Business Models for Transactive Energy in the Wholesale Market

December 5, 2012

1:30 p.m. to 3:30 p.m.

Irving, Texas

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ISO New England

About ISO New England (ISO)

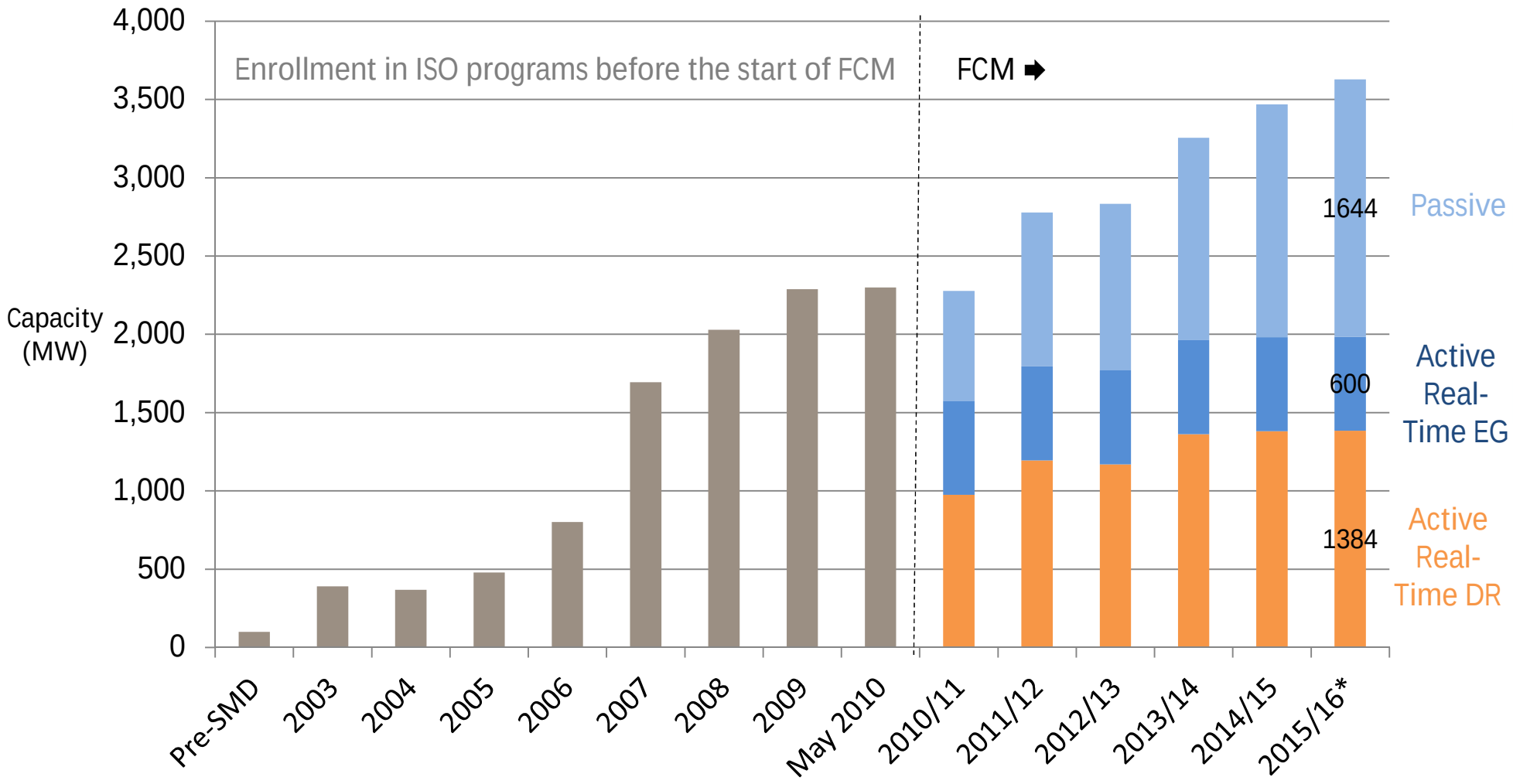
- Not-for-profit corporation created in 1997 to oversee New England's restructured electric power system
  - Regulated by the Federal Energy Regulatory Commission

- Regional Transmission Organization
  - Independent of companies doing business in the market
  - No financial interest in companies participating in the market

- Major responsibilities:
  - Reliable operation of the electric grid
  - Administer wholesale electricity markets
  - Plan for future system needs

