Capacity Markets

Lessons for New England from the First Decade

PRESENTED TO

Restructuring Roundtable
Capacity (and Energy) Market Design in New England

PRESENTED BY

Sam Newell

February 28, 2014

THE Brattle GROUP

Disclaimer

The contents of this document represent our understanding of various markets and analysis of market conditions. It is entirely based on our interpretation of publicly available information.

Nothing in this presentation should be interpreted as a prediction of future prices or market clearing results.

The Brattle Group does not accept any liability with respect to this presentation, any omissions concerning this presentation, any reliance that you may place on this presentation, or any representations (express or implied) made by The Brattle Group or concerning this presentation. The Brattle Group and its affiliates, and their respective principals, employees, directors, officers and agents will not accept liability under any theory for losses suffered, whether direct or consequential, arising from your reliance on the presentation, and cannot be held responsible if any conclusions drawn from the presentation or any explanations in relation thereto that are made should prove to be inaccurate.

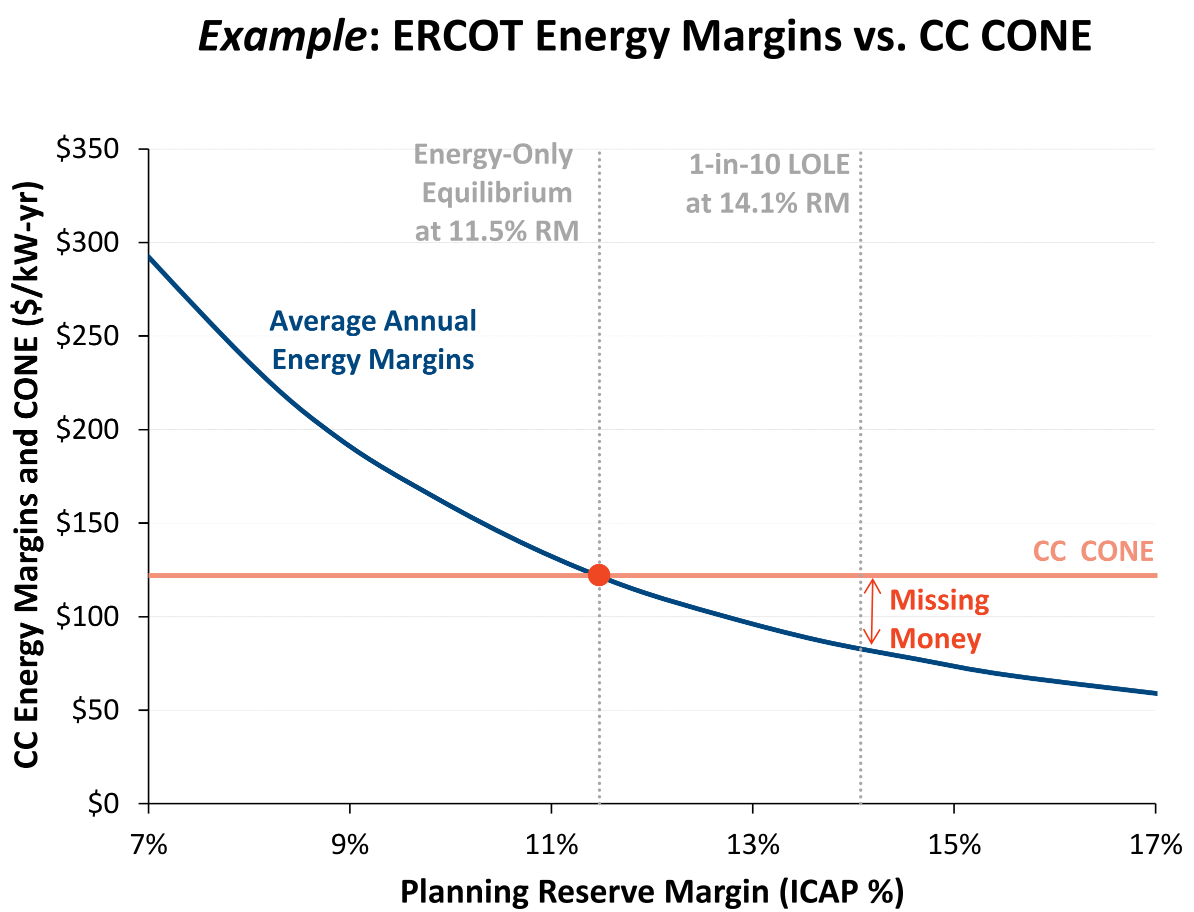
Agenda

