SEPTEMBER 19, 2014 | BOSTON, MA

Managing the Reliability of the Electric Grid While the Power Industry Undergoes Rapid Transformation

ISO new england

Massachusetts Restructuring Roundtable

Gordon van Welie

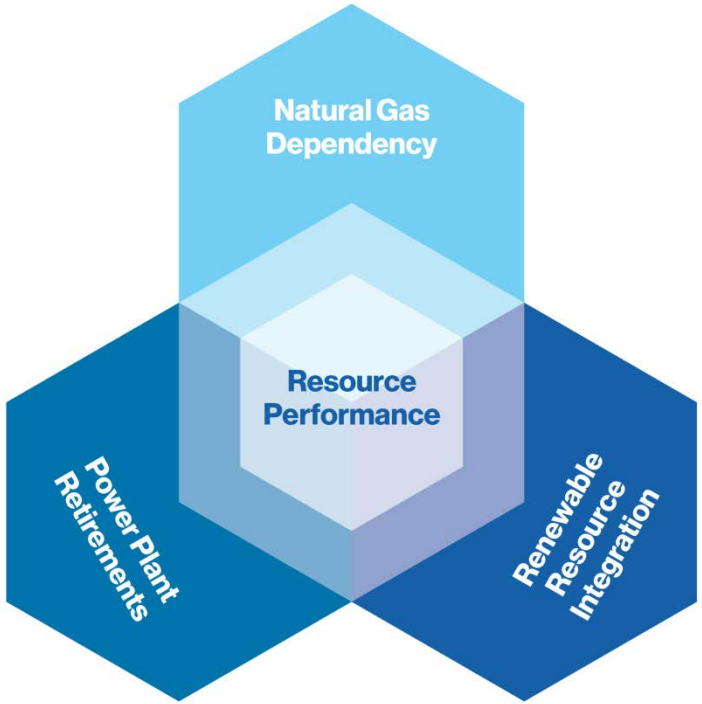
PRESIDENT & CEO

ISO New England's Strategic Planning Initiative

Focused on developing solutions to the region's top reliability risks

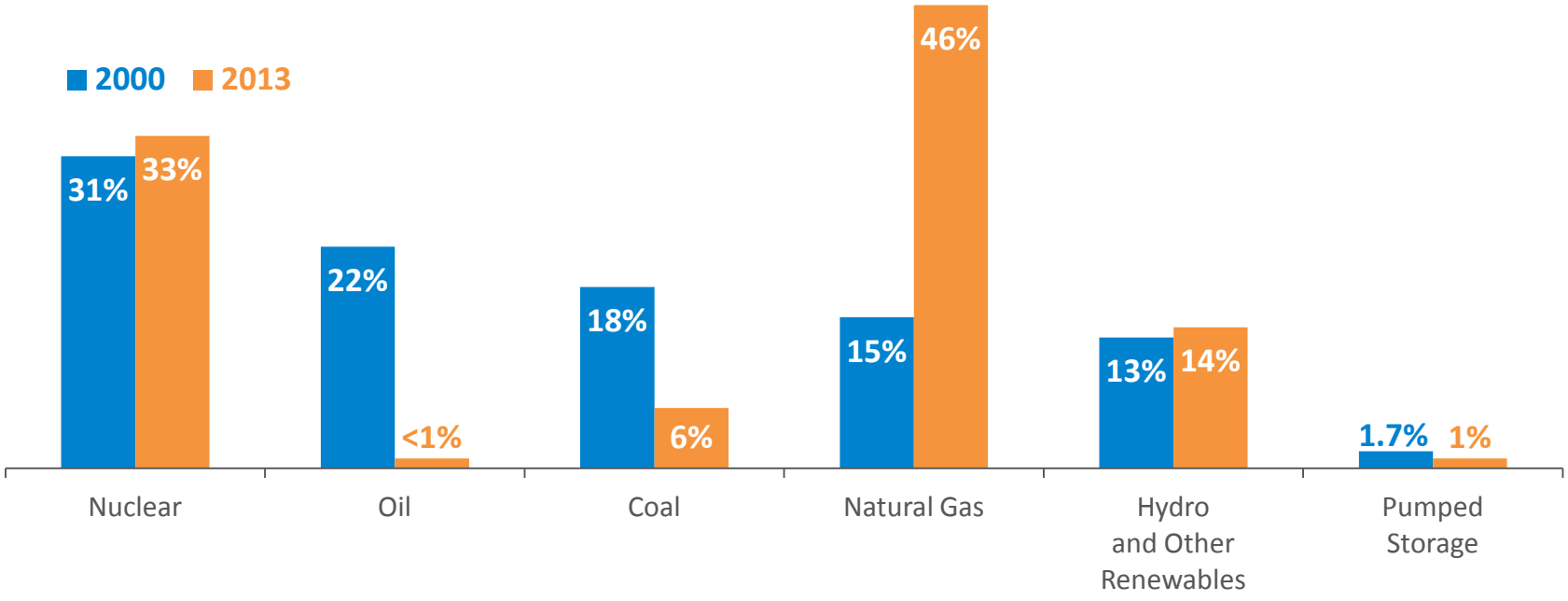
Reliability requires a flexible, high-performance fleet to address strategic risks:

- Natural gas dependency
- Power plant retirements
- Renewable resource integration



