Integrating Wind Resources into New England's Competitive Wholesale Electricity Markets

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Summary

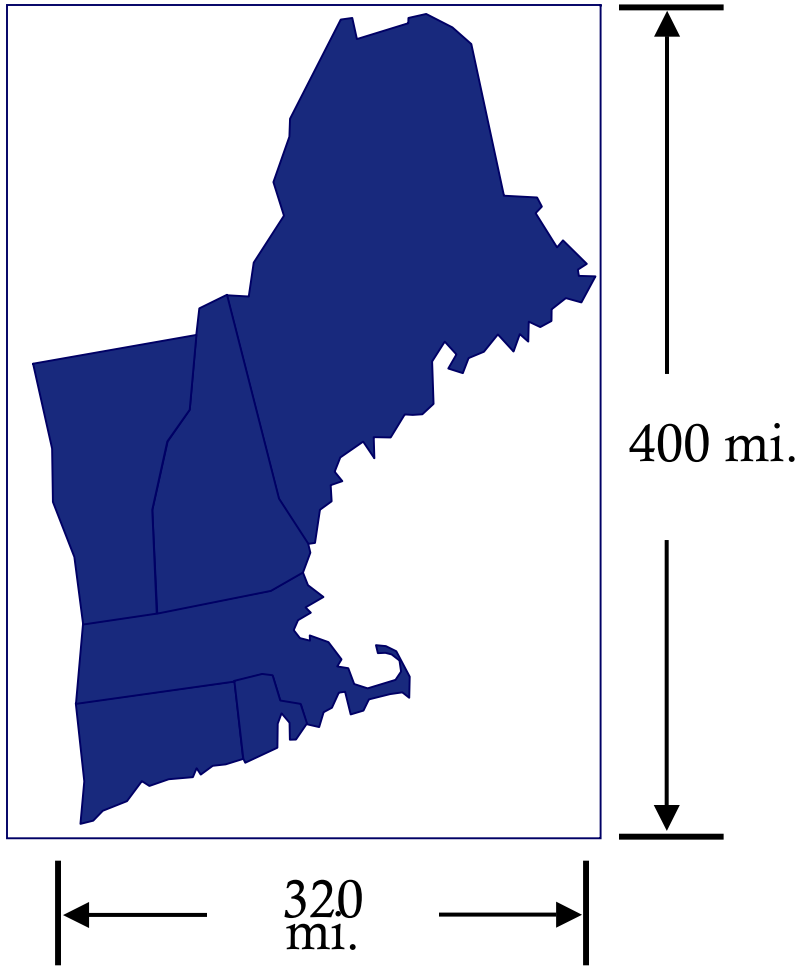
- Wind resources currently account for a very small portion of New England's resource portfolio.
- However, in the next five to ten years wind resources may play a more significant role in New England's energy and capacity markets.
- ISO-NE will address market design issues and market rules to facilitate the active participation of wind resources.

The People Behind New England's Power

- **ISO New England Inc.** is a private, not-for-profit corporation created in 1997 to oversee and manage New England's deregulated electric power system.
- **Responsible for**:
  - Power system reliability
  - Deregulated market operations
  - Regional transmission planning

New England's Electric Power System

- 14 million people; 6.5 million households and businesses
- 350+ generators/power plants
- 8,000+ miles of transmission lines
- 12 interconnections to neighboring systems
- 31,000 megawatt total supply
- All-time peak demand: ~25,500 megawatts on 8/14/02
- Headquarters in Western Mass
  - Four satellite control centers



Benefits of Competition in New England

- Over 200 companies participate in the Wholesale Electricity Market
- Investment Risk with Generation Companies
- Locational wholesale prices reflect the balance of Supply and Demand
- Studies show the Wholesale Markets are working and are reasonably competitive

