2001 Performance of New York ISO Demand Response Programs

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Abstract – In 2001, the New York Independent System Operator implemented two programs aimed at increasing the opportunities for interruptible load and standby generation to participate in the New York wholesale electricity market. One program allows demand side resources to reduce load or start up standby generators when an operating reserves deficiency exists. The second program permits demand side resources to bid load reduction into the day-ahead energy market and receive compensation for actual load reduction provided. The paper discusses the performance of both programs during the summer of 2001 and outlines future efforts in this area.

Keywords – Demand Response, Load Curtailment, Deregulation, Energy Markets, Competition

I. INTRODUCTION

In March 2001, the New York Independent System Operator (NYISO) published a commentary [1] on the tight supply/demand conditions that face New York over the next five years. Although roughly 1800 MW of new generation is currently under construction, it will be at least mid-2003 before this generation will be available to the market. The NYISO recommended that at least 8600 MW of new generation be developed by 2006.

Along with the need for increased supply, the NYISO noted that greater demand side response is essential to a fully functioning deregulated electricity market. To facilitate programs for the wholesale market, the NYISO Business Issues Committee in August 2000 created the Price-Responsive Load Working Group (PRLWG). This paper describes the two programs created by the working group that expand the role of demand side resources in the day-ahead energy market and during system emergency conditions:

1. An Emergency Demand Response Program (EDRP), and
2. A Day-Ahead Demand Response Program.

A. New York ISO background

The NYISO is a not-for-profit corporation established in 1999 to facilitate the restructuring of New York State's electric industry. In addition to administering the State's wholesale energy markets, the NYISO operates the State's high voltage electric transmission system. Last year, the NYISO's market volume (including energy, ancillary services, ICAP and TCC auctions) exceeded $5.2 billion.

B. Demand Response Program Evolution

In developing a demand response program for New York, the PRLWG first focused on use of demand resources to augment system real-time security during operating reserve deficiencies. The Emergency Demand Response Program (EDRP) [2] allows registered interruptible loads and standby generators to participate on a voluntary basis and be paid for their ability to restore operating reserves. EDRP was approved by the Federal Energy Regulatory Commission (FERC) in May 2001.

The PRLWG then turned their efforts toward a program to permit demand resources to bid into the NYISO's day-ahead energy market, analogous to generating units. In creating the Day-Ahead Demand Response Program (DADRP)[3], the intent was to allow a mechanism for demand resources to compete on an equal basis with generation, thereby reducing price volatility. The most controversial aspect of the DADRP program has to do with payments to demand resources who successfully curtail according to their day-ahead schedule. Not only do these resources receive credit for the price of energy not consumed, they are also paid for each Mwhr of demand reduction realized in real-time.

The following sections provide an overview of both programs.

II. EMERGENCY DEMAND RESPONSE PROGRAM

EDRP allows participants to be paid for reducing their energy consumption upon notice from the NYISO that an operating reserves deficiency (1800 MW, equal to 150% of the largest single contingency, generation or transmission, in the New York Control Area) or major emergency exists. The program is open to interruptible loads or local "behind-the-fence" generation greater than or equal to 100 kW per Zone. Loads may register for the program through three types of Curtailment Service Providers (CSPs): directly with their Load-Serving Entity (LSE), Curtailment Program Aggregators, or directly with the NYISO. CSPs will be given notice no less than two hours in advance of the time specified to reduce load, pursuant to NYISO emergency operations procedures. When called upon, CSPs will be paid for verified load reduction at the rate of $500/MWhr or real-time zonal locational-based marginal price (LBMP), whichever is greater, for two hours or the duration of the event, whichever is longer. Load reduction is calculated using a customer baseline consumption level determined by the five highest of the last ten days of energy consumption, as described below.

If, as a result of the next day's load forecast, it is determined that an operating reserve shortage is likely after all available bids have been used, operations staff take corrective action in accordance with the procedures set forth

in the Emergency Operation Manual and System Operation Procedures. At the step where EDRP resources are called upon, the operations staff Shift Supervisor contacts transmission owners to contact the EDRP resources in their programs, and contacts the NYISO's Customer Relations group. Customer Relations contacts all other CSPs (outside of the transmission owners) participating in the EDRP program.

