

New England Wind Integration

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Presentation Overview

- Current Levels of Penetration in New England
- Integration Challenges and Opportunities
- Texas Event
- ISO New England Action Plan

Levels of Wind Penetration

- Until recently only small distributed wind farms existed in New England
 - 24 MW of Utility Scale wind is now online with another 57 expected in the next week
 - Over 300 MW scheduled during calendar year 2009
- To this point there has been no impact to the ISO or its systems related to wind integration
- However, we want to be ready and able to meet challenges before they arrive

Map of New England Wind and Projects

http://www.eere.energy.gov/windandhydro/windpoweringamerica/ne_projects.asp#operating_windfarms



- **Operating Projects**
 - **Windfarms**
 1. [Searsburg Wind Energy Project](#) 6.6 MW
 2. [Mars Hill Wind Farm](#) 42 MW NB
 - [Lempster Wind Farm](#) 24 MW
 - **Community Scale**
 3. [Hull Wind 1](#) .7 MW
 4. [Hull Wind 2](#) 1.8 MW
 5. [Jericho Mountain Wind](#) 1.05 MW
 - **Customer Sited (100 kW+)**
 6. [Portsmouth Abbey](#) .7 MW
 7. [MA Maritime Academy](#) .7 MW
 8. [Jiminy Peak](#) 1.5 MW
 9. [IBEW](#) .1 MW
 10. [Forbes Park Wind Project](#) .6 MW
 - **Small Wind (<100 kW)**
 11. [Burlington Electric Department](#)
 12. [Beaulieu](#)
 13. [Manchester/Hillsborough](#)
 14. [Dynapower](#)
 15. [Butterworks Farm](#)

Wind in the Queue

- Wind projects make up almost 90% of the renewable resources in the queue: 4,297 MW
 - http://www.iso-ne.com/genrtion_resrcs/nwgen_inter/status/index.html
 - 1,259 MW offshore
 - 3,038 MW onshore
- Of the 4,297 MW, 813 MW have System Impact Studies and Review of Proposed Plans (I.3.9) processes completed
- At these current levels we do not see major operational or planning issues other than at local levels of congestion
- But what is coming? Wind resources in the queue continue to grow

Integration Challenges and Opportunities

Transmission Interconnection

- Transmission Capacity in Areas of High Wind Capability is limited
- Who pays for the new transmission capacity
 - Texas Plan (State identifies sites and orders TO's to build)
 - California Plan (Build trunk line and they will come)
 - New England Economic Study Process Stakeholder Group
- Siting
 - Attractive Wind Source
 - Land Owner and Community Support
 - Feasible Permitting and Environmentally Suitable
 - Interconnection Point
 - Offshore may have an advantage if built close to load centers
 - Favorable Markets

Great Wind Locations are not Necessarily Coupled with Great Transmission Corridors with Surplus Capacity

Source Levitan Phase II Wind Study for ISO New England
1 meter per second roughly 2.2 mph

Legend

Class 7 >8.8 (m/s)

Class 6 8-8.8 (m/s)

Class 5 7.5-8 (m/s)

