



2007 Assessment of the Electricity Markets in New England

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Introduction

- Potomac Economics serves as the Independent Market Monitoring Unit (“IMMU”) for the ISO New England. In this role, we:
 - ✓ Work closely with the Internal Market Monitoring to review market outcomes and conduct on an ongoing basis; and
 - ✓ Periodically evaluate the competitive performance, design, and operation of the wholesale markets operated by ISO New England.
- This presentation summarizes our assessment of New England’s wholesale power market in 2007. We address two primary areas:
 - ✓ The prices and operation of the market; and
 - ✓ The competitive performance of the market.
- In addition to our findings in these two areas, we also present recommendations for potential improvements in the ISO’s markets.



Introduction

- The current wholesale electricity markets began operation in March 2003.
- ISO New England has made enhancements to the markets and introduced new markets for other products that have improved market performance.
- ISO New England's markets currently include:
 - ✓ *Day-ahead and real-time energy*: coordinates commitment and dispatch of the region's generation and demand resources, and facilitate energy trading;
 - ✓ *Financial Transmission Rights ("FTRs")*: allows participants to hedge the congestion costs associated with delivering power over the network;
 - ✓ *Forward and real-time operating reserves*: ensures that sufficient resources are available when an outage or other contingency occurs;
 - ✓ *Regulation*: allows the ISO to instruct specific units to increase or decrease output moment-by-moment to balance system supply and demand; and
 - ✓ *Forward Capacity Market ("FCM")*: intended to provide efficient long-term market signals to govern decisions to invest in new generation and demand resources and to maintain existing resources.

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Benefits of the ISO New England Markets

The ISO New England markets produce substantial savings in the following areas.

- Daily commitment of generation: Coordinated commitment of generation through the day-ahead market produces savings relative to the prior decentralized system by:
 - ✓ Reducing the quantity of generation that is committed; and
 - ✓ Ensuring that the most economic generation is committed.
- Efficient dispatch and congestion management: Total dispatch costs are reduced by:
 - ✓ Producing energy from the most economic supply and demand resources;
 - ✓ Employing the lowest cost redispatch options to manage congestion; and
 - ✓ Much fuller utilization of the transmission capability in the region.
- Reliability: Reliability is improved because the 5-minute dispatch provides much more responsive and accurate control of power flows on the transmission system versus Transmission Line Loading Relief procedures ("TLR") relied on previously.
- Price Signals: The prices produced by the energy market provide a transparent economic signal to guide short and long-run decisions by participants and regulators.

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Summary of Findings and Conclusions

Competitive Assessment:

- We found that the markets performed competitively in 2007 with little evidence that suppliers withheld resources to raise market prices.
- However, we did find that a supplier in Boston with units needed for local reliability engaged in conduct that resulted in substantial increases in Net Commitment Period Compensation (“NCPC”) payments in 2007.
- Our report includes a recommendation to modify the mitigation measures to more effectively address conduct that raises NCPC payments.

Prices and Market Operations

- In general, the day-ahead and real-time markets operated efficiently in 2007 with prices that reflected underlying market fundamentals.
- Although energy prices increased in 2007, it was due primarily to the increases in fuel prices and demand.
- To maintain reliability, the ISO has taken appropriate actions make supplemental commitments after the day-ahead market. However, these commitments increase NCPC costs and reduce market efficiency.
- The ISO has made a number of changes in its market rules and worked with participants to address the underlying reasons for the supplemental commitments.

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Recent Market Enhancements

- The ISO made several market enhancements since late 2006, including:
 - ✓ Adding local requirements to the forward reserve market;
 - ✓ Introducing of real-time reserve markets with local requirements that are co-optimized with the energy market; and
 - ✓ Implementing a forward capacity market that procures capacity three years ahead to facilitate the efficient entry of new supply and demand resources.
 - The first auction was conducted successfully in February 2008 to meet the capacity requirements for June 2010 through May 2011.
- These changes are important because markets that are consistent with the ISO’s reliability needs will reduce manual actions by the operators, reduce uplift costs, and improve the economic signals produced by the market.
- The improvement in economic signals should reduce New England’s heavy reliance on reliability agreements (used to ensure that units needed for reliability remain in operation).
 - ✓ Reliability agreements are poor substitutes for transparent market prices and do little to facilitate efficient investment in new resources.