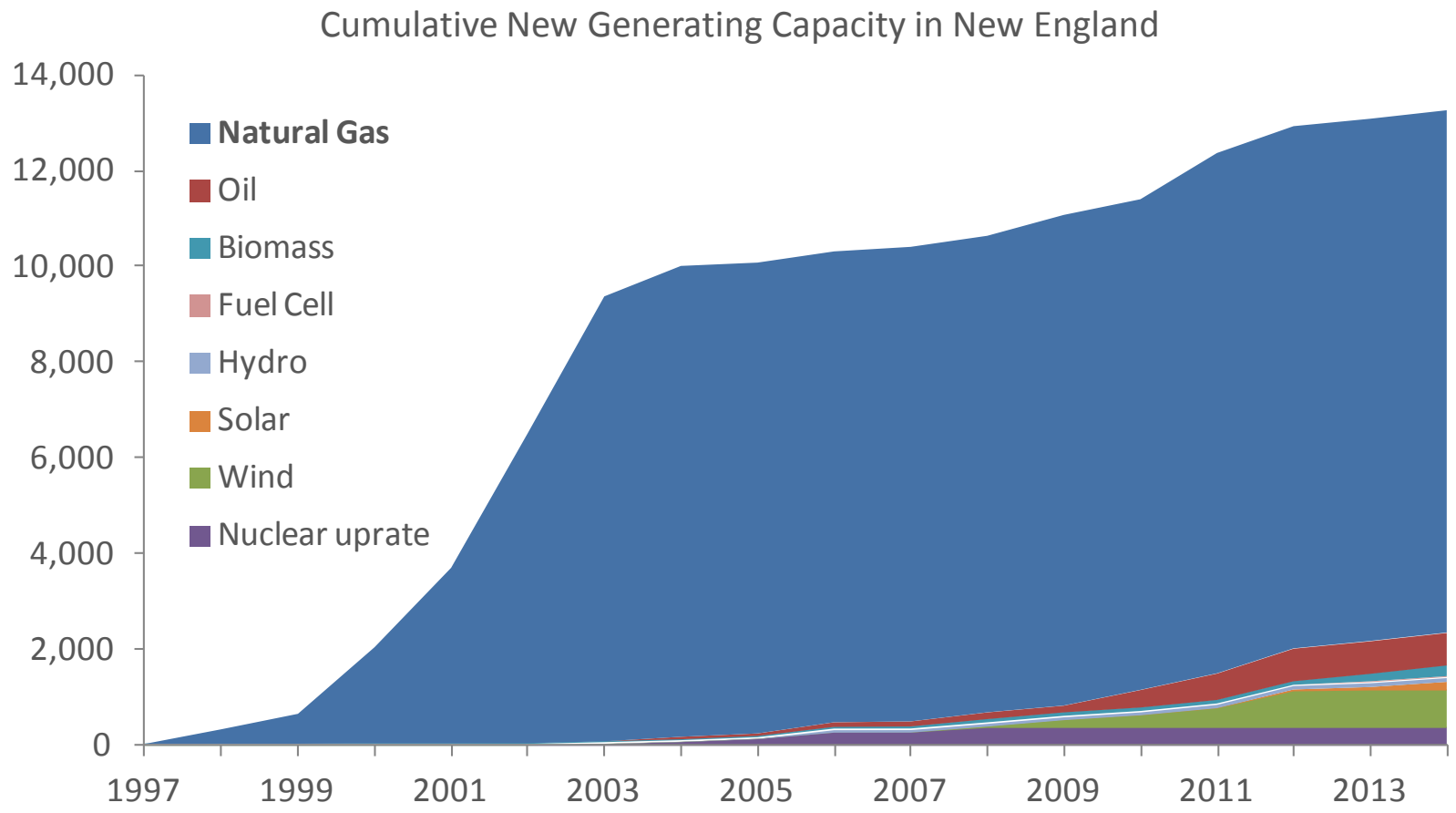
Dramatic Changes in the Energy Mix

Percent of Total **Electric Energy** Production by Fuel Type
(2000 vs. 2013)



Source: ISO New England Net Energy and Peak Load by Source

Region Has Not Developed Gas Infrastructure to Keep Pace With Growth of Gas-fired Generation



Region Is Losing Non-Gas Resources

More than 3,000 MW of generation has announced retirement in the coming years

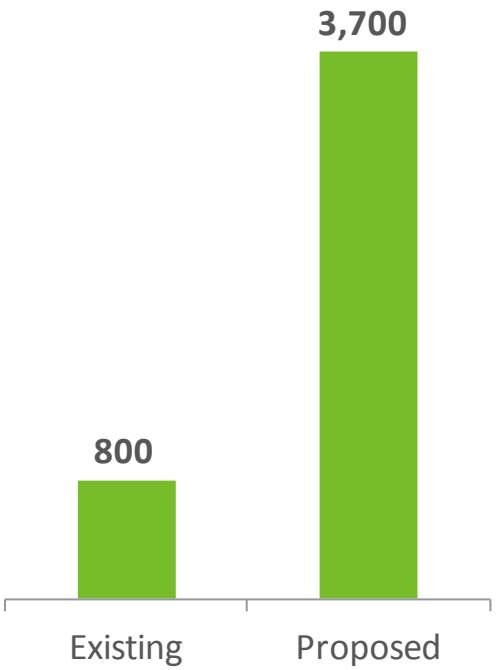
Major Retirement Requests:

- Salem Harbor Station (749 MW)
  - 4 units (coal & oil)
- Vermont Yankee Station (604 MW)
  - 1 unit (nuclear)
- Norwalk Harbor Station (342 MW)
  - 3 units (oil)
- Brayton Point Station (1,535 MW)
  - 4 units (coal & oil)
- *Additional retirements are looming*

Source: *Generator Retirement Study*, ISO New England, 2012.

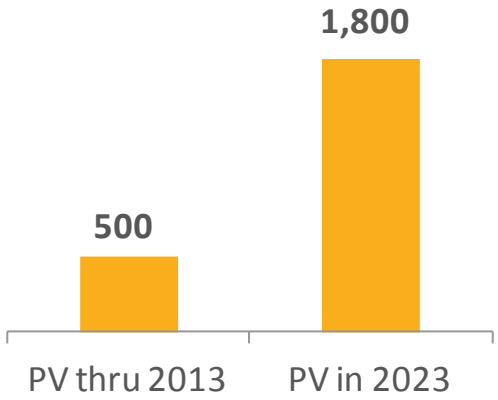
Renewable and EE Resources Are Trending Up

Wind
(MW)



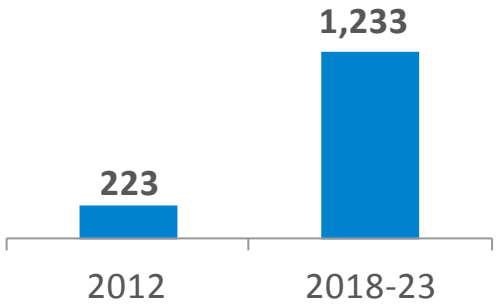
Nameplate capacity of existing wind resources and proposals in the ISO-NE Generator Interconnection Queue; megawatts (MW).

