Highlights of the 2009 Annual Report on the ISO New England Markets

David B. Patton, Ph.D.

Potomac Economics
External Market Monitor

June 22, 2009

Introduction

- Potomac Economics serves as the External Market Monitor ("EMM") for the ISO New England. In this role, we:
  - ✓ Evaluate and report on the competitive performance and operation of the wholesale markets operated by ISO New England; and
  - ✓ Identify and recommend necessary changes to existing and proposed market rules, tariff provisions and market design elements.
  - ✓ Evaluate the quality and appropriateness of mitigation by the Internal Market Monitor.
- This presentation summarizes our assessment of New England's wholesale power markets in 2009. 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 production from the region's generation and demand resources, and facilitate wholesale 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 a contingency occurs;
  - ✓ *Regulation:* allows the ISO to instruct specific units to adjust 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.

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 re-dispatch 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 than the previous Transmission Line Loading Relief procedures ("TLR").
- Price Signals: The prices produced by the energy and capacity markets provide a transparent economic signal to guide short and long-run decisions by participants and regulators.

Highlights of Market Performance in 2009

- We found that the markets performed competitively in 2009. Our analyses identified no significant competitive concerns that suppliers withheld resources to raise market prices.
- In general, the day-ahead and real-time markets operated efficiently in 2009, producing prices that reflected underlying market fundamentals.
  - ✓ Energy prices fell by almost 50 percent in 2009, due primarily to the sharp decline in natural gas prices of 52 percent.
  - ✓ The close correspondence of energy prices and natural gas prices in New England demonstrates of the competitiveness of ISO New England’s markets.
- Significant transmission upgrades in Connecticut and Southeast Massachusetts were completed in 2009. These upgrades led to:
  - ✓ Sharply reduced congestion in these areas; and
  - ✓ Reductions in uplift charges from reliability agreements and supplemental commitment for local reliability of almost $250 million in 2009.
  - ✓ Less frequent supplemental commitment led to:
    - A substantial reduction in surplus online capacity, reflecting more efficient commitment and system operations; and
    - More frequent operation of fast-start generation, reflecting that peaking resources are needed more often when the ISO operates with a thinner margin in real-time.