- Why capacity markets?
- Regional overview/comparison
- Successes and challenges
- Takeaways for New England

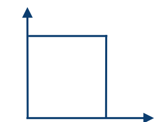
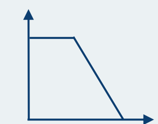
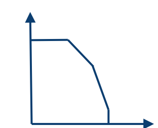
Why Capacity Markets?

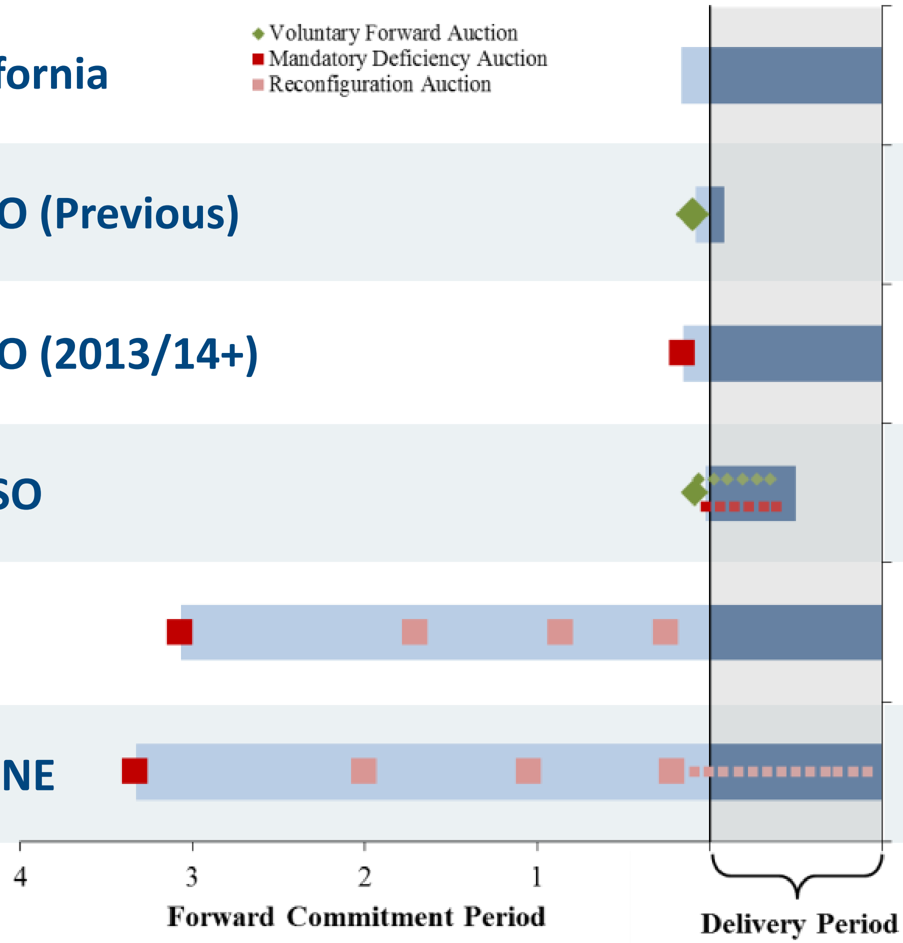
- **Capacity markets help meet resource adequacy requirements** in restructured markets, where resources are supplied by merchant investors rather than regulated entities
  - Load serving entities must buy enough capacity to meet their peak load + reserve margin (often with the RTO procuring on their behalf)
  - Resources compete to provide that capacity at least cost
  - Resources that "clear" are paid the capacity clearing price
- The price needed to clear the market is positive because energy margins are typically insufficient to attract enough resources to meet the target reserve margin. **This "missing money" has two causes**:
  - Energy prices may be below the true marginal system cost
  - Even if prices reflected the marginal system cost, an energy-only market would provide the economically optimal reserve margin, but this would likely be below the high levels mandated based on "1-in-10"; such high reserve margins depress energy prices, so an additional payment is needed

