The Brattle Group

Cost-Benefit Analysis of Replacing the NYISO's Existing ICAP Market with a Forward Capacity Market

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I. EXECUTIVE SUMMARY

The Brattle Group was retained by the New York Independent System Operator (NYISO) to evaluate the costs and benefits of replacing the existing Installed Capacity (ICAP) market with a new forward capacity market (FCM). *The Brattle Group*'s evaluation considers the NYISO's proposed FCM design in which the full resource adequacy requirement is procured four years in advance, followed by several reconfiguration auctions and, finally, a spot auction with a sloped demand curve. It also considers alternative design variations to evaluate the inclusion of demand curves and a multi-year price lock-in option.

The evaluation is based on three key inputs: (1) stakeholder comments elicited in focus groups with each sector; (2) PJM's and ISO-NE's experiences with their recently implemented forward capacity markets; and (3) a review of the economic theory and literature related to forward capacity markets. These inputs informed the issues, design variants, and evaluation criteria that the evaluation would address. Evaluation criteria include stability of reserve margins and prices, risks that forward obligations place on suppliers and buyers, supplier and buyer market power, reliance on out-of-market solutions and administrative price determinations, accommodation of demand response and energy efficiency, alignment with planning processes and with neighboring RTOs' forward capacity markets, and implementation costs. These are the right evaluation criteria to consider because they ultimately affect the cost of capacity and the efficiency of the capacity market, although they were not quantified monetarily due to the lack of empirical data.

The evaluation takes into account New York-specific market and system conditions. One major factor is that, unlike the capacity markets that preceded ISO-NE's and PJM's forward capacity markets, the NYISO's existing ICAP market is considered to be working acceptably.[1] The existing market already provides locational price signals, and it is attracting or retaining capacity without relying on out-of-market reliability agreements. A second relevant factor is that there is no projected need for new capacity through 2018, according to the 2009 Reliability Needs Assessment (RNA). These factors were considered in assessing the net benefits of a forward capacity market construct for New York over the next 5-10 years and over the long term.

The primary finding is that a mandatory forward capacity market could have greater long-term net benefits than the existing ICAP market, but the incremental benefits would not be reaped until new capacity is needed. The RNA base case projects capacity surpluses through 2018. Thus, the significant implementation costs would be unlikely to be offset for possibly more than ten years. It is possible, however, that environmentally-driven generation retirements and other unexpected factors could cause capacity shortages sooner, which would accelerate the benefits of implementing a forward capacity market.

Ideally, a forward market would be implemented slightly before future load growth and/or retirements create a need for new capacity. Waiting would allow the NYISO to observe and

[1] FERC has not found the existing ICAP market construct to be unjust and unreasonable; the identified market power issues in New York City have been addressed; the market monitor has not found fundamental problems with the design.

benefit from additional years of forward capacity market experience in PJM and ISO-NE. But it would be important not to wait too long so that an initial design could be implemented before the stakes are high (when the risk of shortages is higher and prices are higher and more sensitive). This would allow time to resolve any major design flaws, and it would increase the likelihood that a well-functioning forward capacity market would be in place by the time new capacity is needed. Implementing a forward market before new capacity is needed regionally could also avoid a situation in which neighboring ISOs secure scarce resources three years forward without the NYISO or its market participants knowing until spot auctions occur.

The long-term incremental benefits of a mandatory forward capacity market derive from aligning procurement timing with generation development lead times, the planning process, and neighboring ISOs' forward capacity markets.

- Alignment with development lead times allows *potential* new resources to participate, which increases market competitiveness and efficiency.
- Participation by potential resources increases the elasticity of supply, which reduces the dependence of auction clearing prices on the level and shape of the administratively-determined demand curve.
- Alignment with development lead times also allows the developer to make investment decisions contingent on clearing in the auction (with an adequate level of cost recovery, at least in the first year of operation), which induces capacity to be built if and only if it is needed. This creates a less risky framework for investment, reduces the risk and magnitude of boom-bust cycles, reduces price volatility, and lowers costs.
- Alignment of procurement timing with the planning process allows solicitation of market solutions to identified resource needs and thus reduces reliance on out-of-market (OOM) solutions.
- Alignment with neighbors' FCMs gives the NYISO and its market participants more advance notification when formerly relied-upon external resources commit to external forward markets.
- These benefits may not be available if forward procurement is not mandatory since retail providers lacking captive customers may otherwise contract forward.

However, there are also several disadvantages of replacing the existing short-term ICAP market construct with a mandatory forward capacity market.

- Although the forward procurement timeframe may be aligned with generation development lead times, developers face the risk of deficiency penalties if they are not able to complete their projects by the delivery year. This increased risk also applies to existing generation that could become disabled between the auction and delivery year. These risks, and the security deposits that suppliers would need to make in order to ensure their ability to pay deficiency penalties, add to the cost of capacity.
- A four-year forward auction is not aligned with development lead times for some resources, in particular demand-side resources. Demand response assets generally will not commit that far in advance, so special provisions would be needed to avoid excluding

them, as in ISO-NE and PJM.[2] Energy efficiency is also difficult to integrate accurately in a four-year forward capacity market because the load reductions it will deliver and the baseline load to which those reductions will apply are both uncertain.

- In general, four-year forward load forecast uncertainty is considerable – a few percentage points – raising the risk of under-procurement or over-procurement. These risks can be partially mitigated by adjusting the quantity procured in forward auctions and with reconfiguration auctions that address both incremental and decremental needs.
- There are substantial administrative costs of implementing a new forward capacity market design, including the NYISO's direct software/administrative costs of setting up and maintaining a forward capacity market, market participant administrative costs of adjusting to a new market design, potentially large litigation costs for the NYISO and stakeholders, and the risk of initial design flaws.

The market design feature of greatest concern to stakeholders is whether and how to include a sloped demand curve in a forward capacity market. The NYISO's proposed forward market design includes a sloped demand curve in the spot market but not the forward auctions or reconfiguration auctions. Outcomes would likely resemble having the demand curve in all auctions to the extent that suppliers could adjust their forward offers according to their expectations for the spot market. Incorporating the sloped demand curve directly in all auctions seems more transparent and possibly more conducive to market monitoring, but this study treats the two approaches as equivalent. This study focuses instead on major differences between the existing short-term ICAP market (with a sloped demand curve) and a mandatory forward market with a sloped demand curve, and then it also compares to a mandatory forward market with a vertical demand curve.

The advantages and disadvantages of including a sloped demand curve in a forward market are similar to those in short-term ICAP markets. A sloped demand curve helps mitigate market power by reducing the price impact of suppliers withholding or buyers developing excess capacity. It similarly reduces price volatility caused by lumpiness and short-term shifts. It also recognizes the (reduced) value of capacity when there is excess. The major disadvantage of a sloped demand curve is that the parameters are set administratively and thus subject to error. The Net Cost of New Entry (Net CONE) parameter can deviate from the "true" Net CONE reflecting the 1-year price at which suppliers would be willing to develop sufficient new capacity (of any supply-side or demand-side technology), given their costs and expectations for future revenues. Likewise, the slope parameter can deviate substantially from the incremental value of reliability. However, the effects of such errors (and possibly the benefits) should be less pronounced in a forward capacity market because the four-year forward supply curve is much more elastic than the supply curve in a short-term ICAP market.

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[2] ISO-NE and PJM allow aggregators to offer non-asset-specific resources corresponding to their customer retention and acquisition plans, subject to subsequent verification and penalties in the event of deficiencies or poor performance. PJM also holds back 2.5% of its projected need in the initial auction in order to give shorter lead-time resources, such as demand response, an opportunity to enter the market through annual incremental auctions.

Some stakeholders expressed the need for a multi-year price lock-in option like ISO-NE offers in its FCM. We have concerns that offering such an option only to new resources would not address retention of existing capacity (including future capacity after it becomes "existing"). Yet offering the option to all capacity could contribute to inefficiencies and wealth transfers if all resources exercise the option when prices are high initially but are expected to fall. Moreover, a 3-5 year lock-in would not substantially enhance revenue certainty for new entrants with 30-40 year operating lives. This limitation highlights the importance of reducing suppliers' risks in other ways, *e.g.*, through regulatory stability and a market design that supports efficient and stable prices.

The findings from this evaluation should help the NYISO and stakeholders decide whether to continue pursuing a forward capacity market. If they decide to, they should consider including a sloped demand curve directly in the forward auctions. They should also consider delaying implementation until closer to the time when new capacity is needed and thus a forward capacity market's relative advantages are about to become active. In the meantime, they can maximize the chances of eventually developing a successful forward market design by continuing to monitor PJM's and ISO-NE's ongoing experiences with their forward capacity markets.

II. STUDY SCOPE AND APPROACH

The NYISO is considering replacing the existing ICAP market with a mandatory forward capacity market and has retained *The Brattle Group* to evaluate the costs and benefits of doing so. *The Brattle Group*'s evaluation considers whether the specific design that the NYISO has proposed for a potential forward capacity market would reduce the cost of meeting resource adequacy objectives. It also assesses the effects of including a demand curve and multi-year lock-in periods in a forward capacity market. However, this evaluation does not provide a comprehensive review of all market design details. It provides a mostly qualitative assessment of the incremental benefits, costs, and risks of a forward capacity market (with a few design variants) relative to the current short-term capacity market.

The Brattle Group's approach to this assignment is based on three key inputs: stakeholder comments; PJM's and ISO-NE's experiences with forward capacity markets; and a review of the economic theory and literature related to forward capacity markets.

Stakeholder comments were elicited in focus group discussions that *The Brattle Group* facilitated with each of the following stakeholder groups: (1) generators; (2) transmission owners; (3) other suppliers; (4) public power and environmental stakeholder groups; (5) end-use sector; (6) demand response providers; and (7) the New York State Public Service Commission (NYSPSC). Discussions addressed each group's comments, concerns, and questions regarding replacing the current market design with a forward capacity market. The discussions also revealed specific design elements that materially affect the acceptability of a forward capacity market (the most controversial being whether to include a demand curve).

The second key input is the (limited) experience of ISO-NE and PJM with their recently implemented forward capacity markets. PJM has conducted six forward auctions, the first four of which were conducted with a compressed forward period, and last two of which were conducted a full 3 years forward. ISO-NE has conducted two 3-year forward auctions. However, neither has yet had reached the delivery year corresponding to a multi-year forward auction. Both are in the process of reviewing and/or revising their market designs in light of their own initial experiences.[3] Their experiences inform the evaluation of a forward capacity market for the NYISO only in light of differences in market conditions, system configuration, and the prior capacity market design. Unlike the NYISO's existing ICAP market design, PJM's and ISO-NE's pre-existing short-term capacity markets had been deemed unacceptable by FERC and market participants.

Third, this evaluation was informed by a review of the benefits and costs that have already been documented in the literature regarding other forward capacity market design efforts. The literature largely addresses the benefits of capacity markets relative to energy-only markets, including increased reliability, reduced volatility and increased liquidity of power markets, improved investment incentives and lower investment costs, increased competition, and mitigation of market power, among others. However, our cost-benefit analysis of the NYISO's proposed forward capacity market design depends on the extent to which the proposed new design achieves and incrementally increases net benefits relative to what is already provided through the NYISO's existing capacity market design.

These three sources of inputs were used to define the issues that the evaluation would address. Figure 1 lists the issues according to the types of stakeholders they primarily concern, but some issues are listed under an "other" category, and several of the issues concern multiple stakeholder groups. All of these issues ultimately affect the success and cost (to customers) of meeting resource adequacy requirements.