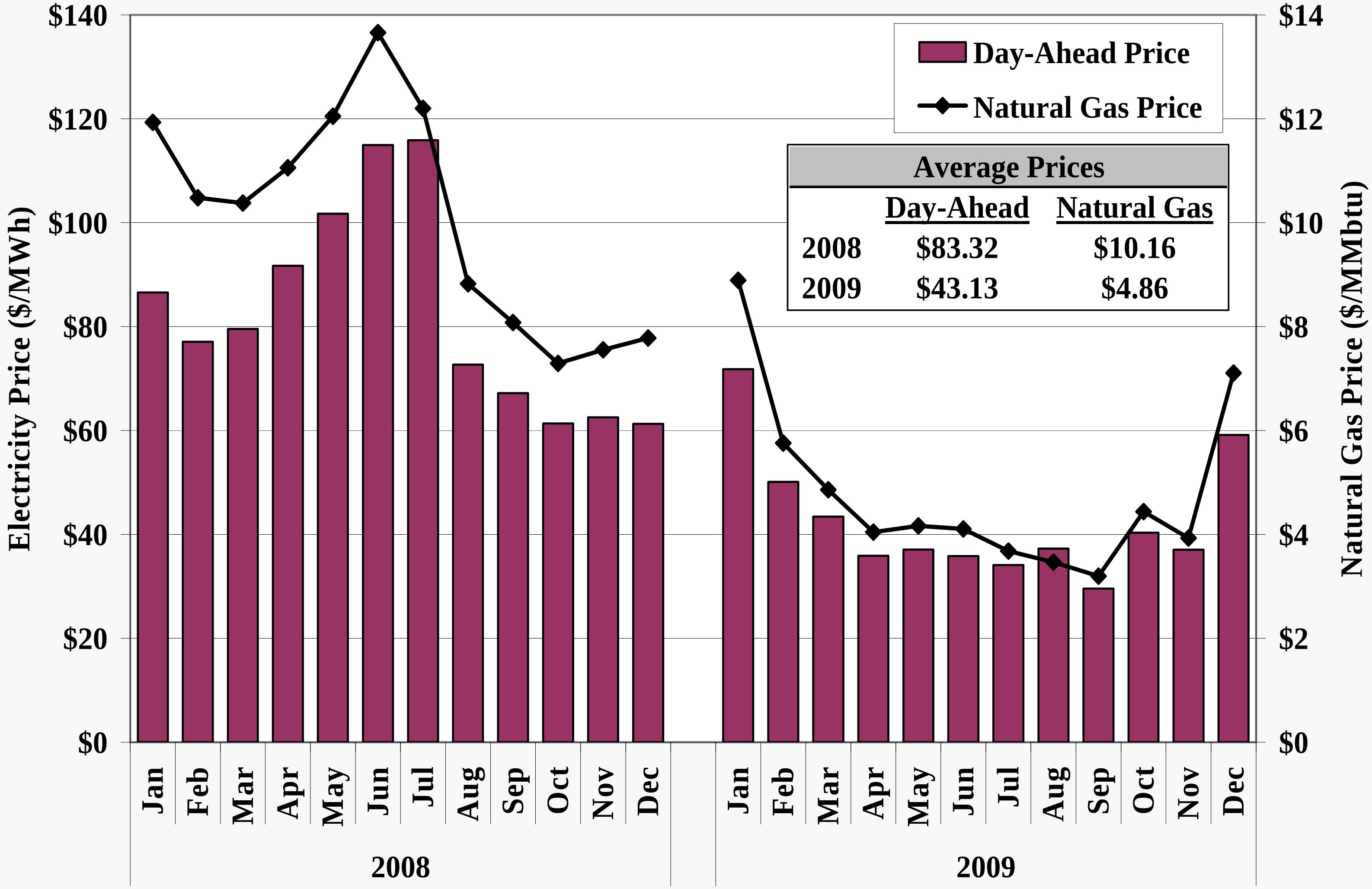
Prices and Market Operations

POTOMAC ECONOMICS

Energy Prices

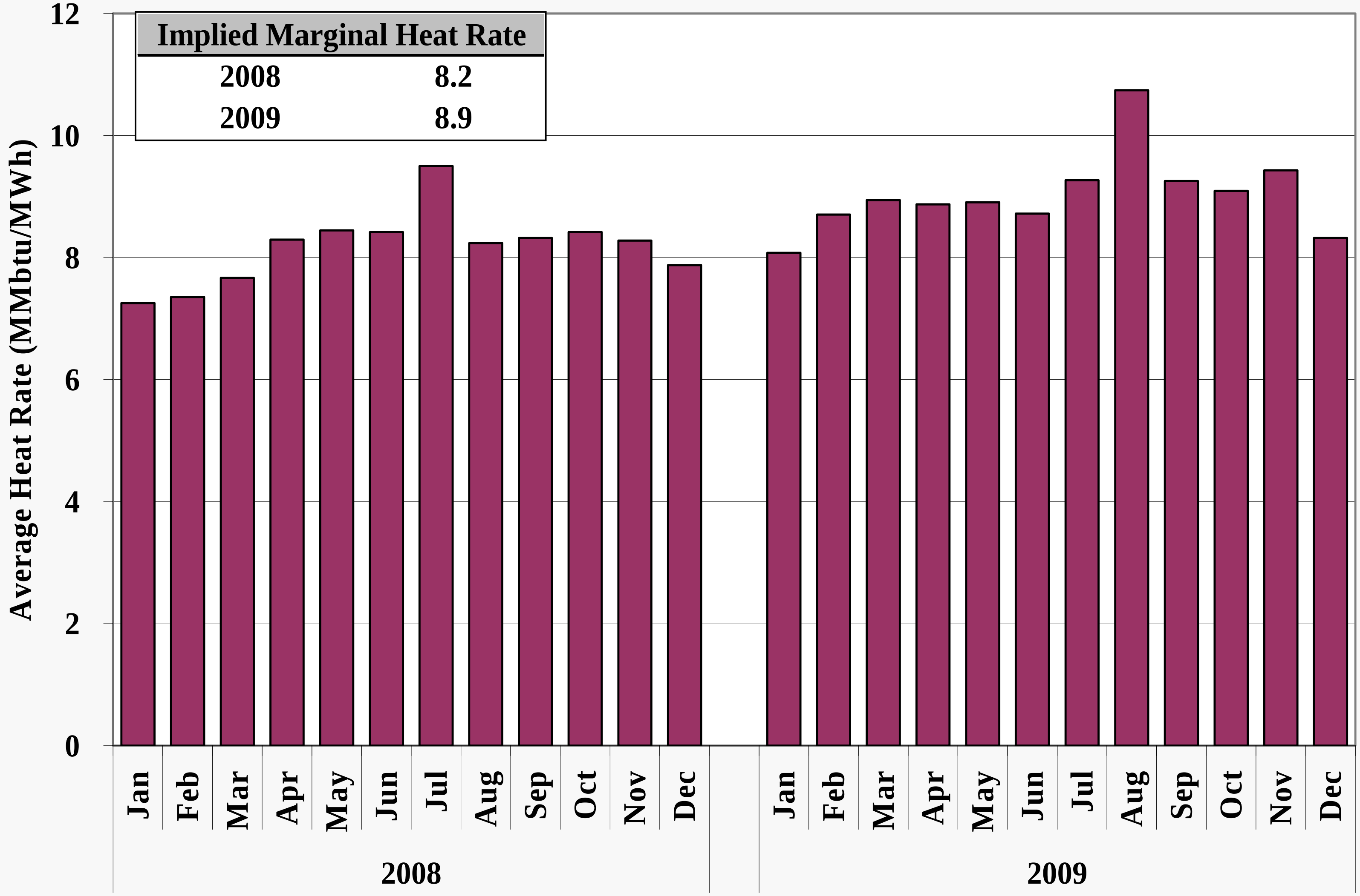
- The first figure shows the average day-ahead price at the New England Hub and the average natural gas price for each month in 2008 and 2009.
  - ✓ Overall, electricity prices fell 48 percent from 2008 to 2009, primarily due to a 52 percent decrease in natural gas prices.
  - ✓ Because fuel costs constitute the vast majority of the marginal costs of most generation, lower fuel costs translate to lower offer prices and market clearing prices in a well-functioning, competitive market.
- The Implied Marginal Heat Rate shown in the second figure 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.
  - ✓ The average implied heat rate rose from 2008 to 2009, due to:
    - Substantially lower natural gas prices. Since some of the generation costs are not related to fuel, the implied heat rate rises as fuel prices fall;
    - The cost of RGGI-compliance obligations; and
    - More frequent real-time price spikes from the reduction in surplus capacity.
- There were no significant capacity deficiencies in 2009 as the peak demand level (25.3 GW) was much lower than summer 2009 forecast (27.9 GW).

Day-Ahead Electricity and Natural Gas Prices
2008 & 2009



Note: The electricity prices are load-weighted averages.

Implied Marginal Heat Rate
2008 & 2009



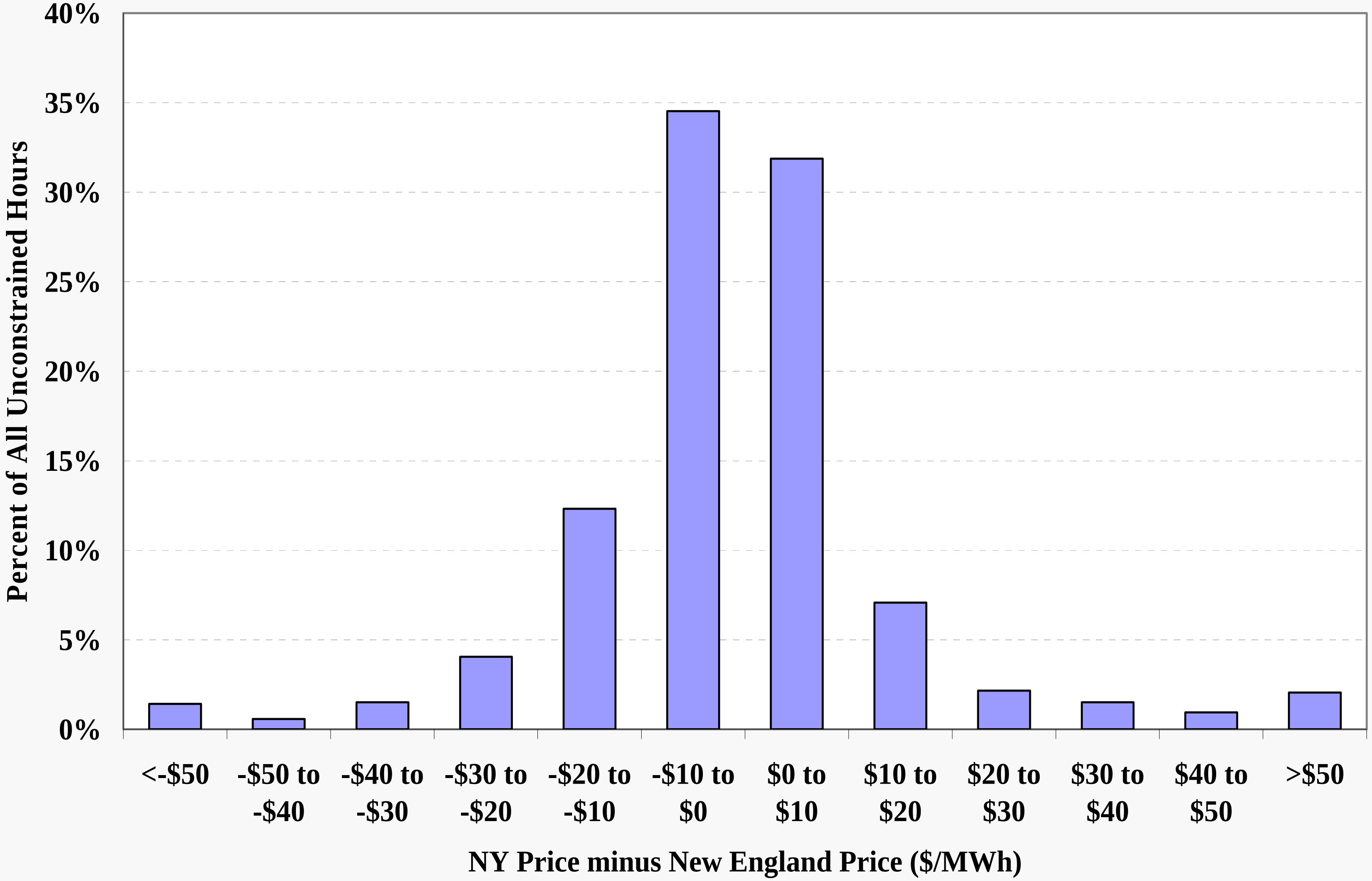
Congestion and Financial Transmission Rights

- New England experienced very little congestion into historically import-constrained areas.
  - ✓ Congestion revenues collected by the ISO from the day-ahead and real-time markets fell 79 percent from $121 million in 2008 to $25 million in 2009.
- Transmission upgrades completed in 2009 significantly reduced congestion into Lower SEMA and Connecticut.
  - ✓ Most notably, the average congestion price difference between the Hub and Lower SEMA in the day-ahead market fell from more than $10 per MWh in 2008 to less than $1 per MWh in 2009.
- The sharp reduction in natural gas prices also contributed to lower congestion since redispatch costs are generally highly correlated with fuel prices.
- FTRs allow participants to hedge congestion costs. Efficient FTR markets should cause prices to reflect rational expectations of congestion patterns.
  - ✓ Annual FTR prices generally over-estimated the congestion that prevailed in the energy markets in 2009, suggesting that participants may not have fully anticipated the effects of transmission upgrades on the congestion pattern.
  - ✓ The consistency of FTR prices and congestion improved from the annual auction to the monthly auctions as participants gain additional information.