Solar
(MW)



2014 Final Interim ISO-NE Solar PV Forecast, nameplate capacity, based on state policies.

Energy Efficiency
(MW)

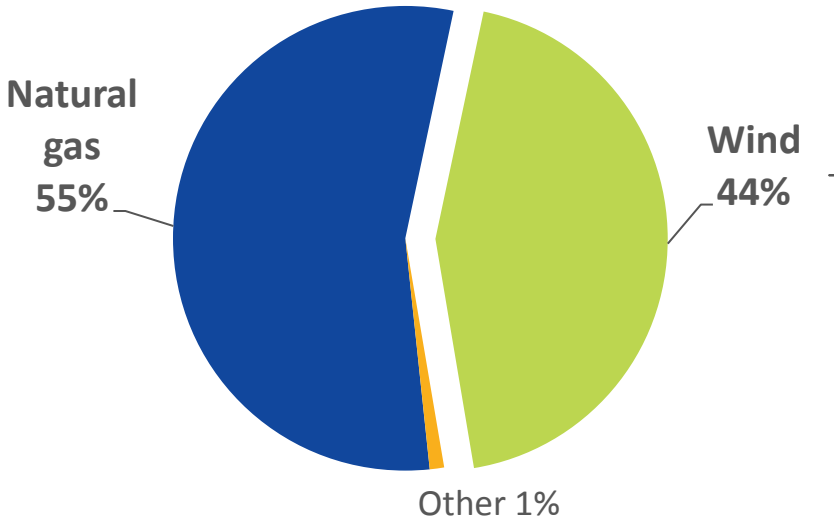


Final ISO-NE Energy-Efficiency Forecast for 2018-23, peak MW savings based on state-sponsored EE program budgets: $5.7 billion.

Proposed Generation Is Primarily Gas and Wind

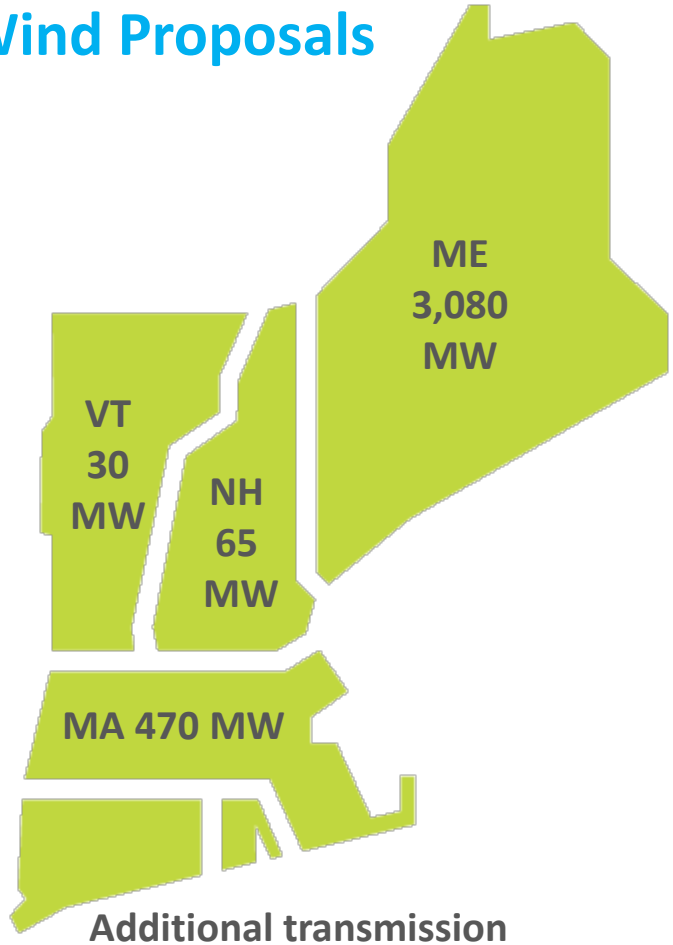
All Proposed Generation

Developers propose >5 GW of gas-fired generation and >3 GW wind; wind is mostly onshore in northern New England and offshore in southern New England