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Prices and Market Operations

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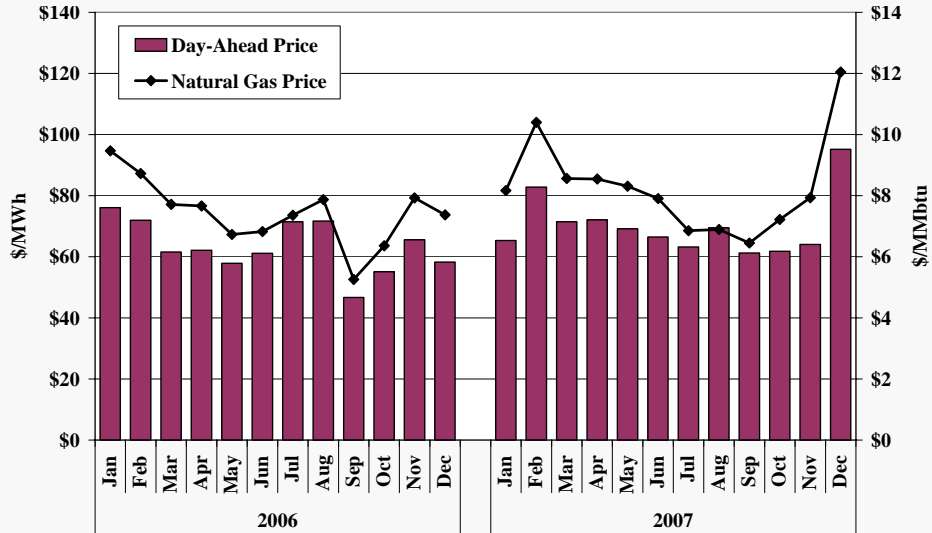


Energy Prices

- The first figure shows the average day-ahead price at the New England Hub and the average natural gas price for each month in 2006 and 2007.
 - ✓ Overall, energy prices increased by more than 10 percent from 2006 to 2007, primarily due to increases in natural gas and oil prices.
 - ✓ Energy are closely correlated with natural gas prices.
- The correlation between natural gas prices and energy prices indicates a well-performing market because fuel costs are the vast majority of most units' marginal costs and gas-fired units frequently set the market price.
- The Implied Marginal Heat Rate isolates changes in electricity prices that are not related to the changes in natural gas prices.
 - ✓ During the summer, power prices rise due to higher demand levels.
- Shortage pricing did not occur for significant periods in 2007 as peak demand levels were considerably lower in 2007 than in 2006.
 - ✓ The peak demand was 26.2 GW in 2007, compared to 28.0 GW in 2006.



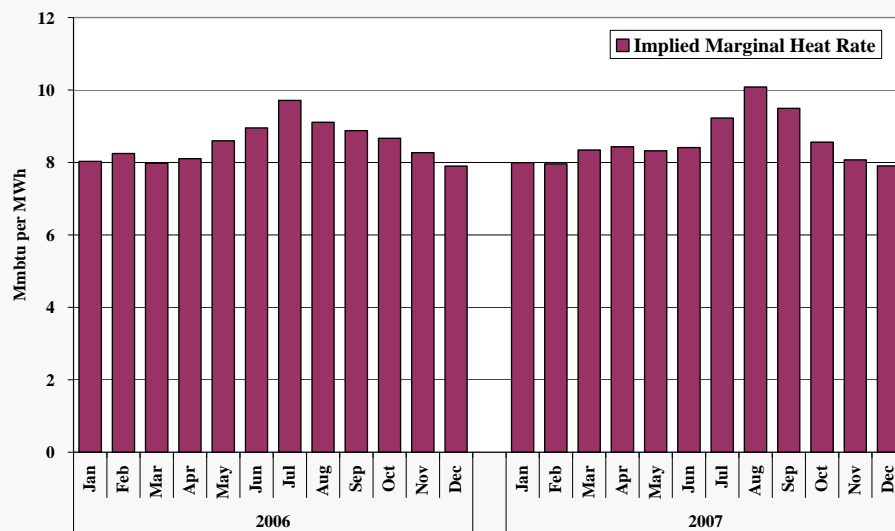
Day-Ahead Electricity and Natural Gas Prices 2006 & 2007



Note: The electricity prices are load-weighted averages.