Why Capacity Markets?



Snapshot of U.S. Capacity Markets

	Forward Period	Procurement	Demand Curve
California		Bilateral	n/a
MISO (Previous)		Bilateral + Voluntary Auction	n/a
MISO (2013/14+)		Bilateral + Mandatory Auction	
NYISO		Bilateral + Voluntary & Mandatory Auctions	
PJM		Bilateral + Mandatory Auctions	
ISO-NE		Bilateral + Mandatory Auctions	TBD soon



Summary of Successes

- **Meeting resource adequacy objectives**
  - All markets in surplus or balance (but started w/excess)
  - PJM forward market cleared sufficient supply despite 10% of the fleet retiring
- **Competition among resource types has lowered the cost**
  - Retention of existing capacity
  - Surprising amount of entry of DR, uprates, and imports
  - Need for costly new generation was deferred
- **Proven ability to support merchant generation entry**
  - Large amounts of new merchant CCs in PJM
  - Some merchant entry in NYISO and now ISO-NE

PJM Entry

Response to Exceptional Scale of Retirements

- 10% of generation fleet retiring from MATS and NJ HEDD and low gas prices
- Impressive market response maintaining resource adequacy

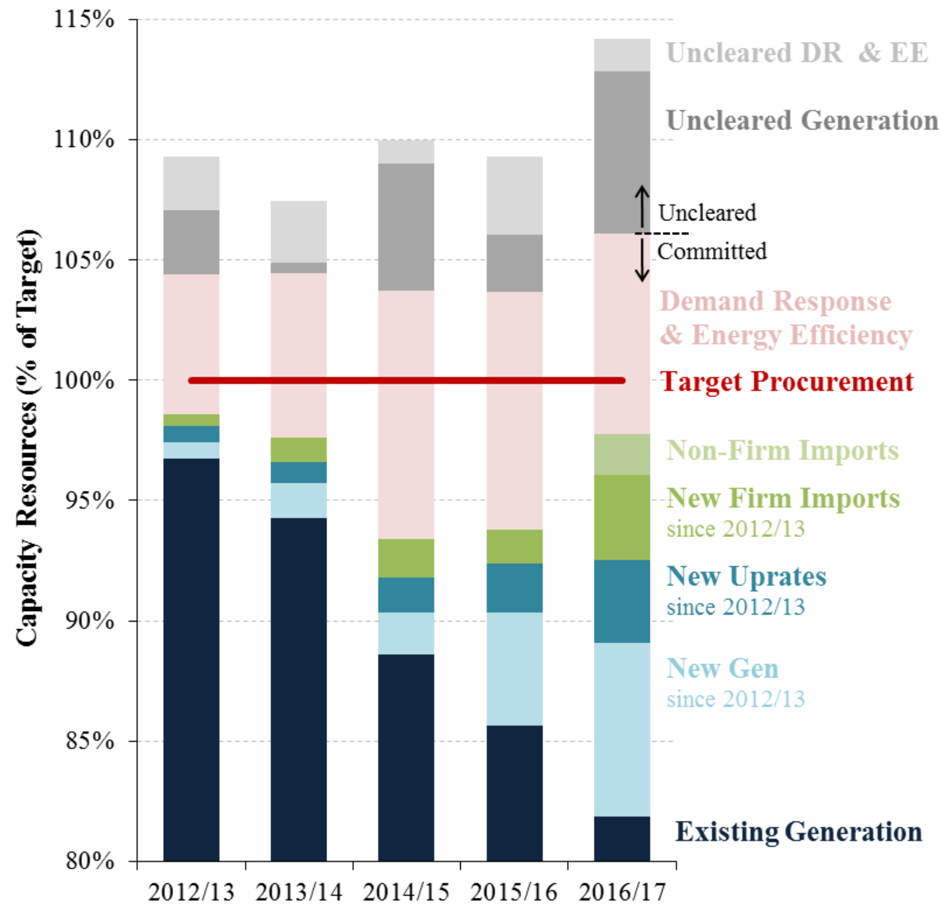
Entry of Merchant Generation

- Approximately 9,300 UCAP MW of new gas CCs cleared over two years, representing a commitment to build (5,400 MW merchant)

High Reliance on DR

- DR at 9.9% of peak load in 2015/16, but then declining; next auction will restrict Limited DR
- Declining gen reserve margin, increased DR calls, and improved scarcity pricing should mean higher energy prices
- Implementation of scarcity pricing rules esp. when deploying DR is key

PJM Committed Capacity



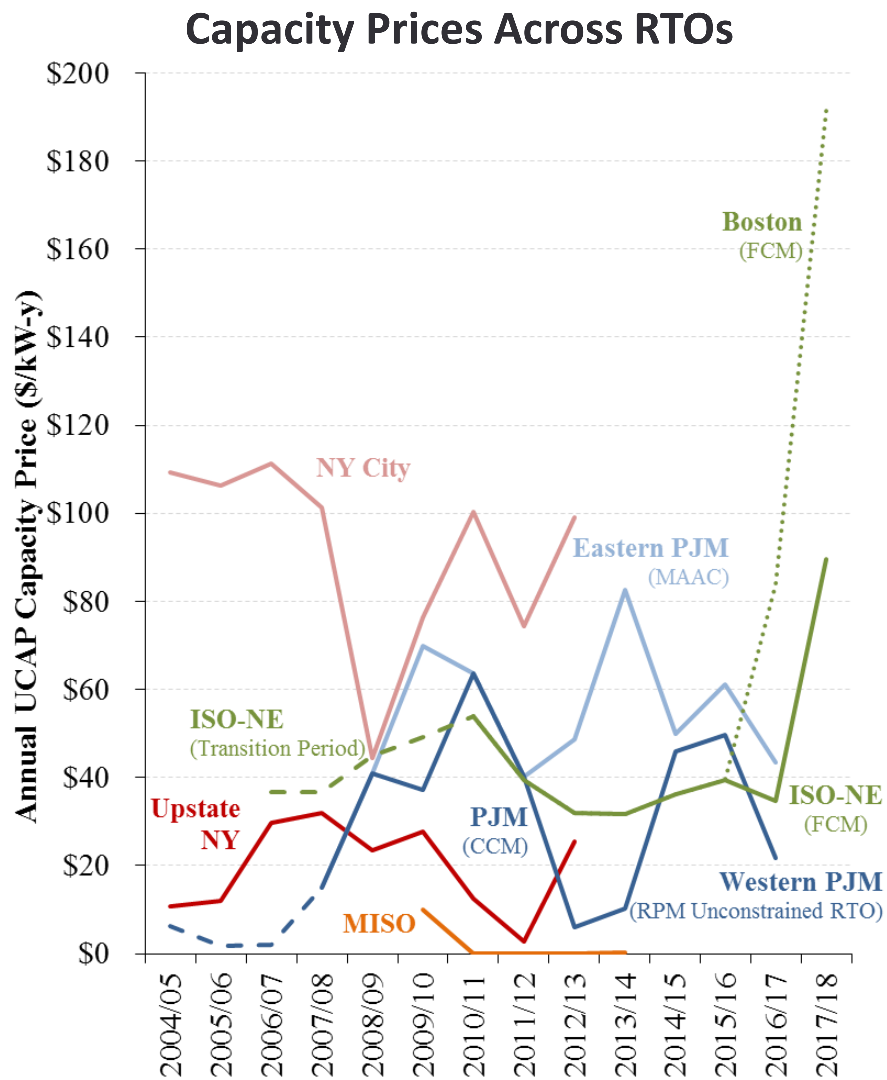
Sources: BRA results and parameters. *Brattle* 2011 RPM Review.

