Wind Energy Projects

Task 27 Quality Labeling of Small Wind Turbines

Task 26 Cost of Wind Energy

Task 25 Design and Operation of Power Systems with Large Amounts of Wind Power

Task 23 Offshore Wind Technology Deployment

Task 19 Wind Energy in Cold Climates

Task 11 Base Technology Information Exchange

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# Data for IEA Wind

| Table 1 Key Statistics of IEA Wind Member Countries 2007 | | |
|---|---|---|
| | 2006 | 2007 |
| Total installed capacity | 61.855 GW | 74.844 GW |
| Total offshore wind capacity | 891 MW | 1,125 MW |
| Total new wind capacity installed | 10,463 MW | 13,315 MW |
| Annual increase in capacity from previous year | 22% | 21% |
| Total annual output from wind | 118 TWh/yr | 155 TWh/yr |
| Wind generation as % of national electric demand | 1.42% | 1.6% |

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# IEA Wind Strategic Plan for 2008-2013

1. Wind Technology Research to Improve Performance and Reliability at Competitive Costs
2. Power System Operation and Grid Integration of High Amounts of Wind Generation Including Development of Fully controllable, Grid-friendly "Wind Power Plants"
3. Planning and Performance Assessment Methods for Large Wind Integration
4. Offshore Wind in Shallow and Deep Waters
5. Social, Educational, and Environmental Issues

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# IEA Disclaimer

The IEA Wind agreement, also known as the Implementing Agreement for Co-operation in the Research, Development, and Deployment of Wind Energy Systems, functions within a framework created by the International Energy Agency (IEA). Views, findings, and publications of IEA Wind do not necessarily represent the views or policies of the IEA Secretariat or of all its individual member countries.

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