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[3] "Review of PJM's Reliability Pricing Model (RPM)," by Johannes P. Pfeifenberger, Samuel A. Newell, Robert L. Earle, Attila Hajos, and Mariko Geronimo, *The Brattle Group, Inc.*, June 30, 2008 (FERC Docket No. ER05-1410, *et al.*, 2006). ISO-NE's Internal Market Monitoring Unit and *The Brattle Group* are jointly reviewing the results of ISO-NE's first two auctions and design elements, to be filed with FERC on June 5, 2009.

Figure 1 – List of Key Issues Evaluated

Buyer Perspective

- Supplier Market Power
- Level & Stability of Prices
- Risk of Insufficient Capacity
- Risk of Over-Procurement
- Interference with Self-Supply
- Price Distortion from Administrative Provisions

Supplier Perspective

- Rationalize Auction Timing with Development Times
- Price Stability to Support Investment
- Sufficient Prices to Support Investment
- Risks of Taking on Capacity Obligation
- Discrimination between New and Existing Supply
- Reliance on OOM Solutions
- Buyer Market Power

Other Key Attributes

- Accommodation of Demand Response
- Recognition of Energy Efficiency
- Alignment with Planning Process
- Alignment with Neighbors
- Transition Costs

III. RELEVANT BACKGROUND

A. RESOURCE ADEQUACY REQUIREMENTS AND RELIABILITY PLANNING

The purpose of capacity markets is to satisfy resource adequacy requirements efficiently and reliably. Resource adequacy requirements determine the demand in capacity markets. In New York, resource adequacy requirements are determined jointly by the New York State Reliability Council (NYSRC) and the NYISO. First, the NYRSC determines the installed reserve margin (IRM) for the entire New York Control Area (NYCA). IRM is the amount of planning reserves necessary to meet the NERC reliability criteria that load is involuntarily shed due to inadequate supply no more than once in ten years.[4] Given the IRM, the NYISO multiplies it by its annual peak load forecast to calculate the ICAP requirement for NYCA. The NYISO also determines Locational Capacity Requirements (LCR) in the New York City and Long Island zones.[5]

The NYISO's determination of ICAP and LCR requirements is part of its Comprehensive Reliability Planning Process (CRPP). The CRPP is an annual, ongoing process that was instituted in 2005. The CRPP includes a Reliability Needs Assessment (RNA), which evaluates the adequacy and security of the bulk power system over a 10-year Study Period. If the RNA identifies a reliability need (*i.e.*, either a resource adequacy need or a transmission security need) in the 10-year Study Period, the NYISO designates one or more Responsible Transmission

[4] The IRM was reduced in May 2007 from 18 percent to 16.5 percent. The latest IRM in May 2008 further reduced the ICAP requirement to 15 percent.

[5] For the period from May 2007 to April 2008, the New York City LCR was 80 percent and the Long Island LCR was 99 percent. For the period from May 2008 to April 2009, the New York City LCR remained at 80 percent and the Long Island LCR declined to 94 percent ("2007 State of the Market Report: New York Electricity Markets,", Potomac Economics, May 2008,page 107).

Owners to develop a regulated backstop solution to address the identified need if the market should fail to respond.

The resulting ICAP and LCR requirements are the basis for capacity procurement obligations placed on all load serving entities (LSEs)[6]. The NYISO uses an Unforced Capacity methodology to determine the amount of Unforced Capacity (UCAP) that each resource is qualified to supply and the amount of Unforced Capacity (UCAP) that LSEs must procure.[7]

Imposing UCAP procurement obligations on LSEs creates the demand for capacity and thus creates a market. Slightly more than 50 percent of the capacity is procured bilaterally, and the NYISO's centralized ICAP auctions are designed to accommodate LSEs' and suppliers' efforts to enter into UCAP transactions to otherwise meet their obligations.

B. EXISTING ICAP MARKET DESIGN

Approximately 45% of the capacity requirements are transacted through the NYISO-administered capacity auctions, at an annual dollar volume of over $850 million,[8] and a portion of the remaining requirements are met through bilateral contracts that might be affected by auction outcomes. With so much money being transacted, even a 5% change in costs and prices could have a $50 million effect annually. Hence, market redesign should only be done very carefully.

The NYISO currently conducts three types of Installed Capacity auctions: forward strip auctions in which capacity is transacted in six-month blocks for the upcoming capability period, monthly forward auctions in which capacity is transacted for the remaining months of the capability period, and monthly spot auctions. Participation in the monthly auction and the capability period (forward strip) auction consists of: (1) LSEs seeking to purchase Unforced Capacity; (2) any other entity seeking to purchase Unforced Capacity; (3) qualified Installed Capacity Suppliers; and (4) any entity that owns excess Unforced Capacity. Participation in the ICAP spot market auction consists of all LSEs and any other entity that has an Unforced Capacity shortfall.[9] Thus, the two forward markets are voluntary, but all requirements must be satisfied at the conclusion of the spot market immediately prior to each month. LSEs that have purchased more than their obligation prior to the spot auction may sell the excess into the spot auction.

A major component of the ICAP spot market auction is the sloped demand curve used in the spot market auctions. There are actually three different demand curves: one to determine the

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6 The Minimum Unforced Capacity Requirement for each LSE in each Transmission District in which it serves load is based on the LSE's contribution to the Transmission District's coincident forecast peak in the prior calendar year adjusted for load growth, a reserve margin, locational requirements where applicable and an average forced outage factor.

7 The Unforced Capacity methodology estimates the probability that a resource will be available to serve Load, taking into account forced outages, as described in the "NYISO Installed Capacity Manual," October 2008.

8 "ICAP Automated Market User's Guide," February 2009, page 2-1.

9 "NYISO ICAP Manual," October 2008.

locational component of LSE Unforced Capacity Obligations for Long Island, one to determine the locational component of LSE Unforced Capacity Obligations for the New York City Locality, and one to determine the total LSE Unforced Capacity Obligations for all LSEs.[10] As the "2007 State of the Market Report: New York Electricity Markets" summarizes, "The demand curves are set so that the demand curve price equals the levelized cost of a new peaking unit (net of estimated energy and ancillary services revenue) when the quantity of UCAP procured equals the UCAP requirement. The demand curve price equals $0 when the quantity of UCAP procured exceeds the UCAP requirement by 12 percent for NYCA and 18 percent for New York City and Long Island. The demand curve is defined as a straight line through these two points."[11] In addition, the demand curves continue linearly to the upper left, with higher prices at quantities below the target, up to a maximum price equal to 1.5 times the estimated localized CONE, at which point the demand curves become horizontal.[12]

C. EXISTING ICAP MARKET PERFORMANCE

At present, the New York capacity market does not appear to have fundamental design flaws that require total redesign of the market FERC has not found the NYISO market to be unjust and unreasonable as it did for the capacity markets that preceded the implementation of forward capacity markets in PJM and ISO-NE.[13] The NYISO's Independent Market Advisor has likewise not identified fundamental design flaws, although he has recommended creating a new Southeast New York capacity zone and some other adjustments. The Independent Market Advisor's largest concern, about market power in New York City has already been addressed through a proceeding and a series of FERC Orders, first in March 2008.[14]

The NYISO's Independent Market Advisor's "2007 State of the Market Report: New York Electricity Markets" describes the market power problems that had been present in New York City:

> "Before March 2008, seasonal variations in capability accounted for most of the changes in the clearing prices and quantities sold in New York City. Clearing prices were near $6/kW-month in the winter capability periods and $12/kW-month in the summer capability periods. The clearing prices were close to the revenue caps imposed on the Divested Generation Owners ("DGOs") that purchased the capacity from ConEd when it was required to divest most of its generation in 1998.

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[10] The amount of UCAP purchased varies depending on the clearing price for UCAP, which is determined by the intersection of UCAP supply offers and the demand curve.

[11] "2007 State of the Market Report: New York Electricity Markets," Potomac Economics, May 2008, page 108.

[12] "NYISO Installed Capacity Manual," April 2009.

[13] PJM Interconnection, L.L.C., 115 FERC ¶ 61,079 (2006) (April 20 Order) at P 1-6; Devon Power Company *et al*., 104 FERC ¶ 61,123 (2003) (July 24 Order) at P 33.

[14] "2007 State of the Market Report: New York Electricity Markets," Potomac Economics, May 2008, page iii.

> This pattern persisted even after a surplus emerged in New York City when approximately 1000 MW were added in 2006. Prices remained near the revenue caps because a significant amount of existing capacity was not sold in the UCAP market due to the suppliers' offer prices.[15] Since the unsold capacity participated in the energy market, significant competitive concerns were raised regarding the highly concentrated New York City capacity market."[16]

In March 2008, FERC ordered the NYISO to implement market power mitigation measures to address the seller-side market power described above as well as potential buyer-side market power in order to ensure that future capacity market results would be competitive. The new mitigation measures for New York City implemented in March 2008 included: (1) a must-offer requirement for pivotal suppliers for their available capacity in the spot capacity auction, and (2) a limit on the offer price of pivotal suppliers in the spot auction set by the higher of the default reference price, or if applicable, a unit-specific adjusted reference price.[17] In addition, for protection against uneconomic entry, new resources are required to bid a floor price of 75% of net Cone.[18]

D. OUTLOOK FOR SUPPLY AND DEMAND IN THE NYISO FOOTPRINT

The 2009 RNA projects that NYCA will not need any new capacity between 2009 through 2018.[19] This outlook is driven by a reduced load growth forecast combined with an increase in supply, which is already in surplus. The reduced load forecast reflects the implementation of New York's Energy Efficiency Portfolio Standard (EEPS) and, to a lesser extent, a lower employment outlook than in past RNAs. Supply projections are based on planned generation additions, scheduled retirements, and a continuation of demand response participation by special case resources (SCRs) at current levels.

Table 3-7 of 2009 RNA Final Report, reproduced here as Table 1, shows the 2009 RNA Base Case load and resource margin assumptions from 2009 through 2018 for NYCA as a whole, and

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15 "Market power mitigation measures were imposed as part of the divestiture. The measures consisted of caps on the revenue that each DGO could earn on the divested capacity from the capacity market, and a requirement to offer the capacity in the NYISO's auction at a price no higher than the cap. This provision was intended to mitigate the DGO's market power, but it allowed the DGOs to raise prices substantially above competitive level under conditions when New York City has surplus capacity."

16 "2007 State of the Market Report: New York Electricity Markets," Potomac Economics, May 2008, pages 109-110.

17 "MP Training Slides for ICAP In-City Mitigation," April 2008, available at http://www.nyiso.com/public/products/icap/incity.jsp.

18 "2007 State of the Market Report: New York Electricity Markets," Potomac Economics, May 2008, page 110.

19 According to the "2009 Reliability Needs Assessment, Final Report,", New York City is expected to fall below its 80% LCR by 2011, but it is not expected to violate the reliability target limiting the loss of load expectation to one event in ten years. "2009 Reliability Needs Assessment, Final Report," January 13, 2009, available at http://www.nyiso.com/public/webdocs/services/planning/reliability_assessments/ RNA_2009_Final_1_13_09.pdf.

also for New York City (Zone J) and Long Island (Zone K) separately. The reported resource margin for NYCA is 123.5% in 2009 and is expected to decrease to 119.3% by 2018, still above the IRM target. Zone K's forecasted resource margin is 122.31% in 2018, above the LCR target. In Zone J, the resource margin drops to 79.5% as early as in 2011, and drops further to 75.71% in 2018. Although these margins do not satisfy New York City's 80% LCR, the 2009 RNA finds no expected violation of reliability criteria through 2018..