External Interface Scheduling

- 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 310 MW in 2009).
  - ✓ Power flows in both directions on the large interface between the areas (averaging 200 MW of exports in peak hours and 102 MW of imports in off-peak hours).
- The following figure shows the distribution of real-time price differences between New England and up-state New York during non-transmission constrained periods.
  - ✓ The current process does not fully utilize the primary interface with New York.
  - ✓ Explicit coordination of the physical interchange of power between the markets is needed to achieve efficient utilization of the interface.
- We employed simulations to estimate the benefits of optimal hourly scheduling of the primary interface between New England and New York from 2006 to 2009.
  - ✓ The following table shows that the optimal utilization of the interface would have saved an annual average of $43 million for New England consumers over the four years. The savings would rise significantly if the frequency of shortages increases.

Real-Time Price Differences Between NE and NY
Unconstrained Hours in 2009



Estimated Benefits of Coordinated Interface Scheduling
Interface Between Upstate NY and NE, 2006 – 2009

	2006	2007	2008	2009	Average
Estimated Production Cost Net Savings (in Millions)	$17	$21	$19	$10	$17
Estimated Consumer Net Savings (in Millions):					
New England Customers	$61	$22	$25	$64	$43
New York Customers	$59	$177	$127	$65	$107
Total for New England and New York Customers	$120	$199	$152	$129	$150
During Reserve Shortage Hours	$16	$75	$31	$13	$34

Forward Reserve Market

- The ISO operates a forward reserve market on a seasonal basis. We evaluated the results of recent forward reserve auctions and found that:
  - ✓ In Connecticut, prices cleared at the $14/kW-month price cap in the two auctions in 2009 since supply was insufficient to meet the local requirements.
  - ✓ In Boston, prices cleared at the same level as Rest Of System in 2009 because recent transmission upgrades allowed the local requirement to be satisfied with External Reserve Support.
  - ✓ Outside local areas, TMOR cleared at $0/kW-month and TMNSR price cleared between $6 and $7/kW-month in both auctions in 2009.
- The single price cap of $14 for all reserve products has raised the following incentive issues.
  - ✓ Suppliers with 10-minute reserve capable units in Connecticut have the incentive to sell 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 to the price cap to address these incentive issues.

Real-Time Reserve Markets

- In addition to a forward reserve market, the ISO operates a real-time reserve market to meet the reliability needs of the system:
  - ✓ Reserves are scheduled with local requirements and co-optimized with the real-time energy market.
  - ✓ Reserve prices are set at the level of RCPFs during reserve shortages.
- Real-time reserve clearing prices for all reserve products were low in 2009, equaling $0/MWh in 98 percent of hours and averaging well below $1/MWh.
  - ✓ This is not unexpected because the economic commitments facilitated by the day-ahead market has generally resulted in surplus reserves in the local areas.
  - ✓ However, local reliability commitment decreased in the second half of 2009, leading to less surplus online capacity and higher reserve clearing prices.
    - – Average clearing prices increased to $1.80/MWh for TMSR and $1.50/MWh for TMNSR in the last quarter of 2009.
- In local reserve zones, the reserve requirements were rarely binding in 2009. This was largely due to transmission upgrades that have significantly reduced local reserve requirements.

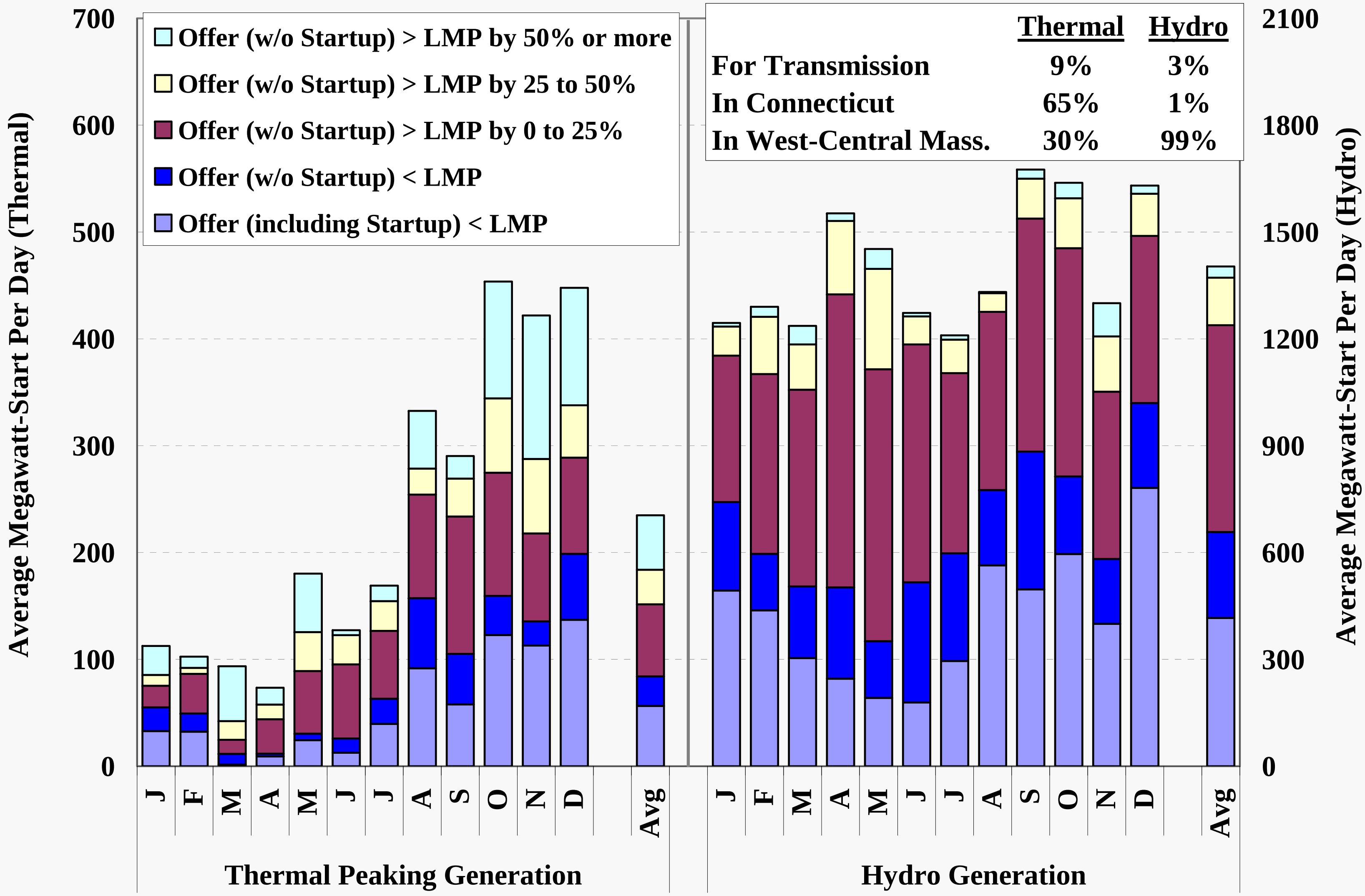
Real-Time Market Performance

- Efficient real-time prices (particularly during shortages) are important because they encourage competitive scheduling by suppliers, participation by demand response resources, and investment in new resources when and where needed.
- We evaluated five aspects regarding the real-time market pricing and dispatch:
  1. *Price Corrections*: very infrequent, which reduces uncertainty for market participants transacting in the New England wholesale market.
  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. Although they were very infrequent in 2009, these shortages should be priced efficiently.
  4. *Real-Time Pricing During Demand Response Activation:* Demand response has surged from 530 MW in January 2006 to 2,300 MW in January 2010. Although these resources provide substantial benefits, they also pose significant challenges for efficient real-time pricing that should be addressed.
  5. *Ex Ante and Ex Post Pricing:* the ISO re-calculates prices after each interval (ex post pricing) rather than using the prices produced by the real-time dispatch model. We found that this: a) biases prices upward slightly in un-congested areas, and b) sometimes distorts the value of congestion into constrained areas.
- The report includes four recommendations to improve real-time market performance.

