

Integration of Renewables into the Electric System: Opportunities and Challenges



Consumer Liaison Group Meeting

Robert Ethier

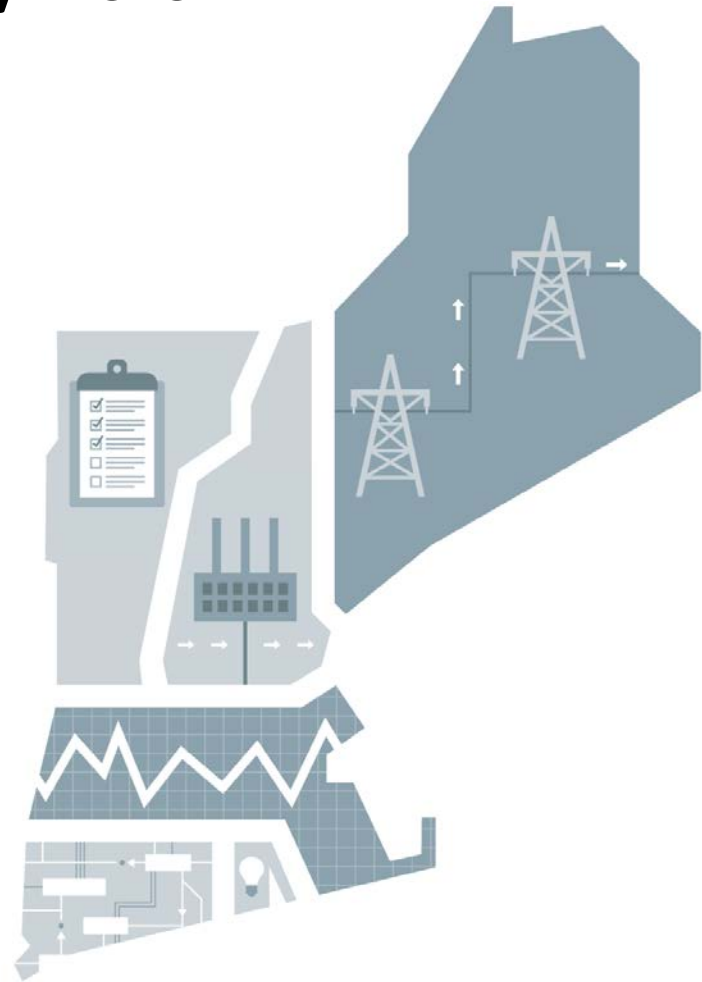
VICE PRESIDENT, MARKET OPERATIONS



ISO New England Is Focused on Developing Solutions to the Region's Top Reliability Risks