Implied Marginal Heat Rate 2006 & 2007





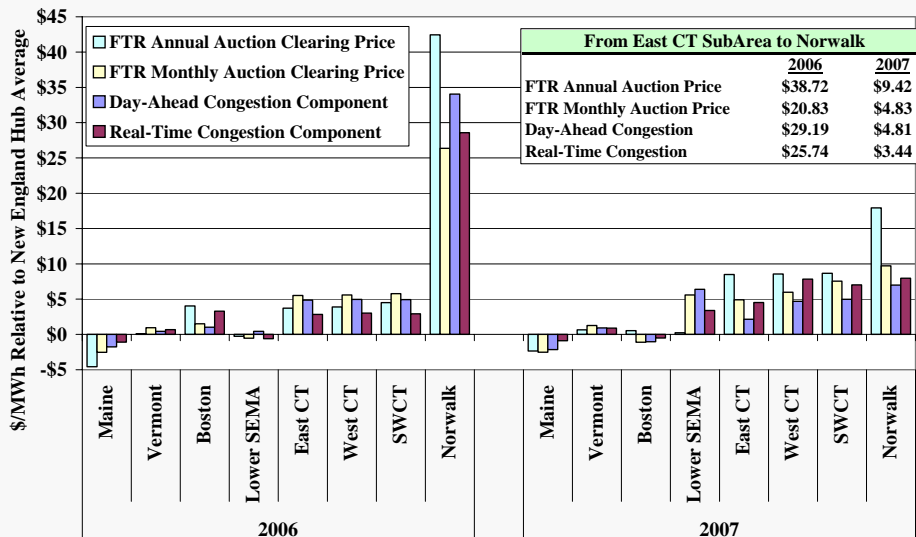
Congestion in New England

- The following figure shows day-ahead and real-time congestion at various locations, as well as the FTR prices corresponding to those areas.
- Under SMD, New England has experienced relatively little congestion in most historically-constrained areas. Our analysis shows:
 - ✓ Norwalk-Stamford became less congested in 2007 due a transmission project and the expiration of the Peaking Unit Safe Harbor (“PUSH”) offer rules.
 - ✓ Lower Southeast Massachusetts (“Lower SEMA”) exhibited congestion since the ISO began to model the Lower SEMA interface in late 2006.
 - ✓ Boston congestion declined in 2007 due to the transmission additions in the spring of 2007 and conduct that led to substantial excess capacity.

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Congestion and FTR Auction Prices Peak Hours in 2006 & 2007



Note: Prices Shown Relative to New England Hub

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Financial Transmission Rights

- The ISO operates annual and monthly markets for FTRs.
- FTRs are invaluable in a locational energy market because they allow participants to hedge the congestion costs on the network.
- Efficient FTR markets should cause prices to reflect rational expectations of regarding congestion patterns.
- Our analysis of FTR prices indicates:
 - ✓ FTR prices were consistent with the congestion that prevailed in the energy markets in 2007.
 - ✓ The consistency of FTR prices and congestion improved from the annual auction to the monthly auctions.
 - This is expected because participants gain additional information about market and system conditions after the annual auction.
 - ✓ Overall, these results indicate that the FTR markets are liquid and performing well.

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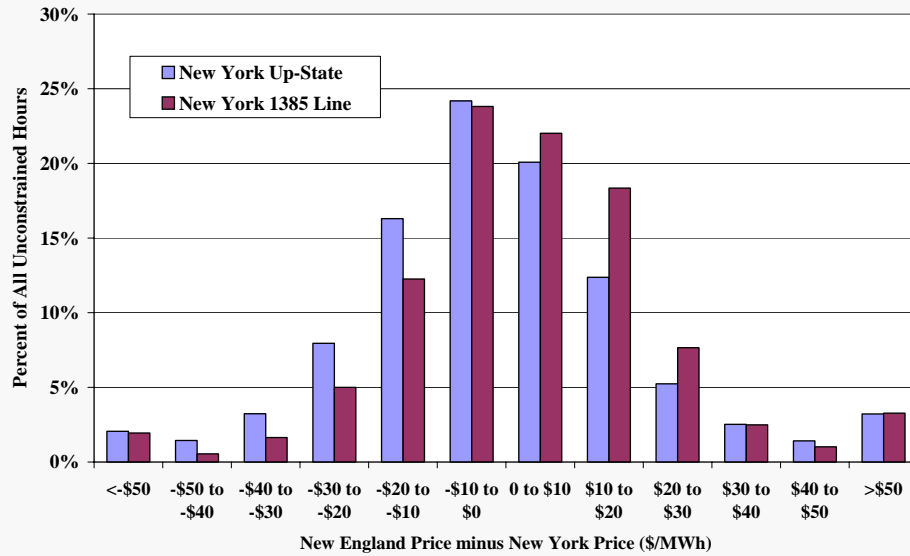
Imports and Exports

- External transactions are scheduled with Quebec, New Brunswick and New York. Power is usually imported from Quebec and New Brunswick, rising in peak hours and falling in off-peak hours consistent with hydro operations.
- New England and New York are connected by three interfaces.
 - ✓ Exports are consistently scheduled across two small interfaces from Connecticut to Long Island (averaging 270 MW in 2007).
 - ✓ Power flows in both directions on the large interface between the areas (285 MW exported in peak hours and 200 MW imported in off-peak hours).
- The following figure indicates that prices have not been well arbitrated during non-transmission constrained periods.
 - ✓ However, uncertainty and long scheduling lead times have prevented participants from fully utilizing the interfaces with New York.
 - ✓ Explicit coordination of the physical interchange of power between the markets is needed to achieve efficient utilization of the interfaces.
- The following table shows our estimates of the savings of full utilization of the interfaces -- \$83 million over the past two years. These savings will rise sharply as the frequency of shortages increase.