Efficient Pricing of Fast-Start Resources

- Fast-start generators can start-up and ramp to their maximum output within 30 minutes of notification. They provide valuable offline reserves and better enable the ISO to respond to unexpected system changes.
- The next figure compares the average total offer of fast-start units that were started by UDS with the average LMP over the initial commitment period.
  - ✓ Starts are shown separately by type of unit, by location, and by the difference between average offers and average real-time LMPs.
- Flexible hydro generation accounted for the majority of fast-start generation that was started by UDS in 2009, but an average of 235 MW of thermal peaking capacity was also started by UDS each day in 2009.
  - ✓ The average amount of thermal peaking capacity that was started by UDS increased considerably in the last five months of 2009, which coincided with the decrease of surplus online capacity in the second half of 2009.
- The full cost of the fast-start unit was frequently higher than real-time LMPs.
  - ✓ If the average total offers were fully reflected in the energy price, the average real-time LMP would increase approximately $6/MWh.
  - ✓ However, this would be partially offset by increased scheduling of imports and non-fast start generation.

Comparison of RT LMP to Offers of Fast-Start Units
Initial Period Following Start-Up

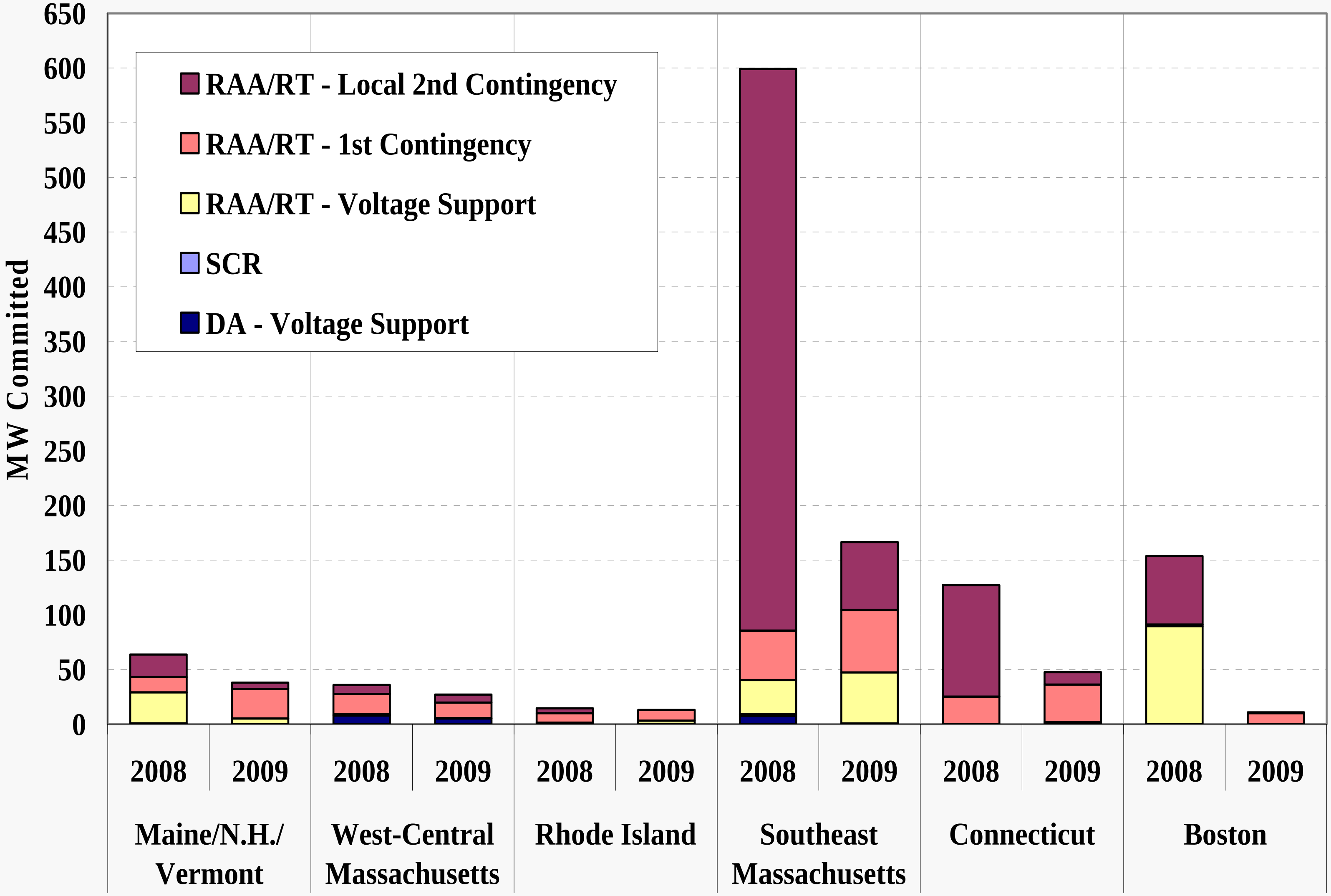


	Thermal	Hydro
For Transmission	9%	3%
In Connecticut	65%	1%
In West-Central Mass.	30%	99%

Supplemental Commitments

- The ISO commits additional resources after the day-ahead market to maintain reliability. These commitments increase uplift costs and affect real-time prices.
- The following figure summarizes commitments for local reliability, which decreased from a daily average of 1,000 MW in 2008 to 300 MW in 2009.
- Nearly all of the decline occurred in SEMA, Boston, and Connecticut.
  - ✓ In SEMA, the reduction was primarily due to the transmission upgrades in Lower SEMA that were brought into service in July 2009.
  - ✓ In Boston, the reduction was primarily due to revisions that the ISO made in early April 2008 in its operating guide for Boston-area reliability.
  - ✓ In Connecticut, the reduction was primarily due to transmission upgrades under Phase II of the SWCT Reliability Project fully placed in service in early 2009.
- Significant transmission upgrades have reduced the need for supplemental commitment as well as the use of reliability agreements for local reliability.
  - ✓ Accordingly, the associated uplift charges decreased sharply from $387 million in 2008 to $139 million in 2009.

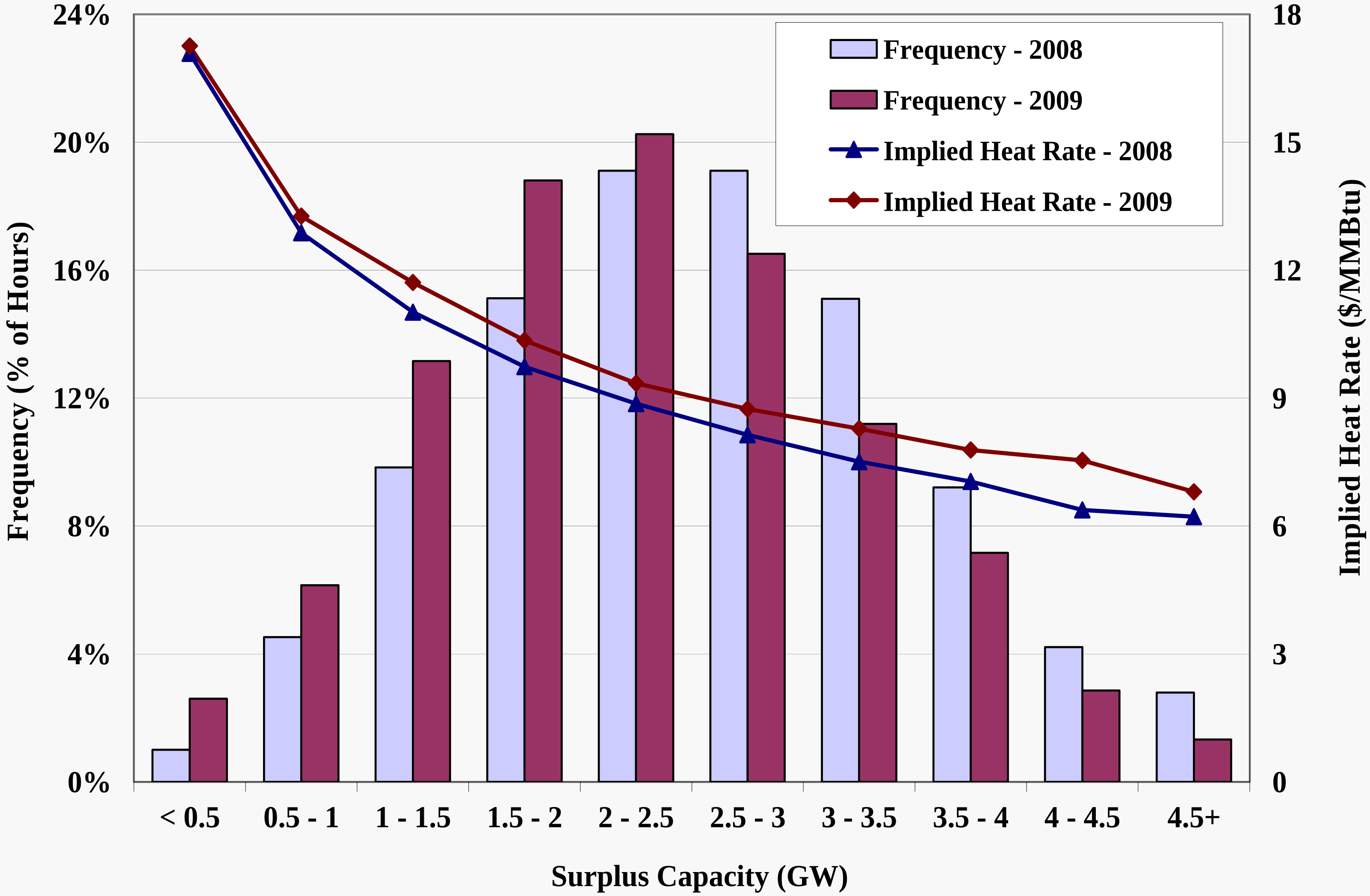
Commitment for Local Reliability by Zone
Daily Peak Hour, 2008 & 2009



