

ISO New England Regional Electricity Outlook

Maine Joint Committee on Energy, Utilities and Technology

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Michael S. Giaimo

SENIOR EXTERNAL AFFAIRS REPRESENTATIVE

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

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



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

- **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



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

Ensuring Reliable Power System Operations Is a Major Responsibility

- Maintain minute-to-minute reliable operation of region's generation and transmission system
- Perform centralized dispatch of the lowestpriced resources
- Coordinate and schedule maintenance outages
- Coordinate operations with neighboring power systems



Economic Dispatch on Peak Summer Day



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Ensuring Fair and Efficient Wholesale Markets Is a Major Responsibility

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Energy Market Daily market for wholesale customers to buy and sell electric energy

Forward Capacity Market ISO determines capacity needs three years into the future and resources compete to sell capacity to the system through annual forward capacity auctions

Ancillary Markets Resources are compensated for providing regulation services and reserves to ensure reliability in real time

Annual Value of Wholesale Electricity Markets (in billions)



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 <u>Net Energy and Peak Load by Source</u> 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

Cumulative New Generating Capacity in New England (MW)



Natural Gas and Wholesale Electricity Prices Are Linked



Fuel \$/MMBtu

Monthly Average Natural Gas and Wholesale Electricity Prices in New England

Power Plant Emissions Have Declined with Changes in the Fuel Mix



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Reduction in Aggregate Emissions (ktons/yr)

Year	NO _x	SO ₂	CO ₂
2001	59.73	200.01	52,991
2014	20.49	11.68	39,317
% Reduction, 2001–2014	₩ 66%	₽ 94%	₽ 26%

Reduction in Average Emission Rates (Ib/MWh)

Year	NO _x	SO ₂	CO2
1999	1.36	4.52	1,009
2014	0.38	0.22	726
% Reduction, 1999–2014	₹ 72%	₽ 95%	₽ 28%

Source: 2014 ISO New England Electric Generator Air Emissions Report, January 2016

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



Capacity Market Has Attracted New Peaking and Combined-Cycle Gas Generation to Load Centers

- 3,000 MW of gas-fired generation have come forward in recent auctions (FCAs 7–10) with commitments to be available in 2017–2019
- A mix of existing and new resources cleared in FCA 10, including three new, gas-fired, dual-fuel power plants totaling 1,300 MW
- FCA 10 also attracted new renewable resources, demand resources, and imports



Renewable and EE Resources Are Trending Up



Nameplate capacity of existing wind resources and proposals in the ISO-NE Generator Interconnection Queue; megawatts (MW) as of January 2017. *Final 2016 ISO-NE PV Forecast*, AC nameplate capacity from PV resources participating in the region's wholesale electricity markets, as well as those connected "behind the meter."

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2016 CELT Report, EE through 2015 includes EE resources participating in the Forward Capacity Market (FCM). EE in 2025 includes an ISO-NE forecast of incremental EE beyond the FCM.

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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

Cumulative Growth in Solar PV through 2025 (MW)



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.

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Maine Installed Solar PV "Heat Map"

- Based on the data provided by distribution owners, the ISO has aggregated the installed nameplate capacity by town within each state, and generated heat maps (see right)
- As of August 2016, Maine has over 2,500 solar installations with approximately 20 MW of cumulative installed capacity



Note: Heat map reflects solar PV installed through August 31, 2015.

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



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)

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Closing Thoughts

- New England's generation fleet is changing rapidly as older coal, oil and nuclear plants are retiring
- Region has locational wholesale energy and capacity markets that send proper signals
- Region's investments in energy efficiency and solar resources are having impacts on system planning and operations
- We are moving toward a hybrid grid with grid-connected and distributed resources and a continued shift to natural gas and renewable energy

CHANGES AHEAD