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Light or Heat

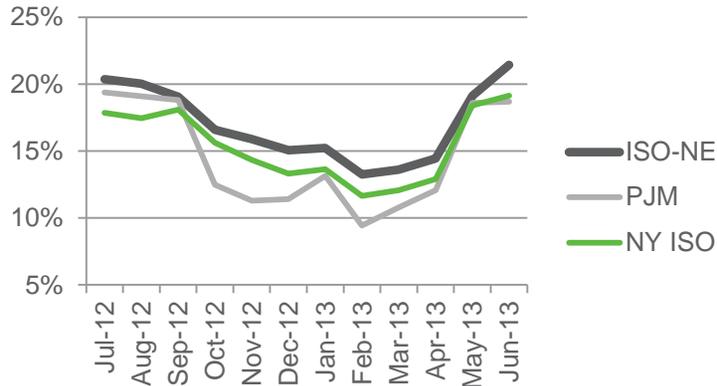
ISO New England Generation Mix

January 2014

ISO New England Is An Interesting Place

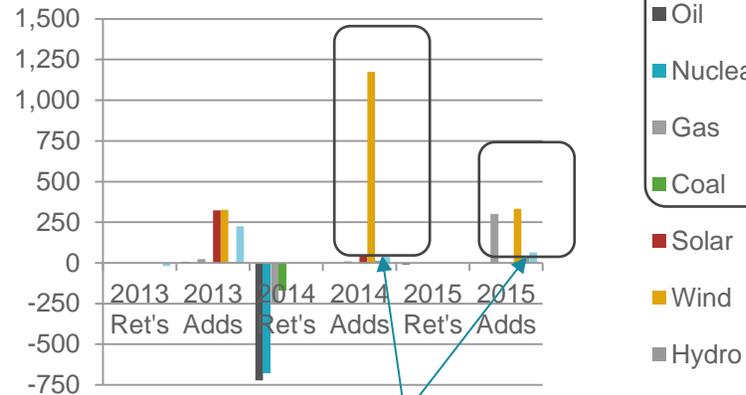
- ISO New England has made a decision to shift its generation portfolio strongly toward more renewable generation sources
- This decision puts new expectations on simple and combined-cycle generation and the natural gas pipelines that serve those plants
- And it is not an easy market to serve, given the volatility of generation requirements

Monthly Load Standard Deviation as a % of Load



- So, how are they keeping up so far? Let's look at the natural gas generation portfolio first

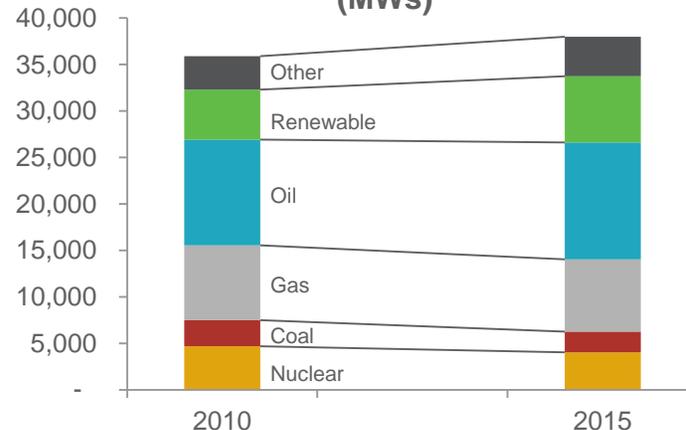
Projected Retirements and Additions in ISO NE



Retirements are comprised entirely of capacity fired by these four fuels

New capacity is overwhelmingly renewable, comprised of intermittent wind and solar capacity

Historic and Future Generation Mix (MWs)



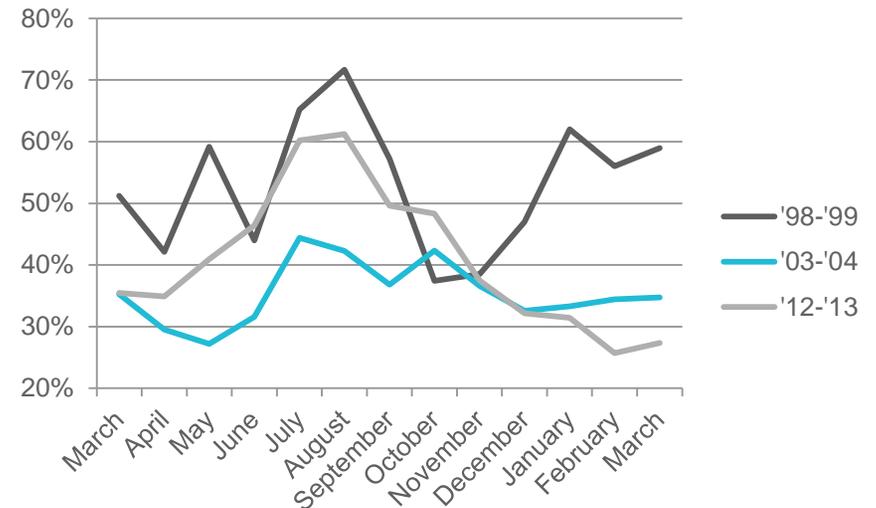
Gas-fired generation supplies about **half** of the MWhs consumed in ISO-NE

Combined Cycles Are Running Less?