Summary of Challenges

- **Price Volatility**
- **Tension Between Planning and Markets**
- **Ongoing Refinements of Design Elements**
  - Demand curves
  - Performance incentives/penalties
  - Accommodating large amounts of DR: reliability value; relationship to scarcity prices
  - Transmission constraints
- **Fundamentals Challenges**
  - Fuel adequacy challenges: best to address through changes to energy and A/S markets or refinements to capacity market products?
  - Ongoing retirements

Price Volatility and Uncertainty are a Concern

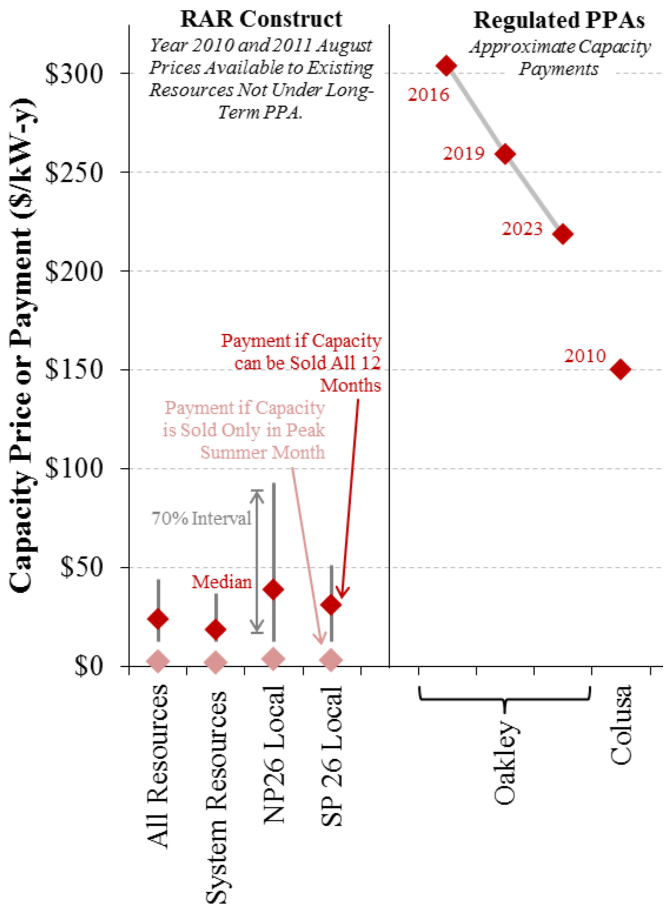
- **Price volatility and uncertainty** are a big concern in restructured markets without substantial forward bilateral contracting
- **Several contributing factors**:
  - Market Fundamentals – efficient result to have prices move with fundamentals, but the markets are structurally volatile due to steep supply and demand curves
  - Rule Changes – one-time design changes contribute to volatility, but impacts not persistent
  - Ongoing Administrative Uncertainties – uncertain administrative parameters are an ongoing concern (e.g. load forecast, Net CONE, transmission limits)
- **New England prices** were initially more stable only because of the price floor