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Real-Time Price Differences Between NE and NY Unconstrained Hours, 2007



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Estimated Benefits of Interchange Coordination Between New York and New England, 2006 & 2007

	2006	2007
Estimated Production Cost Net Savings (in Millions)	\$17	\$21
Estimated Consumer Net Savings (in Millions):		
New England Customers	\$61	\$22
New York Customers	\$59	\$177
Total for New England and New York Customers	\$120	\$199
During Reserve Shortage Hours	\$16	\$75

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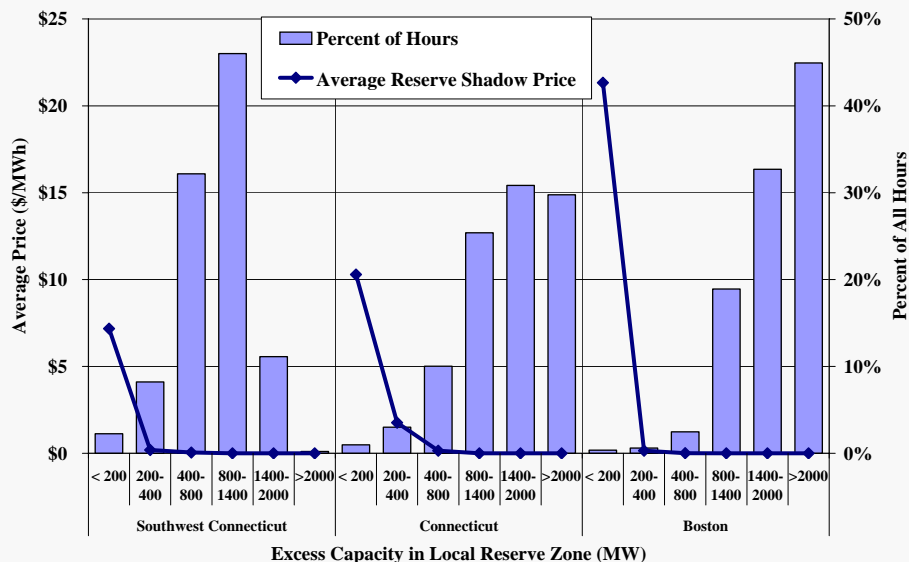
Real-Time Reserve Markets

- In October 2006, the ISO made enhancements that better enable the wholesale market to meet the reliability needs of the system:
 - ✓ Local requirements were added to the forward reserve market, and
 - ✓ Real-time reserve markets with local requirements that are now co-optimized with the real-time energy market.
- Real-time reserve clearing prices were low in 2007 – \$0/MWh in most hours for all types of reserves and averaged below \$1/MWh.
- The following figure shows the strong correlation between the local reserve clearing price and the amount of local excess capacity.
 - ✓ Substantial excess capacity was generally usually available in the local reserve zones.
 - ✓ Hence, it is important that the Reserve Adequacy Assessment (used to commit units for reliability) minimizes any unnecessary commitments.
- The report includes a number of recommendations that should improve the performance of the reserve markets.

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Excess Capacity and Reserve Prices in Reserve Zones 2007



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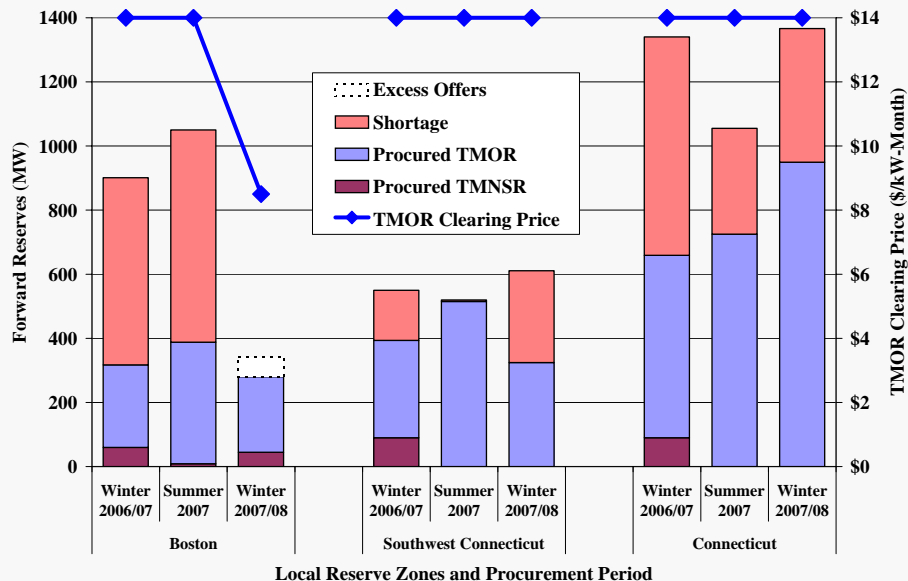
Forward Reserve Market

