ISO new england

The Decarbonization Journey in New England and the Future of Wholesale Electricity Markets

VELCO Board of Directors

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KEY MESSAGES

- ISO New England has a strong track record operating a reliable grid using competitive markets
- Economic and environmental factors are resulting in generator retirements while state policies are driving investments in clean and renewable energy
- A hybrid grid is rapidly emerging, and operational and wholesale market complexity is increasing
- ISO is focused on energy security with a planned FERC filing in April 2020
- New England's ongoing decarbonization journey will be challenging and wholesale markets will continue to evolve

Transmission Is the Backbone of a Reliable Electric Grid and the Platform to Connect Large-Scale Renewable Energy

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- **9,000 miles** of high-voltage transmission lines (115 kV and above)
- **13 transmission interconnections** to power systems in New York and Eastern Canada
- **17%** of region's energy needs met by imports in 2018
- **\$10.9 billion** invested to strengthen transmission system reliability since 2002; **\$1.3 billion** planned
- Developers have proposed multiple transmission projects to access non-carbon-emitting resources inside and outside the region



New England's Energy Mix Is Changing Dramatically

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Gas has displaced oil and coal for electric generation ...



Source: ISO-NE Net Energy and Peak Load by Source Electric generation within New England; excludes imports and behind-the-meter (BTM) resources, such as BTM solar.

... as *solar* grows rapidly ...



Source: Final 2019 PV Forecast (March 2019); MW values are AC nameplate

... and wind dominates the queue



Source: ISO-NE Generator Interconnection Queue (October 2019)

Natural Gas and Wholesale Electricity Prices Are Linked

Monthly average natural gas and wholesale electricity prices at the New England hub









Marcellus shale

Source: ISO New England

But the Natural Gas Delivery System Is Not Keeping Up with Demand

- Few interstate pipelines and liquefied natural gas (LNG) delivery points
- Regional pipelines are:
 - Built to serve heating demand, not power generation
 - Running at or near maximum capacity during winter
- Most generators rely on "just in time" fuel

Power Plant Emissions Have Declined with 7,000 MW of Retiring Fossil Resources and Other Changes in the Fuel Mix

New England Generator Air Emissions Have Fallen Dramatically Since 2000



- Policymakers are restricting emissions from power generation (and constraining new fuel infrastructure) to
 speed the transition to a clean power system and the electrification of other sectors of the economy
- Combined with an influx of renewables, we're shifting to an energy-constrained system

Source: 2017 ISO New England Electric Generator Air Emissions Report (April 2019); ISO New England 2019 Regional Electricity Outlook (March 2019)

States Have Set Aggressive Decarbonization Goals: Some Mandated, Some Aspirational



Percent Reduction in Greenhouse Gas (GHG) Emissions Economy Wide by 2050*

The New England states are promoting GHG reductions on a state-by-state basis, and at the regional level, through a combination of legislative mandates (e.g., CT, MA, RI, and ME) and aspirational, non-binding goals (e.g., NH, VT and the New England Governors and Eastern Canadian Premiers).

MA, RI, NH, ME, and VT use a 1990 baseline year for emissions reductions. CT and the NEG-ECP use a 2001 baseline. For more information, see the following ISO Newswire article: http://isonewswire.com/updates/2019/10/2/the-new-england-states-frameworks-for-reducing-greenhouse-ga.html

We Are Transitioning to a Hybrid Grid

There are two dimensions to the transition, happening simultaneously...

1 A shift from conventional generation to renewable energy 2 A shift from centrally dispatched generation to distributed energy COAL OIL NUCLFAR GAS **STORAGE & OTHER TECHNOLOGIES** SOLAR WIND resources

Maintaining reliable power system operations becomes more complex with the shift to greater resources that rely on "just in time" fuel

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In addition to RPS goals, states are contracting for significant resources outside of the wholesale markets, which will put downward pressure on market prices for all resources.

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Lines represent types of ETUs private developers have proposed in recent years

Source: ISO Interconnection Queue (October 2019)

State Policies Support Large-Scale Renewable Energy and Transmission Projects to Deliver Clean Energy to Load Centers

- Developers are proposing roughly 15 elective transmission upgrades (ETUs) to help deliver about 11,000 MW of clean energy to New England load centers
- Policymakers want many of these projects to have unrestricted access to capacity markets (or via CASPR)

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Energy Efficiency Is a Priority for New England Policymakers



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Spending tops a billion dollars annually, with more coming

- Nearly \$5.3 billion invested from 2012 to 2017
- ISO estimates \$10.6 billion to be invested from 2020 to 2028

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Final 2019 CELT Report, EE through 2018 includes EE resources participating in the Forward Capacity Market (FCM). EE in 2028 includes an ISO-NE forecast of incremental EE beyond the FCM.

EE in 2028

EE thru 2018

Emerging Outlook

- Energy efficiency and PV resources have flattened energy growth and peak demand in the medium term (<2029), but decarbonization of transportation and heating will drive up demand on the grid in the longer term (>2030)
- We will have **excess energy** during the shoulder periods as large-scale, renewable-energy deployment unfolds more quickly than demand from other sectors
- New England will likely transition to a **winter-peaking** system
- **Generator retirements** are freeing up space on the transmission system to connect new resources (i.e., wind), but that capacity is not unlimited; conflicts are now emerging
- Goal-setting for **renewable energy** is accelerating; expect states to continue to procure their preferred resources

Positioning the Power System for the Journey

- The easy part of the **decarbonization** journey is behind us
 - The steep part of the journey is between 2030 and 2050
- What will the power system look like in 2030 and beyond?
 Demand, resources, transmission needs?
- What is the evolutionary **path for the markets**?
 - In Feb. 2020 we will take on commitments for June 2023 to May 2024
 - We have a state-of-the-art market; it is unclear that there is a better solution available, but we are willing to have exploratory discussions
 - Other market designs have different trade-offs and structural prerequisites

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A new market design and transition will take 7 to 10 years

Positioning the Power System for the Journey

- Will **carbon pricing** emerge on the journey to decarbonize the New England economy?
 - This would greatly simplify the market design challenge
- What further **transmission** will be needed to fulfill the states' goals for large-scale renewable energy deployment?
 - Gaps are already emerging
 - Should we be reactive or proactive, given the steep ascent needed during the 2030–2050 timeframe?

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• What will the **balancing source of energy** be during the transition, and in the long-term future?