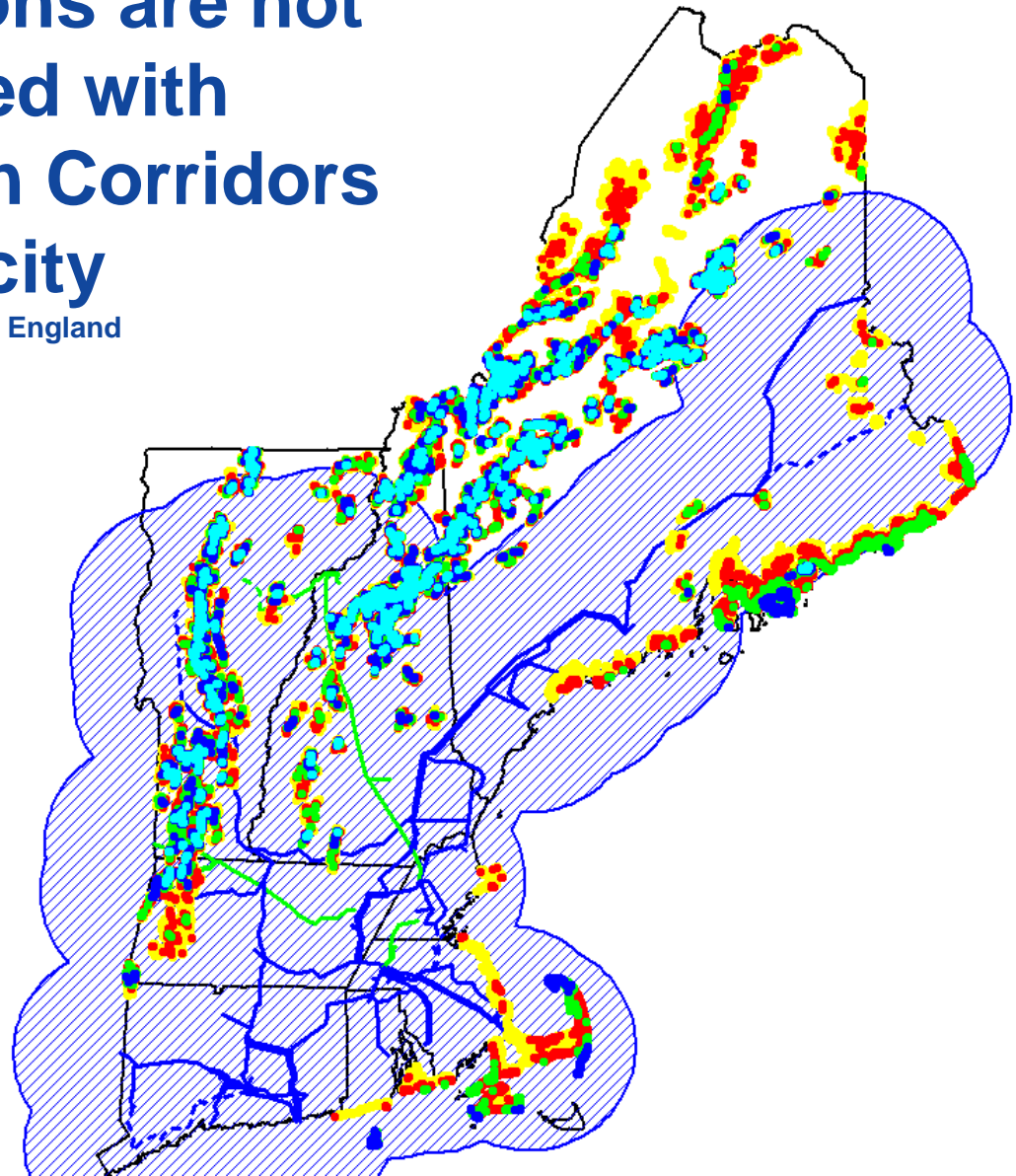
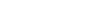
Class 4 7-7.5 (m/s)

Class 3 6.4-7 (m/s)