Table 1 – 2009 RNA Base Case Supply and Demand Outlook

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Peak Load										
NYCA	34,059	34,269	34,462	34,586	34,725	34,905	35,029	35,258	35,430	35,658
Zone J	12,127	12,257	12,361	12,452	12,537	12,627	12,683	12,787	12,879	12,980
Zone K	5,386	5,395	5,403	5,403	5,377	5,370	5,358	5,374	5,354	5,383
Resources										
NYCA										
Capacity	39,992	39,657	40,496	40,496	40,502	40,452	40,452	40,452	40,452	40,452
SCR	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084
Total	42,077	41,741	42,580	42,580	42,586	42,536	42,536	42,536	42,536	42,536
Res./Load Ratio	123.5%	121.8%	123.6%	123.1%	122.6%	121.9%	121.4%	120.6%	120.1%	119.3%
Zone J										
Capacity	10,097	9,206	9,206	9,206	9,206	9,206	9,206	9,206	9,206	9,206
SCR	622	622	622	622	622	622	622	622	622	622
Total	10,719	9,828	9,828	9,828	9,828	9,828	9,828	9,828	9,828	9,828
Res./Load Ratio	88.4%	80.2%	79.5%	78.9%	78.4%	77.83%	77.49%	76.86%	76.31%	75.71%
Zone K										
Capacity	5,938	6,368	6,368	6,368	6,368	6,368	6,368	6,368	6,368	6,368
SCR	216	216	216	216	216	216	216	216	216	216
Total	6,154	6,584	6,584	6,584	6,584	6,584	6,584	6,584	6,584	6,584
Res./Load Ratio	114.3%	122.0%	121.9%	121.9%	122.4%	122.61%	122.88%	122.52%	122.98%	122.31%

New York Control Area (NYCA) "Capacity" values include resources internal to New York, Additions, Reratings, Retirements, Purchases and Sales, and UDRs with firm capacity. Zone K "Capacity" values include UDRs with firm capacity. Wind generation values include full nameplate capacity.

"SCR" values reflect projected August 2009 ICAP capability period values held constant over the 10-year Study Period.

The load forecast in the RNA starts with a 2009 forecast that appears to be conservatively high. The projected 2009 peak load of 34,059 MW is 267 MW higher than the 2008 actual weather-normalized peak load, in spite of the recession.[20] The growth rate after 2009 depends partly on employment, which is assumed to grow by 0.5% annually until 2013 and 0.3% thereafter.[21] These projections are only slightly below the 0.7% and 0.4% rates assumed in the 2008 RNA.[22] Together, the 2009 forecast and the employment growth rates embedded in the rest of the forecast appear to be conservatively high, given the current economic outlook. If actual loads turn out to be lower, reserve margins would be even higher than projected in the RNA.

[20] Ibid, Table B-5.

[21] Ibid, Appendix page 11.

[22] "2008 Reliability Needs Assessment, Final Report,", Table 2.1.1, available at http://www.nyiso.com/public/webdocs/services/planning/reliability_assessments/2008_RNA__Supporting_FINAL_REPORT_12_12.pdf.

The load forecast is also affected by assumptions on energy efficiency developments in New York State. The NYSPSC has taken the initial steps to implement its jurisdictional portion of the Governor's Energy Efficiency Portfolio Standard (EEPS). The goal of EEPS is to reduce electric energy consumption by 15% by 2015 relative to the 2007 forecast for that year. The NYISO conservatively estimates a reduction of approximately 2,100 MW, or only five percent of forecast peak load, based on currently-authorized spending levels for efficiency programs.

On the supply side, the RNA Base Case assumes 2,163 MW of new generation and uprates in 2009-11 (only 1,397 MW with wind derated to 10% of nameplate capacity). These are partially offset by 1,271 MW of generation retirements assumed in the Base Case.[23] The RNA also assumes continued demand response participation at current levels by Special Case Resources (SCR). The NYISO currently has registrations of approximately 2,084 MW of SCRs, an increase of 761 MW of resources over the SCR levels included in the 2008 RNA.[24]

In addition, the construction of capacitor banks at the Millwood Substation incorporated in both 2007 and 2008 CRPs has increased transfer capability from the lower Hudson Valley into New York City by 240 MVArs.[25]

The 2009 RNA's Base Case conclusion that no new capacity is needed through 2018 is sensitive to the assumptions identified above. In order to test the extent to which these assumptions affect the main conclusion, the RNA included several sensitivity analyses. The sensitivity analyses indicate several plausible ways in which new resources could be needed before 2018:

1. In the absence of effective implementation of the EEPS programs, reliability needs would arise in 2017.
2. If extreme weather conditions combined with high load growth (total effect of 7.5% higher in the load forecast compared to the Base Case) occur, new resources could be needed as soon as 2010.
3. Implementation of new programs to control nitrogen oxides (NOx) emissions from fossil fueled generators on high electric demand days could render some units unavailable and others limited to reduced output at times of peak energy needs, and under certain circumstances the resource adequacy criterion could be violated for all years from 2009 through 2018 due to these programs.
4. Other reasons for resource adequacy violation before 2018 include the level of RGGI allowance cost, fuel price spread, and other environmental program compliance costs.

In addition, economically and environmentally-driven retirements that are not currently planned or anticipated in the RNA could create a need for new capacity before 2018. The RNA states:

> "[T]he unexpected retirement of certain generation could cause immediate resource adequacy violations and the need for new resources in New York. For example, due to its location in a constrained part of the system, retirement of one of the two Indian Point nuclear power plant units, which are due for relicensing before the Nuclear Regulatory Commission, would cause

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[23] "2009 Reliability Needs Assessment, Final Report," January 13, 2009, pages.3-8 to 3-11.
[24] Id. pages i to ii.
[25] Id. pages i to ii; 2-7, 3-11 to 3-12.

an immediate violation of the reliability standard in 2014. Retirement of both units would cause a severe shortage in resources needed to maintain bulk power system reliability, resulting in the probability of an involuntary interruption of load that is approximately 40 times higher than the reliability standard in 2018." [26]

E. THE NYISO'S PROPOSED FCM MARKET

The NYISO's proposed forward capacity market design has the following stated objectives: (1) use forward procurement in conjunction with the CRPP/RNA process where appropriate to help ensure resource adequacy through market based solutions; (2) minimize the likelihood that a regulated or gap (non-market) solution would ever need to be implemented to achieve adequacy; and (3) provide for an opportunity for adequacy to be achieved on a voluntary basis prior to the NYISO conducting a forward procurement that will be binding upon load.[27]

The proposed design consists of voluntary auctions held five and six years prior to the delivery year, followed by a "mandatory" forward auction held 44 months in advance of the delivery year, in which the NYISO would bid on behalf of load to purchase 100% of forecast requirement.[28] All certified advance auction capacity, bilateral contracts, and self-supply would be bid in at zero in the forward auction.

The forward auction would be followed by three or four voluntary reconfiguration auctions in which the suppliers could trade their obligations (*i.e.*, deficient suppliers can shed their obligation to other suppliers). Presumably, the NYISO could also procure additional capacity if the load forecast increases or let deficient suppliers buy out their obligations if the forecast decreases, but the details have not been established. The NYISO's proposed FCM design also includes 6-month advance strip auctions and spot auctions, similar to the current ICAP design. There would be an administratively determined demand curve only in the spot auction (as in the existing market) and CONE would continue to be reset using administrative process similar to the current design. The following figure prepared by the NYISO and reproduced here as Figure 2, summarizes the proposed auction timeline:[29]

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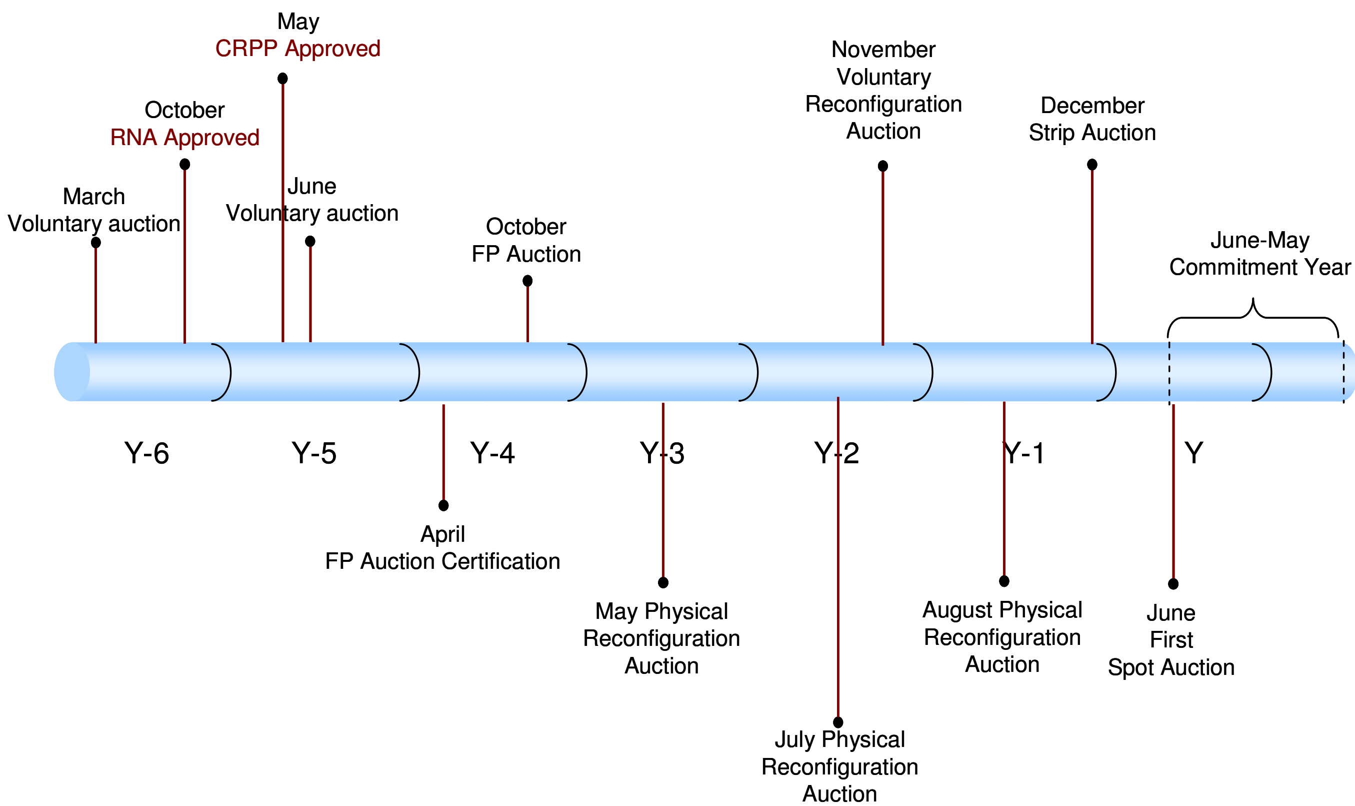
[26] "2009 Reliability Needs Assessment, Final Report," January 13, 2009, page iii.

[27] "NYISO Proposed Forward Capacity Market Design – Details Part 1," NYISO presentation to the ICAPWG, October 3, 2008.

[28] If participation is not mandatory, load serving entities without captive load are unlikely to contract forward.

