



ISO New England Regional Transmission Operator

History and Geography of ISO New England

The Independent System Operator (ISO)¹ New England was established as a non-profit corporation in 1997. It was designated by the Federal Energy Regulatory Commission (FERC) as a Regional Transmission Operator (RTO) in 2005.² ISO New England is responsible for ensuring reliability and establishing and overseeing competitive wholesale electricity markets for six U.S. states: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont (Exhibit 1). As of January 2013, ISO New England dispatches approximately 32,000 MW of generating capacity and 2,000 MW of demand resources over 8,000 miles of transmission lines providing electric service to 14 million people.³ An all-time peak demand of 28,130 MW was set on August 2, 2006.

Similar to other RTOs and ISOs, a primary function of ISO New England is to facilitate the energy markets in its service area, maintain minute-to-minute reliable electricity service in a cost-effective manner, manage wholesale markets, and develop bulk power system planning processes. ISO New England operates the electricity (energy, capacity, and ancillary services) markets to serve load and meet reserve obligations with the lowest-cost resources possible. It has designed a locational market structure to ensure that transmission capability is used efficiently and that energy prices reflect the marginal cost of providing the service at each location. The electricity price in ISO New England (Exhibit 2) is dominated by energy cost (i.e., the cost of generating power, which includes fuel costs, operation and maintenance for generators, and reimbursement for the capital cost of generators).

Exhibit 1 ISO New England market area



(Used with permission from ISO New England.³)

Exhibit 2 ISO New England average wholesale electricity price 2009, 2010, and 2011 (\$/MWh)⁴

Price	2009	2010	2011
Energy	\$ 42.89	\$ 50.98	\$ 48.00
Capacity	\$ 13.90	\$ 12.69	\$10.47
Ancillary Services	\$ 2.51	\$ 1.93	\$ 0.88
Total	\$59.30	\$ 65.60	\$59.35

¹ Many of the technical terms used in this primer are defined in a companion *Glossary for Power Market Primers*.

² ISO New England. (2011). *Timeline*. Retrieved on November 14, 2011, from http://www.iso-ne.com/aboutiso/co_profile/timeline/index.html

³ ISO New England. (2013). *Key Facts: New England's Power System and Wholesale Electricity Market*. Retrieved on April 6, 2013 from: http://www.iso-ne.com/nwsiss/grid_mkts/key_facts/ (Also source of map in Exhibit 1)

⁴ ISO New England. (2013). *2011 Annual Markets Report*. Retrieved on January 17, 2011, from http://www.iso-ne.com/markets/mkt_anlys_rpts/annl_mkt_rpts/2011/2011_amr_final_051512.pdf

ISO New England Products and Services

ISO New England manages competitive markets that provide energy services and reliability services through a day-ahead energy market, real-time energy market, forward capacity market, financial transmission rights (FTR) market, and an ancillary services market. In 2011, these markets aggregated billings of over \$8.2 billion (\$6.8 billion were traded in energy markets and \$1.4 billion were traded in capacity and ancillary services markets) across ISO New England's 500 market participants.⁵

Energy Market

ISO New England's main role as an RTO is to coordinate an energy market throughout the service area, which consists of facilitating the continuous buying, selling, and delivery of wholesale electricity; providing dispatch requests to generators; and acting as a data clearinghouse. In addition to acting as a clearinghouse for bilateral power contracts, ISO New England manages a day-ahead market and a real-time market for power delivery. In each market ISO New England "clears the market," i.e., coordinates which generators will operate at what time, at what price, and at over 900 pricing nodes, to meet electricity demand. The price of electricity is based on the cost of bringing the next marginal unit of electricity on line at specific locations throughout the New England area. This method of calculating electricity price is called locational marginal pricing (LMP). ISO New England features the LMP since 2003 (Exhibit 3).⁶

The day-ahead market clears both energy and operating reserves for each hour of the next operating day by matching energy demand bids at each LMP node and operating reserve requirements throughout the system with the generators' ability to provide power. Thus, ISO New England ensures scheduling adequate resources to meet the next day's expected demand, taking into account physical limiting factors such as transmission capacity and the generators' scheduled maintenance.