40 Miles

230 kV

345 kV



Integration Challenges and Opportunities

System Flexibility

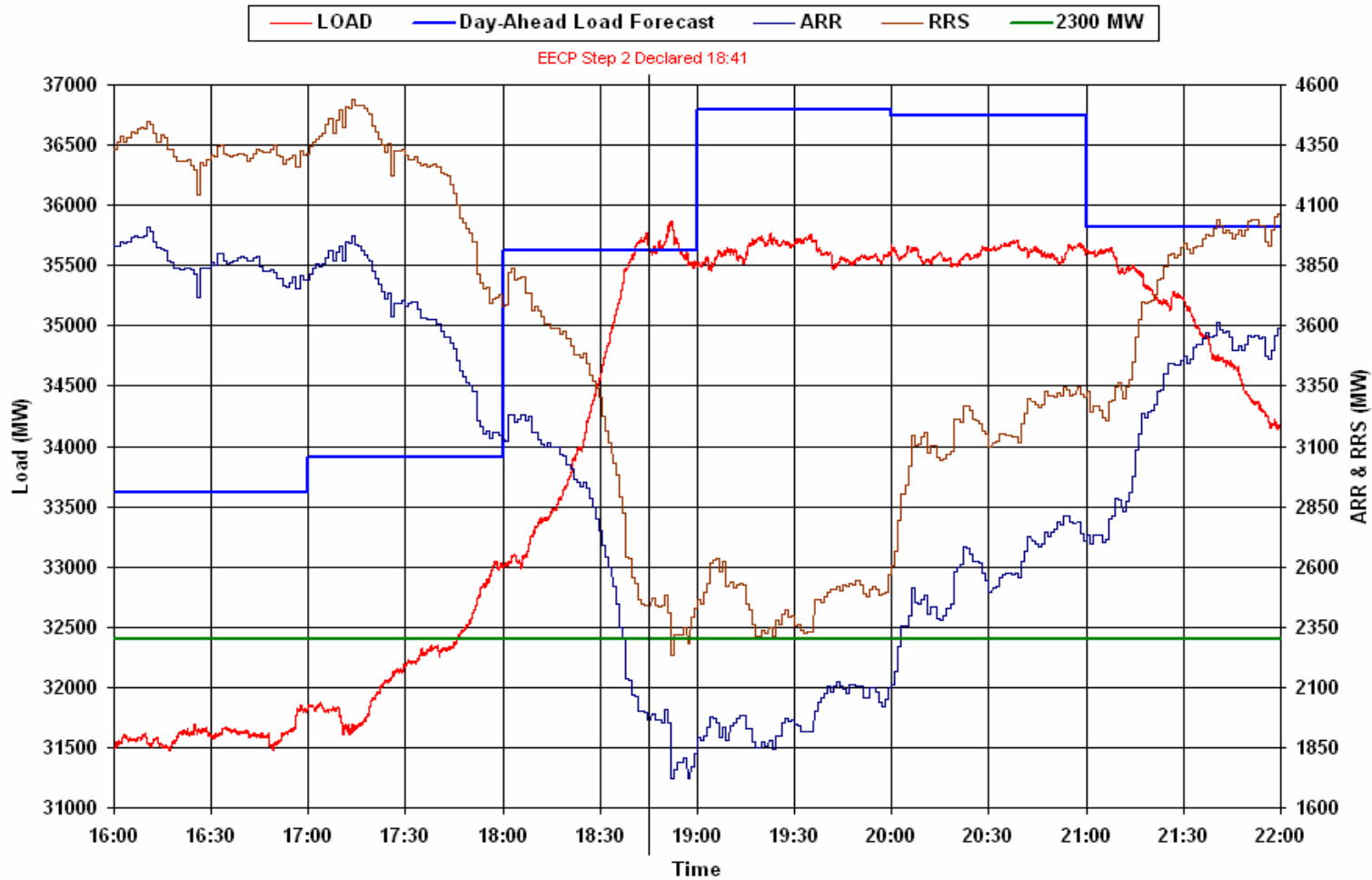
- Load Following Requirements
 - Opposing ramps of load and wind
 - Ramp Rates
 - Impacts to other resources
- Automatic Generation Control Requirements
 - Meeting Control Performance Requirements CPS1 and 2
- Reserve Requirements and Contingency Coverage Requirements for loss of wind
 - Disturbance Recovery Standards
- All of these depend on geographic diversity, level of penetration and weather
 - Distributed generation can aid in diversity of the wind resources, however scale may be an issue for offshore wind