[29] NYISO Forward Capacity Market Design Matrix 3-19-2009.

Figure 2 – The NYISO's Proposed FCM Auction Timeline



IV. BENEFITS OF REPLACING EXISTING ICAP MARKET WITH FCM

The primary objective of this study is to assess the costs and benefits of replacing the existing short-term capacity market construct with a mandatory forward capacity market construct. Because it is not very meaningful to evaluate forward capacity markets generically, we examined four specific design variations regarding the most critical design elements identified by stakeholders: demand curves and multi-year price commitments. The first design variant corresponds approximately to the NYISO's proposed forward capacity market design, except that it includes a sloped demand curve in the forward auction in addition to the spot auctions. This simplification avoids having to evaluate the dynamics by which suppliers would incorporate their expectations for the spot market (with its sloped demand curve) into their forward market bids. The second design has no demand curve in any auction, including the spot auctions. The third design variant also has no demand curve, and it incorporates the provision of a multi-year price lock-in for new resources.

The remainder of this section evaluates the first design versus the existing ICAP market construct. Sections V, VI, and VII compare the three forward capacity market design variations.

A. ALIGNMENT OF PROCUREMENT TIMING WITH DEVELOPMENT LEAD TIMES

The scope of resources that are available to procure in a capacity auction depends on the length of the forward procurement period. If the forward period is only days or months, as in the current construct, the procurement options are limited to the capacity that is already online. If the period is several years, the procurement options expand to include potential resources that are not already online but could be developed by the delivery year. This expansion of procurement options has numerous efficiency and competitiveness benefits. These benefits are assessed below, following a brief analysis of development lead times.

1. Development Lead Times

Many generation technologies can be developed in three to four years, although some resources require more time and others require significantly less, as shown in Figure 3.[30] Baseload nuclear and coal resources tend to require substantially more time. Conversely, many imports, uprates to existing facilities, and new demand resources may take much less time. However, a three- to four-year window should allow enough economic resources to adjust their entry and exit decisions to stabilize capacity prices and reserve margins in the forward auctions. Resources with different lead times can still provide capacity, especially if the capacity market construct has special provisions to accommodate shorter lead-time resources such as Demand Response (DR), as discussed in Section V.B..

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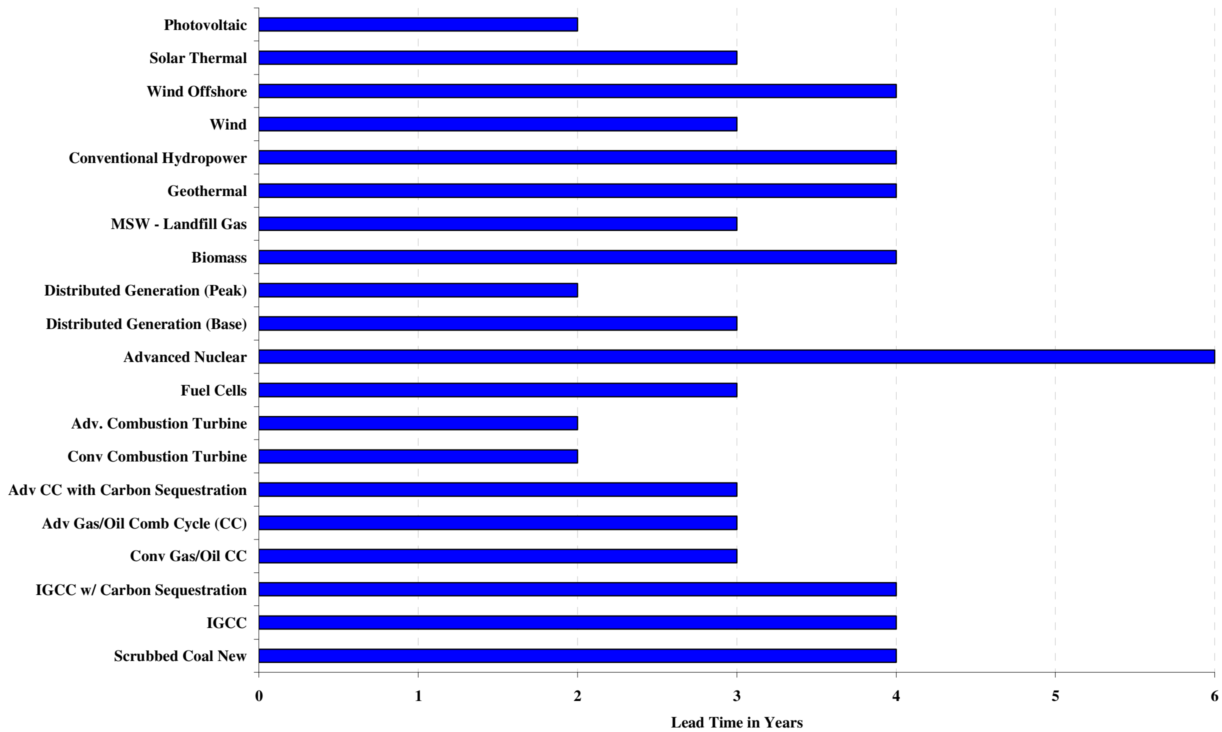
30 These assumptions do not account for significant financing and permitting delays. Data for Figure 3 are taken directly from "Assumptions to the Annual Energy Outlook 2009," Table 8.2; Report#:DOE/EIA-0554(2009), Release date: March 2009.

Figure 3 – Lead Times for New Central Station Electricity Generating Technologies



2. Competition and Efficiency Benefits

A forward capacity market held sufficiently in advance of the delivery year can admit many different types of resources. This fosters competition among the new potential entrants and between existing resources and potential new entrants, a force not directly present in the existing short-term auctions. The argument that forward capacity markets foster competition is supported by the auction results in PJM and ISO-NE. Their forward auctions have attracted a large number of potential new resources competing to fulfill a limited need.

Table 2 – Qualified Capacity in Recent ISO-NE and PJM Forward Auctions

		ISO-NE FCA2			PJM BRA5		
		[1]			[2]		
		Generation	DR	Imports	Generation	DR	Imports
	Qualified New (MW)	3,299	1,386	2,613	2,833	689	3,877
	Qualified Existing (MW)	31,401	2,767	1,311	135,015	908	1,842
	Total Qualified (MW)	34,700	4,153	3,924	137,848	1,597	5,719
[4]	Cleared New (MW)	1,157	448	1,529	2,337	411	3,208
[4]	Cleared Existing (MW)	31,050	2,488	769	130,414	908	1,842
[4]	Total Cleared (MW)	32,207	2,936	2,298	132,751	1,319	5,050
[3]	Uncleared New (MW)	2,142	938	1,084	496	278	669
[3]	Uncleared Existing (MW)	351	279	542	4,601	-	-
[3]	Total Uncleared (MW)	2,493	1,217	1,626	5,097	278	669

[1] "Review of PJM's Reliability Pricing Model (RPM)," by Johannes P. Pfeifenberger, Samuel A. Newell, et. al, *The Brattle Group*, Inc., June 30, 2008.
[2] From "Second Forward Capacity Auction (FCA #2) Results Summary," ISO-NE, January 21, 2009.
[3] Uncleared New and Existing resources in ISO-NE FCA2 are calculated as the difference between Qualified and Cleared New and Existing resources for each relevant category.
[4] We separated Cleared capacity data into "New" and "Existing" categories by assuming that all Cleared resources from BRA4 cleared as Existing resources in BRA5,.

Admitting many different types of existing and potential resources into the forward capacity auctions also encourages the least-cost and economically efficient resource to be developed and retained. For example, PJM's and ISO-NE's forward capacity markets have attracted and retained a variety of new resources with varied cost structures, including new generation capacity, imports, and demand-side resources. The existing short-term ICAP market can also accommodate a variety of resource types, but the auction itself has a much smaller supply pool to choose from since it only admits what is already built.

3. Reserve Margin Stability

Forward capacity markets help to stabilize reserve margins by procuring the required amount of capacity – and no more – before developers decide whether or not to build. This argument is supported by the forward auction results in ISO-NE and PJM. The capacity that cleared the auction is going to be built; the substantial amount of new capacity that did not clear presumably will not be built.[31] However, the dynamics could be different in the NYISO over the next several years. FCM's ability to stabilize reserve margins by aligning the amount of new entry to reliability needs is active only when new entry is needed, which is not anticipated to occur until after 2018.

[31] Excess capacity cleared in ISO-NE only because of the auction price floor and the pro-rating rule, which allow more than the installed capacity requirement to clear and be paid a prorated price. PJM does not meet its reserve margin targets exactly because its demand curve allows for excess (shortfall) to clear with a reduced (elevated) price.

4. Price Stability

All else being equal, a forward capacity market should have more stable prices than a short-term capacity market. This is because the supply curve in a forward auction is more elastic, reflecting the fact that there is time for the supply to adjust. If prices are high, more capacity will enter, thus mitigating price spikes; if prices are low, less capacity will enter, also providing a dampening effect on price volatility. Prices are also partially stabilized by the ability of suppliers to incorporate some capital cost recovery into competitive offers, since the auction precedes the investment decision. By contrast, short-term capacity markets admit only existing resources, which would generally treat their investment costs as sunk if submitting a competitive offer.

Forward capacity markets further stabilize prices relative to short-term capacity markets by fostering greater competition among suppliers. Assuming no major barriers to entry, the potential entry of new resources reduces other suppliers' ability to increase prices by withholding capacity. The extent of this effect in New York would depend on barriers to entry and the effectiveness of market power mitigation measures.

Finally, as discussed above, FCM tends to stabilize reserve margins, and that leads to more stable prices for capacity as well as energy. However, there is generally a lack of empirical evidence to demonstrate how effective FCM actually is in reducing price volatility, especially in a constrained market like New York City.

To the extent that a forward capacity market would have more stable prices, there would be at least two types of benefits: (1) rate stability for customers; and (2) more dependable revenues for developers, which improves their decision making and decreases investment risks, thus lowering investment costs. Reduced investment costs should ultimately lower prices for customers, assuming a competitive long-run market in which prices reflect suppliers' costs.

5. Capital Recovery from Future Prices

Forward capacity markets can also help developers make better investment decisions by signaling whether their capacity is economically needed before they make an irreversible financial decision. A sufficiently high clearing price signals that entry will be profitable for the auction delivery year, and a low price signals that it will not. In addition to providing revenue certainty in the resource's first year, a high price also suggests the possibility of sufficient future prices, assuming continued load growth and retirements cause new capacity to be needed in future auctions, setting prices at the net cost of new entry (Net CONE).

However, there is no guarantee that prices will remain at the same level or higher. Developers continue to face the risk that new capacity is not needed in the future (*e.g.*, because of economic contraction or accelerated penetration of energy efficiency), that new technologies will set prices at a lower Net CONE, or that legislative/regulatory interventions depress prices.

B. ALIGNMENT WITH RELIABILITY PLANNING PROCESS

As discussed in Section III, the NYISO's reliability planning process assesses resource adequacy needs over five- and ten-year planning horizons.[32] These needs are not expressed in the existing ICAP market construct until just before the capability period. Although developers can read the RNA several years before the delivery year, they may or may not be willing to take a risk by assuming that they (and not too many other developers) will clear and earn sufficient revenues in the short-term capacity market. If sufficient resources do not appear to be on track, the planners may be forced to trigger out-of-market (OOM) solutions.