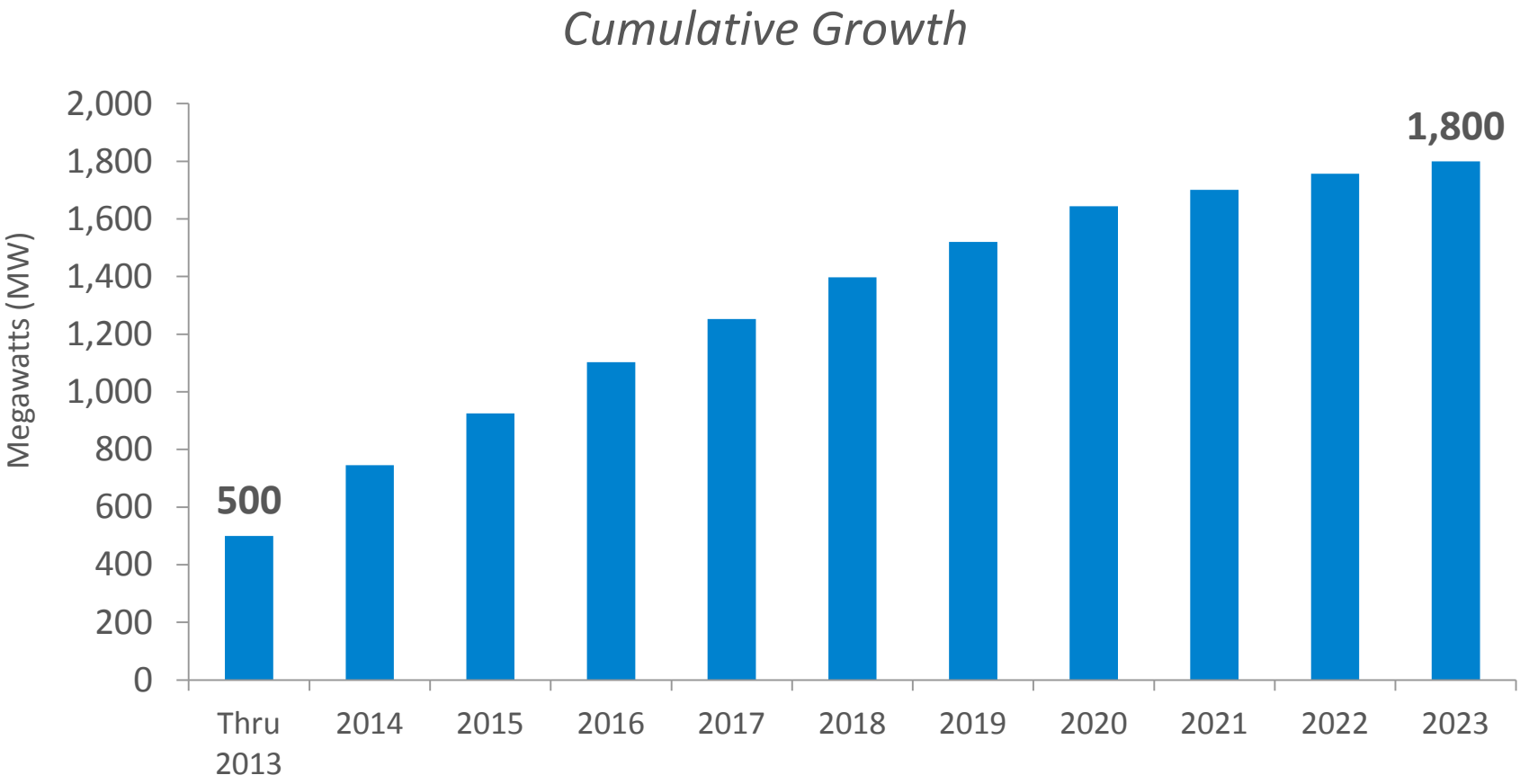
Source: ISO Generator Interconnection Queue (September 2014)
FERC Jurisdictional Proposals Only

Wind Proposals



Additional transmission infrastructure will be required

ISO-NE's Interim Distributed Generation Forecast Predicts Steady Growth in Solar PV through 2023

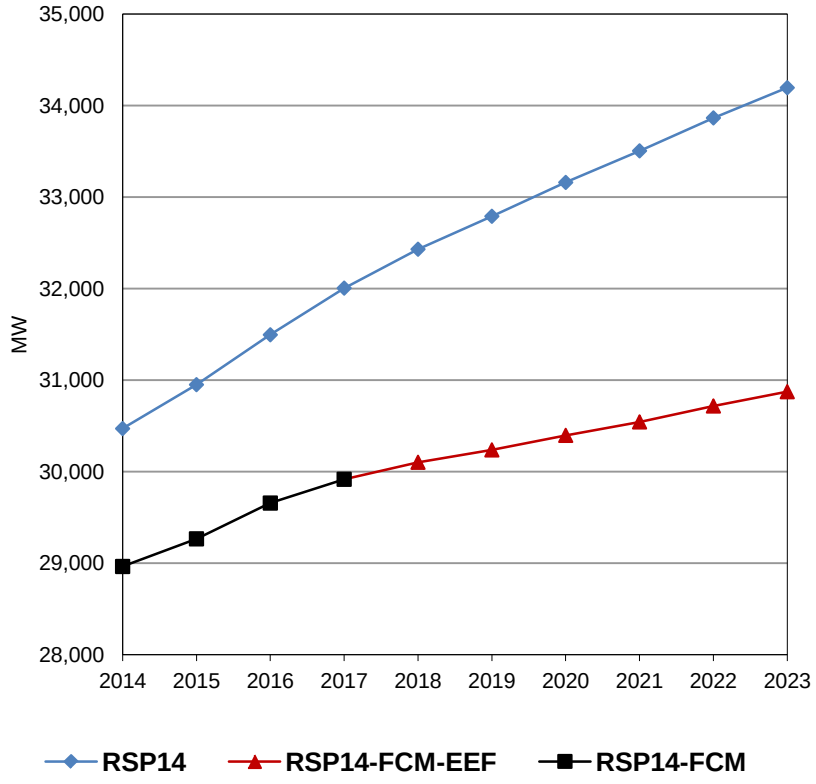


Source: Final Interim PV Forecast (April 2014)

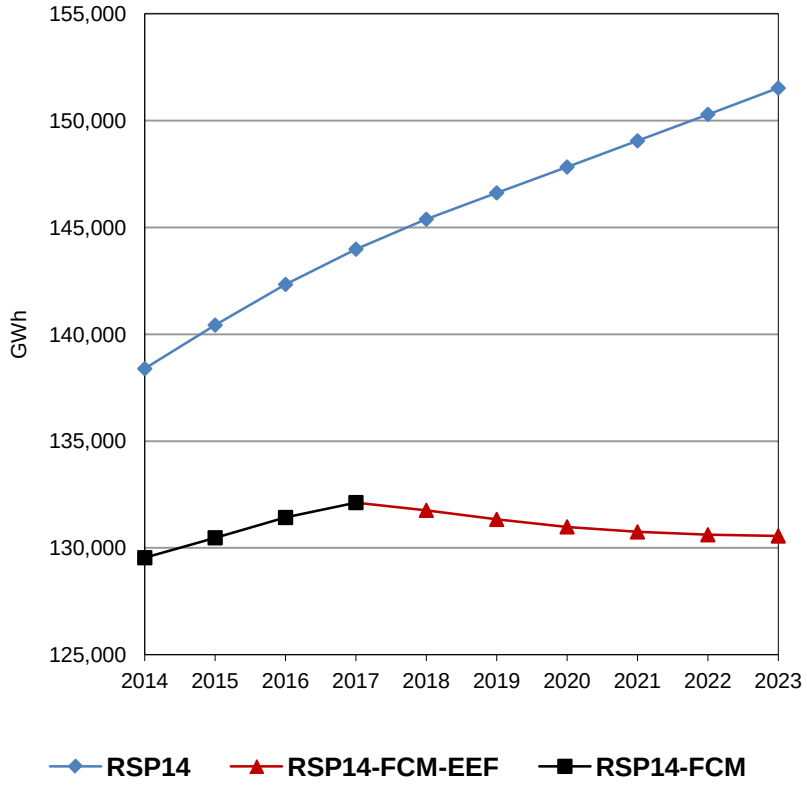
Energy Efficiency Investments Are Producing Results

