European Wind Energy: Status and Prospects

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UWIG

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UWIG – A Short History

- Established by 6 utilities in 1989 with support from EPRI and DOE/NREL
- Includes Associate Members from wind development community
- Non-profit corporation governed by board of directors from utility and ISO/RTO members
- Ex officio members include APPA, NRECA, EEI, and EPRI
- Currently has 65 members
- Focus on technical issues

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UWIG Mission and Evolution

- The mission of the Utility Wind Interest Group (UWIG) is to accelerate the appropriate integration of wind power into the electric system through the coordinated efforts and actions of its members in collaboration with wind industry stakeholders, including federal agencies, trade associations, and industry research organizations.
- Evolving from role of
  - Self-education and sharing experience to
  - Addressing research topics and developing new knowledge

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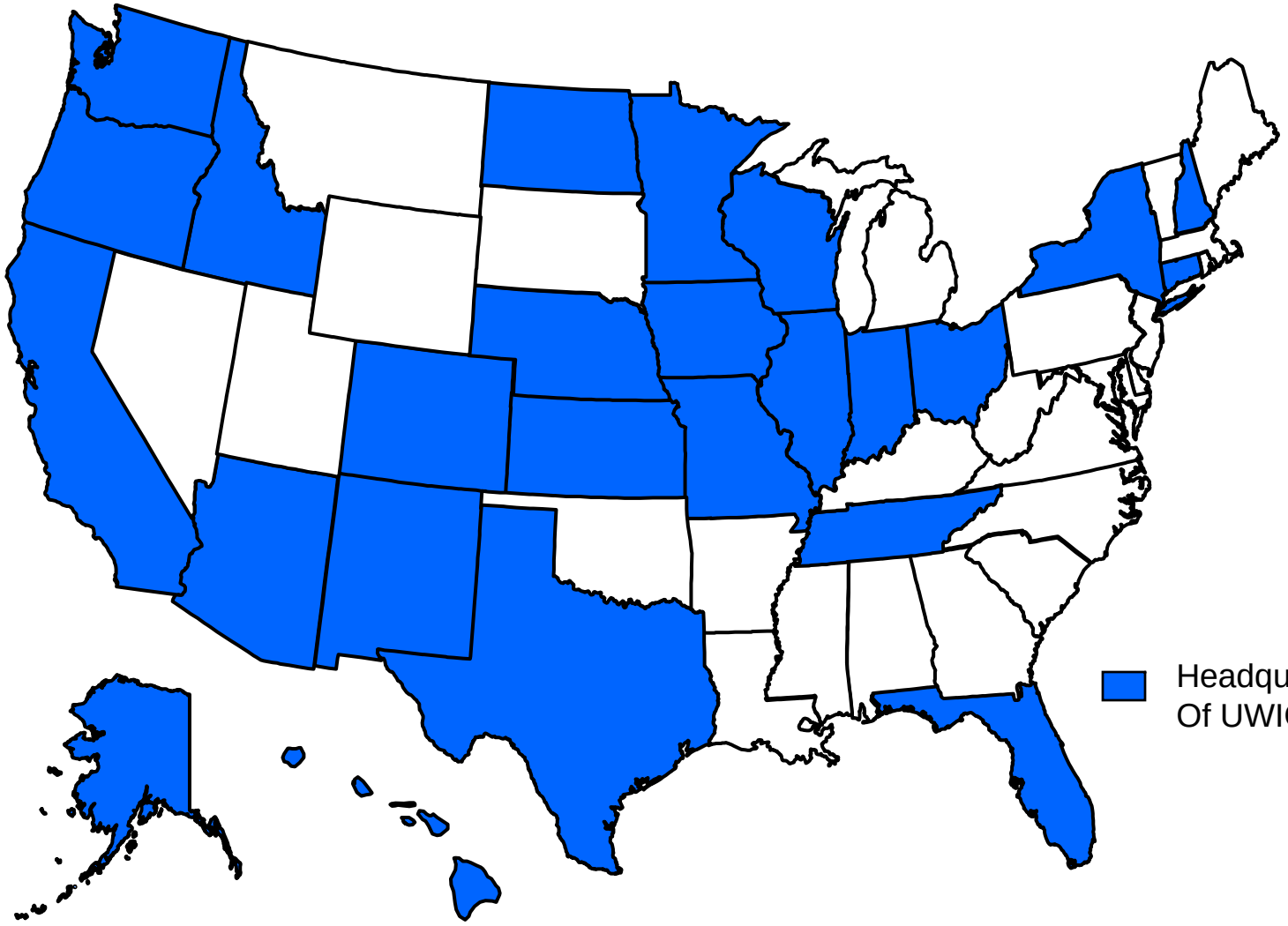
The UWIG Membership



UWIG – International Collaboration

- Co-sponsored Wind Interconnection and Integration Workshop in Albuquerque in May, 2004
- Partners were AWEA, NREL, and CIGRE (International Conference of Large Electric Systems)
- Established working relationship with European utilities
- Continuing cooperation through UWIG, CIGRE, AWEA, NREL, and IEEE activities

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Global Wind Industry Status

- Rapid development in last 5 years
- Major new players include GE, Shell, Siemens, ABB
- Average wind plant size increased from 10's to 100's of MW
- 40,000 MW worldwide at beginning of 2004
  - 28,000 MW Europe (70%)
  - 6,400 MW US (16%)
  - 5,600 MW rest of world (14%)

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European Wind Energy Status

- Development moving offshore
  - 500 MW off Netherlands, Denmark, Sweden, Ireland, UK
  - 10,000 MW anticipated by 2010
- 9 of world's 10 largest turbine suppliers based in Europe
- Market incentives backed by national targets to promote the production of clean energy
- Companies employ 72,000 for the home market.