- We evaluate the results of the first three forward reserve auctions, which are summarized in the following two figures.
 - ✓ In the local areas, prices generally cleared at the \$14,000/MW-month price cap since supply was not sufficient to meet the local requirements.
 - ✓ Outside the local areas, outcomes varied more significantly.
 - In the first auction, TMNSR and TMOR cleared at the same price;
 - In later auctions, the TMNSR price cleared well above the TMOR price.
- If there had not been a separate ROS TMOR requirement, TMOR prices would have cleared at \$0 outside the local areas.
- The single price cap of \$14,000 for all reserve products has raised the following incentive issues.
 - ✓ Suppliers with 10-minute reserves are selling 30-minute reserves because there is no incremental revenue for selling higher-quality reserves.
 - ✓ Suppliers with reserves in narrower constrained areas (e.g., SW Connecticut) have the incentive to sell their reserves in broader areas (e.g., Connecticut).
- We recommend changes in the cap to address this issue.

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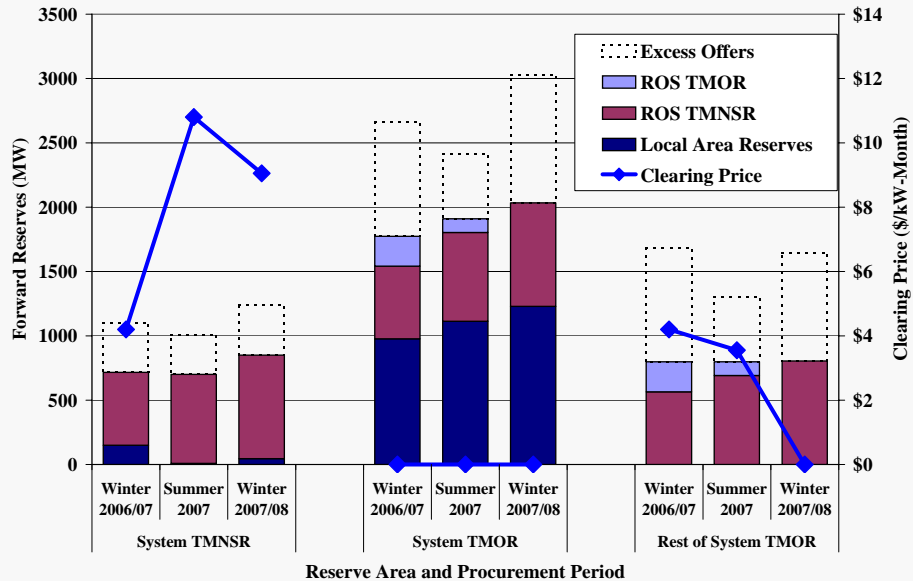
Forward Reserve Auctions for Local Areas Procurement for October 2006 to May 2008



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Forward Reserve Auctions Outside Local Areas Procurement for October 2006 to May 2008



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Regulation Market

- Regulation expenses increased substantially after a new market design was deployed in October 2005 due to:
 - ✓ Reduced supply of regulation capability in late 2005,
 - ✓ Higher natural gas prices, and
 - ✓ Issues associated with the new market design.
- Our 2006 assessment of the New England markets provides a detailed and discussion of these issues, as does the 2006 Annual Markets Report by the Internal Market Monitor.
- Regulation expenses decreased in 2006 as additional supply entered the market and decreased further in 2007 after the design issues were addressed.
- There are likely significant benefits that could be achieved by allowing the real-time market to co-optimize energy, regulation, and operating reserves.

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Real-Time Market Performance

- Efficient real-time prices (particularly during shortages) are important because they encourage competitive scheduling by suppliers, participation by demand response, and investment in new resources when and where needed.
- We evaluated five aspects of the real-time market pricing and dispatch:
 1. *Price Corrections*: very infrequent, even after the significant changes to the market software to implement the real-time reserve markets in October 2006.
 2. *Real-Time Pricing of Fast-Start Resources*: Real-time prices do not always reflect the full costs of deploying fast-start resources due to their inflexibilities.
 3. *Real-Time Pricing During Transmission Scarcity*: Local shortages can arise when resources are not sufficient to manage congestion into an area. Changes are recommended to improve pricing during these conditions.
 4. *Real-Time Pricing During Demand Response Activation*: Demand response has surged from 530 MW in Jan. 2006 to 1684 MW in Jan. 2008. Although these resources provide substantial benefits, they will need to set real-time prices to avoid undermining real-time market signals during shortages.
 5. *Ex Ante and Ex Post Pricing*: ISONE re-calculates prices after each interval (ex post pricing) rather than using the prices produced by the real-time dispatch model. We find that this: a) biases prices upward slightly in uncongested areas, and b) periodically distorts the value of congestion into constrained areas.