Growth of Demand Resources in New England

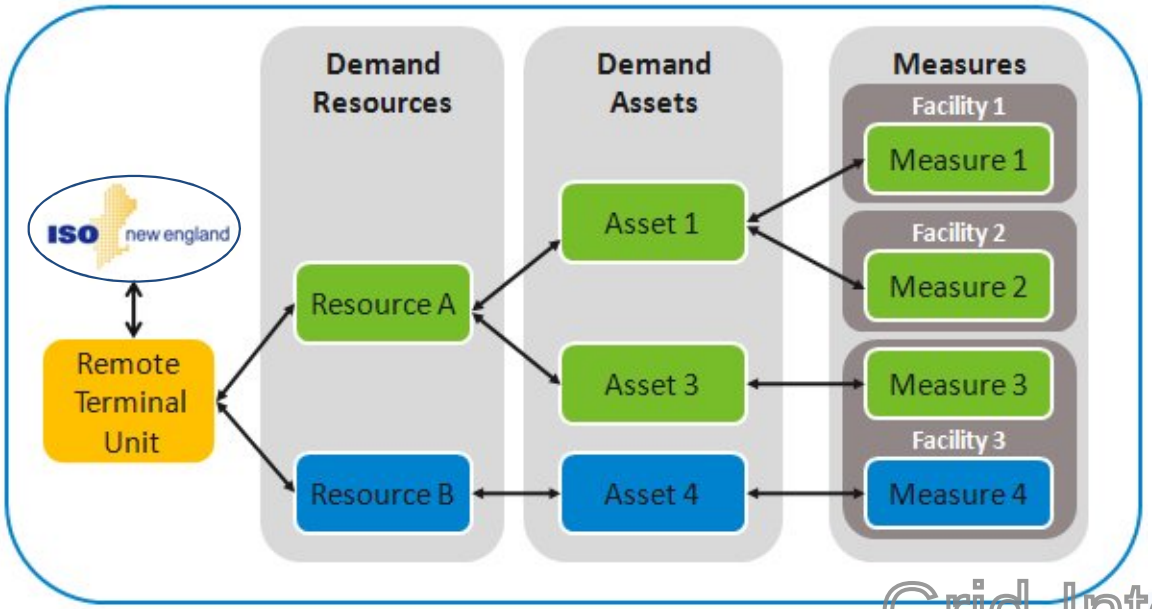
- Capacity market has stimulated growth in demand resources



2010/11–2015/16: Total DR cleared in FCAs #1 – #6; real-time emergency generation capped at 600 MW

Dispatch for Demand Resources

- ISO New England uses co-optimization (for energy and reserves) to dispatch most economic resource
  - Dispatch instructions for demand response originates with ISO
  - Received by the demand designated entity
- ISO dispatch software to the demand designated entity
  - Demand designated entity will communicate the interruption instructions to the end-user customer



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Energy Market Participation

- Demand reductions can receive energy payments in limited situations
  - Demand reduction offers submitted day ahead
  - Resources paid day ahead locational price when offer is economic (i.e. offer lower than cost of marginal unit)
  - Scheduled and paid real time locational price for difference between offered (scheduled) reduction and actual demand reduction
  - Offers at high prices clear in a limited number of hours, which helps prevent resource fatigue
- Demand reduction payments based on baseline
  - Baseline allows for accurate measurement of demand reductions
  - Baseline measures expected consumption absent demand reduction measures

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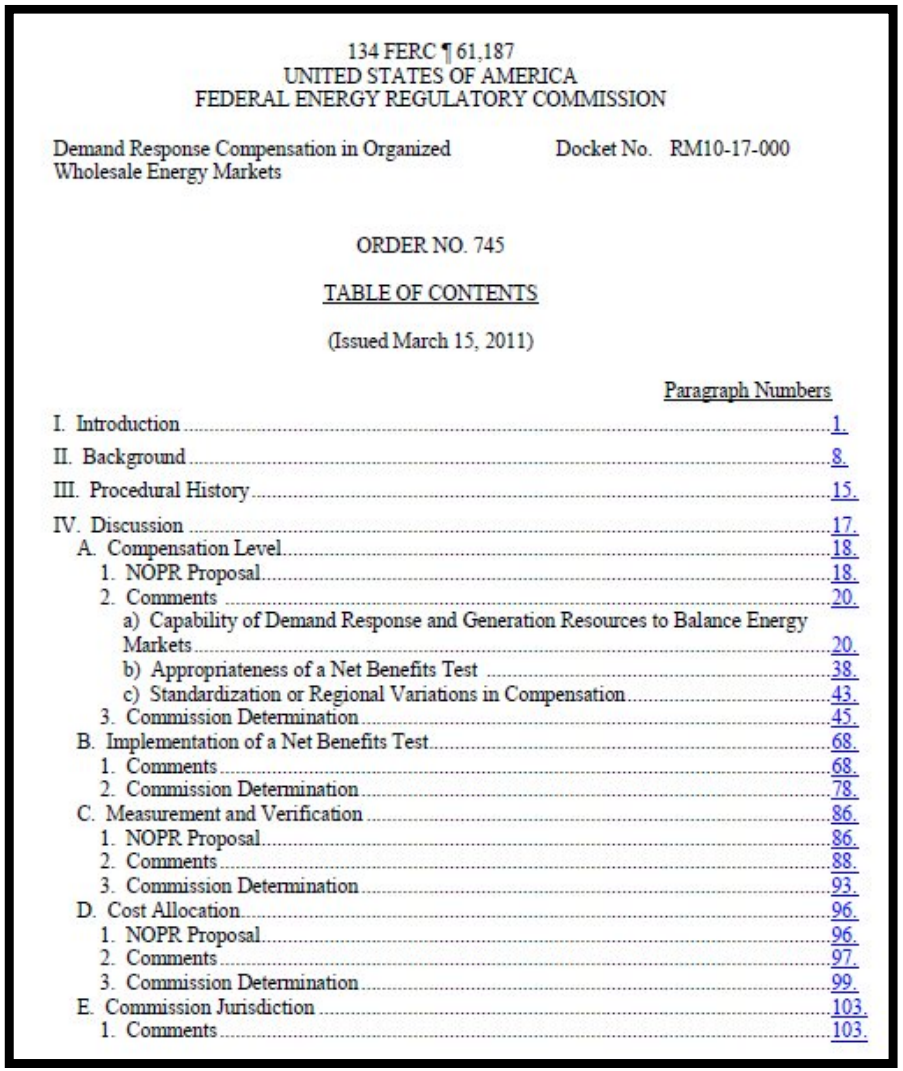
FERC Order 745