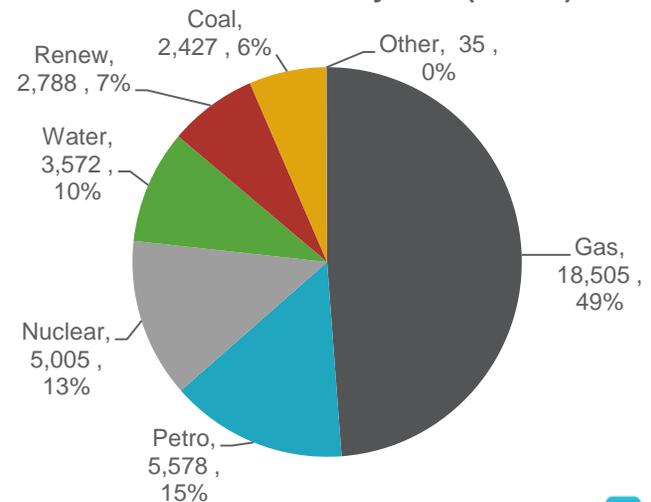
Combined Cycle Capacity Factors Have Decreased

- We expected to find that capacity factors had increased in ISO New England, but that is just not the case
 - The peak combined-cycle capacity factors experienced in 1998-99 occurred when gas prices nationally were at record lows
 - Higher gas prices since have correlated with lower capacity factors in late 2012/early 2014
- Renewable generation has not exactly displaced combined-cycle generation, since renewables were 11% of the supply curve in 2003 and about 12% in 2013
- Overall reduction in load is part of the explanation. Put simply, the slowdown in economic growth means less generation is needed
 - With reserve margins of 20% in 2013 and low load growth, it will take years for the excess capacity to be absorbed through load growth and plant retirements
- So far, gas-fired generation appears able to keep up with load and renewable support requirements, but does that winter price spike in natural gas prices in the Northeast point to trouble?

Monthly Combined-Cycle Capacity Factors



Current Generation by Fuel (MWHs)



Gas Pipeline Capacity Stresses ISO New England in the Winter

Gas Consumption Patterns

- Gas for heating is typically purchased with firm transportation to assure delivery in critical winter months
- Natural gas-fired generation typically relies on excess pipeline capacity for its supplies
- In the winter months, heating and electricity compete for scarce gas transportation resources, creating a demand “double peak”
- ISO New England uses coal and oil-fired generation to supplement gas fired, but these assets are being retired in favor of renewables, ultimately requiring gas-fired generation to run more

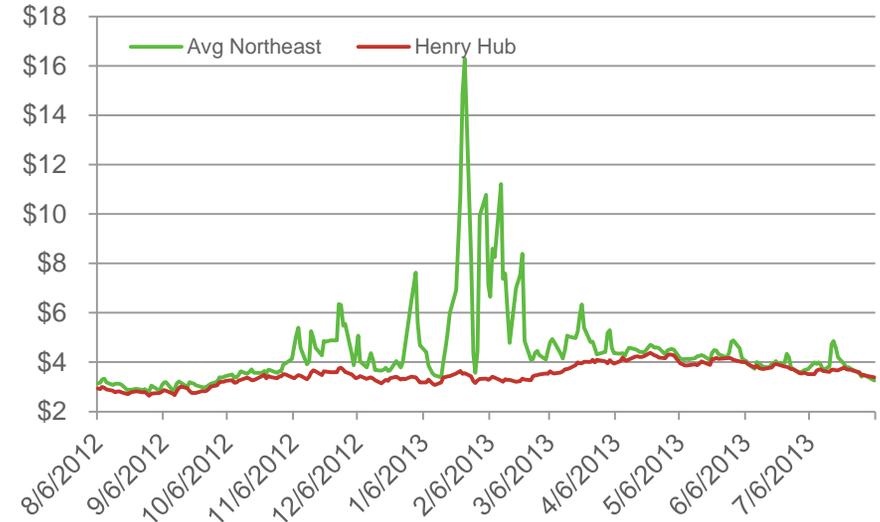
High Natural Gas Prices in ISO New England

- ISO New England has yet to benefit year-round from the historically low gas prices
- In fact, in the days following a blizzard in February 2013, natural gas in the region was triple the price being charged in other parts of the country, as high gas demand for electricity coincided with a spike in gas demand for space heating
- Pipeline capacity restrictions are a year-round phenomenon, for ISO New England. Summer pipeline maintenance and winter heating needs both conflict with electricity generation
- ISO New England has responded by changing its day-ahead market timing, creating a winter reliability program and refining the reserve market to maximize pipeline capacity and bolster coal and oil generation alternatives