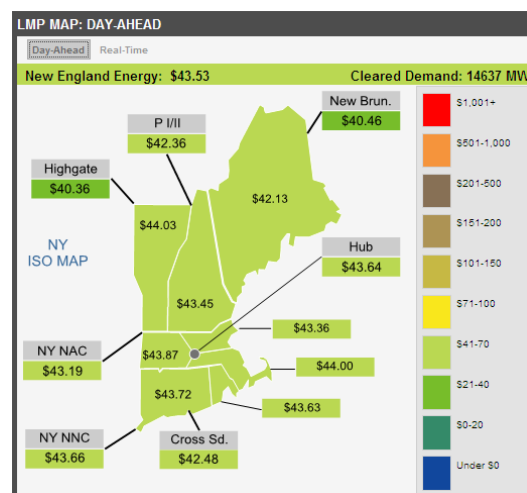
Generators participate in the real-time market by submitting bids to provide electricity at a certain price during a reoffer period. The reoffer period is between 4:00 – 6:00 p.m. the day before operating day. ISO

New England produces real-time hourly commitments after 6:00 p.m. the day before operating day and sends the generators' dispatch signals every ten minutes during the operating day based on the current demand and the generators' bid price—with the lowest-cost resources dispatched first.⁷

Capacity Market

ISO New England established a forward capacity market (FCM) to provide appropriate price signals to attract new capacity investments and maintain existing resources in order to ensure the reliability of the New England bulk power system.⁸ The capacity market includes traditional generation (e.g., oil, coal, natural gas) and non-traditional supply resources (e.g., demand resources [demand-side management,

Exhibit 3 Day-ahead market - zonal LMP [\$/MWh]



(Used with permission from ISO New England.)⁶

⁵ ISO New England. (2012). *2011 Financial Report*. Retrieved on December 3, 2012, from http://www.iso-ne.com/aboutiso/fin/finstmts/2011_financial_statements.pdf

⁶ ISO NE. (2013). *ISO Express*. Retrieved on March 28, 2013, from <http://isoexpress.iso-ne.com/guest-hub>

⁷ Potomac Economics. (2011). *2010 Assessment*. Retrieved on November 14, 2011, from http://www.potomaceconomics.com/markets_monitored/iso_new_england

⁸ ISO New England (2011). *Overview of ISO New England (ISO-NE 101). Module 6 – Introduction to New England's Forward Capacity Market*. Retrieved on November 14, 2011, from http://www.iso-ne.com/support/training/courses/isone_101/index.html

energy efficiency, load management, distributed generation], intermittent generation and imports). ISO New England projects the need of the power system and conducts the forward capacity auction approximately three years in advance (e.g., auction in 2011 for delivered capacity in 2014/2015) for a one-year period (e.g., from June 1, 2014 to May 31, 2015). Capacity obligations are adjusted by annual and monthly reconfiguration auctions.

Ancillary Services Market

ISO New England facilitates an ancillary services market to ensure the reliability of electricity production and transmission. The ancillary services include a forward reserve market, real-time reserve market, and regulation market.

The forward reserve market is held two months in advance of the Summer Capability Period (from June 1 to September 30) and the Winter Capability Period (from October 1 to May 31) to acquire off-line operating reserve. The forward reserve market is a locational forward reserve market where the clearing prices are based on the cost of serving the next increment of reserve at specific locations throughout the New England area. Capacity resources that were cleared in the forward reserve market have to offer their capability into the real-time energy market.⁸

The real-time reserve market is cleared simultaneously with the real-time energy market to provide reserve every five minutes during the operating day. The hourly reserve market clearing prices are determined using energy offers. Real-time reserve is provided by all units in New England that are capable of providing operating reserve.⁹

Regulation service allows ISO New England to manage small changes in the system's electrical load by increasing or decreasing the generators' output. Generators submit offers by 6:00 p.m. the day before operating day. Hourly real-time regulation clearing price is computed from five-minute samples while the generator receives a control signal to adjust output every four seconds.¹⁰

The ISO New England offers two specialized ancillary services: voltage support and black-start capability. The voltage support is used to maintain transmission voltage while black-start capability is used to restart the transmission system following a system-wide blackout.⁷

Financial Transmission Rights (FTR)

The FTR market provides a financial instrument for market participants to hedge against congestion costs in the system. In the absence of any transmission constraints, all LMP nodes would price at the lowest-priced generation resource. However, there is not enough physical transmission to deliver electricity from low-cost resources to the place demanding the electricity at all times. Thus, some nodes will, by necessity, use power from higher cost resources and therefore the LMP at that node will be higher. The difference in LMPs between two nodes that is attributable to the transmission constraints multiplied by the transfer amount is called "congestion cost" or "the cost of congestion" because, but for the lack of transmission capacity, a lower-cost resource would be used to meet demand. An FTR can be thought of as a "reservation" for access to a specific transmission path (e.g., between LMP nodes) for a specific timeframe, but does not actually correspond with a physical right to deliver energy. Rather, an FTR will create a revenue stream (or charges) based on the difference between two day-ahead LMP prices at specific times.