By contrast, a forward capacity market could incorporate any resource adequacy-related needs identified in the RNA in time for market-based resources to respond. As Figure 2 showed, the forward auction would take place within a year after the RNA and CRPP are conducted, which is still 44 months in advance of the delivery year. This would provide transparent capacity need and pricing signals to all existing and potential participants, allowing them to compete to fulfill the resource adequacy need and reducing reliance on OOM solutions. OOM solutions could still be implemented in cases where the market does not provide adequate resources and to meet transmission security needs that are unrelated to resource adequacy.

C. ALIGNMENT WITH NEIGHBORING ISOS

ISO-NE and PJM have recently replaced their short-term capacity markets with forward capacity markets. Even though the NYISO's existing ICAP market occurs on a very different timeframe, all three markets are similar in that they all have reliability requirements and centralized capacity markets which facilitate inter-regional transfers of capacity. However, the NYISO's shorter-term capacity market construct can cause NYISO market participants to learn too late whether an external resource has become committed to ISO-NE or PJM. For example, an external resource which has been available historically to New York may have committed itself in the other RTO's 3-year forward capacity market without having any obligation to notify the NYISO. To receive such information, the NYISO may have to wait until its request for import rights to identify whether or not that resource will participate as usual.

If the NYISO adopts a forward capacity market, the NYISO and its stakeholders will have more timely information regarding the availability of external resources. This, in turn, would provide advance information of potential resource need to market participants in New York to respond to the disappearance or appearance of external resources. It could also increase the economic efficiency of capacity markets regionally.

However, aligning the forward nature of capacity market auctions with the neighboring ISOs' will not eliminate all inter-regional inefficiencies. The free flow of resources will still be inhibited by the requirement that resources de-list from one market before participating in another, preventing the markets from "co-optimizing" resource assignments across the region. In addition, design differences among ISOs may create distortions. For example, an ISO with a demand curve may absorb excess capacity during regional surplus years, but when there is true

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[32] "2009 Reliability Needs Assessment, Final Report," January 13, 2009,, page 2-1.

region-wide scarcity, that same excess capacity may flow to a relatively high-priced region without a demand curve.

D. Reduced Dependence on Administratively Determined Parameters

As will be discussed in Section VI, demand curves can mitigate capacity market power and volatility and recognize some value of excess capacity, but their administrative determination is subject to errors that can have a major impact on auction clearing prices. This major disadvantage of demand curves is smaller in a forward market than a short-term market because forward markets have more elastic supply curves. As supply becomes more elastic, the market clearing price becomes less sensitive to the administrative demand-curve parameters (see Section VI).

V. COSTS OF REPLACING EXISTING ICAP MARKET WITH FCM

A. Implementation Costs and Risks

The implementation costs and risks of replacing the existing ICAP market with a forward capacity market construct are likely to be quite significant. A large share of direct implementation costs would involve the developing, testing, and deploying of the necessary new software to support forward auctions and settlement. In addition, the NYISO would likely have to expand its staff significantly in order to implement proper resource verification and tracking procedures similar to those employed to support ISO-NE's forward capacity market. Also, market participants would incur their own direct risks and costs adapting to new rules and procedures.

There is a sense among many NYISO stakeholders that both PJM and ISO-NE incurred considerable implementation costs in introducing FCM to their markets. There is little publicly available data, however, on the actual expenses incurred. For illustrative purposes, Table 3 shows that Phase I of ISO-NE's FCM budget was allotted $8.9 million.[33] A major part of ISO-NE's Phase I outlays went to software development. Moreover, the amounts in Table 3 do not include the costs for Phase II and III nor the ongoing cost of additional staff. The NYISO's direct implementation costs are unlikely to be much lower even though it already has a functioning capacity market, and it could benefit from ISO-NE's and PJM's innovations. Software is highly specialized, reflecting specific tariff language, rules, and system characteristics unique to each ISO. Similarly, verification of specific planned resources and other administrative procedures would still require new staffing. Therefore, human capital and software costs are likely to resemble those at ISO-NE and PJM.

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[33] "Forward Capacity Market (FCM) Project Update", NEPOOL Participants Committee Meeting, Vamsi Chadalavada, March 7, 2008.

The indirect costs of implementing a new forward capacity market could be even larger. Given the lack of a consensus on whether and how to design a forward capacity market in the NYISO, some market participants have expressed concern that the participants and the NYISO would have to expend considerable resources litigating the outcome. Some stakeholders also argue that the time required to develop and implement a contentious new market design would divert scarce NYISO resources from other ongoing projects related to system operations and market structure redesign.

Finally, implementing a fundamentally different market design always opens the possibility of unanticipated market design flaws. Design flaws could create reliability risks, economic inefficiencies, gaming opportunities, or substantial wealth transfers.

Table 3 – ISO-NE FCM Phase I Budget

Capital Budget Category	2006	2007	2008	Totals
Labor	$1,726.5K	$5,003K	$750K	$7,479.5K
Hardware		$250K		$250K
Contingency			$50K	$50K
Total Project	**$1,726.5K**	**$5,253K**	**$800K**	**$7,779.5K***

*This is a projection based on preliminary February numbers. Final FCM Phase I capital expense will be determined by the end of March. Approved Overall Capital Budget for FCM Phase I: $8,976.5K.

Source: ISO New England "Forward Capacity Market (FCM) Project Update." March 7, 2008.

B. Risks and Costs to Suppliers from Taking on Long-Term Obligations

Suppliers that clear a forward capacity auction take on the obligation to provide capacity in the delivery year, approximately four years after the auction. This forward obligation imposes risks on the suppliers, for whom unanticipated costs or difficulties can prevent them from delivering the promised capacity. If they are deficient, they must find replacement capacity (at a price that could be higher) in reconfiguration auctions or else face deficiency penalties. These risks raise suppliers' financing costs and can create barriers to entry. In turn, higher costs and entry barriers lead to increased capacity prices and, thus, raise consumers' costs.

The risks associated with a forward obligation are especially significant for new generation resources and demand resources, but they also affect existing generation. New generation bids based on expectations of its development schedule and future costs that will be incurred after the auction. The longer the period between the auction and the expected project completion date, the more difficult it becomes to accurately predict financing and permitting outcomes, final project costs, and the project completion date. Similarly, existing generators with future FCM obligations face the risk of a unit breaking down in the four years between the auction and the delivery year. The unit might require expensive repairs or costly environmental upgrades that were not anticipated in its bid, or it might be unavailable altogether.

Forward capacity market obligations create a special risk for demand response (DR) providers. Most DR is provided by aggregators of many end-users that contract to be curtailable in exchange for payment. However, most end-users do not sign long-term contracts with aggregators (or sell directly into the capacity market) due to uncertainty about their business longevity, opportunity costs, and the frequency with which they would be activated in four years. Thus, aggregators can provide material amounts of DR in forward capacity markets only if they are allowed to bid *potential* resources that are not yet contracted. The aggregators must be compensated for taking on the financial risk, and this could increase the price at which DR bids into the auction and decrease the amount of DR.

Nevertheless, ISO-NE and PJM have attracted large amounts of new DR, but only by allowing aggregators to offer *potential* resources for which they do not yet have contracts. PJM also provides DR opportunities to enter closer to the delivery year by holding back some procurement in the base auction.[34]

Suppliers that are deficient and do not shed their obligations in reconfiguration auctions are penalized in order to deter speculative resources from participating in the forward auctions. For example, deficiency penalties are 20% of the annual capacity clearing price in PJM and 25% of the annualized cost of new entry (CONE) in ISO-NE. Both ISOs also require suppliers of new resources to provide financial assurance deposits to indicate that their projects are not speculative and to guarantee their ability to pay for replacement capacity or penalties.[35] In addition, suppliers must demonstrate credit-worthiness in the resource qualification process. These financial requirements could pose barriers to entry, especially for smaller DR providers.

C. Challenges Recognizing Energy Efficiency

Given the great extent of state initiatives to promote cost-effective energy efficiency, it is important that the capacity market recognizes energy efficiency. Energy efficiency relates to capacity markets on two levels. First, measures that save energy when the system load is highest, such as high-efficiency air conditioners, can create capacity value by reducing the total amount of supply needed. And second, the entities paying for the energy efficiency measures

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[34] Originally, PJM allowed DR to enter after the base auction through a special out-of-market mechanism, but it is now using incremental auctions to procure DR and other short lead-time resources (126 FERC ¶ 61,275).

[35] ISO-NE requires new resources to provide a deposit of 3 times the cost of new entry (CONE), paid in three installments, and the deficiency penalty consists of losing that deposit (see ISO-NE Tariff, Exh. IA, “Financial Assurance Policy for Market Participants,” Section V.b.2, available at http://www.iso-ne.com/stlmnts/assur_crdt/pol_amndts/fap_mktpart_sec1_rtotarif.pdf.).

need to be able to capture the capacity value in order to have the incentive to implement the right amount and right types of measures.

Recognizing new energy efficiency is more challenging in a forward capacity market construct than in a short-term market construct. The ISO must know four years in advance the amount by which energy efficiency will reduce peak loads, from a baseline load forecast that is uncertain and implicitly embeds an unknown amount of baseline efficiency. It might seem sensible to wait until the effects of new energy efficiency measures are demonstrated in metered usage. However, this would fail to recognize savings until five to six years after installation, a large portion of the life of many energy efficiency measures. It takes one to one-and-a-half years before the load reductions appear in the meter data and can be incorporated in a forward auction, then another four to five years from the forward auction to the delivery year. Such a lag can result in over-procurement and inadequate incentives.

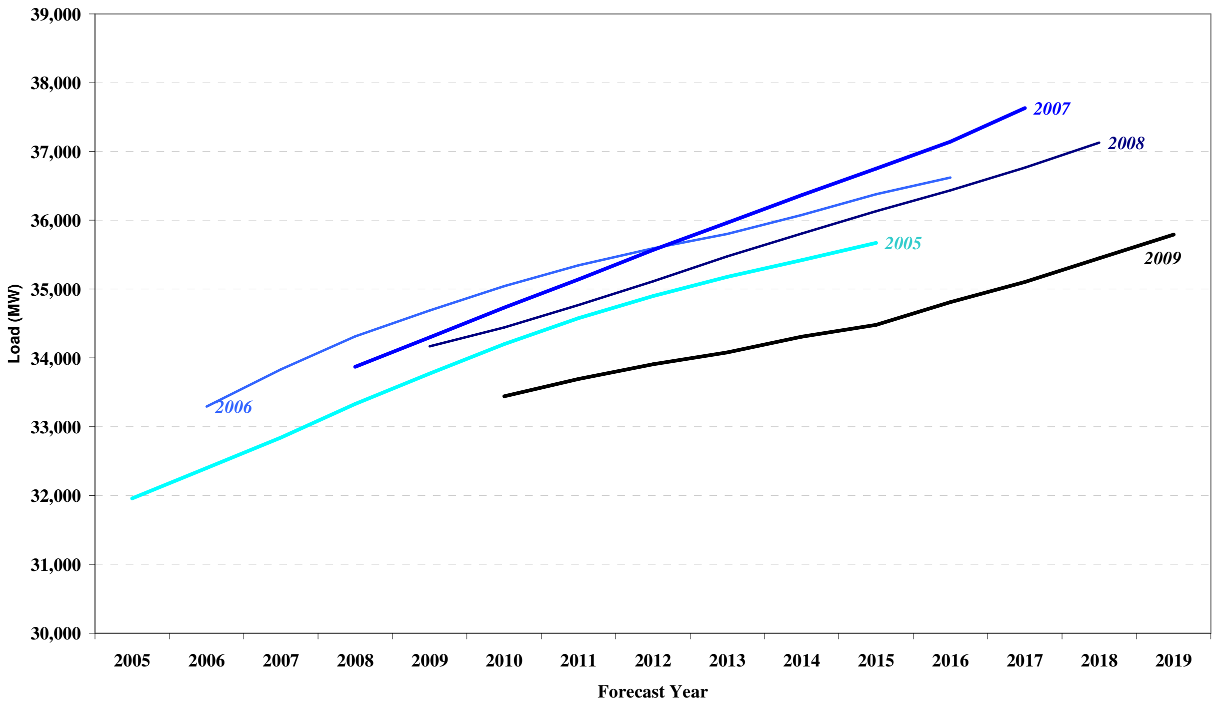
The incentive lag can be reduced to one year by assigning each load serving entity its share of the system capacity obligation just before to the delivery year, based on peak load contributions metered in the prior year. But this does not address the over-procurement problem, which can be addressed only by incorporating energy efficiency plans into the load forecast or on the supply side. ISO-NE and PJM both permit energy efficiency to participate on the supply side, much like demand response, although this poses some measurement and verification problems. Either way, procuring the target amount of reliability four years forward is unlikely unless the load forecast accounts for energy efficiency accurately, explicitly, and consistently with any treatment of energy efficiency on the supply side.