Pipeline Construction Continues

- The industry added 245 miles and 3.2 Bcf/d of new pipeline capacity to the Northeast grid system in 2012, representing two-thirds of total capacity additions in the nation, and this was the second highest level of regional capacity additions since 1997

Daily Natural Gas Spot Prices – NE vs. Henry Hub

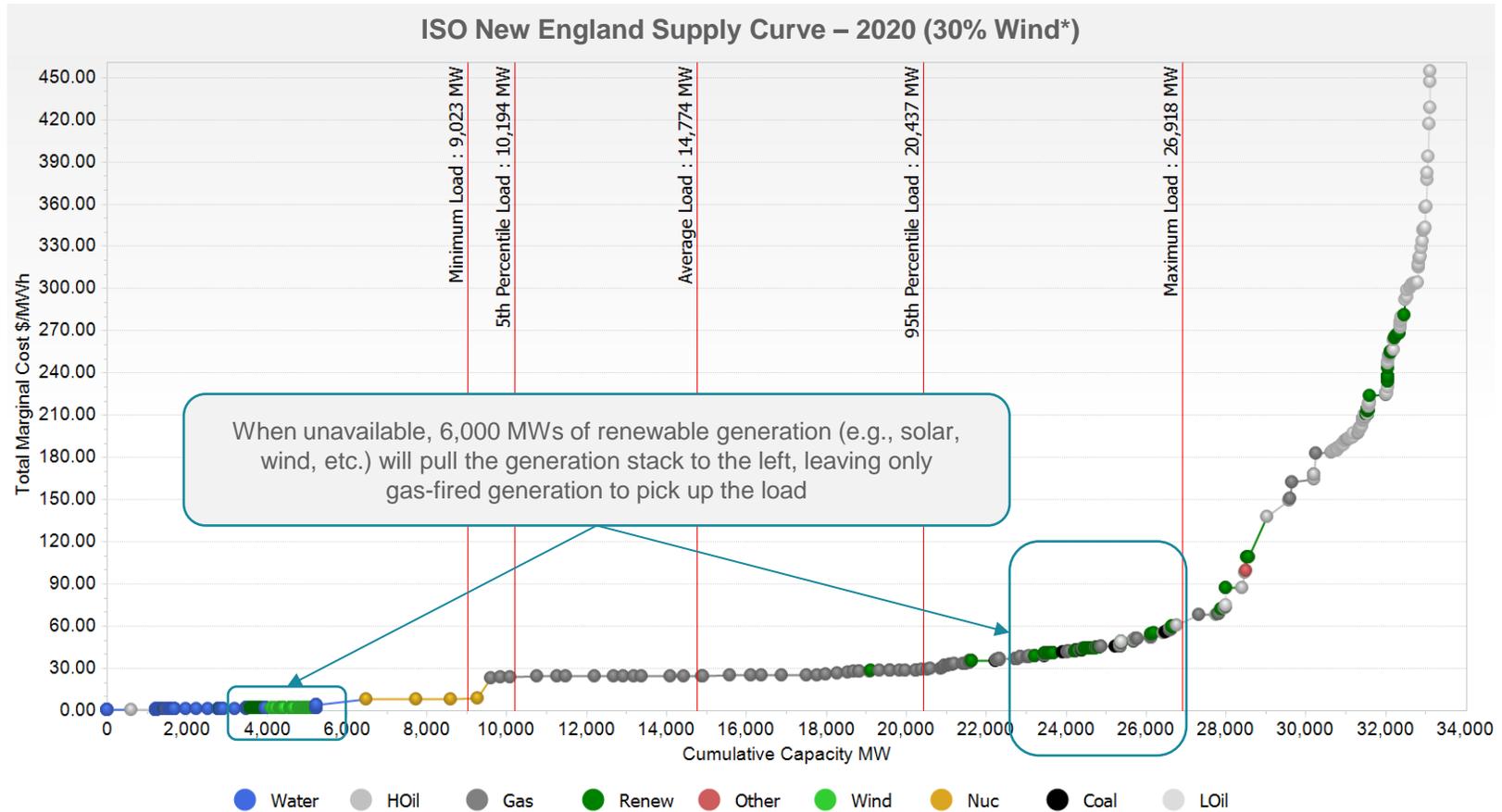


“On a peak day, when Algonquin is hitting \$30 plus [per MMBtu], [New England] is not only the most expensive market in the United States, it is the most expensive market in the world, and it's very close to some of the least expensive supplies in the world. So there is an obvious solution to that, and that is the infrastructure needs to be expanded back to where the supply is plentiful.”

Greg Crisp, Spectra Energy's director of northeast business development

The Future Does Not Get Easier in New England

Gas-fired generation will be required to run more often to integrate renewables, which is even riskier in the winter months when electricity generation will compete with heating needs in a market with fewer and fewer coal, nuclear, and oil assets.



As ISO New England’s fuel mix becomes less diverse, more gas pipeline capacity is needed to serve the “double peak” in winter months

*Note: Assumes a 30% capacity factor for wind in the region

Sources: Ventyx Energy Velocity; ScottMadden analysis

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