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Wind Plant Economics and Cost

- Average turbine size increasing-1.5 MW by 2002
- Turbine efficiency increasing 2-3%/yr for 15 yrs
- Average installed cost of 900-1100 Euro/kw
- O&M cost of 1.2 eurocent/kwh: app. 20-25% of COE (cost of energy)
- COE 4-5 eurocent/kwh at good sites, 6-8 eurocent/kwh at average site
- COE goal of 3.1 eurocent/kwh by 2010

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High Penetration Experience

- Countries currently with highest wind capacity are Germany, Spain, and Denmark
- Ability to manage the system depends on quality of wind forecast (good, bad, and ugly)
- Denmark experienced > 20% of annual electric energy production from wind in 2003
  - In some hours wind and CHP (must run) exceeded 100% of load
  - System depends on strong interconnections to neighbors
  - System requires increasing amounts of reserve capacity; can be self-provided or procured from the market
- Denmark planning to accommodate increasing wind capacity

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Policy Drivers

- Kyoto Protocol – December 1997
  - Parties to 1992 UN Framework Convention for Climate Change
  - Emissions reduction targets for developed countries
  - First commitment period 2008-2012
  - EU basket of greenhouse gases down 8% below 1990 levels
- Renewable Energy Systems Directive 2001/77/EC:
  - Assigns indicative, individual renewable energy production targets to member states; backed up by national legislation
  - Establishes basis to review future need for mandatory targets
- Policy driven by strong public support

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EU15 Wind Capacity Target 2010

Country	2004	2010
Germany	14,600	28,000
Spain	6,200	15,000
UK	700	6,000
France	240	6,000
Denmark	3,100	5,000
Others	3,160	15,000
Total	**28,000**	**75,000**

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EU15 Wind Target Breakdown

- 75 GW total by 2010
  - 10 GW offshore
  - 5.5% of electric consumption
- 180 GW by 2020
  - 70 GW offshore
  - 12.1% of electric consumption
- Large exploitable resource
  - 600 TWh onshore
  - 3,000 TWh offshore
  - 425 TWh wind production goal for 2020

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External Costs

- EU ExternE project, conducted over 15 member states for past 10 years, estimates wind externalities of .26 eurocent/kwh, coal at 2-15 eurocent/kwh
- Report estimates costs between Euro 85-170 billion, exclusive of global warming and climate change
- "Until external costs are fully integrated, some form of market incentives or support is required to develop the technology"

  – Wind Energy, The Facts. Executive Summary, p. 9.

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Market Incentives and Support Mechanism

- Support systems provided in EU Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources
- Sets indicative targets for renewable contribution to electricity supply of each country by 2010
- Overall target to go from 14% renewable energy content in electric supply in 1997 to 22% in 2010
- Wind contribution would increase from 5.5% in 2010 to 12.1% in 2020
- Denmark has highest annual wind energy penetration currently at 20%

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Fixed Price Support System

- Fixed feed-in tariffs
  - Operators paid fixed price per unit of output with extra cost paid by all consumers (Germany, Spain, Denmark)
  - German subsidy app. 1 Euro/mo for ave. household
- Investment subsidies
  - Inefficient, generally out of favor
- Fixed premium system
  - Payment in addition to energy cost; difficult to do in practice
- Tax credits
  - US is best example

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Fixed Quantity Renewable Quota Support System

- National government decision on the level of renewable electricity to be achieved during some period, leaving market forces to establish the price
  - Tendering system (e.g. Ireland, competitive bidding for limited number of power purchase contracts; offshore)
  - Tradable green certificates (e.g. UK, Sweden, Belgium, Italy, tradable certificates issued to reflect additional cost of renewable energy produced to meet agreed quota)
    - » Still in early development stage
    - » Implementation remains a challenge

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WindForce 12 National Policy Recommendations

- Establish legally binding targets for renewable energy
- Provide defined and stable returns for investors
  - Competitive risk-return profiles
  - Sufficient duration to recover investment
- Introduce electricity market reforms
  - Streamlined and uniform planning and permitting procedures
  - Removal of discriminatory grid access and transmission pricing barriers to renewables
  - End subsidies to fossil fuel and nuclear power
  - Internalize social and environmental costs of energy

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Public Policy Driven Development in Europe

- European utilities have generally accommodated the policy, recognizing it as part of their job
  - Operating rules have been modified accordingly
  - Utilities have not been hurt financially – costs are passed on to ratepayers and taxpayers
- Growing recognition that wind needs fair – not preferential – treatment in electricity markets.
- **This is most likely to occur with leadership from the public policy sector.**

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Plea for More Policy Leadership

- "The EU should make it compulsory for European power companies to produce or trade green power, says the boss of a leading European utility. Only in this way can the Netherlands meet its target of 9% renewables by 2010, says Ludo van Halderen, CEO of Dutch power marketer Nuon, one of the world's top 10 owners of wind power generation."

  – Wind Power Monthly, July, 2004, p. 23.

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Sources of Information

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- EU Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources. Official Journal of the European Communities, 27 Oct 2001. http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf

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