

## ISO New England Regional Electricity Outlook

Connecticut General Assembly

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Energy and Technology Committee

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ISO New England (ISO) Has Two Decades of Experience Overseeing the Region's Restructured Electric Power System

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- Regulated by the Federal Energy Regulatory Commission
- Reliability Coordinator and Planning Coordinator for New England under the North American Electric Reliability Corporation
- Independent of companies in the marketplace and neutral on technology



### **Reliability Is the Core of ISO New England's Mission**

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Fulfilled by three interconnected and interdependent responsibilities

Overseeing the day-to-day operation of New England's electric power generation and transmission system

Managing comprehensive regional power system planning

> Developing and administering the region's competitive wholesale electricity markets

## A Range of Generation and Demand Resources Are Used to Meet New England's Energy Needs

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- **350** generators in the region
- **30,500 MW** of generating capacity
- **13,250 MW** of proposed generation in the ISO Queue
  - Mostly natural gas and wind
- **4,200 MW** of generation has retired or will retire in the next five years
- 600 MW of active demand response and 1,900 MW of energy efficiency with Capacity Supply Obligations in the Forward Capacity Market (FCM)\*

\* In the FCM, demand-reduction resources are treated as capacity resources.



**Existing and Future Resources** 

### New England's Transmission Grid Is the Interstate Highway System for Electricity

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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 2016
- \$8 billion invested to strengthen transmission system reliability since 2002; \$4 billion planned
- Developers have proposed multiple transmission projects to access non-carbon-emitting resources



# Annual Value of Wholesale Electricity Markets Varies with Changes in Fuel Prices

A robust transmission system allows the region to access the most economic resources



Source: 2015 Report of the Consumer Liaison Group; 2016 wholesale electricity market values are preliminary and subject to reconciliation

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## The Forward Capacity Market Is Attracting Efficient and Fast-Starting Resources

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 Roughly **3,000 MW** of new gas-fired generation have come forward in recent auctions

> Wallingford (90 MW) Combustion Turbines *Commercial: June 1, 2018*

**Towantic (725 MW)** Combined-Cycle Gas Turbine *Commercial: June 1, 2018* 

Bridgeport Harbor (484 MW) Combined-Cycle Gas Turbine – *Commercial: June 1, 2019*  Footprint (674 MW) Combined-Cycle Gas Turbine Commercial: June 1, 2017

Medway (195 MW) Combustion Turbine *Commercial: June 1, 2018* 

Canal (333 MW) - Combustion Turbine *Commercial: June 1, 2019* 

Clear River Energy Center (485 MW) Combined-Cycle Gas Turbine *Commercial: June 1, 2019* 

#### **Energy Efficiency Is a Priority for State Policymakers**



Source: American Council for an Energy-Efficient Economy

- Billions spent over the past few years and more on the horizon
  - Nearly \$4 billion invested from 2009 to 2014
  - ISO estimates \$6.6 billion to be invested in EE from 2020 to 2025

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#### **ISO New England Forecasts Strong Growth in Solar PV**



Note: This chart reflects the ISO's projections for nameplate capacity from PV resources participating in the region's wholesale electricity markets, as well as those connected "behind the meter." Source: Final 2016 ISO-NE PV Forecast (April 2016); MW values are AC nameplate.



#### **Connecticut Installed Solar PV "Heat Map"**



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**MEGAWATTS** 

### Energy Efficiency and Solar PV Are Slowing Peak Demand Growth and Flattening Energy Use



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

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- Inadequate Natural Gas Infrastructure
  - New England is challenged to meet electricity demands with existing natural gas infrastructure, particularly during the winter

#### • Power Plant Retirements

- New England will need new ways to meet peak demand as aging plants close
- Renewable Resource Integration
  - Maintaining reliability as increasing levels of distributed generation and intermittent resources come online



#### **Dramatic Changes in the Energy Mix**

The fuels used to produce the region's electric energy have shifted as a result of economic and environmental factors

Percent of Total **Electric Energy** Production by Fuel Type (2000 vs. 2016)



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

Renewables include landfill gas, biomass, other biomass gas, wind, solar, municipal solid waste, and miscellaneous fuels

## Natural Gas Is the Dominant Fuel Source for New Generating Capacity in New England



Note: New generating capacity for years 2016 – 2019 includes resources clearing in recent Forward Capacity Auctions.