Tension: Mixing Regulated and Market Constructs

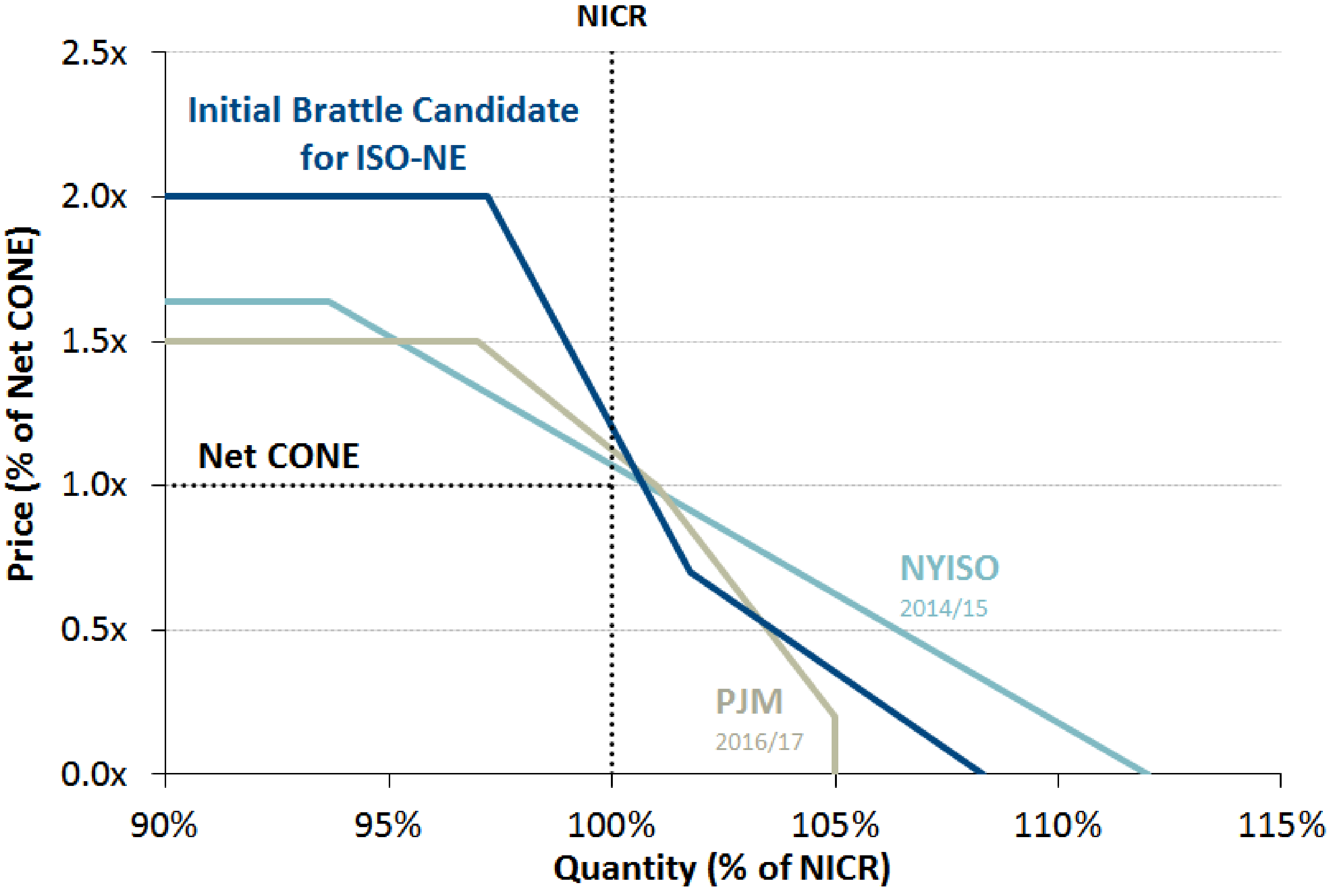
- How can merchant entry co-exist with regulated planning?
- In Eastern Markets:
  - If merchant entry is needed for resource adequacy even after self-supply, prices will need to be at merchant Net CONE in long-run average
  - Requires effective MOPR, but potential inefficiency if applied too broadly (e.g. merchants without incentive to manipulate prices)
  - Recent DC Court rulings to cancel NJ and MD contracts may have broader implications (appeals may be pending)
- In MISO and California:
  - Bifurcated capacity markets where new units enter under long-term contracts (existing paid far less)
  - Some options exist for enabling primarily-regulated regions to benefit from competition in capacity markets (e.g. to attract low-cost merchant DR & uprates), but strong opposition from state regulators