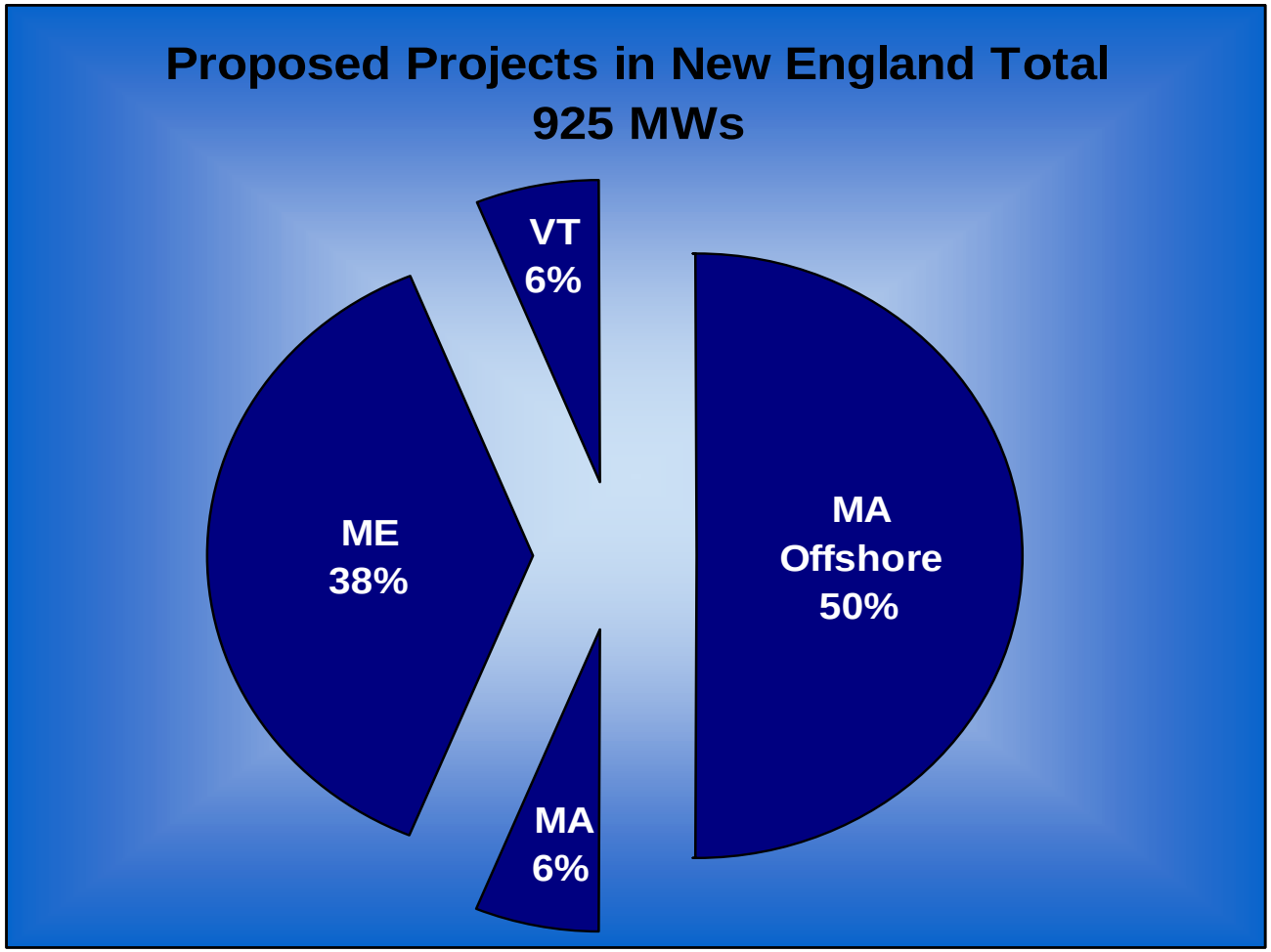
Market Structure, Demand and Supply

- **Market Structure**: New England introduced Standard Market Design (SMD) on March 1, 2003
- **Supply**: By 2005, new power plants will have increased New England's capacity by over 40 percent since the markets were deregulated in 1999:
  - 31,000 MW of total supply
  - Overall supply exceeds peak load forecast by 11% in 2005
- **Transmission**: Plans for major upgrades in Southwest Connecticut, Northwest Vermont and other areas.