#### New England Has Relatively Few Interstate Natural Gas Pipelines and Few Delivery Points for LNG



#### Natural Gas and Wholesale Electricity Prices Are Linked



Monthly Average Natural Gas and Wholesale Electricity Prices in New England

Electric Energy \$/MWh

Fuel \$/MMBtu

## The Region Has Lost—*and Is at Risk of Losing*— Substantial Non-Gas Resources

#### **Major Generator Retirements:**

- 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)
- Mount Tom Station (143 MW)
  - 1 unit (coal)
- Pilgrim Nuclear Power Station (677 MW)
  1 unit (nuclear)
- Additional retirements are looming



## States Have Set Goals for Significant Reductions in Greenhouse Gas Emissions



Percent Reduction in Greenhouse Gas (GHG) Emissions Below 1990 Levels by 2050 Economy Wide\*

\* Some states have different baseline and target years (e.g., Maine's goal specifies reductions below 2003 levels that may be required "in the long term")

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100%

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 aspirational, non-binding goals (e.g., ME, NH, VT and the New England Governors and Eastern Canadian Premiers).

# 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 Renewable Energy Standard has a 'total renewable energy' requirement (reflected above), which recognizes all forms of new and existing renewable energy, and is unique in classifying large-scale hydropower as renewable.

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#### Infrastructure Will Be Needed to Deliver Energy from Proposed Resources

#### **All Proposed Generation**

Developers are proposing to build roughly 13,250 MW of generation, including nearly 6,400 MW of gas-fired generation and more than 5,800 MW of wind





#### Developers Are Proposing to Move Renewable Energy to New England Load Centers

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Map is representative of the types of projects announced for the region in recent years

- As of **January 1, 2017**, seventeen elective transmission projects had been proposed in the ISO Interconnection Queue, totaling more than **10,000 MW** of potential transfer capability, including:
  - Large-scale hydro resources from eastern Canada, and
  - Onshore wind resources from northern New England
- Projects seek to address public policy goals, not reliability needs
- In addition, offshore wind resources are emerging in southern New England

Source: ISO Interconnection Queue (January 2017)

#### For More Information...

- Subscribe to the ISO Newswire
  - <u>ISO Newswire</u> is your source for regular news about ISO New England and the wholesale electricity industry within the six-state region
- Log on to ISO Express
  - <u>ISO Express</u> provides real-time data on New England's wholesale electricity markets and power system operations
- Follow the ISO on Twitter
  - @isonewengland
- Download the ISO to Go App
  - <u>ISO to Go</u> is a free mobile application that puts real-time wholesale electricity pricing and power grid information in the palm of your hand

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#### About the Power Grid



## Questions

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#### **APPENDIX: BACKGROUND INFORMATION**



### **Overall Electricity Demand Is Flattening Due to Energy Efficiency and Behind-the-Meter Solar**

- **7.1 million** retail electricity customers drive the demand for electricity in New England (14.7 million population)
- Region's all-time summer peak demand set on August 2, 2006 at **28,130 MW**
- Region's all-time winter peak demand set on January 15, 2004 at **22,818 MW**
- Energy efficiency and behind-the-meter solar slow the growth in summer *peak* demand to 0.3% annually and flatten the growth in *overall* electricity demand to -0.2% annually





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Note: Without energy efficiency and solar, the region's peak demand is forecasted to grow 1.1% annually and the region's overall electricity demand is forecasted to grow 1.0% annually. Summer peak demand is based on the "90/10" forecast for extreme summer weather.

