Overview of New England’s Wholesale Electricity Markets

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Disclaimer

The materials presented are intended as an overview and does not address all the issues and requirements of the Wholesale Electricity Markets operated by ISO New England Inc.

You should not rely solely on this presentation for information, but should consult the effective Markets, Services and Transmission Tariff ("Tariff") and the relevant Market Manuals, Operating Procedures and Planning Procedures ("Procedures").

In case of a discrepancy between this presentation and the Tariff or Procedures, the Tariff and Procedures shall govern.
New England’s Wholesale Electricity Markets

Quantity buying, selling, and reselling of the electric energy generated by a bulk power system to meet the system’s demand for electric energy.

**Energy Market**
System for purchasing and selling electricity using supply and demand to set the price

**Capacity Market**
Market where resources receive compensation for having invested in capacity and delivers in the capacity commitment period(s)

**Ancillary Services Markets**
Services that ensure the reliability of production and transmission of electricity
Electric Energy Markets

The Day-Ahead Energy Market produces financially binding schedules for the production and consumption of electricity the day before the operating day.

The Real-Time Energy Market balances differences between the day-ahead scheduled amounts of electricity and the actual real-time requirements.
Economic Dispatch during Day-Ahead or Real-Time Committed Resources

• Objective is to minimize the total cost of producing electricity while keeping the system in balance

• Economic dispatch uses the least-cost resources in a single period (hourly in the Day-Ahead Energy Market, 10-minutes in the Real-Time Energy Market) to meet the demand

• New England assesses hourly resource costs and establishes the wholesale cost of energy based on a uniform clearing price auction
Locational Marginal Pricing

- Hundreds of regional price points help establish wholesale prices
- Since 2003, the Energy Market features locational marginal pricing (LMP)
- Prices are made up of energy, congestion, and losses
Essential Features of the Energy Markets

- **Nodes**
  - 900+ specific pricing locations across New England
  - Generators are paid at their individual nodal price, which is unique for each modeled generator

- **Zones**
  - Eight load zones
  - Vast majority of load settles at zonal price
  - Zonal price is load-weighted average of nodal prices within a zone
  - 19 Dispatch zones for dispatching active Demand Resources

- **Hub**
  - Predefined node; straight average of 32 nodal prices
  - Hub was created to support bilateral trading
The Elements of LMP

*Energy, Congestion, and Losses Reflect Local System Conditions*

- **Energy**
  - $32.00/MWh
  - (same across all of New England)
  - The same price across all of New England; established as the load-weighted average LMP within New England

- **Congestion**
  - $4.25/MWh
  - The cost impact, due to transmission constraints, to operate one or more expensive, local power plant to meet local demands

- **Losses**
  - $0.75/MWh
  - The added cost due to the energy that is lost as power flows across the transmission system

**Locational Marginal Price**
- $37.00/MWh
Day-Ahead Market (DAM)

- A forward market to hedge against Real-Time (RT) price volatility
  - Allows Generation and Load Participants to secure Day-Ahead (DA) prices and reduce vulnerability to RT price fluctuations
  - Allows wholesale demand to participate in price determination
  - Provides a starting point for the initial unit commitment for the next operating day
New England’s Electric Energy Markets

Day-Ahead Energy Market

Energy Markets

Day-Ahead Energy Market

Real-Time Energy Market
DAM Participant Inputs

Day-Ahead Market

Purchase
- Demand/ARD Bids
- Decrement Bids
- Export External Transactions

Sell
- Generator Offers
- Increment Offers
- Import External Transactions

Export
- Purchase
- Sell
Inputs to Day-Ahead Energy Market

“Physical” Transactions

- Tied to actual physical injections or withdrawals expected in the Real-Time Energy Market
- Allows participants an opportunity to establish a position in the financial market
- Generator offers - submitted information contains incremental energy offers in $/MWh, also may contain fixed costs and parameters which contain attributes about the generator (minimum run time, maximum output, etc.)
- Demand bid - a bid to procure electricity at a specified load zone in the Day-Ahead Energy Market; demand bids must be associated with expected consumption in real-time
Inputs to Day-Ahead Energy Market

Virtual Transactions

- Virtual transactions are not tied to physical delivery of electricity
- Allows participants an opportunity to establish a position in the electricity market
- Increment offer (INC) - a financial offer to sell electric energy at a specified location in the Day-Ahead Energy Market; virtual supply
- Decrement bid (DEC) - a financial bid to buy electricity at a specified location in the Day-Ahead Energy Market; virtual demand not associated with a physical load
Inputs to Day-Ahead Energy Market

Day-ahead bids and offers must be submitted by noon the day before the operating day.