California: Capacity Price Differentials



See: Pfeifenberger, Spees, & Newell. (2012). *Resource Adequacy in California: Options for Improving Efficiency and Effectiveness.*

Demand Curves Can Reduce Volatility



Notes:

Other RTO curves are the system-wide curves drawn as a function of the 1-in-10 reliability requirement and Net CONE of their respective markets. PJM's curve is drawn before the subtraction of the 2.5% deduction for short-term resource procurements.

Status of Current Issues by Region

	MISO	PJM	NYISO	ISO-NE	CAISO
Demand Curves	• IMM/merchants propose sloping • Others oppose due to quantity risk	• Recent CONE dispute • Added safeguard to prevent price cap collapse • Triennial review	• Recent dispute over reference technology	• Demand curve to be filed in April	• Not applicable
MOPR	• No MOPR (FERC now re-reviewing in response to generator/IMM concerns)	• Effective MOPR but still tweaking (strict but narrowly targeted)	• Recent litigation	• Concerns that it is too broadly applied (e.g. to renewables and small self-supply)	• Not applicable • MOPR is one reason CPUC and IOUs are wary of capacity market
Demand Response and Scarcity Pricing	• High reserve margins means fewer calls/scarcity events for now	• Multiple DR products; new cap on "Limited" • Increasing reliance on DR creating more calls, scarcity pricing being tested	• Increasing DR calls highlighting importance of scarcity mechanism & effective E&A/S integration	• Strict DR energy offer rules (along with PI) may squeeze some DR out of FCM	• No mechanism for enabling merchant DR in capacity
Retirements	• Large risks from MATS, but little forward transparency of price or quantity	• 25,000 MW of retirements from MATS and NJ HEDD (15% of fleet)	• Potential Indian Point retirement	• ~3,000 retiring	• 16,000 MW to retire or reinvest in next decade from once-through-cooling
Other	• Tension between IRP and market	• Worry about "non-firm" resources: imports, planned gen and DR	• New Hudson capacity zone	• Performance incentives; concerns about fuel adequacy	• Tension between IRP and market • Flexible resource requirements

Takeaways for New England

- Demand curve will help reduce volatility, susceptibility to market power, and recognize some incremental value of capacity
- Performance incentives will have some effects similar to scarcity pricing in the E&AS markets, but fundamentally changes nature of capacity obligation
- Tension between regulated and merchant entry likely to continue; current question is about enabling exemptions for renewables