D. RISK OF OVER- OR UNDER-PROCUREMENT

In the NYISO's proposed design for a forward capacity market, the NYISO would procure four years in advance 100 percent of the forecast resource adequacy requirement. If the forecast turned out to be too low, there would be inadequate capacity, but presumably the incremental need could be procured in reconfiguration auctions or the spot auction, as in the existing ICAP market construct. But if the forecast turned out to be too high, customers would still be financially obligated to pay for all of the capacity that they already procured in the forward auction. They would have to pay for more capacity than they need to meet reliability targets.

The possibility of over-procurement is material, due to the inherent uncertainty in four-year-forward load forecasts. The load could unexpectedly decrease, for example, if the recession is deeper and longer than anticipated, or if there is an exodus of industrial customers from the state. Load could also decrease if energy efficiency programs develop faster than anticipated, as discussed above. Figure 4, compiled from data published in the NYISO's annual "Load and Capacity Data reports" (2005-2009), illustrates forecasts in the NYISO have been changing substantially. For example, the 2006 forecast for 2010 was more than 1,600 MW higher than the current 2009 forecast for 2010.

Figure 4 – The NYISO's Annual Ten-Year Forecasts



Load forecasts can also increase as the delivery year approaches. For example, the forecast for 2010 increased by approximately 500 MW from 2005 to 2007. It might be tempting for planners to set the ICR conservatively high (thus increasing the likelihood of over-procurement) in order to avoid the risk of resource scarcity caused by under-forecasting, even though deficiencies could likely be covered in the spot auction.

VI. BENEFITS AND COSTS OF A SLOPED DEMAND CURVE IN FCM

A. ROLE OF THE DEMAND CURVE IN CAPACITY MARKETS

The advantages and disadvantages of including a sloped demand curve in a forward capacity market construct are similar to those pertaining to the existing ICAP market. A sloped demand curve was first implemented in the NYISO's ICAP market in the 2003 Summer Capability Period, replacing a vertical demand curve that had been used in prior auctions.[36] The NYISO now updates the parameters defining each of the three demand curves (for NYCA, New York City, and Long Island) every three years through a stakeholder process. The parameters of the demand curves are set so that "the demand curve price equals the levelized cost of a new peaking

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[36] "In the NYISO's Demand Curve Filing and the Commission's May 20, 2003 Order, the NYISO and the Commission predicted that the ICAP Demand Curve would result in price stability, an increase in the amount of capacity committed to Bilateral Transactions, and incentives to build new generation." NYISO "New York Independent System Operator, Inc. Report on Implementation of the ICAP Demand Curve" before FERC Docket No. ER03-647-000.

unit (net of estimated energy and ancillary services revenue) when the quantity of UCAP procured equals the UCAP requirement. The demand curve price equals $0 when the quantity of UCAP procured exceeds the UCAP requirement by 12 percent for NYCA and 18 percent for New York City and Long Island. The demand curve is defined as a straight line through these two points."[37] In addition, the demand curves continues to generate higher prices at quantities below the target, up to a maximum price equal to 1.5 times the estimated localized CONE, at which point the demand curves become horizontal at lower quantities.[38]

Revising and setting the demand curve parameters is often a contentious stakeholder process, which invokes a wide range of views from market participants. The purpose of this analysis is not to evaluate the appropriateness of specific demand curve parameters but rather to assess the role of a demand curve in the design of a forward capacity market.

A capacity market with a vertical demand curve[39] is subject to several potentially disadvantageous outcomes. Even relatively small fluctuations and shifts in supply could result in large price swings—cleared supply that is even slightly less than the reliability target will result in a market price at the cap (which is a multiple of the estimated localized CONE). On the other hand, cleared supply that is slightly above the reliability target will bring the market clearing price to zero. As a result, a vertical demand curve assigns no value to capacity levels in excess of the reliability target, while it sets prices at the cap under deficiency conditions regardless of the magnitude the deficiency. Accordingly, boom-and-bust cycles can occur, resulting in volatile market clearing prices.

This potential for pronounced volatility in capacity prices in a market with a vertical demand curve also facilitates the profitable exercise of market power on both buyers' and sellers' sides of the market. The possibility to receive a high price for capacity (at the cap) encourages suppliers to engage in physical or economic withholding of capacity. Among large buyers, the opportunity to depress the market price to zero can induce them to create excess capacity by self-providing beyond their actual needs.

An additional disadvantage of the vertical demand mechanism is that it fails to address the issue of capacity lumpiness. Given annual load growth that is small relative to the size of a new unit, capacity additions would tend to collapse the market price for several consecutive periods thus rendering the value of capacity to zero for some time.

A demand curve with a slope has the ability to at least partially mitigate the above disadvantages. A sloped demand curve recognizes that capacity has some incremental value both below and above the reliability target, so deviations in quantity around the reliability target do not cause excessive price volatility. Consequently, a sloped demand curve reduces the incentive and

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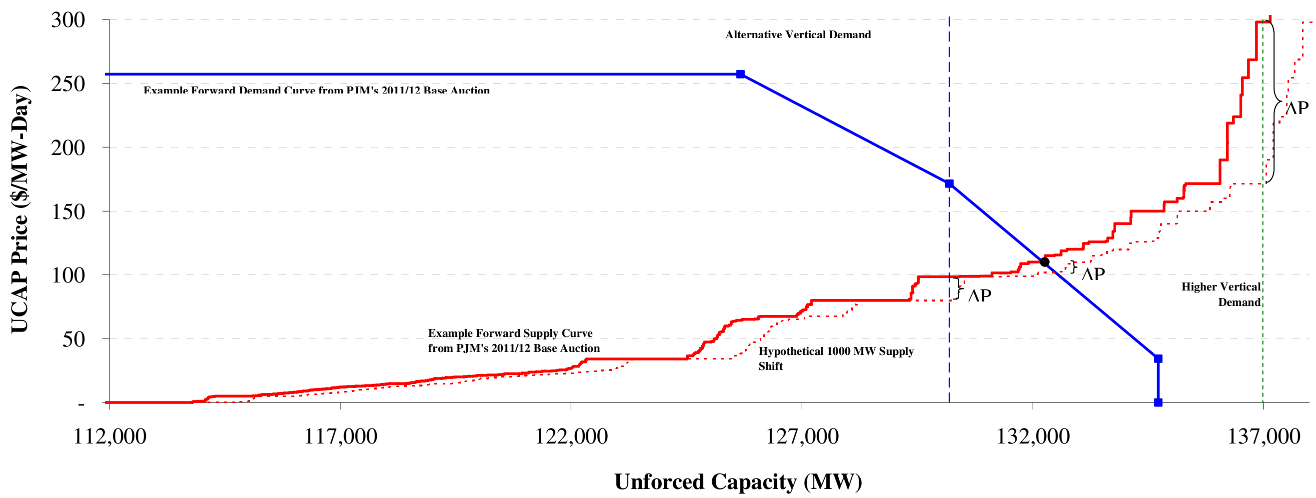
37 "2007 State of the Market Report: New York Electricity Markets," Potomac Economics, May 2008.

38 "NYISO Installed Capacity Manual," April 2009.

39 To be precise, what is often referred to as a "vertical demand curve" is neither vertical nor a curve, but rather a step-wise function, which is horizontal at a price cap for quantities less than the reliability target, vertical at the reliability target capacity quantity and, vertical again at a price of zero for quantities above the target capacity quantity.

ability to exercise market power as it moderates the potential price impacts of quantity changes. A sloped demand curve can also diminish the extreme price outcomes associated with lumpiness as well as booms and busts. As illustrated in Figure 5, a hypothetical 1,000 MW supply increase results in a more moderate price impact with a sloped demand curve than with vertical demand curves, especially in the steeper regions of the supply curve.

Figure 5 – Illustrative Price Sensitivity with Sloped and Vertical Demand Curves



Although a sloped demand curve in a capacity market can mitigate market power and price volatility, the parameters defining the curve are determined administratively and are subject to errors. The level of the curve is set by Net CONE, which is susceptible to numerous potential errors—the choice of reference technology, the estimation of that technology's installed costs and an appropriate capital charge rate, and determining the energy and ancillary services offset.[40] Given those limitations, the administratively-determined demand curve could potentially produce inefficient outcomes that deviate from what an ideal competitive market would produce. It is possible, however, for the administrative process to incorporate an increasing amount of empirical market data as the forward capacity market matures and information becomes reliable.

The slope of the current demand curve is a product of a comprehensive yet administrative process. A slope that is too steep might not be sufficient to adequately mitigate market power and its effects on price. On the other hand, a slope that is too flat could produce over-procurement with inefficiently high prices in surplus conditions or under-procurement with inefficiently low prices in scarcity conditions.

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40 The energy and ancillary services revenue offset is largely based on a combination of production simulation and econometric methodologies thus incorporating only a limited amount of actual empirical information. See "New York Independent System Operator, Inc. Proposed NYISO Installed Capacity Demand Curves For Capability Years 2008/2009, 2009/2010 and 2010/2011 FINAL", Source: http://www.nyiso.com/public/webdocs/products/icap/demand_curve_documents/demandcurveproposal10-5-2007_final_V2_redlined_101007.pdf.

The demand curve is designed to provide desirable price behavior by mitigating market power and volatility. It should also not deviate too much from the marginal value of capacity or market outcomes will be inefficient.[41] However, empirically determining the marginal value at various capacity levels presents a significant challenge. The marginal value should depend on the capacity's incremental effect on the Loss of Load Expectation (LOLE) multiplied by the marginal Value of Lost Load (VOLL) to end-users. The proper measurement of VOLL is a controversial issue and, often, studies on this topic report estimates that differ by a factor of 10.[42]

B. EVALUATION OF SLOPED DEMAND CURVES IN FORWARD MARKETS

The benefits and disadvantages of sloped demand curves in spot markets are also relevant to forward capacity markets. However, the effects are not equivalent. A forward capacity market would reduce the dependence on the demand curve's administratively-determined parameters due to an essential difference in the elasticities of the short-run (spot market) supply curve and the long-run supply curve in the forward capacity market. As discussed in Section IV, the short-run (spot) supply curve is relatively inelastic—that is, to the extent that producers cannot build additional capacity on a short notice, their response is limited to available capacity. In the longer term (3-4 years forward), however, the elasticity of the supply curve is much higher since, given an appropriate length of time, producers can add new capacity when resources are needed. An idealized constant-cost, long-run supply function is perfectly elastic, transforming the curve into a horizontal line. This cost would set the market clearing price no matter how the demand curve was set.