Participation of Wind Resources: Existing & Proposed

- Wind capacity is located in Vermont and Massachusetts with a total winter capacity contribution of approximately 1.5 MWs. Those projects generate electricity on a Settlement Only basis.
- 925 MWs of wind projects have been proposed in MA, ME and VT respectively.
- Only 45 MWs or roughly 5 % of the proposed projects have completed their interconnection studies.

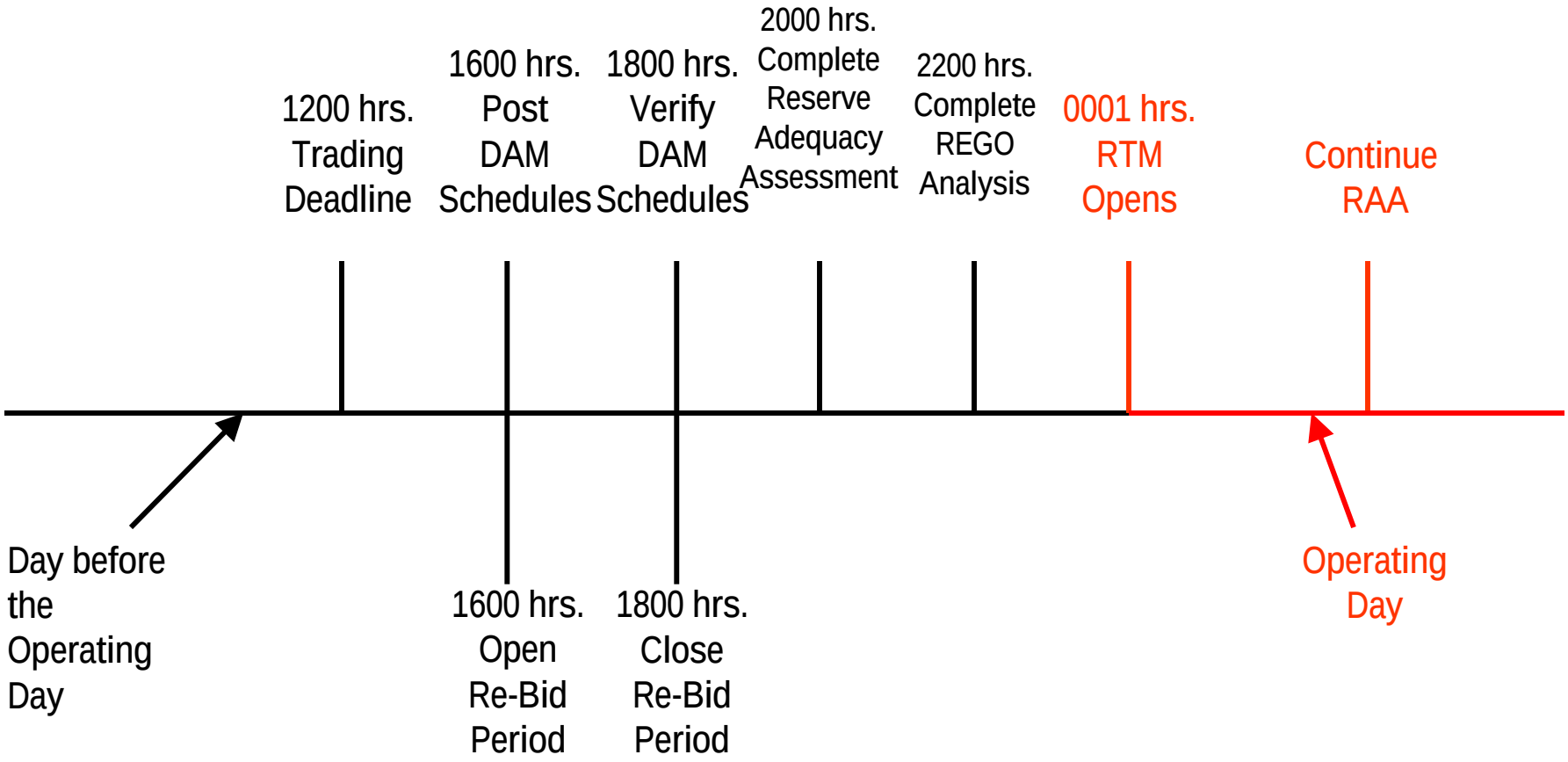
Participation of Wind Resources: Proposed Projects