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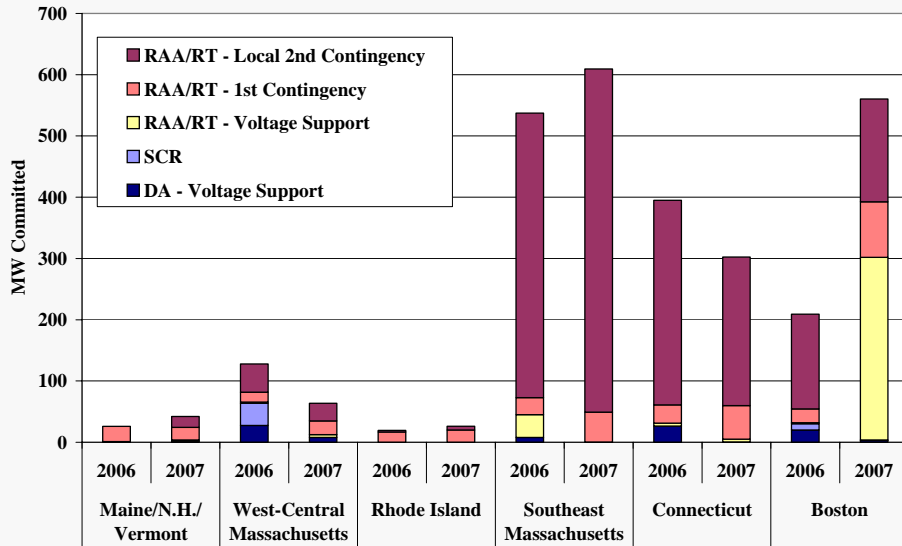
Supplemental Commitments

- When the wholesale market does not meet all of these requirements, the ISO will commit additional generation. These commitments increase uplift costs and affect real-time prices.
- The following figure summarizes commitments for local reliability, which increased from a daily average of 1,310 MW in 2006 to 1,600 MW in 2007.
 - ✓ In Boston, the large supplier caused its units to be committed less in the day-ahead market, compelling the ISO to make more supplemental commitments.
 - This issue has been resolved because the ISO was able to modify its local reliability requirements for Boston after new transmission was added.
 - ✓ In Lower SEMA, one large unit continues to be committed for local reliability protection of the Cape Cod area.
 - Transmission upgrades planned for 2009 should substantially reduce the frequency of these commitments and the resulting uplift costs.
 - ✓ Recommended mitigation changes should reduce uplift costs associated with these commitments.
- Although supplemental commitments increased in 2007, total local reliability costs decreased \$325 million as reliability agreements expired.

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Commitment for Local Reliability by Zone Daily Peak Hour, 2006 & 2007



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Uplift Costs for Reliability 2006 & 2007

Category of Uplift	Millions of Dollars	
	2006	2007
Reliability Agreement		
Connecticut	\$223	\$115
Boston	\$194	\$3
Other Areas	\$65	\$25
Local Second Contingencies		
Connecticut	\$60	\$35
Boston	\$33	\$22
Southeast Massachusetts	\$85	\$108
Other Areas	\$3	\$4
Special Case Resources	\$9	\$2
Voltage Support	\$19	\$46
Other (Mostly Local First Contingencies)	\$25	\$29
Total	\$715	\$390

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Competitive Assessment

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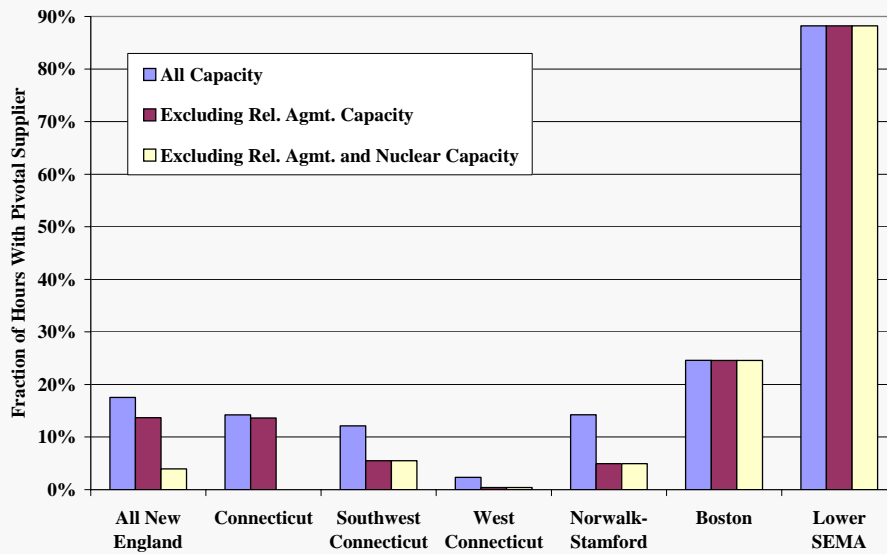