This idealization is useful to illustrate that the closer the actual long-run supply curve is to a horizontal (zero-slope) line, the more accurately the clearing price would reflect the actual entry costs, and the more independent it would be of the administratively-set demand curve parameters. Hence, a forward capacity market, which typically involves a longer-run supply curve due to its forward timing, would reduce the reliance on the demand curve's administratively-set parameters in comparison to the spot capacity market. This insight also highlights the importance of accurately estimating Net CONE during the administrative process for the existing short-term ICAP market. Given the relative inelastic short-term supply curve, the clearing price will be much more sensitive to the parameters of the demand curve and the accuracy with which the level of Net CONE is determined.

However, even without a sloped demand curve, forward procurement can provide some of the benefits that a sloped demand curve can provide. If a need for new capacity exists, the elastic long-run supply curve expressed in forward capacity markets should ideally intersect the demand curve (even if demand is vertical) and set the price at the long-run cost of entry. In addition, the breadth of actual and potential entrants participating in forward markets naturally mitigates supplier market power by reducing the ability to withhold profitably. Therefore, in a forward

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41 Cramton & Stoft, "The Convergence of Market Designs for Adequate Generating Capacity," 2006.

42 "A Framework and Review of Customer Outage Costs Integration and Analysis of Electric Utility Outage Cost Surveys," Ernest Orlando Lawrence Berkley National Laboratory, 2003.

market construct, a steeper slope of the demand curve could be considered without significant loss of benefits.

Overall, there are likely to be net benefits to including sloped demand curves in forward capacity market construct. The benefits are most likely to realized if the demand curves are included directly in forward auctions, not only in spot auctions as the NYISO has proposed. Although suppliers' bidding behavior could translate the expected effects of the spot auction's demand curves backwards into the forward auction, the translation is likely to be imperfect due to uncertainty. In addition, the resulting complexity of bidding behavior would likely make the market monitor's job more difficult.

VII. MULTI-YEAR PRICE COMMITMENT OPTIONS

One of the major barriers to entry in an annual capacity market (forward or spot) is the uncertainty of future revenues. Absent long-term contracts, there is no guarantee of future prices. Prices could decrease due to new technologies, capacity surpluses, and various types of regulatory interventions. This risk substantially raises the cost of entry for long-lived generating assets. As several stakeholders pointed out in our Focus Group discussions, one possible way to reduce such risks could be to provide price guarantee to new and/or existing resources for a multi-year period, instead of just one year of commitment period forward auction clearing price. However, a multi-year price lock-in can be inefficient, as we discuss below. The need for a multi-year lock-in should be carefully weighed against its costs and also other possible alternatives to a multi-year lock-in.

Under a multi-year lock-in provision the resources (new and/or existing) could opt to receive the initial FCM clearing price not only in the first delivery year, but also in the subsequent 3-5 years. The clearing price in FCM will be market-determined based on the forecasted market conditions only in the delivery year, which can be very different from what the market conditions will turn out to be in subsequent future years. Thus, locking in a price based on a single year's market conditions is likely to be inconsistent with the next few years' market-based price which could lead to inefficiencies in the market. For example, if prices are expected to fall in future auctions, suppliers would tend to exercise the lock-in option, and they will be online (*e.g.*, will build or commit not to retire) even if their capacity is not economic according to the true market price.

ISO-NE's FCM does provide an option for new resources to lock in a price for as much as five years. PJM's forward capacity market also has a provision that allows a new capacity resource to lock-in a new entry price for three years, but only under certain stringent conditions for which no resource has qualified.[43] Accordingly, PJM filed with FERC for relaxation of the pre-conditions and an extension of the lock-in period to seven years. FERC rejected PJM's proposal

[43] "Review of PJM's Reliability Pricing Model (RPM)," by Johannes P. Pfeifenberger, Samuel A. Newell, Robert L. Earle, Attila Hajos, and Mariko Geronimo, *The Brattle Group, Inc*., June 30, 2008 (FERC Docket No. ER05-1410, *et al*., 2006). ISO-NE's Internal Market Monitoring Unit and *The Brattle Group* are jointly reviewing the results of ISO-NE's first two auctions and design elements, to be filed with FERC on June 6, 2009.

on the ground that a multi-year lock-in provision available only to new resources is discriminatory and bifurcates the market, and an extension to the existing provision "would result in further price discrimination between existing resources, including demand response, and new generation suppliers."[44] These weaknesses could be partially addressed by offering the lock-in option to all resources. However, expanding the scope of a lock-in option could increase the inefficiencies associated with setting prices for several years based on market conditions in a single year.

The main argument in favor of a multi-year lock-in for new resources is to provide developers with a price assurance such that investment becomes less risky and costly. However, even a 3-year price assurance provides revenue certainty for only a small fraction of the life of a 30-year asset. Thus, a multi-year lock-in falls much short of eliminating price risks for developers.

VIII. CONCLUSIONS

The major benefits and costs of replacing the existing short-term ICAP market construct with the NYISO's proposed forward capacity market construct are summarized in a "scorecard" presented in Table 4.

The scorecard compares these two constructs to each other and to two alternative forward design variants in which demand is vertical and a multi-year price lock-in option is offered. Each design is rated on a scale from -2 (the worst rating, depicted as a full red circle) to 2 (the best rating, depicted as a full green circle) along 13 evaluation criteria corresponding to the issues discussed in Sections IV-VII of this report. Each criterion is assigned relative weights of importance on two different timeframes: the next 5-10 years when there is no projected need for new entry for reliability (as discussed in Section III), and the long-term when new entry is needed to meet future load growth and/or generation retirements, and the relative advantages of forward procurement are more active. Finally, a weighted average score is computed for each design in each of the two timeframes by multiplying criteria weights by criteria scores and summing over all criteria. These weighted average scores represent the likely success and ultimate cost to customers of meeting resource adequacy requirements because even the issues of direct concern to suppliers affect the price at which they can offer capacity.

More specifically, the design variants compared in the scorecard are:

- *Spot Market with Demand Curve* reflects the existing short-term ICAP market in the NYISO.
- *FCM with Demand Curve* reflects the NYISO's proposed forward capacity market. For simplicity, we assume that the effects of the sloped demand curve proposed for the spot market would work backwards into the forward market through suppliers' bidding behavior, as if a sloped demand curve were incorporated directly into the forward market.
- *FCM without a Demand Curve* represents a mandatory forward capacity market much like the NYISO's proposed construct, but with vertical demand in all auctions.

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[44] Docket No. ER05-1410-000, *et al.,* March 26, 2008 Order on RPM, paragraph 149.

- *FCM with Lock-In Provisions and No Demand Curve* is the same as "FCM without a Demand Curve" but with suppliers allowed to lock in a forward auction price for up to three to five years.

The evaluation criteria were discussed in Sections IV-VII. The criteria included in the scorecard and brief descriptions are as follows:

- *Capital Recovery from Future Prices* reflects the level of confidence that once there is a need, new entrants can expect subsequent prices to provide recovery of fixed costs over the life of the asset.
- *Price Stability* refers to price volatility and its effects on customer rate stability and supplier investment risk.
- *Mitigation of Buyer Market Power* reflects the extent to which buyers are precluded from depressing auction prices by self-providing or procuring capacity in excess of system needs.
- *Mitigation of Supplier Market Power* refers to suppliers' ability to increase market prices by physically or economically withholding capacity.
- *Dependence on Administrative Determinations* addresses the degree to which auction clearing prices and quantities depend on administrative determinations such as demand curve parameters and the Net CONE.
- *Stability around IRM Requirement* reflects whether the market design promotes stable reserve margins — avoiding both under-procurement and over-procurement — by encouraging the development of the right amount of new capacity when it is needed.
- *Risk that IRM Is Too High* refers to the extent to which the IRM may be higher than needed to meet reliability requirements, due to forecast errors and conservative behavior in the planning process.
- *Alignment with Planning Process* describes whether a given market design aligns procurement timing with the planning process in order to improve the likelihood of market solutions and reduce reliance on out-of-market solutions.
- *Accommodation of Demand Response* refers to whether there are barriers to DR participation in the market.
- *Recognition of Energy Efficiency* rates the accuracy and timeliness with which the effects of energy efficiency can be reflected in capacity auctions.
- *Supplier Risk Obligation* refers to the level of risk to suppliers from taking on a capacity obligation in a given market design structure.
- *Alignment with Neighbors* reflects the extent to which there is a derived benefit from alignment between a given market design structure in the NYISO and the market features of neighboring RTOs' capacity markets.
- *Implementation Costs* refers to the expected level of expenditures and risks incurred by the NYISO and market participants implementing market design changes.

Table 4 presents the scorecard, and Table 5 summarizes the reasons for the individual scores and weight assigned.

Table 4 – Scorecard

Red – Half red – Empty – Half green – Green Worst ⟷ Best **Attribute**	**Weight for Next 5-10 Years** new entry is *not* needed for resource adequacy	**Weight for Long Term** new entry is needed for resource adequacy	**Spot Market with Demand Curve** (Existing ICAP Market)	**FCM with Demand Curve**	**FCM with No Demand Curve**	**FCM with Lock-In and No Demand Curve**
Capital Recovery from Future Prices	1	3	Half green	Green	Empty	Half green
Price Stability	2	3	Half green	Green	Empty	Half green
Mitigation of Buyer Market Power	2	3	Half green	Half green	Empty	Empty
Mitigation of Supplier Market Power	2	3	Half green	Green	Half green	Half green
Dependence on Admin. Determinations	3	3	Red	Half green	Green	Half green
Stability around IRM Requirement	1	3	Half red	Empty	Green	Half green
Risk that IRM is too High	1	1	Half green	Half red	Half red	Half red
Alignment with Planning Process	1	3	Half red	Green	Green	Green
Accommodation of DR	2	3	Green	Half green	Half green	Empty
Recognition of EE	2	3	Half green	Half red	Half red	Half red
Supplier Risk of Obligation	1	3	Half green	Half red	Half red	Red
Alignment with Neighbors	1	2	Half red	Empty	Half green	Half green
Implementation Costs	3	2	Green	Red	Red	Red
TOTAL SCORE -- NEXT 5-10 YEARS			5	4	2	0
TOTAL SCORE -- LONG TERM			4	6	4	3

It should be noted that the lack of empirical data reflecting alternative designs under New York's projected system and market conditions limited this evaluation to a primarily qualitative analysis. Our qualitative analysis was grounded in the relevant economic theory and literature, and it incorporated stakeholder comments and findings from ISO-NE's and PJM's limited experience with forward capacity markets. However, the resulting scores and weights presented in the scorecard inevitably depend on subjective judgment. Yet the broader insights expressed in the scorecard are arguably robust.

The broader insight is that a mandatory forward capacity market could have greater long-term net benefits than the existing ICAP market. By procuring capacity with sufficient lead-time such that a range of potential new resources can enter (or not), forward capacity markets increase market competitiveness and efficiency, and they can stabilize reserve margins and prices and thus lower investment costs/risks (aligning the procurement timing with the planning process and with neighboring ISOs' forward capacity markets is also a benefit). Including sloped demand curves in the auctions would further mitigate market power and price volatility, contributing to a more favorable investment environment.