Peak demand growth is lower; energy use is flat

New England: Summer 90/10 Peak (MW)



New England: Annual Energy Use (GWh)



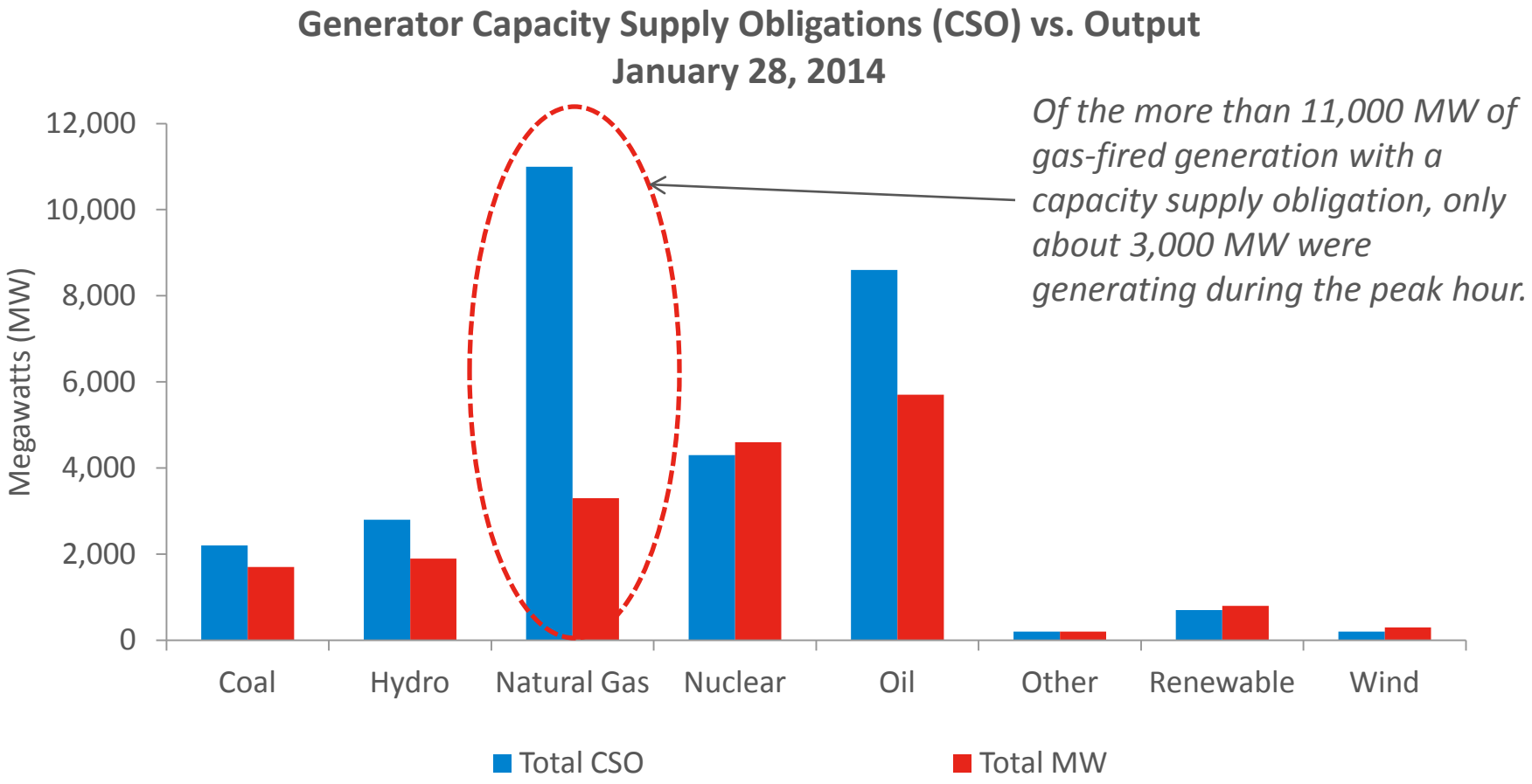
Source: Final ISO New England EE Forecast for 2018-2023 (April 28, 2014)