Structural Indicators of Market Power

- The competitive assessment includes structural assessments of market power in New England and evaluations of participant conduct.
- We use a pivotal supplier analysis to identify conditions under which a supplier may have market power – a supplier is “pivotal” when energy and operating reserve needs cannot be satisfied without the supplier.
- The following two figures summarize the pivotal supplier analyses for 2007, which shows:
 - ✓ The largest suppliers in most areas are pivotal in a large number of hours.
 - ✓ However, when we account for the large amounts of nuclear capacity and the mitigating effects of reliability agreements, we find:
 - A pivotal supplier in SEMA in 88 percent of hours, and in Boston in 25 percent of hours.
 - ✓ The second figure shows that suppliers become substantially more pivotal in most areas as load rises.
 - ✓ The mitigation measures effectively address market power in these areas.
- Market power will be a more significant concern in Connecticut once the large quantity of reliability agreements begin to expire.



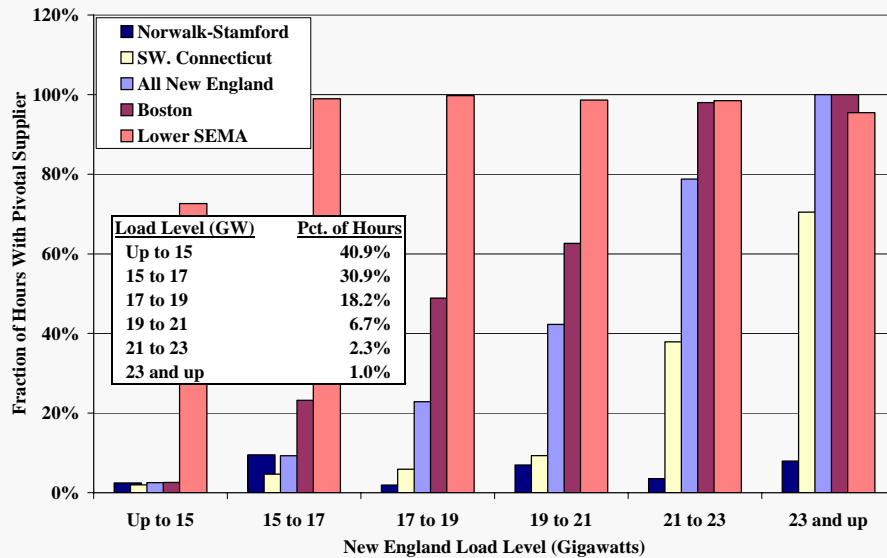
Frequency of Pivotal Suppliers by Region 2007



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Pivotal Supplier Frequency by Load Level Excl. Capacity Under Reliability Agmts, 2007



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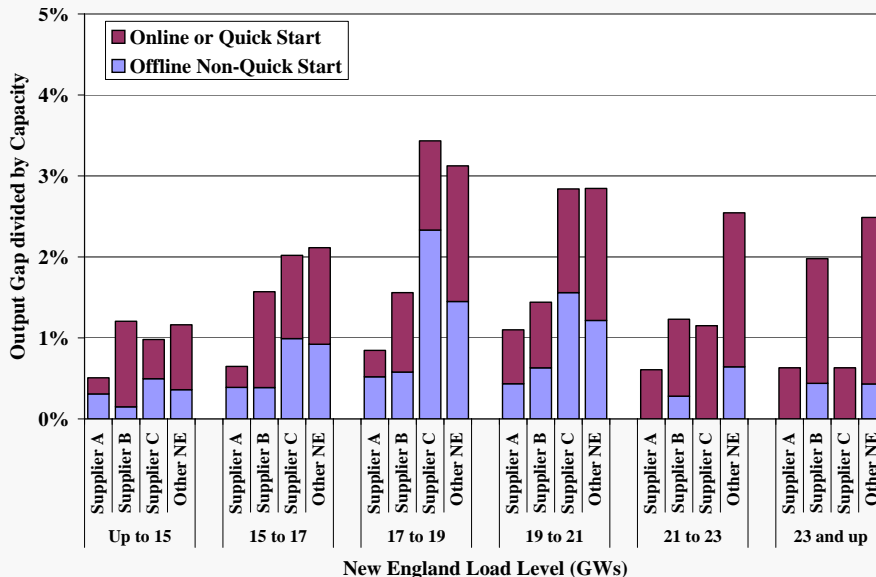
Competitive Assessment: Evaluation of Withholding