Surplus Capacity and Real-Time Prices

- Surplus capacity is equal to the amount of capacity that is online or capable of starting within 30 minutes minus the amount of capacity that is required to meet load and reserve requirements.
- The following figure summarizes the relationship of surplus capacity to real-time energy prices at the Hub in each hour of 2008 and 2009. The figure indicates:
  - ✓ There is a strong negative correlation between the quantity of surplus capacity and the implied marginal heat rate (and LMPs) in real-time; and
  - ✓ A significant reduction in the average amount of surplus capacity from 2008 to 2009, which was largely due to the sharp reduction in supplemental commitments for local reliability in 2009. Reduced surplus capacity led to:
    - More frequent starts of fast-start generation by UDS in 2009; and
    - More real-time price spikes in 2009.
- Real-time LMPs are generally higher as a result of more efficient commitment and dispatch, which it is an indication of more efficient market operations and real-time pricing.

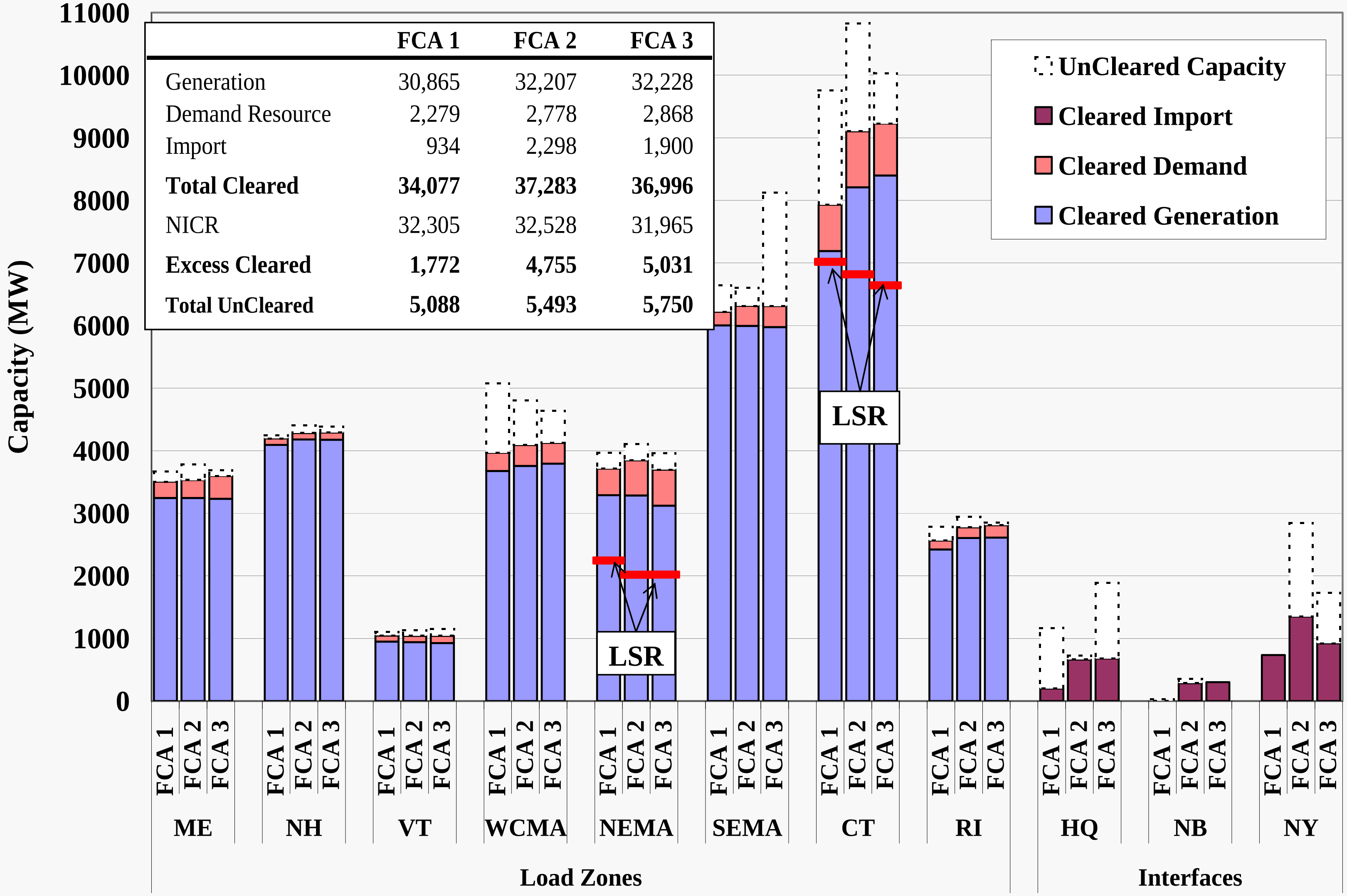
Surplus Capacity and Implied Marginal Heat Rates Based on RT Hub LMPs in Peak Hours, 2008 & 2009



Forward Capacity Market

- The Forward Capacity Market ("FCM") was filed and approved in 2006, and it was successfully introduced in 2008.
  - ✓ The qualification processes and the auctions have occurred on schedule, which is noteworthy for a major wholesale market design initiative.
  - ✓ The results for the first three auctions were competitive, and sufficient capacity will be in-service to satisfy the needs of New England through May 2013.
  - ✓ The use of out-of-market payments by the ISO to retain existing resources has been virtually eliminated, which should improve long-term incentives to invest in and retain existing capacity.
- The following figure summarizes the procurements in the first three auctions, which shows:
  - ✓ The amount of capacity procured was more than sufficient to satisfy the reliability requirements of New England in each auction.
  - ✓ In the two historically import-constrained areas (Connecticut and NEMA\Boston), the amount of generation resources procured alone was sufficient to satisfy the zone's Local Sourcing Requirement ("LSR").
  - ✓ FCM has prompted large quantities of new demand resources to enter the market at prices well below the entry cost for generation resources.

