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Stanford University, April 26, 2004
Over half the population lives in coastal counties:

- 6% of the nation’s electric load
- 7% of the nation’s electric load
- 24% of the nation’s electric load
State Incentives

Renewables Portfolio Standards

Public Benefit Funds

Can enough wind be built on land in the Northeast?

http://www.dsireusa.org
Why Go Offshore?

- No windy lands near many load centers
- Transmission barriers on land for long distances
- Strong winds reside offshore; good load matching too
- Offshore wind can help satisfy RPS and SBC initiatives and still be cost-competitive with other renewables
Offshore Components

- Tower heights >200 ft (60 m)
- Turbines rated 2 - 5 MW
- Spaced 1/3 to ½ mile apart
- Rotor diameters 250-350 ft
- Foundations
- Substation & marine cable
- Port facilities

Nysted Project, Denmark
Key Design/Siting Factors

- Water Depth
- Extreme Wind/Waves
- Seabottom Geology
- Distance to Transmission
- Installation Equipment
Why Europe is Pursuing Offshore Wind

- Strong, aggressive government policies promoting green energy
- Shrinking opportunities on land
- Widespread acceptance/familiarity with land-based wind projects
- Shallow waters well offshore

160 MW Horns Rev Project, Denmark
U.S. in Contrast

- Only two serious pending projects
- Independent pioneers
- Almost no wind projects on nearby land
- Fickle renewable energy support
Land vs Offshore Potential In Coastal Areas

- Compare amount of windy areas in coastal states and offshore
- Assume higher threshold wind resource for offshore projects
- Assume maximum water depths for offshore projects in near-term
- Contrast public with private lands
New England Wind Power Class Map

- Commercial Land Wind Projects Require Class 4+ Wind Class
- Offshore Wind Projects Require Class 5+ Due to Higher Construction Costs
New England Water Depths

- Most Offshore Projects Have Been Built in Waters <50 ft Deep
- Some New Offshore Projects Are In Waters Up to 75 ft Deep
- Deep-Water Foundation Designs Are Under Development
New England Windy Areas

- Windy Lands (Class 4+) With and Without Parks/Govt. Forests
- 28% of windy lands are in parks/govt. forests
- Windy Waters (Class 5+) with depths <70 ft
- 40% of windy waters beyond 3-mile limit
Mid-Atlantic Wind Power Class Map

- Commercial Land Wind Projects Require Class 4+ Wind Class
- Offshore Wind Projects Require Class 5+ Due to Higher Construction Costs
Mid-Atlantic Water Depths

- Most Offshore Projects Have Been Built in Waters <50 ft Deep
- Some New Offshore Projects Are In Waters Up to 75 ft Deep
- Deep-Water Foundation Designs Are Under Development
Mid-Atlantic Windy Areas

- Windy Lands (Class 4+) with and Without Parks/Govt. Forests
- 42% of windy lands are in parks/govt. forests
- Windy Waters (Class 5+) with depths <70 ft
- 80% of windy waters beyond 3-mile limit
West Coast – Wind Power Class
West Coast – Water Depths
West Coast – Windy Areas

75% of windy lands in parks/govt. forests
Available Windy Area

*Class 4+ on Land; Class 5+ Offshore and Water Depths <70 ft; No land use exclusions
Economics of Offshore

COE for other Renewables
- Landfill Gas: 3¢ – 8¢/kWh
- Biomass: 5¢ – 9¢
- Photovoltaics: 17¢ – 25¢
- Geothermal: 4¢ – 8¢

Source: Dept. of Energy
Offshore Wind Matches Peak Load Profiles

Typical Peak Load Day, Coastal New Jersey, 1999-2003

Typical summer peak day afternoon capacity factor for offshore NJ wind plant >50%
Conclusions

- East coast has large energy appetite but relatively little windy land
- Offshore offers large wind development opportunities, for many eastern states
- Offshore can be cost-competitive with other renewables and can help wind fulfill RPS and SBC initiatives
- West coast has strong offshore wind resources but very deep water; offshore deep water foundations not yet available
Conclusions

• Many barriers to overcome
• Need for more public familiarity with wind power, particularly in eastern US
• Include offshore wind in the visions of state and federal energy policies
• Earmark R&D funds to address offshore engineering & development issues
• Learn from European experiences and support international collaboration
Thank You!

Questions?

Samsø Project, Denmark