- The competitive assessment examines market participant behavior to identify potential exercises of market power through:
 - ✓ Economic withholding (i.e., raising offer prices to reduce output and raise prices or uplift costs); or
 - ✓ Physical withholding (i.e., reducing the claimed capability of a resource or falsely taking a resource out of service).
- The next two figures summarize our analyses, showing our results by load level for the largest suppliers in New England all others. They showing:
 - ✓ Indicators of potential withholding are relatively low and do not increase under the highest load conditions (which would raise competitive concerns); and
 - ✓ The conduct of the largest suppliers is not substantially different than other smaller suppliers;
 - ✓ Our report shows similar results for load pockets where the pivotal supplier analysis indicated there was significant potential for local market power.
 - ✓ Based on these results and the ongoing monitoring we performed over the year, we find little evidence of attempts to exercise of market power in 2007.

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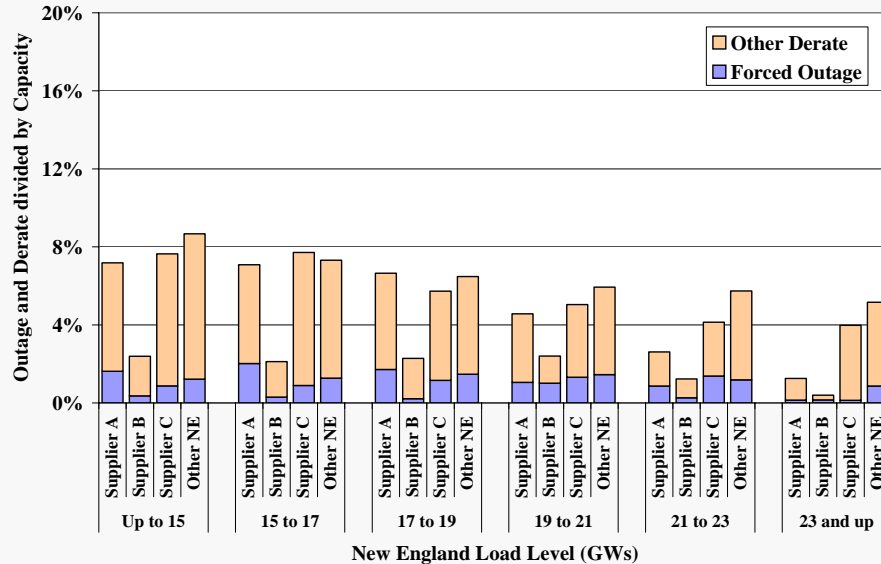
Average Output Gap by Load Level 2007



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Forced Outages and Deratings 2007



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Local Market Power

- While there is no substantial evidence that suppliers withheld capacity to raise prices, suppliers can also exercise market power by raising NCPC payments they receive when they are committed for local reliability.
 - ✓ Conduct described above that occurred in the Boston area substantially increased NCPC payments.
- We have been coordinating the Internal MMU to evaluate of the criteria used to mitigate offers that increase NCPC payments.
 - ✓ We agree that the mitigation criteria for conduct affecting NCPC should be tightened, particularly in chronically constrained areas that routinely require supplemental commitments.
- A proposal to address this issue should be presented later this year.

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List of Recommendations

Energy Pricing and Market Design

1. Evaluate potential pricing changes that would allow the costs of fast-start units to be more fully reflected in the real-time prices.
2. Develop rules for allowing demand response resources to set prices when they are needed to avoid a shortage.
3. Consider replacing the current ex post pricing process with one that would utilize ex ante prices for settlement.
4. Consider providing generators with additional flexibility to modify their offers closer to real-time to reflect changes in marginal costs.

Ancillary Services Markets

5. Set the local RCPFs at levels that are more consistent with the costs incurred to meet the local-area reserve requirements.
6. Create additional local reserve zones in the real-time market to satisfy the local reliability requirements more efficiently.
7. Consider whether the “Rest of System” TMOR requirement is necessary in the forward reserve market.

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List of Recommendations

Ancillary Services Markets (continued)

8. Consider replacing the forward reserve market’s current price cap with a tiered price cap to recognize higher-value classes and locations of reserves.
9. Evaluate the benefits of moving to a regulation market that is co-optimized with the energy and ancillary services markets.

System Operations

10. Consider changes in rules or cost allocation to discourage self-commitment when it leads to inefficient supplemental commitments.
11. Develop provisions to explicitly coordinate the physical interchange between New York and New England in real-time.
12. Discontinue use of the relaxation algorithm for violated transmission constraints -- set penalty factors that reflect the value of constraints and allow them to determine LMPs when a constraint is violated.

Market Power Mitigation

13. Modify the mitigation criteria to address inflated NCPC payments to suppliers whose units are frequently needed for local reliability.

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