Lessons and Observations from Winter Operations

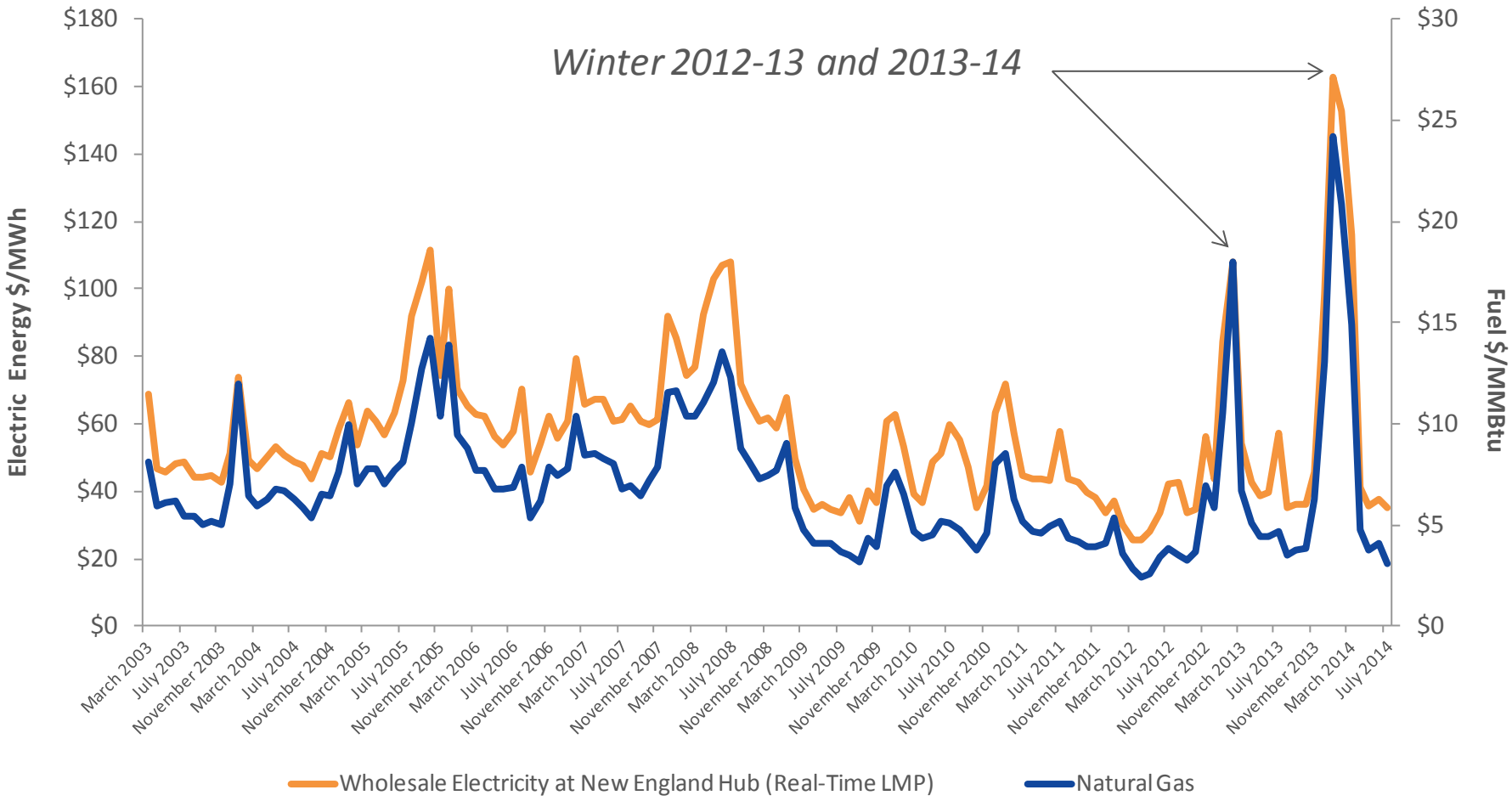
Operational options are very limited and becoming more constrained

- Gas pipelines are severely constrained when weather is cold, limiting gas generation to minimal levels
- Oil-supply chain is fragile and unable to respond quickly during adverse weather conditions and/or when demand is high
- We observe that it is becoming more difficult to site/permit new dual-fuel facilities (gas generators that can switch to oil)
- Imported Canadian hydropower is limited during very cold weather (because Québec is a winter-peaking system)
- The region is very vulnerable to the loss of large non-gas generators during cold weather (e.g., nuclear units)

Current Pipeline Infrastructure is Inadequate to Serve Region's Natural Gas-fired Generation