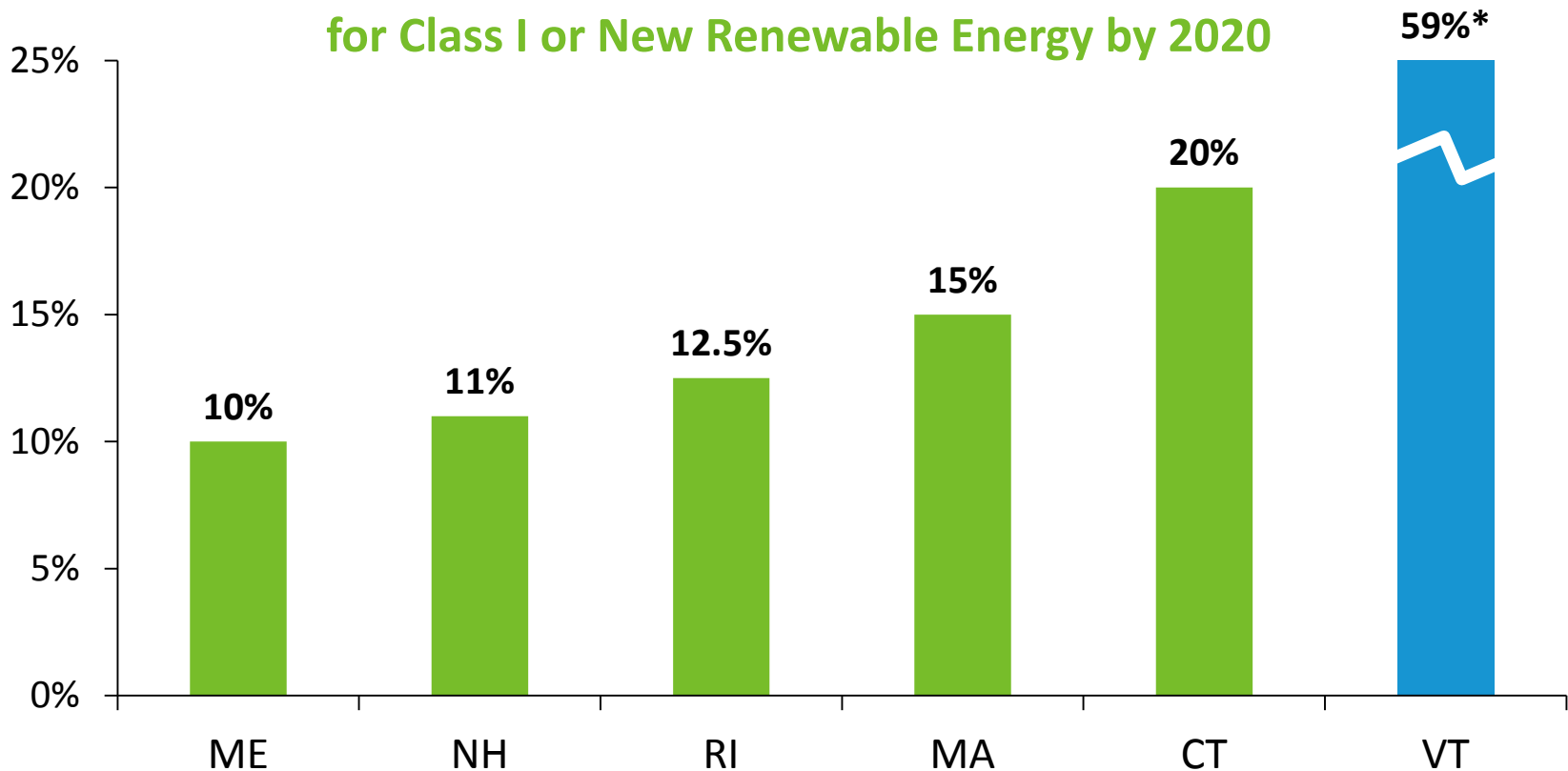
Reliability requires a flexible, high-performance fleet:

- Reliance on Natural Gas
 - “Just-in-time” fuel delivery presents an immediate risk to reliability
- Power Plant Retirements
 - New England will need new ways to meet peak demand as aging plants close
- Renewable Resource Integration
 - Balancing variable generation with reliability will require changes in system operations



State Policy Requirements Drive Proposals for Renewable Energy

State Renewable Portfolio Standard (RPS)* for Class I or New Renewable Energy by 2020