Integration Challenges and Opportunities

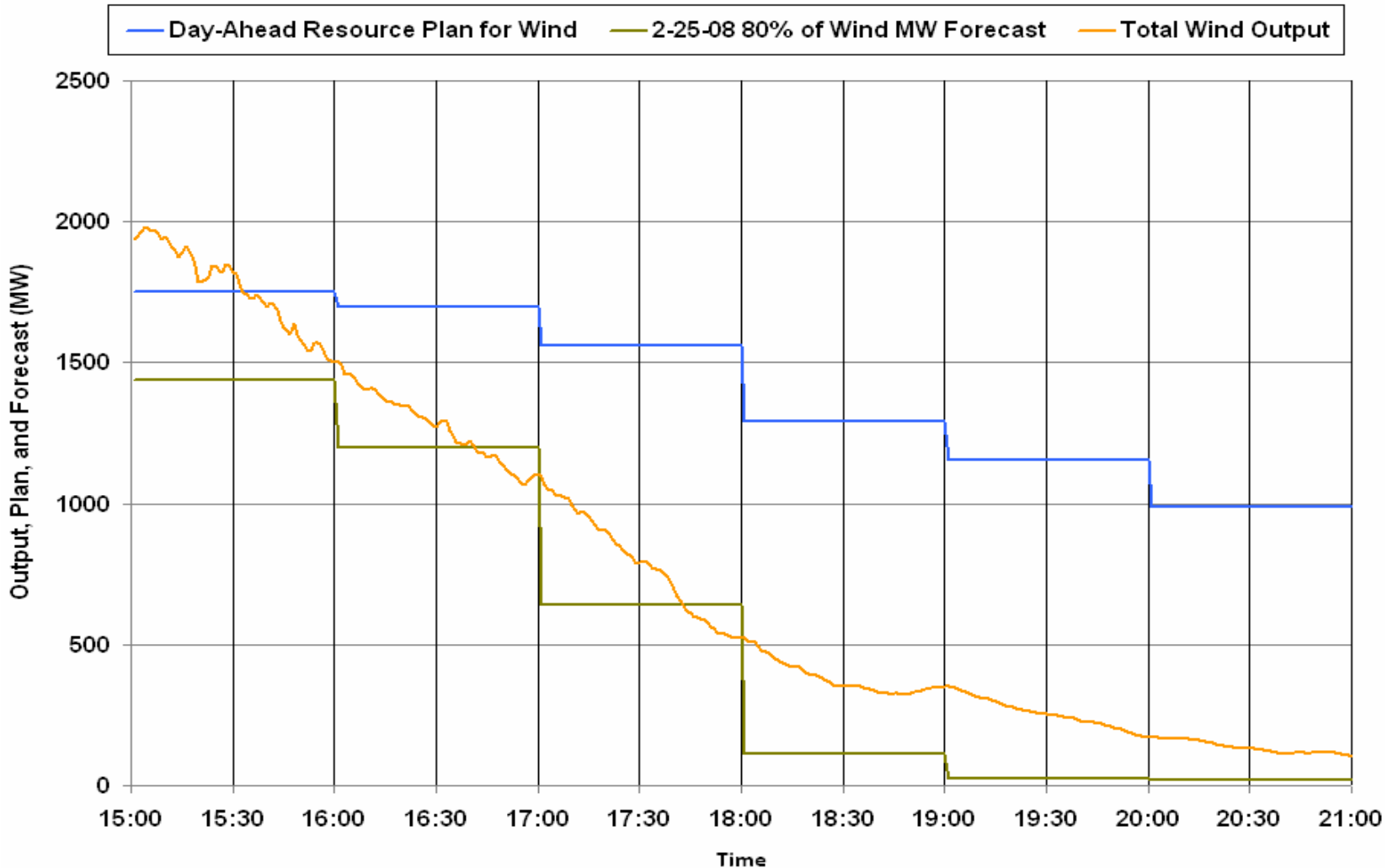
Operator Awareness and Practices

- Forecasting
 - Who does it: ISO's or wind developers?
 - Emergency monitoring tools
 - Approaching weather systems
 - Ensuring that we are forecasting accurately enough to displace more expensive resources or otherwise we have not achieved our goals
- Texas Events of 2/26/08

Texas Events: February 26, 2008



Texas Events: February 26, 2008 (cont.)



Integration Challenges and Opportunities

Operator Awareness and Practices

- Congestion Management
 - Competing for limited transmission
- Minimum Generation Emergencies
 - High wind, high hydro, low loads and limited transmission capacity
 - Storage
- Visibility to the System Operator
 - Real-time weather information
 - Metering and Telemetry
 - Real-time Control of Facilities (SCADA)
 - Voice Communication
 - Outage Coordination

Integration Challenges and Opportunities

Wind Gen Performance and Standards

- Low Voltage Ride Through
- Power Factor and ability of new technologies to control voltage
- New technologies coupled with system impact studies appear to have satisfied these concerns
- High Wind cut-out
- Neighbors with windy ambitions (NY, Maritimes)

ISO NE Wind Integration Action Plan

- ISO is actively engaged with developers of current and future projects to ensure successful integration of assets
- Future planning and operational studies
 - ISO Planning staff conducting economic transmission analysis under the New England Economic Study Process Stakeholder Group
 - ISO has hired a senior renewable resource engineer to develop RFP for operational and planning study and to facilitate renewables integration
 - RFP expected to be completed and issued by Winter of 2008 for wind integration study
 - Detailed study expected in 2009
- NERC Variable Generation Task Force Report
 - Focus is primarily wind operations and planning integration
 - Scheduled for completion end of 2008 early 2009
- ISO/RTO council conducting looking at the market practices dealing with wind

What the (Near) Future Holds

- New England Wind Integration Study
 - ISO-NE will be taking an active role
 - Operational, Markets, Planning aspects
 - What are the novel aspects
 - Offshore, Windy Neighbors, Technology advances
 - Developing technical interconnection requirements
 - Online data reporting/gathering requirements
 - Grid support capability

ISO-NE is reaching out to stakeholders to enable renewables

- ISO-NE has 3 primary responsibilities
 - System reliability
 - Fair and efficient market
 - Planning
- Goal is to remove barriers for participants
 - Market
 - Technical
 - Information
 - Regulatory



The rotor is raised on the GE 1.5sle wind turbine at Jiminy Peak Ski Area in the Berkshire Mountains of western Massachusetts. (Photo credit: Sally Wright, Renewable Energy Research Lab, UMass/PIX15160)