Additional Reading

- Newell, Spees, Pfeifenberger, Karkatsouli, “Estimating the Economically Optimal Reserve Margin in ERCOT,” January 2014.
- Peifenberger, Spees, “Resource Adequacy Requirements: Reliability and Economic Implications,” September 2013.
- Spees, Newell, Pfeifenberger, “Capacity Markets: Lessons Learned from the First Decade,” *Economics of Energy & Environmental Policy.* Vol. 2, No. 2. Fall 2013.
- Pfeifenberger, Spees, Newell, “Resource Adequacy in California: Options for Improving Efficiency and Effectiveness,” October 2012.
- Newell, Spees, Pfeifenberger, Mudge, DeLucia, Carlton, “ERCOT Investment Incentives and Resource Adequacy,” June 2012.
- Pfeifenberger, Newell, “Trusting Capacity Markets: Does the Lack of Long-Term Pricing Undermine the Financing of New Power Plants?” *Public Utilities Fortnightly.* December 2011.
- Pfeifenberger, Newell, Spees, Hajos, Madjarov, “Second Performance Assessment of PJM’s Reliability Pricing Model: Market Results 2007/08 through 2014/15,” August 26, 2011.
- Newell, Spees. (2013) “Get Ready for Much Spikier Energy Prices: The Under-Appreciated Market Impacts of Displacing Generation with Demand Response.” February 2013.
- Spees, Newell, Carlton, Zhou, Pfeifenberger, “Cost of New Entry Estimates for Combustion Turbine and Combined-Cycle Plants in PJM,” August 24, 2011.
- Pfeifenberger, Spees, “Evaluation of Market Fundamentals and Challenges to Long-Term System Adequacy in Alberta’s Electricity Market,” April 2011 (Original Study), and March 2013 (Update).
- Newell, Spees, Hajos, “The Midwest ISO’s Resource Adequacy Construct: An Evaluation of Market Design Elements,” *The Brattle Group*, January 19, 2010.
- Hesmondalgh, Pfeifenberger, Robinson, "Resource Adequacy and Renewable Energy in Competitive Wholesale Electricity Markets,” BIEE, September 2010.
- Pfeifenberger, Spees, “Best Practices in Resource Adequacy,” PJM Long Term Capacity Issues Symposium, January 27, 2009.
- LaPlante, Chao, Newell, Celebi, Hajos, “Internal Market Monitoring Unit Review of the Forward Capacity Market Auction Results and Design Elements,” ISO New England and *The Brattle Group*, June 5, 2009.
- Newell, Bhattacharyya, Madjarov, “Cost-Benefit Analysis of Replacing the NYISO’s Existing ICAP Market with a Forward Capacity Market," *The Brattle Group*, June 15, 2009.
- Pfeifenberger, Spees, Schumacher, “A Comparison of PJM's RPM with Alternative Energy and Capacity Market Designs,” *The Brattle Group*, September 2009.
- Pfeifenberger, Newell, Earle, Hajos, Geronimo, “Review of PJM's Reliability Pricing Model (RPM),” June 30, 2008.

Presenter Information

SAM NEWELL
Principal | Cambridge, MA
sam.newell@brattle.com
+1.617.234.5725

Dr. Samuel Newell's expertise is in the analysis and modeling of electricity markets, the transmission system, and RTO rules. He supports clients in regulatory, litigation, and business strategy matters involving wholesale market design, contract disputes, generation asset valuation and development, benefit-cost analysis of transmission enhancements, the development of demand response programs, and integrated resource planning. He frequently provides testimony and expert reports to RTOs, state regulatory commissions, and the FERC.

Dr. Newell earned a Ph.D. in technology management and policy from the Massachusetts Institute of Technology, an M.S. in materials science and engineering from Stanford University, and a B.A. in chemistry and physics from Harvard College.

About the Brattle Group

The Brattle Group provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governmental agencies worldwide.

We combine in-depth industry experience and rigorous analyses to help clients answer complex economic and financial questions in litigation and regulation, develop strategies for changing markets, and make critical business decisions.

Our services to the electric power industry include:

- Climate Change Policy and Planning
- Cost of Capital
- Demand Forecasting Methodology
- Demand Response and Energy Efficiency
- Electricity Market Modeling
- Energy Asset Valuation
- Energy Contract Litigation
- Environmental Compliance
- Fuel and Power Procurement
- Incentive Regulation
- Rate Design and Cost Allocation
- Regulatory Strategy and Litigation Support
- Renewables
- Resource Planning
- Retail Access and Restructuring
- Risk Management
- Market-Based Rates
- Market Design and Competitive Analysis
- Mergers and Acquisitions
- Transmission

Offices

NORTH AMERICA

Cambridge

New York

San Francisco

Washington, DC

EUROPE

London

Madrid

Rome