However, the incremental benefits relative to the existing ICAP market, which has no identified fundamental flaws, would not be reaped until new capacity is needed. The significant implementation costs would be unlikely to be offset for possibly more than ten years.

Ideally, a forward market would be implemented shortly before future load growth and/or retirements create a need for new capacity. In addition, waiting would allow the NYISO to observe and benefit from additional years of forward capacity market experience in PJM and ISO-NE. Yet it would be important not to wait too long so that an initial design could be implemented before the stakes are high (when the risk of shortages is higher and prices are higher and more sensitive). This would allow time to resolve any major design flaws and ensure that a well-functioning forward capacity market would be in place by the time new capacity is needed for reliability. Implementing a forward market before new capacity is needed regionally could also prevent neighboring ISOs' forward procurements from making scarce resources unavailable to the NYISO without the NYISO even knowing it until its spot auctions occur.

Table 5 – Explanation of Weights and Ratings in Scorecard

Attribute	**Weight for Next 5-10 Years** new entry is *not* needed for resource adequacy	**Weight for Long Term** new entry is needed for resource adequacy	**Spot Market with Demand Curve** (Existing ICAP Market)	**FCM with Demand Curve**	**FCM with No Demand Curve**	**FCM with Lock-In and No Demand Curve**
Capital Recovery from Future Prices	**1**	**3**	◐	●	○	◐
	Less important because the main implication is encouraging new entry.	Very important to support new entry when new entry is needed.	Medium-high score because demand curve helps stabilize prices near Net CONE, but investment costs are sunk and would not be included in competitive bids.	Highest score because forward auctions precede investment, signaling entry only when needed, thus stabilizing reserve margins and prices, and allowing competitive bids to include some capital cost recovery. Demand curve further stabilizes prices around Net CONE.	Neutral score because, although future auctions would ideally clear at Net CONE when new capacity is needed, prices would be vulnerable to buyer market power and lumpiness.	Higher score than "FCM with No Demand Curve" because suppliers electing the lock-in option enjoy initial prices for first few years of operation.
Price Stability	**2**	**3**	◐	●	○	◐
	Price stability is important to customers. It also can reduce investment risks, but this is less relevant when entry is not needed.	The value of stable prices to investors becomes important in the long term when new entry is needed.	Medium-high score because demand curve reduces price sensitivity to quantity changes, thus reduces price volatility, but supply curve is less elastic than long-run supply curve.	Highest score because both forward procurement and sloped demand curves help to stabilize prices.	Neutral score because, although more elastic long-run supply curve helps to stabilize prices in forward auctions, totally inelastic demand curves destabilize prices.	Higher score than "FCM with No Demand Curve" because suppliers electing the lock-in option enjoy stable prices for a few years.
Mitigation of Buyer Market Power	**2**	**3**	◐	◐	○	○
	Buyer market power is of critical concern to suppliers, but with projected surpluses already depressing prices, buyers have less incentive and ability to affect prices.	The effect of buyer market power is greatest when there is a resource need, and buyers can build sufficient out-of-market capacity to prevent new resources from setting prices.	Medium-high score because demand curve reduces buyer market power by making prices less sensitive to quantity. In addition there are bidding rules for mitigation. However, these measures do not eliminate the threat.	Medium-high score, similar to buyer market power in existing ICAP market.	Neutral score because vertical demand increases buyer market power, but existing mitigation rules help.	Neutral score, similar to "FCM with No Demand Curve."

Attribute	**Weight for Next 5-10 Years** new entry is *not* needed for resource adequacy	**Weight for Long Term** new entry is needed for resource adequacy	**Spot Market with Demand Curve** (Existing ICAP Market)	**FCM with Demand Curve**	**FCM with No Demand Curve**	**FCM with Lock-In and No Demand Curve**
Mitigation of Supplier Market Power	**2**	**3**	◑	●	◑	◑
	Only medium importance because projected surplus fosters competition under any of the market designs.	Supplier market power is greater in the long term when the supply becomes tighter.	Medium-high score because demand curve mitigates market power by making price less sensitive to withholding; assume existing mitigation measures remain in place.	Highest score because forward procurement timing aligns with development lead times, which fosters competition with potential entrants AND demand curve reduces market power.	Medium-high score because forward procurement fosters competition with potential entrants, but no demand curve.	Medium-high score similar to "FCM with No Demand Curve."
Dependence on Administrative Determinations	**3**	**3**	●	◑	●	◑
	Important because demand curve parameters and other administratively-determined parameters can have a large effect on clearing prices and quantities.	Still important. Although economic fundamentals tend to outweigh administrative determinations in the long-run, the stakes are higher when capacity is needed and prices are higher.	Lowest score because market price and quantity depend strongly on the demand curve's Net CONE and slope.	Medium-high score because demand curve is set administratively, but elasticity of long-run supply curve in FCM allows market clearing near true Net CONE. Quantity can be above or below target, more when capacity is cheaper, less when more expensive.	Highest score because price theoretically clears at true Net CONE (and target quantity) when capacity is needed. Temptation to use price ceilings and floors could maintain dependence on administrative determinations.	Slightly lower score than "FCM with No Demand Curve" because the administratively-granted lock-in can interfere with market fundamentals in subsequent years.
Stability Around IRM Requirement	**1**	**3**	◑	○	●	◑
	With projected surplus, there is little risk of shortages.	Avoiding "boom-bust" is important for reliability and mitigating price volatility and investment risks.	Medium-low score because market outcomes are not observed until it is too late to respond, which combined with the demand curve, can support quantities that differ from the target.	Neutral score because forward procurement supports meeting the target, but demand curve allows deviations from target.	Highest score because vertical demand causes the market to clear at the target (apart from lumpiness and anomalies).	Slightly lower score than "FCM with No Demand Curve" because prior lock-in could support excess capacity if load contracts.

Attribute	**Weight for Next 5-10 Years** new entry is *not* needed for resource adequacy	**Weight for Long Term** new entry is needed for resource adequacy	**Spot Market with Demand Curve** (Existing ICAP Market)	**FCM with Demand Curve**	**FCM with No Demand Curve**	**FCM with Lock-In and No Demand Curve**
Risk that IRM is Too High	**1**	**1**	◑	◐	◐	◐
	A conservatively high IRM can result in over procurement; minimal importance when prices are low.	A conservatively high IRM can result in over procurement, but not by more than a few percent.	Medium-high score because near-term procurement is subject to less forecast error and hence less need to increase the IRM to reduce the risk of shortages.	Medium-low score because four-year forward forecasts are uncertain, which can cause conservative planners to increase the IRM.	Medium-low score, similar to "FCM with Demand Curve."	Medium-low score, similar to "FCM with Demand Curve."
Alignment with Planning Process	**1**	**3**	◑	●	●	●
	Less important when new entry is not needed.	Important when new entry is needed. Proper alignment can avoid the need for out-of-market solutions.	Medium-low score because the short-term ICAP market does not incorporate needs until it is too late to respond. Not the lowest score because short-term market would still reward an entrant who built to meet a resource adequacy need identified in the planning process.	Highest score because FCM incorporates identified resource adequacy needs into the forward demand curve, providing incentive and time for market solutions to work.	Highest score, similar to "FCM with Demand Curve."	Highest score, similar to "FCM with Demand Curve."
Accommodation of DR	**2**	**3**	●	◑	◑	○
	DR is a key element of capacity markets, but encouraging *new* DR is less important when new entry is not needed.	Very important because DR can provide an efficient source of new and existing capacity.	Highest score because DR's relatively short development lead-time allows it to benefit from the flexibility of entry and exit in a short-term market.	Medium-high score because neighboring ISOs demonstrate FCM's ability to attract large amounts of DR as long as there are special provisions to mitigate the mismatch between FCM and DR's short development lead time.	Medium-high score, similar to "FCM with Demand Curve."	Medium-high score, similar to "FCM with Demand Curve."

Attribute	**Weight for Next 5-10 Years** new entry is *not* needed for resource adequacy	**Weight for Long Term** new entry is needed for resource adequacy	**Spot Market with Demand Curve** (Existing ICAP Market)	**FCM with Demand Curve**	**FCM with No Demand Curve**	**FCM with Lock-In and No Demand Curve**
Recognition of EE	**2**	**3**	◑	◐	◐	◐
	Projected growth in EE necessitates recognition on either the supply side or the demand side, but accurate inclusion is less important when there are surpluses.	Projected growth in EE necessitates recognition on either the supply side or the demand side for proper incentives and for avoiding over/under-procurement.	Medium-high score because procurement based on *near-term* load forecast can accurately reflect EE more quickly.	Medium-low score because procurement based on long-term forecast is unlikely to reflect EE as accurately; lags dampen incentives and can miss large portion of measure life.	Medium-low score, similar to "FCM with Demand Curve."	Medium-low score, similar to "FCM with Demand Curve."
Supplier Risk of Obligation	**1**	**3**	◑	◐	◐	●
	Risk to new entrants not relevant; risk to existing capacity is minimized by the abundance of capacity available to replace cleared resources that are deficient.	Important risk to new (and less so for existing) resources, especially when lack of surplus capacity makes it more difficult to replace cleared resources that are deficient.	Medium-high score because suppliers' ability to deliver is fairly certain in the short-term.	Medium-low score because potential resources that clear for delivery in four years face penalties (or replacement cost in reconfiguration auctions) if they can not complete their projects on time or if existing resources fail.	Medium-low score, similar to "FCM with Demand Curve."	Low score, slightly worse than "FCM with Demand Curve" because multi-year commitment lengthens the obligation period for resources that opt for the lock in.
Alignment with Neighbors	**1**	**2**	◐	○	◑	◑
	Potential resource shifts with neighbors is less important when surplus exists.	Importance is greater in long-term when new capacity is needed, but importance is still limited by transfer capability.	Medium-low score because short-term ICAP market signals needs and resource availability two to three years after neighbors' forward markets. Not the lowest score because efficient inter-regional transfers are possible even with misaligned procurement timing.	Neutral score because, although forward procurement aligns better with neighbors, demand curve could allow ISO-NE suppliers to take advantage of compensation for excess capacity during regional surplus and could allow ISO-NE buyers to attract scarce capacity if a regional shortage develops.	Medium-high score because forward procurement timeframe would nearly match that of neighbors, but there are still seams issues (no co-optimization, differences in product definition).	Medium-high score, similar to "FCM with No Demand Curve."

Attribute	**Weight for Next 5-10 Years** new entry is *not* needed for resource adequacy	**Weight for Long Term** new entry is needed for resource adequacy	**Spot Market with Demand Curve** (Existing ICAP Market)	**FCM with Demand Curve**	**FCM with No Demand Curve**	**FCM with Lock-In and No Demand Curve**
Implementation Costs	**3**	**2**	🟢	🔴	🔴	🔴
	Important because the costs of market re-design can be large.	Medium importance because, although the costs of redesign can be large, they must be compared to benefits over the long term. Also, future implementation would benefit from the added experience of PJM and ISO-NE.	Highest score because continuing with current design (which has no identified fundamental flaws) imposes no new implementation costs.	Lowest score because of significant implementation costs and risks from new software, human and technical skills, design flaws etc.	Lowest score, similar to "FCM with Demand Curve."	Lowest score, similar to "FCM with Demand Curve."
TOTAL SCORE -- NEXT 5-10 YEARS			**5**	**4**	**2**	**0**
TOTAL SCORE -- LONG TERM			**4**	**6**	**4**	**3**