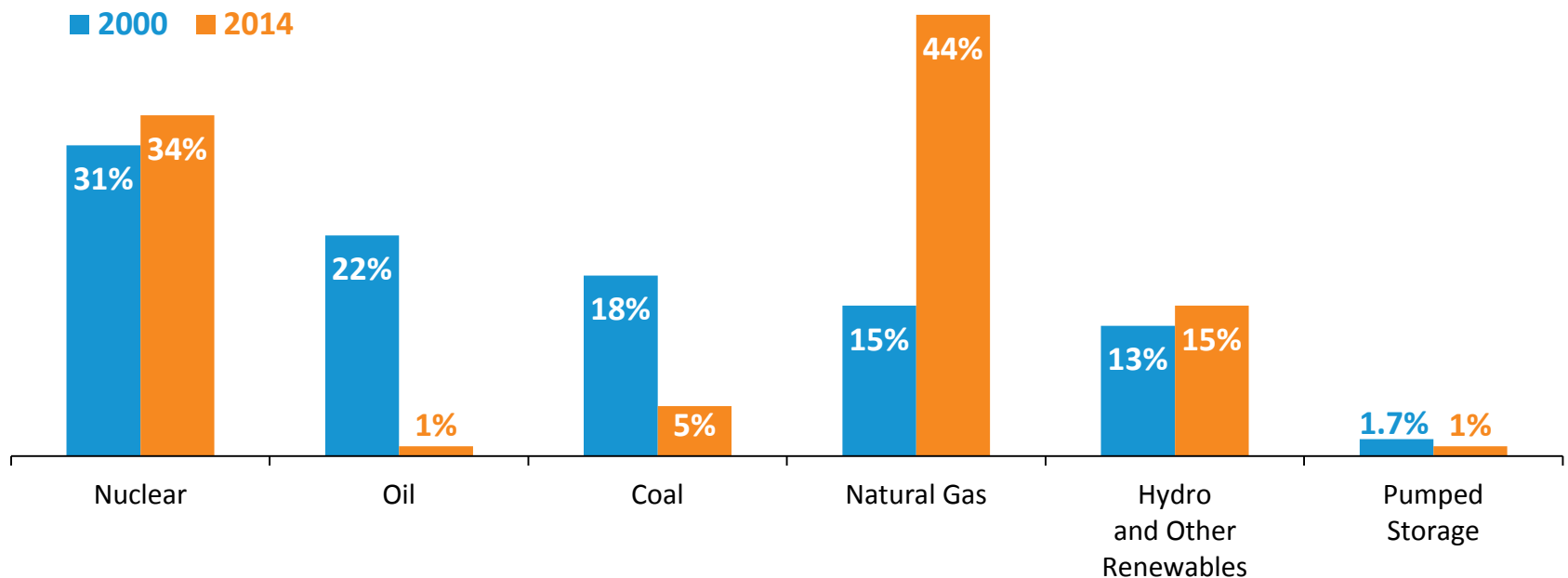


* State Renewable Portfolio Standards (RPS) promote the development of renewable energy resources by requiring electricity providers (electric distribution companies and competitive suppliers) to serve a minimum percentage of their retail load using renewable energy. Vermont's new Renewable Energy Standard has a 'total renewable energy' requirement (reflected above), which recognizes large-scale hydro and all other classes of renewable energy.



Renewables Are Part of the Region's Fuel Mix, But More Will Be Needed to Satisfy Future State Requirements

Percent of Total **Electric Energy** Production by Fuel Type
(2000 vs. 2014)



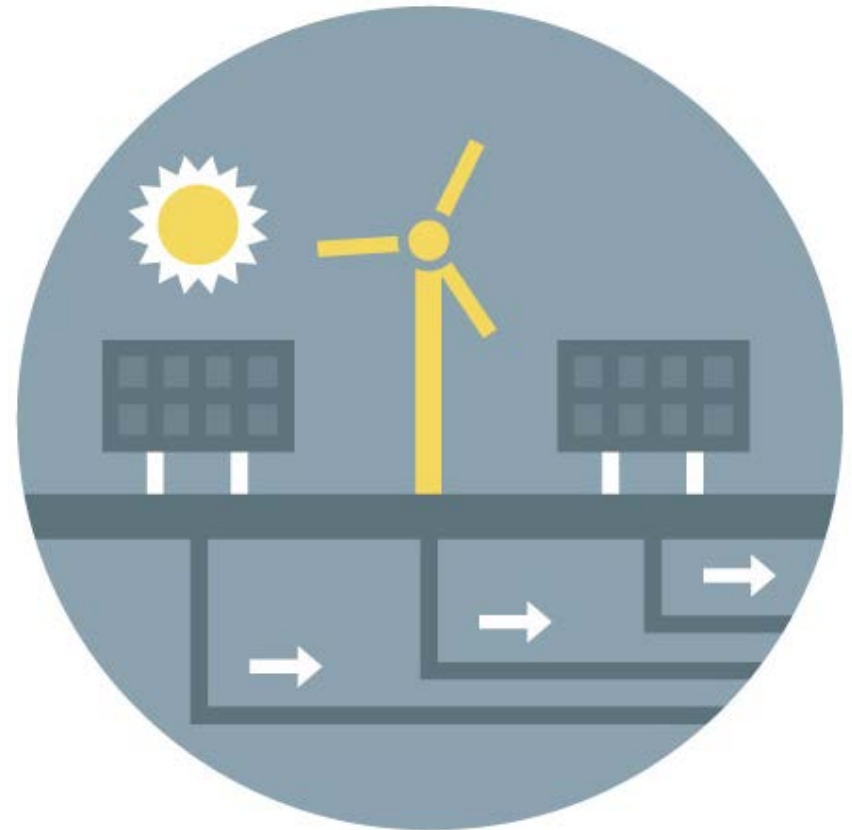
Source: ISO New England [Net Energy and Peak Load by Source](#)