Financial schedules are produced. For generators, these financial schedules translate into scheduled hours for the operating day.
Outputs of Day-Ahead Energy Market

- Schedule of commitments for next operating day (generation and external transactions)
- Day-ahead hourly LMPs
- Day-ahead settlement is based on the day-ahead prices and quantity that cleared
- Outputs occur by 4:00 p.m. (before operating day)
Market Timelines

Day-Ahead Market (DAM)

- DAM offer and bid period closes at 12:00
- Publish DAM LMPs, Schedules, and Constraints at 16:00

Real-Time Market (RTM)

- Re-Offer Period opens 16:00 – 18:00
- Reserve Adequacy Assessment (RAA)/Security Constrained Reliability Assessment (SCRA) complete for Operating Day at 22:00
- Continue to execute SCRA throughout the Operating Day
New England’s Electric Energy Markets

Real-Time Energy Market
Real-Time Energy Market

• Inputs – Reoffer Period between 4:00 - 6:00 p.m. (day before)
  – Actual system operating conditions
    • Metered load, generation, tie-line flows, etc.
    • Actual External Transactions

• Outputs
  – RT Hourly Commitment Schedules are produced after 6:00 p.m. (day before)
  – RT Dispatch signals are sent to generators (and dispatchable load) throughout the day (as often as five-minute updates)
  – RT hourly LMPs based on actual operating conditions
  – RT Settlement
    • Based on deviations between DA schedule and actual operations
Ancillary Services Markets

- Ancillary Services Market
  - Locational Reserve Markets
  - Regulation Market
Ancillary Services Markets

- Services that ensure the reliability and support of the transmission of electricity to serve load, including:
  - Locational Forward Reserve Market
    - Market for acquiring off-line operating reserves
  - Real-Time Reserves Market
    - Market for compensating operating reserves during real-time when supplies are limited
  - Regulation Market
    - Market for selecting and paying for generation needed to manage small changes in system electrical load
Ancillary Services Markets

- Ancillary Services Market
  - Locational Reserve Markets
  - Regulation Market
Ancillary Services Markets

*Forward Reserve Market*

- Compensates resources that will be used as operating reserves
  - Operating reserves are needed when there is a sudden loss of a large generator or a major transmission line during on-peak periods, both system-wide and in smaller load centered areas

- Without resources to replace this sudden loss, load would have to be shed to prevent a blackout
Ancillary Services Markets

Forward Reserve Market (cont.)

• Services procured
  – 10-minute non-spinning reserves (TMNSR) generally provided by resources not currently synchronized to the grid but capable of starting and providing output within 10 minutes
  – 30-minute reserves (TMOR) generally provided by resources not currently synchronized to the grid but capable of starting and providing output within 30 minutes
Ancillary Services Markets

*Real-Time Reserve Market*

- A market used to compensate resources that were used as operating reserves
  - Operating reserves are needed when there is a sudden loss of a large generator or a major transmission line during all periods
- Without resources to replace this sudden loss, load would have to be shed to prevent a blackout
- This market has no bids/offers and uses lost opportunity costs of reserve resources or penalty pricing to set the uniform clearing prices
Day-Ahead and Real-Time Energy Market

**Timelines**

**Day-Ahead Energy Market (DAM)**
- Offers and Bids submitted by Noon
- DAM LMPs and Schedules (4 PM)
- Participants submit DAM Bilateral Contracts.

**Real-Time Energy Market (RTM)**
- Dispatchable Imports/Exports
- Continuous RAA and Transmission Security
- Participants submit RTM Bilateral Contracts and Meter Readings.

Re-Offer Period 4 - 6 PM

OPERATING DAY -1
OPERATING DAY
OPERATING DAY +1
OPERATING DAY +2
Ancillary Services Markets

- Ancillary Services Market
  - Locational Reserve Markets
  - Regulation Market
Ancillary Services Markets

*Regulation Market*

• Regulation service, also known as automatic generation control (AGC), allows the system operator to physically balance supply and demand and maintain frequency as close to 60 Hz as possible

• Approved generators submit offers

• Area Control Error (ACE)
  – Measured every four seconds
  – Determines generation levels (increase or decrease output)
## Comparison of Physical and Reliability Needs to New England Market Tools

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<td>Electric Energy Market</td>
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## Wholesale Electricity Markets

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<td>The purchase and sale of electricity from generators to resellers (marketers and retailers), along with the ancillary services needed to maintain reliability and power quality at the transmission level.</td>
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<td>− FERC assures “just and reasonable” prices at the wholesale (production and transmission) level.</td>
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## Wholesale Competition

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<td>A system whereby a marketer or distributor of power would have the option to buy its power from a variety of power producers, and the power producers would be able to compete to sell their power to a variety of marketers and distribution companies.</td>
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Questions

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Find other information on our site: www.iso-ne.com/Support/Training/TrainingMaterials
Coming soon (anticipated by mid-June, 2011), web-based modules for Supply Resource and Demand Resource Operator Training courses recently held.