FCM Auction Clearing Summary by Location
First Three FCAs



	FCA 1	FCA 2	FCA 3
Generation	30,865	32,207	32,228
Demand Resource	2,279	2,778	2,868
Import	934	2,298	1,900
Total Cleared	**34,077**	**37,283**	**36,996**
NICR	32,305	32,528	31,965
Excess Cleared	**1,772**	**4,755**	**5,031**
Total UnCleared	**5,088**	**5,493**	**5,750**

Forward Capacity Market

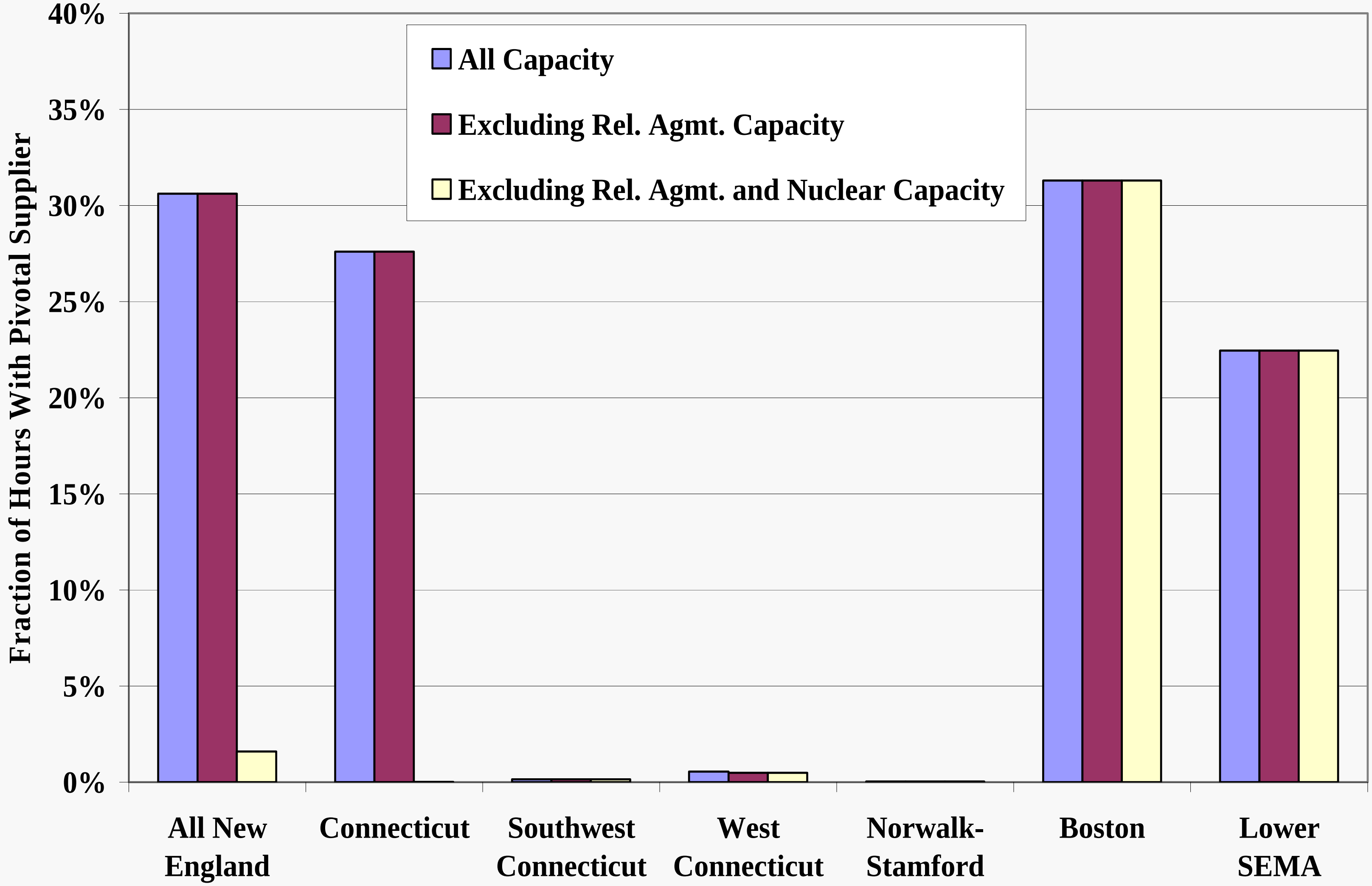
- Nearly 5,400 MW of new capacity (including “new with existing treatment”) has been procured from generation, demand response resources, and imports.
  - ✓ However, most of the new investment in generation under FCM has been motivated by out-of-market payments related to RFPs of the Connecticut PUC.
  - ✓ There is a substantial surplus of capacity in New England, which led prices to clear at the price floor in the auctions.
  - ✓ It is not surprising that little other new generation has cleared in the FCAs. Hence, it is too early to evaluate the long-term effectiveness of FCM in maintaining adequate resources.
- Demand response is beneficial, although they accept different (and potentially less costly) obligations than generation resources or imports.
  - ✓ This may inefficiently bias investment in favor of demand response resources.
- Due to inconsistencies between the LSRs in local areas and planning reliability criteria, delist bids were rejected in CT in FCA 1 and in Boston in FCA 3 even though the LSRs in the two regions indicated an excess of 1 GW.
  - ✓ The ISO made changes to address this issue that will be effective in FCA 4.
- We also conclude that the current APR will not be fully effective in addressing the effects of out-of-market investment, that local capacity requirements should be modeled in all FCAs, and that the market power mitigation should be strengthened.