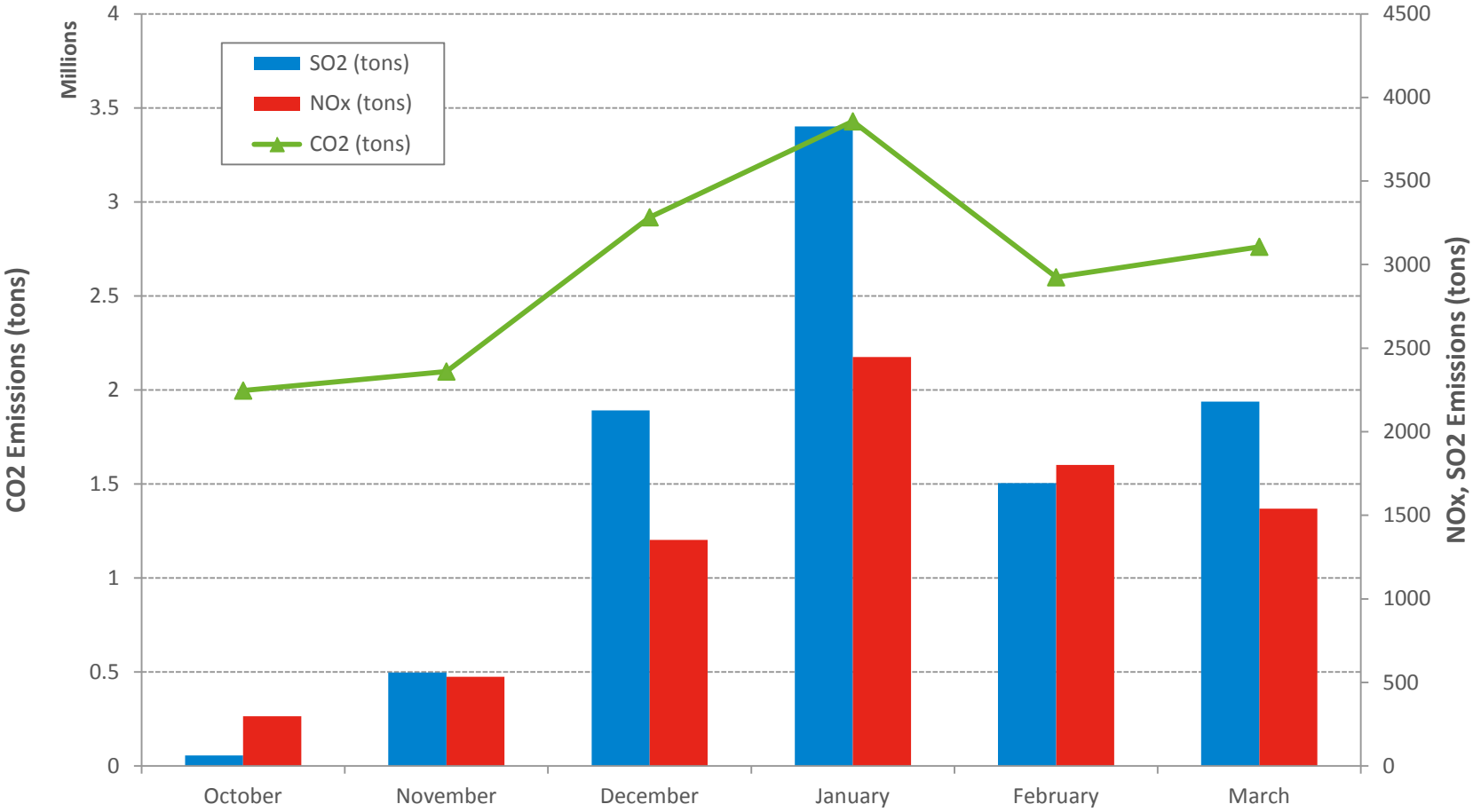


High Gas Prices Drove Wholesale Electricity Prices to Record Levels Over the Past Two Winters



Pipeline Constraints Last Winter Resulted in a Shift to Coal and Oil Resources and Higher Emissions

SO_2, NO_X, CO_2 from Power Generation, Winter 2013 - 2014



Source: US EPA Continuous Emissions Monitoring System

Forward Capacity Market Enhancements Will Improve Resource Adequacy and Resource Performance

Two FERC orders provide reliability solutions for June 2018 and beyond

- **Sloped Demand Curve:**
  - Smoothes the boom-and-bust cycle of investment when the region is either just short, or just long, on capacity
  - Cost of new entry based on an efficient gas combined cycle generator
  - Seven year price 'lock in' for new resources to incent new entry
  - Tailored accommodation for 'out of market' renewable contracts
- **Pay for Performance (PFP):**
  - Capacity payments during stressed system conditions will be closely tied to performance
  - Energy market prices will be increased to reflect scarcity conditions (effective December 2014)
  - Provides strong incentives for resources to invest in secure fuel arrangements, capital improvements, and adequate maintenance and staffing

Fuel Infrastructure Enhancements Are Being Planned, But Are They Enough?

- The ISO is creating stronger incentives for gas generators that install dual-fuel capability or contract for LNG (through the 2014–15 winter reliability program and PFP); these incentives will increase over time (e.g., with the phase in of the Performance Payment Rate)
- A number of developers are proposing to expand pipeline and/or storage capacity in New England; however, a policy/regulatory conundrum has emerged

What Is the Conundrum?

- Unlike electric transmission, pipelines will not be built without customers entering into long-term contracts for firm capacity
- Gas generators have not collectively entered into long-term commitments (because dual fuel and LNG peaking service are cheaper options)
- Gas LDCs cannot contract for gas infrastructure expansion beyond the needs of commercial and residential gas customers
- Gas producers have thus far chosen more economical expansion routes with higher capacity utilization (south and west of the Marcellus shale)

Transformation of the Grid Creates Operational and Political Challenges

- As more renewable energy connects to the grid, and as the region loses conventional non-gas fired generation, the need increases for responsive resources that are not operationally constrained by fuel infrastructure limitations
- The New England states are frustrated by the economic disadvantages and environmental consequences resulting from pipeline constraints, and are concerned about the potential reliability implications

How Will the Region Ensure Adequate Fuel Infrastructure?

- These circumstances raise a **Threshold Policy Question:**
  - Will the broader **"market"** (wholesale electricity and gas markets) bring about necessary investments and will these satisfy the objectives of the New England states? (Who are the players in the market that will voluntarily do the contracting for additional gas pipeline or storage infrastructure and when will they do it?)
  - Or, do the New England states actively intervene and facilitate the investments to ensure the timely outcomes they desire?
- **Market Options** for Investments in Gas Pipelines or Storage:
  - Do gas-fired generators aggregate as buyers? This has already been tried, to no avail, with the Spectra AIM project – so is this realistic given the economic incentives and risks facing generators?
  - Will gas producers contract for pipeline expansion? If so, when?

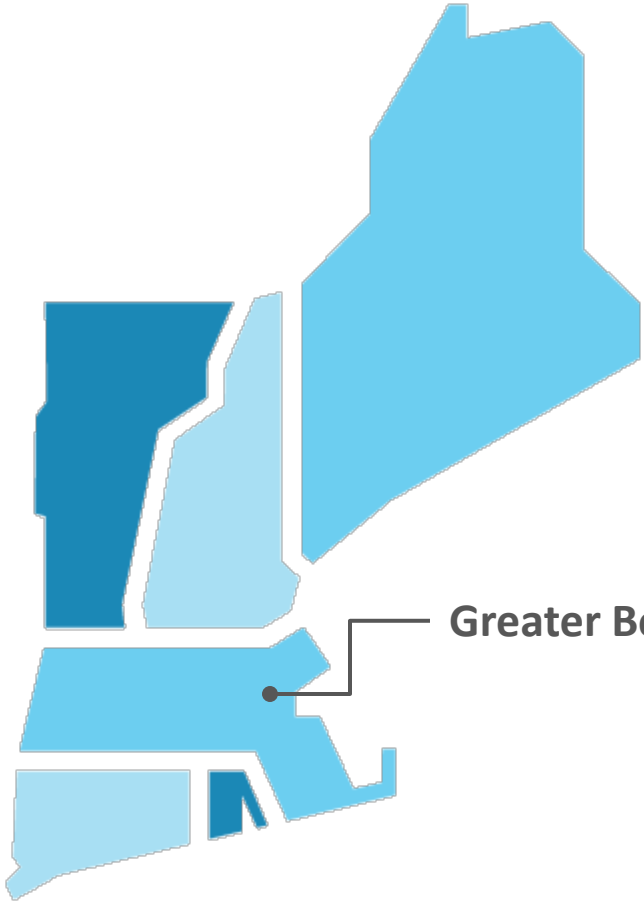
Other Options to Ensure Adequate Fuel Infrastructure?

