Deepwater Offshore Wind in Maine: the Plan, the Timeline

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Outline

1. Why Deepwater Wind in the US?
2. Why Deepwater Wind in Maine?
3. How will Maine Use its Wind Resource?
4. Europe
5. Maine Deepwater R&D Plan
Deepwater Wind: Dominant US Ocean Energy Resource

1. 61% of US offshore wind resource in *deepwater*.
2. US deepwater wind ~ 1,533 GW.
3. Total US electrical generation capacity ~ 1,100 GW.

Why Pay Attention to Maine’s Deepwater Wind?

1. 8.3% of US Deepwater Wind Resource is off Maine.
2. R&D Capacity:
   - UM Advanced Structures and Composites Center
   - UM GIS Offshore Wind Database (25 faculty x 50 years)
3. Governor Established Deepwater offshore Wind Testbed
4. Unique Ocean Industry Assets:
   (a) Boatbuilding industry (BIW)
   (b) Deepwater floating exploration rigs (Cianbro)

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- Maine is larger than all other New England states
- 18% of US population in Northeast

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Maine Deepwater Wind: Part of the Regional RPS Solution
The Maine Plan: More than Turning the Lights on!

OFFSHORE WIND
$20 billion, 15,000 jobs

5 GW

HOME HEATING
- Save 40-60%
- Weatherize, 30 years
- Heat pumps, 30 years
- $1 Billion revolving loan

Smart Grid

Maine

Export to NE

3 GW

LAND-BASED WIND
$7 Billion

3 GW

TRANSPORTATION
Save 40-60% PEHV, 30 years

5 GW of additional wind needed to electrify heating and transportation in Maine

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89% of Maine’s Offshore Wind is in Deepwater; Class 6 & 7 Winds

Source: Walter Musial (NREL, 2008)
Maine’s Role in Meeting U.S. DOE’s Plan: “20% Wind Energy by 2030”

5 GW in each of top 10 offshore states

Cumulative Installed Capacity (GW)

- Offshore
- Land-based

2000 2006 2012 2018 2024 2030

53.9 GW offshore

293.4 GW on land

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US is Behind: Offshore Wind Projects Planned by 2015 Europe and North America

Source: Walter Musial (NREL, 2008)
Floating Wind Turbine Testing
Ongoing in Norway

The Hywind concept
Developed by StatoilHydro
Combines known technologies
Floating concrete or steel hull
“Standard” offshore turbine
Deep water, depth > 100 meters (328 ft)
Harsh environment
Assembled in sheltered waters, towed to field

Relies upon experience from:
Floating platforms
Electrical power production
Onshore wind turbines

Technical data
WTG: 2.3 MW
Turbine weight: 138 tons
Turbine height: 65 m (213 ft)
Rotor diameter: 82.4 m (270 ft)
Draft hull: 100 m (328 ft)
Displacement: 5300 m3 (17388 cuft)
Diameter at water line: 6 m (20 ft)
Diam. submerged body: 8.3 m (27 ft)
Water depths: 120-700 m (400 - 2300 ft)
Mooring: 3 lines
Maine R&D Goal 1(2009-2010): Establish Deepwater Wind Testbed

**Objectives:**
- Evaluate deepwater platform designs in-situ, both scale models and full-size.
- Verify models necessary for design.

**Partners:**
Testbed open to federal, academic and industrial partners.

**Approach:** Establish heavily instrumented, highly characterized ocean environment, >60m

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Maine R&D Goal 2 (2010-2014): Test *Deepwater* Wind Turbines

**Technical Challenges:**
- Predictive models.
- Cost Target ($3.5/W).
- Manufacturability.
- Deployment.
- Durability: corrosion/fatigue.
- Survivability (extreme local events).
- Foundations.
- Optimization for Class 6 and 7 winds.

**Approach:**
- Start with scale model(s), Laboratory → Testbed
- Use macrocomposites (conventional+advanced materials).

Stepping-Stone Project: 20-30 MW

- Design
- Build
- Monitor
Maine to Invest in *Deepwater* Offshore Wind Research

1. **Advanced Deepwater Wind Prototyping Center:**
   - Expands UM Advanced Structure and Composites lab to 70,000 ft²
   - Design, prototype and test under one roof
   - Robotics composites prototyping
   - Nanocomposites

2. **Deepwater Wind Testbed**

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Economic Opportunities for Maine
5GW = 250 MW/Year over 20 Years

Based on Vestas V90-3MW turbine

- $1 billion per year over 20 years
- Local fab and install (30%) = $300M/year
- Local offshore service (2.5% of CI) = $500M/year after built
- With 25-year life, project re-powering sustains regional jobs

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