Competitive Assessment

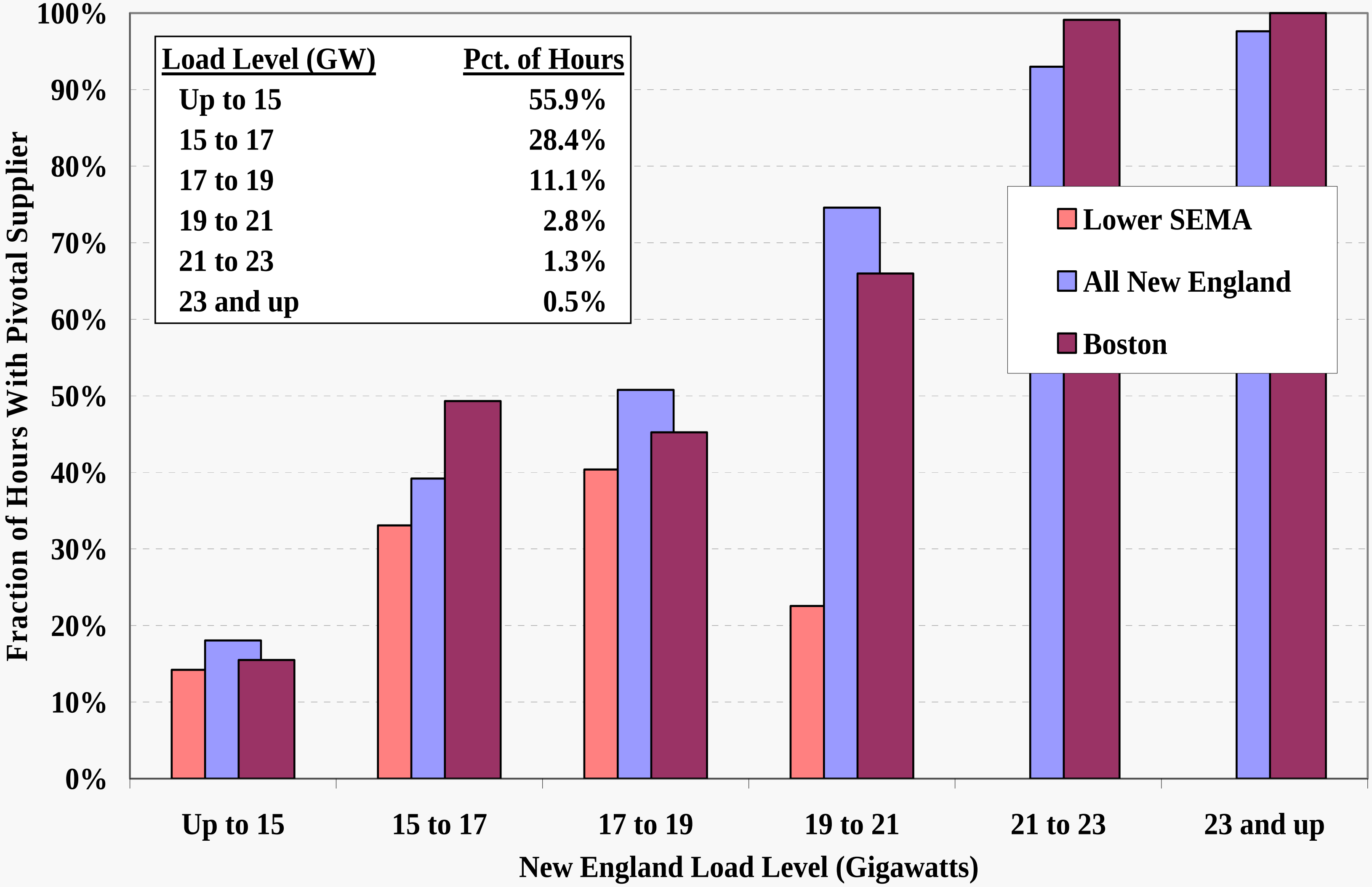
Structural Indicators of Market Power

- The competitive assessment includes structural assessments of market power in New England and evaluations of participant conduct.
- The structural assessment relies on a pivotal supplier analysis, which helps identify conditions when a supplier may have market power.
  - ✓ A supplier is “pivotal” when energy and operating reserve needs cannot be satisfied without the supplier in the real-time market.
- The following two figures summarize the pivotal supplier analyses, showing:
  - ✓ The largest suppliers in most areas are pivotal in a large number of hours.
  - ✓ When we account for the incentives of capacity under reliability agreements and nuclear capacity in Connecticut, we find:
    - A supplier was pivotal in all of New England in 31 percent of hours and in Boston in 31 percent of hours.
    - The pivotal frequency in all of New England rose from 2008, partly due to the decline in reliability commitment, which reduced the supply margin in 2009.
    - No supplier was pivotal in Lower SEMA after the transmission upgrades.
  - ✓ The second figure shows that suppliers are pivotal more often as load rises.

Frequency of Pivotal Suppliers by Region
2009



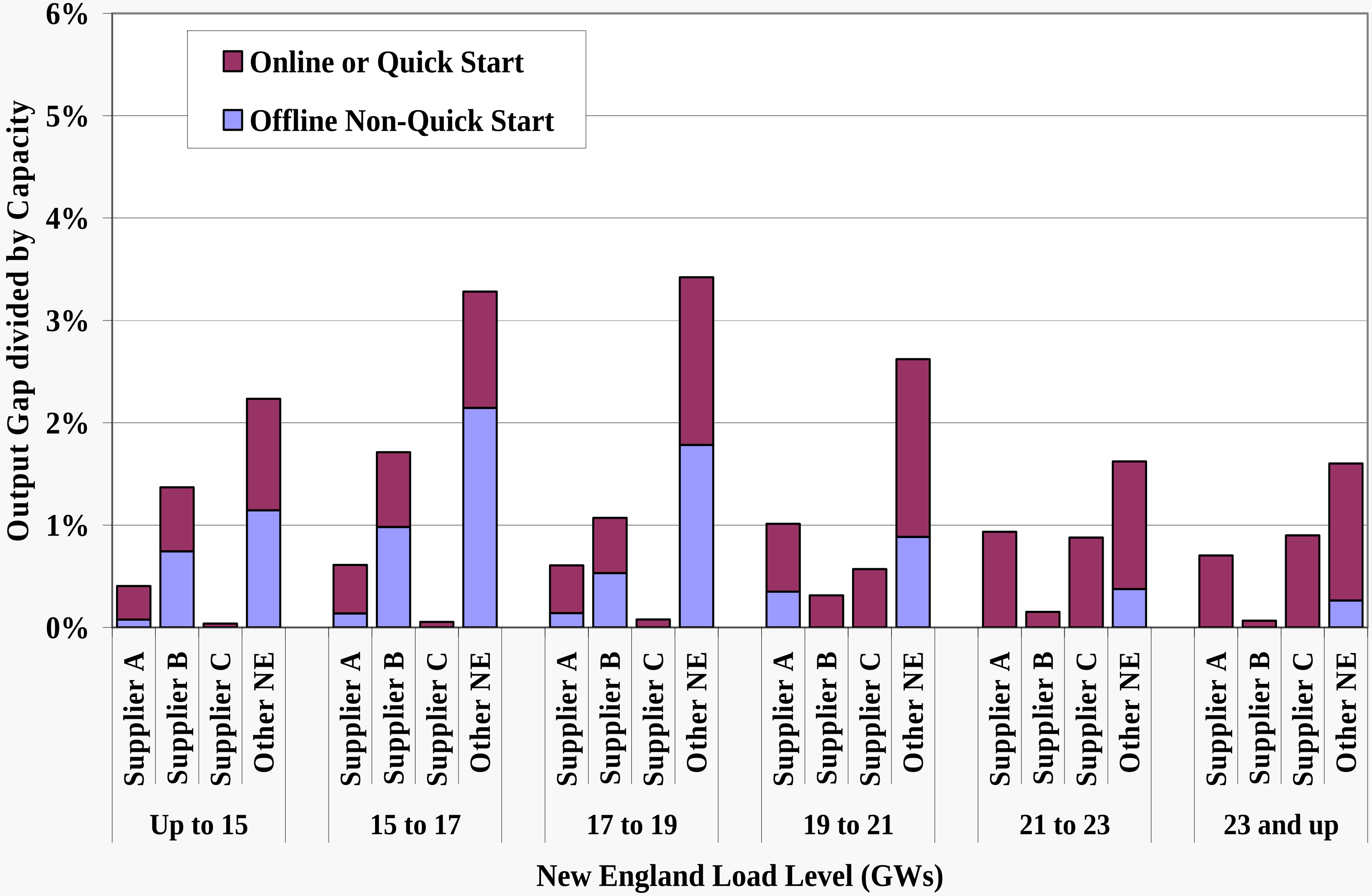
Pivotal Supplier Frequency by Load Level
Excl. Capacity Under Reliability Agreements, 2009



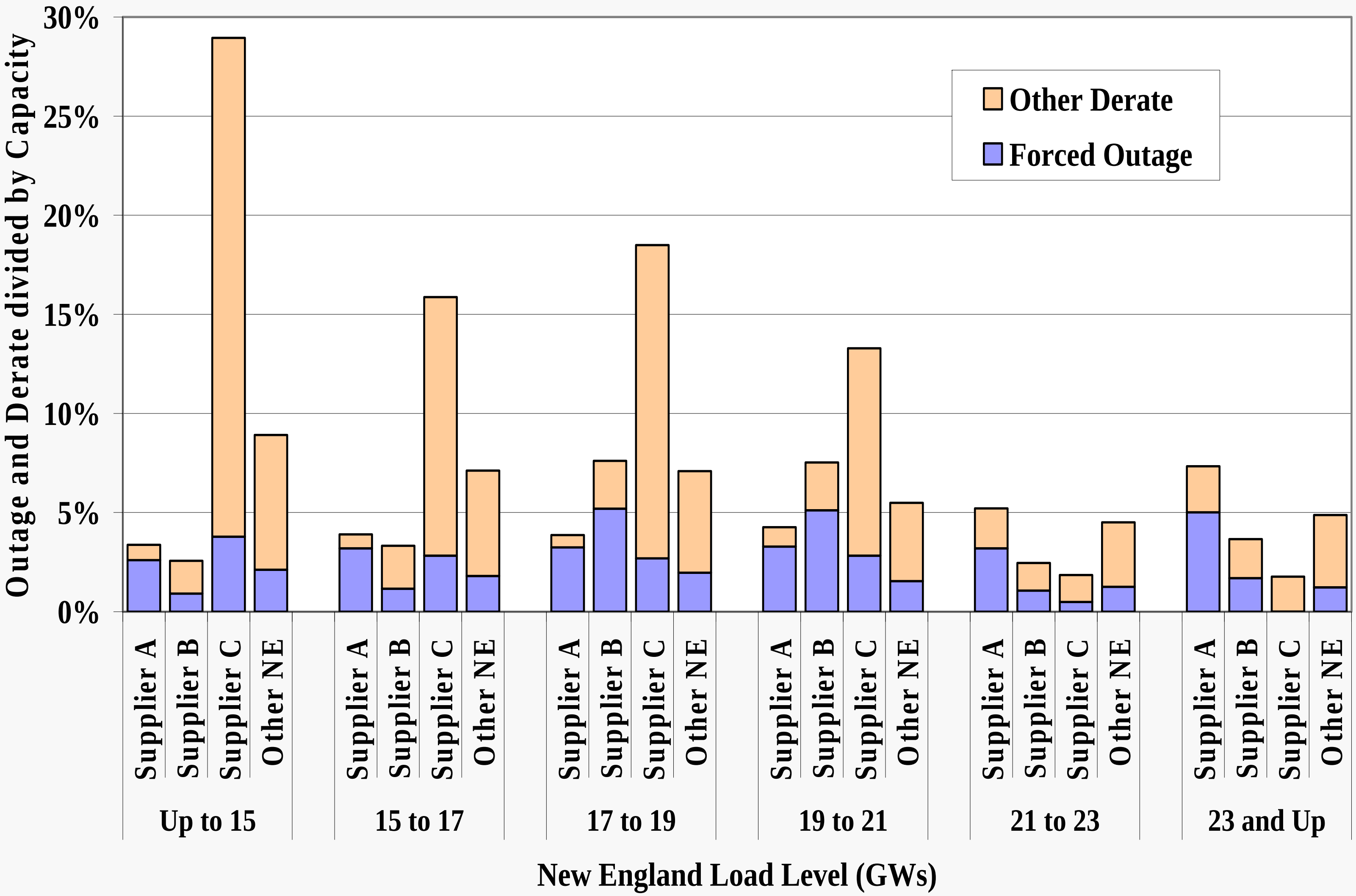
Competitive Assessment: Evaluation of Potential Withholding

