

**CENTRAL RESOURCE ADEQUACY MARKETS
FOR PJM, NY-ISO AND NE-ISO**

Final Report

Prepared by NERA

February 2003

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1. EXECUTIVE SUMMARY

National Economic Research Associates, Inc. (NERA) was retained by ISO New England, the New York ISO and the PJM ISO to conduct a comprehensive analysis of the centralized resource adequacy market model (CRAM) that was developed and proposed by the interregional Resource Adequacy Model Group (RAM Group). The proposal would establish centralized capacity markets that would operate in a coordinated way in the three ISOs. NERA retained and worked with Neenan and Associates, who advised NERA and the ISOs on issues related to demand resources and retail access.

The RAM Group proposal is driven by a desire to provide sufficient economic incentives for, and indeed to assure, resource adequacy. Resource adequacy is defined as having in place, a sufficient amount of resources measured in unforced capacity (UCAP), such that the expected loss of load probability is one day in ten years – a long standing regional reliability standard. This level of resources, relative to load, should result in an acceptable infrequent reliance on emergency operating procedures and avoid extreme upward volatility in spot energy prices that are unacceptable to energy market participants and governmental entities. The fact that at this level of supply, scarce supply conditions are very infrequent and upward price volatility in energy markets is muted means that a capacity market, or capacity requirement, is required. Energy and AS markets as currently structured and mitigated do not provide sufficient revenue to induce resources that will supply the desired level of resource adequacy.

A supplemental incentive to construct new resources and in some cases, continue to maintain and operate existing resources is needed to provide sufficient incentives for resource development and maintenance. This incentive could be provided in two broad ways. First, a capacity requirement could be imposed on load serving entities (LSEs) and LSEs would be required to assure that sufficient capacity was in place with sufficient planning lead-time. This is the model suggested by the FERC in its SMD NOPR. Second, the ISOs could act as a central buyer of capacity and make forward commitments to buy capacity that is financially supported by charges to LSEs during the capacity supply period.

The former model, requiring that LSEs make forward capacity commitment to ensure adequacy, is difficult to reconcile with a retail choice environment in which LSEs have no forward obligation or assurance that they will be serving any load, except as may be provided for in a contract with an end-use customer. All but one state in the region encompassed by the ISOs has full retail choice. The latter model, a centralized market model, is the direction chosen by the RAM Group.

The model specified by the RAM Group, the CRAM possesses an elegant simplicity. The ISO would determine the resource need in advance of the planning period, would hold a central procurement through an auction, would pay the auction price to all resource providers during

the period and would recover the cost from load during the planning period. The difficulties arising from uncertainty with respect to load obligations several years in the future would be eliminated and all LSEs would face a common charge for resource adequacy that would be passed on to consumers and would be competitively neutral at the retail level. Consumers would receive the benefits of adequacy and pay the cost of adequacy. These features are the essence of the CRAM.

NERA was asked to examine several key features of the CRAM which were developed on a conceptual level, but on which no decision had been made. These key features were:

1. The planning horizon or how far in advance of the supply commitment the auction should be held.
2. The commitment period or what the length of the supply commitment or contract should be.
3. The percent procured which encompasses whether the ISOs should procure all capacity for a commitment period at one time or procure various percentages at different times, perhaps even with different planning horizons.
4. The auction format with a particular request to examine a descending clock auction, a Reverse English auction and clearing, versus pay as bid formats.

NERA was asked to examine all these questions relative to the RAM Group objectives and also to carefully consider gaming and market power issues; and monitoring and mitigation to ensure that the CRAM with NERA's recommendations would not be subject to market power. Implicit in NERA's charge was the need to conduct the economic analyses needed to fill in the CRAM, to test the CRAM and to provide an opinion as to whether the CRAM as supplemented by NERA's recommendation could meet the RAM Group objectives - i.e., whether the elegant simplicity of the model would hold up to further detailed specifications and analysis.

Further, NERA addressed several other items, which were labeled implementation issues. These included issues such as offer caps and deficiency charges, compatibility with demand resources, reconfiguration auctions, compatibility with a variable resource requirement (VRR) and compatibility with retail access and bilaterals.

NERA assembled a team of economists with many years of experience in electric markets and auction theory and implementation to address this project. The methodologies used by NERA consisted of a combination of the application of economic reasoning and modeling at all stages of the report. Planning horizon and commitment period issues were further analyzed using simulation models. Auction format and percent-procured issues were further examined by

reference to the extensive theoretical and empirical literature. Each section of the report describes further the methodology used as outlined below.

In this report, NERA first provides discussions of the basic approach to its analysis. That is, after the Introduction (Section 2) the report focuses on the planning horizon and commitment period (Section 3), the percentage of the obligation procured (Section 4) and the structure of the central auction (Section 5). Section 6 focuses on the effect of deficiency charges should have on offer caps. After these basic design and parameter issues are discussed, NERA then addresses the compatibility of CRAM with a variety of key policy initiatives including market monitoring and mitigation (Section 7), Variable Resource Requirements (Section 8), retail choice (Section 9) and non-discrimination among resources (Section 10). Finally, Sections 11 and 12 discuss the impact of CRAM on energy and ancillary markets and how reconfiguration auctions are designed to “fill in the gaps” in capacity markets.