- Payment
  - Demand-response providers must be paid the full locational marginal price when:
    - Demand response resources have the capability to balance supply and demand; and
    - Payment when it is cost effective, as defined by a net-benefits test, to dispatch demand-response resources



134 FERC ¶ 61,187
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Demand Response Compensation in Organized Wholesale Energy Markets — Docket No. RM10-17-000

ORDER NO. 745

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Aggregators

- Aggregator of Retail Customers (ARC)
  - Curtailment Service Provider
  - Demand Response Provider
- ARCs recruit retail customers to be used as a resource to the market
  - Demand response
  - Receives payments from
    - Capacity Market
    - Energy Market
    - Ancillary Services Markets
  - Manages individual asset curtailment to meet dispatch instruction

ARCs do not:

- Purchase energy for retail consumer
- Have a load obligation

The Role of the Aggregator

Sign up retail customers for Demand Response

Manage customer loads (assets) to comply with ISO dispatch

ARC

Pay retail customers

Receives capacity, energy, and ancillary service payments

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Retail Energy Suppliers

- Retail Choice in New England
  - Most customers in New England can choose their retail energy supplier
  - Local distribution company is the provider of last resort
    - May have supply contracts to shift load obligation responsibility
- Retail Energy Suppliers
  - Have hourly load obligation in the wholesale market
  - Are charged by the ISO for energy consumed by their customers through combination of
    - Cleared Demand Bid x Day-Ahead LMP
    - (Real-Time Load – Cleared Demand Bid) x Real-Time LMP
    - Allocation of capacity and ancillary service charges
  - Can manage retail customer load to manage wholesale market charges

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Varying Roles of Aggregators and Suppliers

Demand Aggregators	Retail Energy Suppliers
Submit curtailment offers into energy markets	Meets load obligation through energy purchases, self-supply
Paid for cleared day-ahead and dispatched interruptions in real-time	Can use transactive energy management to incent customers in real-time to increase or decrease consumption
Manages individual asset curtailment to meet dispatch instruction	

Note: A company can fulfill one role, or both roles simultaneously with the same customers

Transactive Energy Management Techniques

- Allows Retail Energy Suppliers to:
  - Manage load in small time increments upon short notice
    - Increments can be less than the market settlement time period
  - Create value by
    - Reducing or increasing load obligation after final supply offers have been submitted
    - Arbitraging between Day-Ahead Market position and Real-Time Energy Market
    - Responding to short-term reductions or increases in self-supplied energy
- Provides incentives for customers to:
  - Increase real-time demand when prices are low
  - Reduce real-time demand when prices are high
  - Manage their retail energy bill

Expanding Opportunities for DR in New England

- Currently
  - Demand resources can sell load reduction capability in the FCM and receive payments comparable to generation resources
  - Opportunities for customers to purchase electricity from the wholesale energy market at wholesale energy prices
    - Deployment of advanced metering in New England currently limited, which limits this opportunity for most customers
- Long-Term Goal
  - Fully integrate demand response into energy, capacity, and ancillary markets
    - Provide comparability with Generation Resources
  - Support state efforts to encourage demand response through the implementation of advanced metering, monitoring/control infrastructure, dynamic retail rates

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