Day Ahead and Real Time Markets

- ISO-NE has a Day Ahead Market (DAM) and a Real Time Market (RTM) in which energy is procured, cleared, dispatched and settled.
  - Suppliers/generators provide offers in the DAM
  - Consumers submit bids in the DAM
  - The DAM allows Participants to secure Day-Ahead (DA) prices and reduce vulnerability to RT price fluctuations.
  - Both supply and demand are subject to charges in instances where they do not follow dispatch instructions or when they deviate from DA schedules.

Day Ahead and Real Time Markets – Timeline



Participation of Wind Resources – DAM & RTM

- Currently there are three registered wind assets rated at approximately 1.5 MWs in New England.
  - These assets participate in the Energy market as "Settlement Only" resources. Settlement Only resources (SORs) generate less than 5 MWs.
  - SORs do not submit offers in the DAM, they generate electricity into the grid in RT and are settled at the RT nodal clearing price.
  - SORs are not subject to any other operating charges for deviations or imbalances.
  - SORs receive UCAP credits. UCAP is determined by multiplying the unit's capacity times one minus its forced outage rate.

Participation of Wind Resources – DAM & RTM

- Intermittent Resources
  - In cases where the wind resource generates more than 5 MWs, the resource would fall into the category of Intermittent Power Resources (IPRs).
  - IPRs have the option of submitting offers in the DAM. However, if offers are not submitted, then prior to the operating day, in the Re-offer/bid period (16:00 – 18:00) IPRs must Self-Schedule (SS) the MW amount for each hour of the operating day.
  - In real time, if the MW amount is different from the SS amount, then the IPR must contact the ISO and "redeclare" its availability limits.

Intermittent Resources contd..

- Actual IPR output in real time does not need to exactly match the amounts that were Self Scheduled. The operating software allows for some “drift.”
- The IPRs actual output is settled at the real time nodal price. There are no imbalance charges or charges for deviations.
- IPRs are not expected to burden the forecasting process which takes place subsequent to the receipt of the SS in the Re-offer period.
- IPRs receive UCAP credits similar to the manner described for SORs (slide 11).

Future Market Developments – Ancillary Services

- At present New England does not have Ancillary Services markets. Markets for Ancillary Services are expected be introduced in the latter half of 2005.
  - Due to the intermittent nature of wind resources, the ability of this resource to participate directly in the provision of the reserve markets is limited.
  - ISO-NE is exploring options to create market-based platforms for financial products that mitigate the effects of the intermittency of wind resources, thereby allowing those resources to participate in various markets (forward and real time reserves) indirectly.
    - E.g. combining intermittent wind with firm hydro.

Future Market Developments – LICAP

- ISO-NE has filed a Locational ICAP (LICAP) proposal with the FERC. LICAP will allow for different ICAP clearing prices in the various zones relative to the supply and demand of capacity at those locations.
- The method of determining capacity revenues will be based on the nominal capacity offered by the resource and on the performance of the resource during "critical hours."
- Wind resources will continue to be eligible to receive capacity revenues under the new LICAP methodology.

Conclusion

- The low penetration rates of wind generation in New England relative to the system peak allows for the projected capacity of wind resources to be integrated relatively easily.
- As penetration increases the following issues will need to be addressed:
  - Forecasting in real time, intra-hour forecasts
  - Incorporating into the energy network model those wind assets that connect at sub-transmission levels
  - Impacts on system operations including:
    - Operating Reserve Requirements
    - Intra-hourly impacts, load following
    - Long-term system reliability and planning