With respect to the major issues NERA reached the following conclusions:

1. The planning horizon must be sufficiently long to enable the CRAM to be a deciding factor in the decision to construct. Only when the CRAM is characterized by new units competing to win a contract to construct plant, will the CRAM meet the objectives of assuring resource adequacy and revealing the market price for adequacy. Further, the capacity market is in very much the same supply and demand balance as peak hour energy and distinguishing between prices that reflect economic scarcity and market power is difficult and contentious. Only when the pool of competitors is expanded to include entrants can market power concerns be adequately addressed. Practically, this means that a three-year planning horizon is the minimum.
2. Sequential auctions are not reliable for determining price and one hundred percent of the capacity required should be procured or under contract to be procured at all times. Auction research shows that sequential auction, where say, fifty percent of the requirement is bought at one time and the remainder is bought later in a subsequent auction, produces unpredictable results and would not provide meaningful price signals.
3. The commitment period could be from one to three years, but three years is preferable as it increases revenue certainty and is more likely to lessen the uncertainty facing bidders and remove uncertainty premia. A major issue in determining the price that is acceptable to an investor in a new plant is the expected future level of capacity revenue. While longer term (say, ten years) contracts would produce price offers not as affected by uncertainty, NERA did not believe that a central market could realistically impose long-term obligations on customers and considered three years as the longest acceptable

commitment period. Three years is consistent with the spirit of deregulated generating markets, which is not to impose long-term risks on customers.

4. An open auction format is desirable and the Descending Clock Auction (DCA) (a multi-round uniform price auction) is the best-suited format. Bidders face major common value uncertainties – in particular the potential level of energy and ancillary services (AS) net revenues and the uncertainty of post commitment period capacity revenues. Open multi-round auctions induce more competitive bids given substantial common value uncertainty. The DCA is also suitable for locational capacity requirements, for auction that allow for limited imports and exports and for a coordinated multi-ISO procurement. The DCA format makes collusion difficult and can be fine-tuned through control of information released and specific auction rules to deter market power.
5. Trust competition to discipline price. Mitigate or use an administrative price only when there is not adequate competition. Capacity markets have been marked by extreme volatility and periods of very low prices and very high prices limited only by an administered price cap or deficiency price. These types of markets do not provide a meaningful economic price signal. When competition is inadequate, mitigation and price caps are a necessity. However, in order to meet the objectives of the RAM Group, the market must be permitted to reveal the competitive price needed to assure adequacy without mitigation or administrative price caps. We address in detail proposed mitigation measures and price caps including an administrative price that we recommend be employed when there is inadequate competition. However, price caps and mitigation should be the exception and not the rule. The CRAM will only work if/when conditions are competitive; there is no mitigation and no price cap.

Throughout its research, NERA remained open to the possibility that it would provide the best possible analyses and recommendation on the issues left open by the RAM Group, but at the end of the day, may render an opinion that the CRAM was not a suitable tool for meeting the RAM Group objectives and we interpret our charge as requiring such a finding if we so believe that this is the case. We, however, do not find this to be the case. We believe that the CRAM is a market model well suited to the objectives of the RAM Group and entirely consistent with the current environment in the ISOs with respect to deregulation of generation and retail access. While our scope did not involve a comparative assessment of the CRAM against other market models, it is difficult to envision an alternative model that would better meet the RAM Group objectives.

We do, however, offer several caveats concerning the CRAM and believe that these caveats should be recognized before proceeding. First, a premise of the CRAM is that the commitment period will not be so long as to transfer the long-term resource decision and capacity market risks to customers. These risks will reside with resource providers. It is unrealistic to expect

that price can reflect life of resource amortization periods when contractual commitments to resource providers are shorter. Market participants must recognize that absent long-term contracts, which are always an option in bilateral markets, prices will need to reflect the competitive view of long term market risks and prices will likely exceed fully amortized capital costs offset by expected energy and AS net revenues. If this unacceptable, an alternative to the CRAM is needed.

A second caveat is that the current short-term residual capacity markets are not at all representative of the prices that would occur in the CRAM, and importantly, market participants must understand this for the CRAM to produce acceptable results. This caveat is stated to address concerns both from resource providers and buyers of capacity. With regard to the former, resource providers have expressed strong concerns that when the market has any non-trivial level of surplus capacity, capacity prices will collapse. We find it difficult to agree with this premise and we believe that with moderate surpluses, there will be a sufficient volume of capacity with high enough going forward costs to prevent a collapse and/or sufficient pricing power resulting from the level of concentration to cause prices from collapsing to low levels. We do not believe that the current short-term residual capacity markets are at all representative of the prices that would occur in the CRAM. Our economic reasoning and modeling both support this conclusion. However, if bidders initially base their offer decisions on expectations that are inconsistent with these findings, then market outcomes may at first be different from our beliefs of what the market equilibrium will be. Thus, a reasonable level of confidence in the market and its price signals is needed for the CRAM to produce acceptable results. There may well be a dislocation between the expectations of load and resource providers until actual market experience demonstrates the price levels that will prevail when capacity surpluses develop.

Finally, there are a variety of next steps and or further research that could be done to enhance the probability of success of the CRAM. At a minimum detailed business and auction rules would need to be developed. Credit and qualification criteria that are consistent with the CRAM as recommended herein will need to be integrated with the model. To the extent feasible, experimental tests of the auction format could be conducted. Most importantly, however, the major hurdle facing CRAM implementation is establishing market confidence in the model and in the application of monitoring and mitigation. The commitment periods do not provide a sufficiently long term to amortize capital over what is generally considered to be a period that produces acceptable prices. We believe that after experience is gained with the model and a pattern of prices is established, greater weight would be given by suppliers to post commitment period revenue opportunities and consumers would be more willing to accept price levels that would reflect the need to offset lower revenues during periods of excess supply with higher revenues when capacity is needed. The most difficult step will be the transition to the CRAM and the largest challenge will be to gain confidence of all parties in the workability of the model and the willingness to accept transitional results that may be less than ideal. In

this regard the most important next step is to develop a consensus of market participants willing to move forward and make the model work.