- 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 increase prices); or
  - ✓ Physical withholding (i.e., reducing the claimed capability of a resource or falsely taking a resource out of service to reduce output and increase prices).
- The next two figures summarize our analyses, showing our results by load level for the largest suppliers in New England and all others.
  - ✓ Indicators of potential withholding are relatively low; and
  - ✓ The quantity of potential withholding for the largest supplier is lower than the levels for other suppliers (that are not likely to have market power);
  - ✓ 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 did not find evidence that suppliers withheld resources to raise market clearing prices.

Average Output Gap by Load Level
2009



Forced Outages and Deratings
2009



Recommendations

POTOMAC ECONOMICS

List of Recommendations

<u>Energy Pricing and Market Design</u>

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 to allow demand response activation to be reflected in prices when they are needed to avoid a shortage.
3. Consider replacing the current ex post pricing process with one that uses ex ante prices for settlement.
4. Consider providing suppliers with flexibility to modify their offers closer to real-time to reflect changes in marginal costs.

<u>Ancillary Services Markets</u>

5. Eliminate the “Rest of System” TMOR requirement in the forward reserve market.
6. Consider replacing the forward reserve market’s current price cap with a tiered price cap to recognize higher-value classes and locations of reserves.
7. Evaluate the benefits of moving to a regulation market that is co-optimized with the energy and ancillary services markets.

List of Recommendations

Forward Capacity Market

8. Modify demand response resources' obligations to be comparable to obligations of generation resources or imports.
9. Revise the APR or any replacement provisions such that they more fully mitigate the price effects of OOM entry and do not treat rejected de-list bids as OOM.
10. Permanently model the capacity zones in order to allow capacity prices to reflect local capacity requirements.
11. Modify market power mitigation measures to be effective given the changes in the market design.

System Operations

12. Develop provisions to coordinate the physical interchange between New York and New England in real-time.
13. Evaluate assumptions made in its capacity evaluation process to determine when supplemental commitments are needed, particularly the assumptions regarding imports and exports.

ISO-NE Compliance Update

NPC Summer Meeting
Water's Edge Resort & Spa, Westbrook, CT
June 2010

Overview

- ISO-NE Compliance Initiatives
- NERC Standard Application in ISO New England Environment
- NERC Developments
- Helpful websites

ISO-NE Compliance Initiatives

- ISO-NE has established internal compliance tracking matrices for:
  - NERC Standards
  - NAESB Business Practices
  - ISO Tariff/Operating Agreements
  - Federal/State regulatory filing requirements
- ISO-NE has received positive feedback from FERC on its line-by-line reviews of regulatory requirements.

NERC Standard Application in ISO New England Environment

- **ISO-NE and NPCC** have worked to facilitate the interpretation of certain standards in the New England RTO/market structure.
  - http://www.iso-ne.com/rules_proceds/nerc_npcc/index.html
- **ISO-NE and NEPOOL** have worked so that compliance with ISO-NE Operating/Planning Procedures can ensure compliance with NERC Standards.
  - *E.g.*, recent passage of NUC-001 required modifications to OP14, 16, NX forms

NERC Standard Application in ISO New England Environment

- **ISO-NE and New England TOs** have worked to summarize split/sharing of tasks associated with Transmission Operator/Planner/Service Provider functions.

- **ISO-NE and New England MPs** have worked to enhance compliance through Survey completion.

In sum, for ongoing and overall compliance with NERC Standards, it is important to be knowledgeable about ISO-NE Operating/Planning Procedures, Forms (e.g., NX9/12), **and** the CAMS database.

NERC Developments

- Second Quarter
  - NUC-001 ("Nuclear Plant Interface Coordination") (Final)
  - PRC-023 ("Transmission Relay Loadability") (Final)
  - PER-004/005 ("Reliability Coordination – Staffing" & "System Personnel Training") (NOPR)

- Tracking Upcoming Changes (expected)
  - Critical Infrastructure Protection ("CIP") Standards (New Versions)
  - Reliability Standard Development Procedure (Revision)
  - Compliance Monitoring and Enforcement Program (Revision)

Helpful Websites to Stay Up-to-Date

- Review NERC clearinghouses of information – http://www.nerc.com
  - **Compliance/Enforcement**
    - Notices of Penalty: http://www.nerc.com/filez/enforcement/index.html
    - Compliance Analysis Reports: http://www.nerc.com/page.php?cid=3|329
  - **Reliability Standards:** http://www.nerc.com/page.php?cid=2|247
  - **Membership information**: http://www.nerc.com/page.php?cid=1|8|118
  - **Compliance Registry:** http://www.nerc.com/page.php?cid=3|25

- Review NPCC's Compliance Reporting Schedule
  - http://www.npcc.org/documents/compliance/ProgDoc.aspx

- Review NPCC's posting of documents and other notices.
  - www.npcc.org

ISO new england

memo

To: New England Power Pool

From: Gordon van Welie

Date: June 21, 2010

Subject: Five-Year Business Plan

You have previously received a draft of ISO New England's five-year business plan, for discussion on Wednesday. The plan is intended to create long-range context for the annual budgeting process. On that topic, please also see the memorandum from me regarding the ISO's structure and budget for 2011 and beyond.

This draft plan has been developed with formal and informal input from stakeholders over several months. It also reflects the results of strategic planning discussions that take place in the first quarter of each year among ISO management and the Board of Directors.

We did not engage in a wholesale rewrite of the plan from last year's version and, in fact, the Company's three primary objectives and the criteria for judging their success have not materially changed. We did, however, update the specific projects which fall within these categories. These projects now include: enhancements to the planning process to provide earlier information about potential solutions that could either satisfy reliability needs or defer proposed transmission projects; participation in the Eastern Interconnection Planning Collaborative; development of smart grid standards; implementation of the synchrophasor project with Department of Energy funds; integration of demand and renewable resources; a focus on compliance; and, as required by our revised mission statement, the provision of quantitative and qualitative analyses of major ISO initiatives.

I look forward to discussing this plan with you at the upcoming NEPOOL meeting.

ISO New England Inc.
One Sullivan Road, Holyoke, MA 01040-2841
www.iso-ne.com **T** 413 535 4000 **F** 413 535 4379