Other renewables include landfill gas, biomass, other biomass gas, wind, solar, municipal solid waste, and miscellaneous fuels.

Note: These percentages capture percent of total electric energy production by fuel type in New England. They do not include imports.

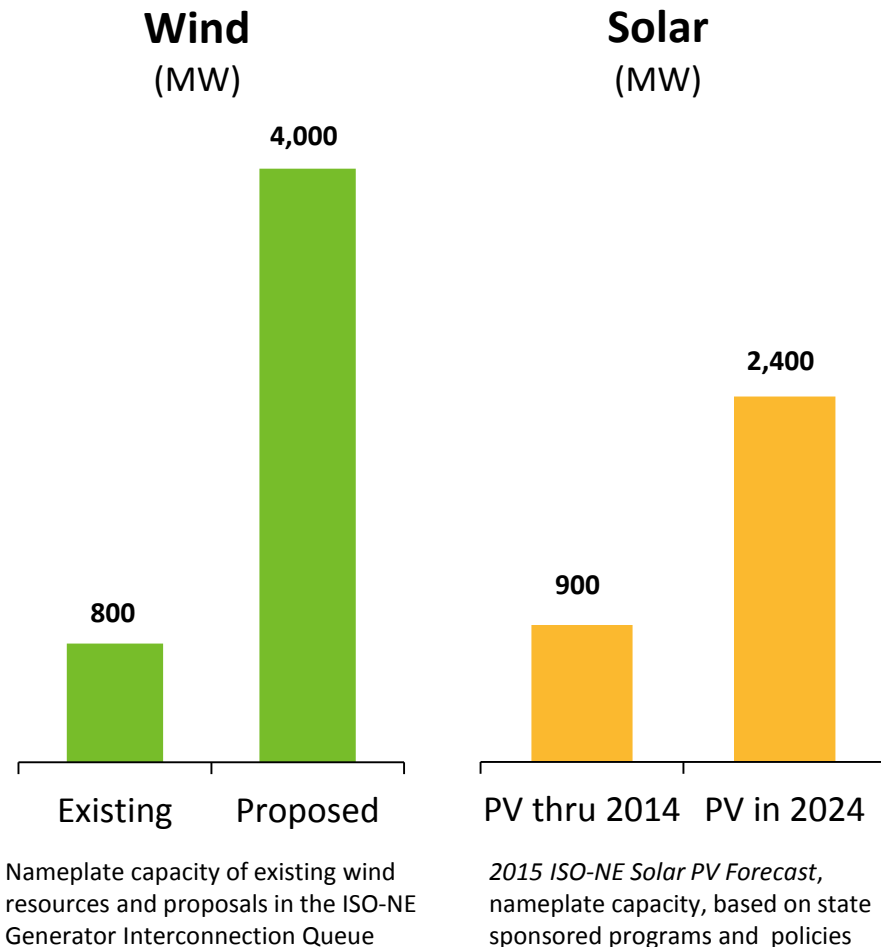
In June, the ISO Released a Discussion Paper on the Capacity Market and a Renewable Energy Future