- **State Facilitated Options** for Gas Pipelines or Storage:
  - Order gas LDCs to contract for the additional gas infrastructure? How do they transfer the costs to retail electric customers?
  - Do the states order electric utilities to contract for additional gas infrastructure?
  - How do the states ensure equitable cost allocation, including limiting 'free riders'?
  - Some state regulators have legislative approval to act, but others do not
  - The NESCOE proposal attempts to address the investment and cost allocation problem through a regional solution; however, will FERC approve cost allocation through the ISO tariff?

- **Other Options?**
  - Do the states invest more aggressively in energy efficiency and renewable energy to offset/obviate the need for gas pipeline infrastructure? What does this mean for transmission infrastructure? How do we balance the additional renewable energy?
  - Do the New England states make it easier to permit dual-fuel generators?

Greater Boston Area Needs Resources and Transmission

- Electricity demand is rising, while at the same time internal resources and transmission supplying the area are limited
- Generator retirements and delays to new generation projects add to challenges
- System operators are challenged given the limited import capability
- Long-term transmission solutions (scheduled to be in service by the 2017–2018 timeframe) are long overdue



Greater Boston includes Boston and the North Shore

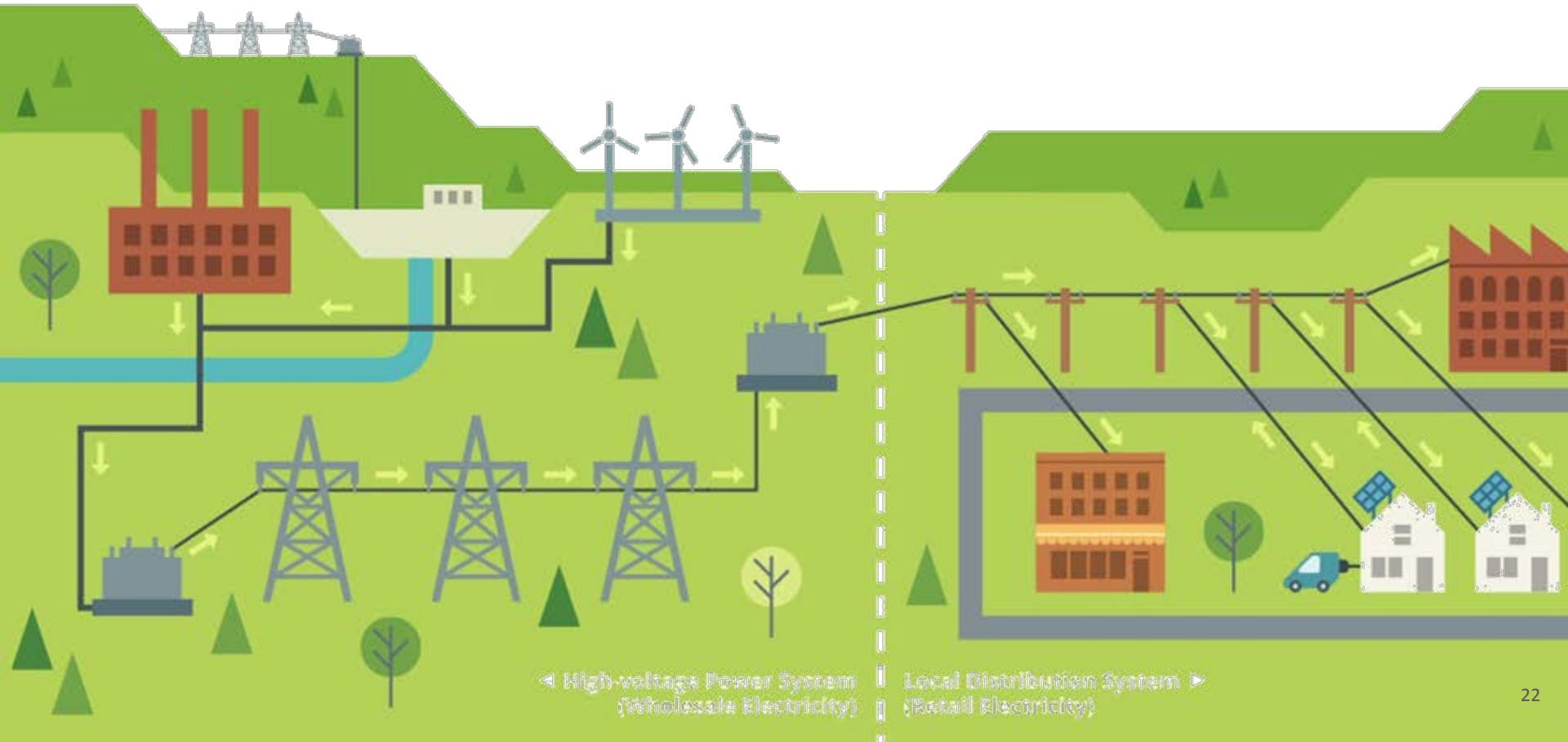
Southeastern Mass and Rhode Island Areas Need Resources and Transmission

- A SEMA/RI area study, led by the ISO, shows overloads of transmission facilities following contingencies, resulting in violation of reliability criteria
- Brayton Point retirement led ISO to restudy the area, and potential new FCM resources, if realized, could prompt further restudy
- ISO and stakeholders are reviewing needs and potential market resource alternatives

SEMA/RI is the area south of Boston, plus Cape Cod, and Rhode Island

Electric Grid Will Look Very Different in 5–10 Years

"Hybrid" grid with grid-connected and distributed resources, and a continued shift toward natural gas and renewable energy



What the Region Will Need

- A responsive fleet of generation (with adequate fuel infrastructure) and demand-side resources, to balance variable renewables
- Additional transmission investments to integrate renewables
- Additional resources and transmission to reliably serve the Greater Boston and SEMA/RI areas

Challenges Ahead

- We are in a precarious operating position for several winters due to inadequate gas pipeline infrastructure and retirements that have already taken place
- Further non-gas generator retirements and/or outages will exacerbate reliability concerns
- Recent ISO and FERC actions will improve long-term resource adequacy and performance, but this alone may not result in timely investments in additional gas infrastructure. The States will have to decide whether to wait for a market response, or to facilitate the infrastructure investment

Questions