Transmission Planning and Resource Adequacy

ISO New England is responsible for maintaining the operations and reliability of the grid in its service area and, as such, conducts periodic reviews of grid adequacy. It publishes a regional system plan

⁹ ISO New England. (2011). *ISO New England Markets and Transmission Services: An Intermediate Overview – Day Two*. Retrieved November 16, 2011, from http://www.iso-ne.com/support/training/courses/mrkt_serv/index.html

¹⁰ ISO New England. (2011). *Overview of ISO New England (ISO-NE 101). Module 5 – Introduction to New England's Wholesale Electricity Market*. Retrieved on November 14, 2011, from http://www.iso-ne.com/support/training/courses/isone_101/index.html

annually. Transmission expansion is assessed on an annual basis, in conjunction with members' annual planning cycles, to understand the projects being studied or currently underway, as well as to suggest future projects needed to ease congestion or other grid issues. Similarly, ISO New England undertakes a resource adequacy study on an annual basis, modeling expected supply and demand to determine available reserve margins and plan for the integration of additional generation or transmission, in order to maintain reliable service. In addition to assessing the need for new transmission or generation resources, ISO New England is also responsible for administration of the generator interconnection process.

Tariff Administration

As an RTO, ISO New England is responsible for administering its "Open Access Transmission Tariff" as a part of ISO New England's "Transmission, Markets and Services Tariff." This tariff is filed with FERC and outlines how ISO New England will determine rates for transmission service, evaluate and approve requests for transmission service, perform transmission impact studies, and coordinate use and administration with other transmission providers in the region, among other activities. With FERC's approval of the tariff, ISO New England is the sole decision-making authority on the provision of transmission service in accordance with the tariff. However, in a case when a dispute cannot be solved internally as a part of good-faith negotiations for a period of not less than sixty (60) calendar days, the dispute may be submitted to arbitration or any other form of alternative dispute resolution.¹¹ The dispute may be submitted by any party for resolution to FERC, to a court, or to an agency with jurisdiction over the dispute.

ISO New England Generation Profile

While ISO New England does not own or directly operate power generation facilities, it is responsible for managing scheduled outages for maintenance and maintaining reliable electricity service at the lowest cost possible, as provided by the different generators on the system. Thus, to maintain reliability, ISO New England continually evaluates the fuel mix of generation assets in the region. As seen in Exhibit 4, the majority of the region's power comes from natural gas generation facilities. Demand resources, such as energy efficiency and demand response, can participate just like traditional generation resources in the forward capacity market. The demand resources accounted for up to 10 percent of the region's annual installed capacity requirements since the forward capacity market started in 2010 (Exhibit 5).

Exhibit 4 New England capacity by fuel type (2010)¹²

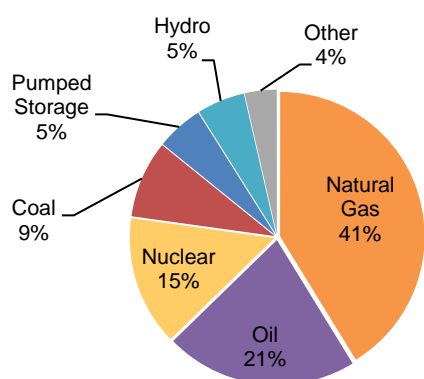
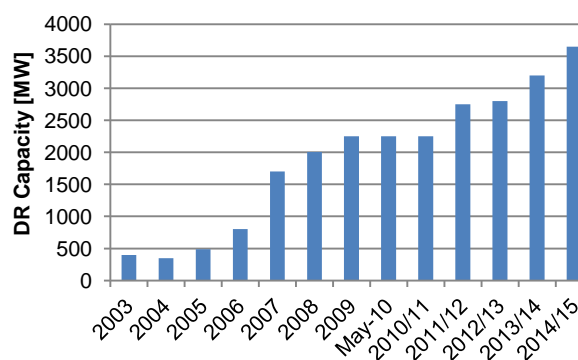


Exhibit 5 New England demand resource⁹



¹¹ ISO New England. (2013). *Transmission, Markets and Services Tariff*. Retrieved on January 17, 2013, from http://www.iso-ne.com/regulatory/tariff/sect_1/sect_i.pdf

¹² ISO New England. (2011). *Overview of ISO New England (ISO-NE 101)*. Module 4 - Overview of ISO New England System Planning. Retrieved November 16, 2011, from http://www.iso-ne.com/support/training/courses/isone_101/index.html