- Describes the magnitude of renewable energy coming onto the system and the interaction of related state policies with the region's wholesale electricity markets
- Discusses the impact of increasing levels of renewable resources (i.e., wind and solar) on other resources participating in the wholesale electricity markets



The Importance of a Performance-Based Capacity Market to Ensure Reliability as the Grid Adapts to a Renewable Energy Future (June 2015)
http://www.iso-ne.com/static-assets/documents/2015/06/iso_ne_capacity_mkt_discussion_paper_06_03_2015.pdf

Renewable Energy Resources Are Growing Rapidly in New England, Most Notably Wind and Solar



- By the end of 2014, the region had achieved **800 MW** of wind power (nameplate capacity), which produced nearly 1% of the region's electricity that year
- By 2015, developers have proposed **4,000 MW** of additional wind power
- ISO studies have shown that New England has up to **12,000 MW** of onshore and offshore wind potential
- By the end of 2014, the region had achieved **900 MW** of solar PV, with more than **2,400 MW** forecasted by 2024 (AC nameplate capacity)

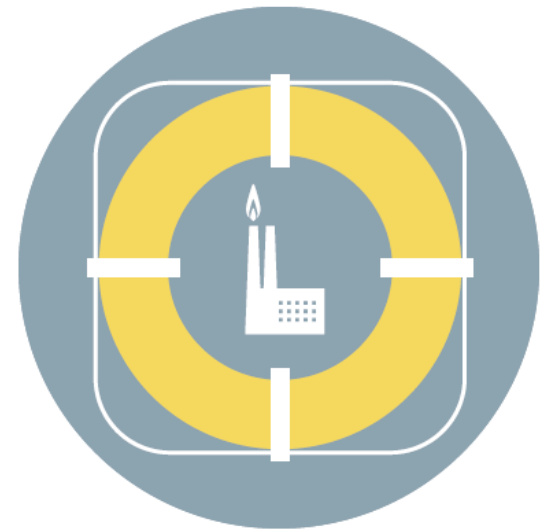
The Energy and Capacity Markets Are Linked; Changes in One Market Will Affect the Other

- The **energy market** is the daily market for wholesale customers to buy and sell electric energy
- The **capacity market** is a forward market intended to ensure New England will have adequate resources to meet all electricity demand plus reserve requirements three years into the future
- Because the resources the states are supporting have **no fuel costs**, they are generally dispatched ahead of conventional generation, such as gas-, coal-, and oil-fired resources, putting downward pressure on energy-market prices
- But this action is **not without consequence**: it will put upward pressure on prices in the capacity market



What Are the Potential Consequences?

- The capacity market will play a **key role** in ensuring that reliability is maintained as increasing levels of renewables are integrated onto the system
- Additional renewables are expected to decrease wholesale electric energy prices, which will result in increased capacity prices to ensure **resource adequacy**
- The **shift in revenues** from the energy to the capacity market will also affect the resource mix, putting additional financial pressure on energy-market dependent resources like nuclear and coal-fired units



How Will the Markets Respond?

- Market interventions should not be needed to ensure reliability, or efficient market responses to an increased penetration of renewable resources
- The **current market design** should ensure adequate resources to meet the reliability standards for which the markets are designed
- The current market design should also ensure that the resulting resource mix appropriately **complements** the capabilities and limitations of the renewable resources entering the market



Conclusions

- The development of large quantities of state-sponsored renewable resources will present **opportunities and challenges** for the region
- The current markets are equipped to respond appropriately to the entry of these resources, maintaining reliability and market efficiency
- However, this new entry will likely **drive down energy prices** and lead to an **increase in capacity prices**
- Capacity market revenues will become even more critical to the continued operation of existing resources and the entry of new resources
- This entry also will likely incent some existing baseload resources to retire earlier than they otherwise would



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