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#### Solar Power Has a Significant Impact on New England's Electricity Demand



Estimated Electricity Needs Served by Solar Power — — Demand Without Solar Power — Electricity Demand Seen in Real Time

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### Natural Gas and Wind Power Dominate New Resource Proposals in the ISO Queue

Approximately 13,250 MW



## Power Plant Emissions Have Declined with Changes in the Fuel Mix



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#### Reduction in Aggregate Emissions (ktons/yr)

Year	NO <sub>x</sub>	SO <sub>2</sub>	CO <sub>2</sub>
2001	59.73	200.01	52,991
2015	18.86	9.11	40,312
% Reduction, 2001–2015	<b>₩</b> 68%	<b>₽</b> 95%	<b>₽</b> 24%

#### Reduction in Average Emission Rates (Ib/MWh)

Year	NO <sub>x</sub>	SO <sub>2</sub>	CO2
1999	1.36	4.52	1,009
2015	0.35	0.17	747
% Reduction, 1999–2015	<b>₹74%</b>	<b>₽</b> 96%	<b>₽</b> 26%

Source: 2015 ISO New England Electric Generator Air Emissions Report, January 2017

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#### **Transmission Provides Benefits Beyond Reliability**

- Transmission has reduced or eliminated out-of-market costs:
  - Reliability agreements with certain generators that were needed to provide transmission support in weak areas of the electric grid
    - These often were older, less-efficient generating resources
  - Uplift charges to run specific generators to meet local reliability needs
- The markets are increasingly competitive: Easing transmission constraints into import-constrained areas has enabled the ISO to dispatch the most economic resources throughout the region to meet customer demands for electricity

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- Transmission congestion has been nearly eliminated
- Transmission facilitates resource transformation: Transmission upgrades have allowed older, lessefficient resources to retire, which helps the states achieve their environmental objectives

#### Transmission and Resource Developments Have Reduced Energy and Reliability Costs



## Fuel-Supply Challenges Have Been Significant in Recent Winters



- New England has experienced volatile natural gas and wholesale electricity prices in recent winters due to constraints on the interstate natural gas pipeline system
  - The ISO has frequently operated with little or no gas-fired generation
  - High natural gas prices have made many oil-fired generators economic
- Gas pipelines have been **constrained** even without significant use by gas-fired generators, and more constrained than expected
- The region has benefitted from the **availability of LNG resources**, but shipments of LNG to the region will depend on world LNG prices
- Oil has been vitally important to **reliability** and will remain important as long as the region faces a constrained natural gas system; the oil supply chain, however, has been increasingly constrained

#### Winter Reliability Program Update

- For the past three winters, ISO New England has administered a **Winter Reliability Program** to address challenges created by the region's constrained interstate natural gas pipeline system
- In September 2015, FERC approved a program to be in place for the 2015/2016, 2016/2017, and 2017/2018 winters, providing compensation for:

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- 1. Carrying costs of fuel oil that was unused at the end of the winter;
- 2. Unused liquefied natural gas contract volumes; and
- 3. Supplemental demand response



### ISO New England Will Run the Eleventh Forward Capacity Auction (FCA #11) in February 2017

- FCA #11 will begin on February 6, 2017 to procure the capacity resources needed for the 2020-2021 Capacity Commitment Period
- On November 8, 2016, ISO New England submitted an informational filing to FERC regarding the qualification of resources for FCA #11
- The filing also included locational capacity requirements based upon the topology of the transmission system, and specifically which capacity zones are to be modeled in the auction



Source: ISO Filings to FERC; <u>https://www.iso-ne.com/participate/filings-orders/ferc-filings</u>

#### **Forward Capacity Auction #11 at a Glance**

- The net Installed Capacity Requirement to be procured in the auction is **34,075 MW**
- The ISO qualified 34,505 MW of existing capacity resources and 5,958 MW of new capacity resources to participate in the auction

**Rest-of-Pool Zone** 

(WCMA and CT)

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- The ISO will model **three** capacity zones in FCA #11
  - Northern New England Capacity Zone
    - Export-Constrained
  - Southeastern New England Capacity Zone
    - Import-Constrained
  - Rest-of-Pool Capacity Zone



Northern New England Zone

(VT, NH and ME)

Southeastern New England Zone

(NEMA/Boston