On-site generators participating in EDRP are subject to additional restrictions imposed by the New York State Department of Environmental Conservation (DEC). Under amendments to the DEC Regulations [4], exempt generators may keep their existing emergency classification and operate during a blackout or when called by the NYISO's EDRP. Generators that operate when the NYISO calls are classified by DEC as "centrally dispatched emergency power generating units". This exemption allows up to 200 hours per year of NYISO operation and is limited to 150 MW of actual dispatch at any given time statewide. This 150 MW limit is only for generators using the emergency generator exemption. Registration, State Facility and Title V Permit operation is not impacted by the 150 MW limit.

The NYISO calls all participating on-site generators statewide during each EDRP event until such time that 150MW has been activated collectively. If more than 150MW of participating on-site generators have subscribed to the EDRP, activation occurs in a "Round Robin" sequence. Dispatch is done by CSP after the NYISO has given consideration to the zonal load conditions and expected transmission constraints during the emergency.

A. Calculating Load Reduction

Since payments are made to EDRP resources on the basis of the load reduction achieved, a fair and equitable method of determining what load consumption would have occurred absent the EDRP performance was needed. After considering a number of variations, the PRLWG settled upon the following baseline calculation method.

Performance in satisfaction of a bid for hours h(i) to h(j) in day d(n) is assessed against a Customer BaseLine Load (CBL) determined by:

- Calculating the energy consumption during similar hours over the past 10 weekdays, starting two days prior to the event and excluding days where curtailment due to participation in the EDRP or DADRP programs occurred.

  Mwhr(k) = sum(h(i)...h(j)) for each day k = d(n-2)...d(n-11)

- Selecting the 5 highest values of Mwhr(k) and use those days d(m), m = 1...5 to calculate the CBL.

- Calculating the CBL for each hour h(i) as the average of the five h(i) values for days d(m), m = 1...5.

- If more than 5 of the past 10 days have been excluded due to EDRP and/or Day-Ahead participation, look back beginning with day d(n-12) until 5 non-excluded days are found. Go back no further than day d(n-31).

III. DAY-AHEAD DEMAND RESPONSE PROGRAM

DADRP allows loads, through their LSE, to bid load reduction into the day-ahead energy market. Load reduction bids are evaluated along with generation supplier bids as part of the NYISO's Security Constrained Unit Commitment (SCUC) program. If scheduled through SCUC, loads are paid day-ahead LBMP for the scheduled demand reduction, and are also paid an incentive (at the day-ahead LBMP) for the actual load reduction provided in real time. If the full scheduled load reduction is not provided in real time, a 10% penalty is charged for the Mwhr of load reduction not provided, using the greater of day-ahead or real-time LBMP.

For 2001, the program is administered by the NYISO and host Load Serving Entities (LSEs) only, but will be open to Curtailment Service Providers (CSPs) including non-host LSEs on January 1, 2002.

The NYISO accepts demand reduction bids wherein an LSE can bid on behalf of a demand side resource for a specific MW curtailment (in minimum increments of 1 MW) in contiguous "strips" of one or more hours. The demand reduction bid includes the day-ahead LBMP above which the load would not consume, and could also include a curtailment initiation cost. Demand reduction bids can set day-ahead LBMP just as a comparably bid generator.

For demand side resources bidding curtailable load, the amount of actual real-time curtailment determined is equal to its customer baseline load (as defined in IIA) less its actual real-time consumption during the specified curtailment.

The program is open to small "behind-the-fence" on-site generation (except diesel generators), provided that each generator has a separate interval. The LSE bidding on-site generation will be paid day-ahead LBMP and any supplemental payments for load curtailed through self-supply. However, to the extent that a demand side resource's curtailed load is self-supplied, its LSE is not be eligible for the incentive payment.

IV. EXPERIENCE WITH DEMAND RESPONSE IN 2001

Both demand response programs were implemented in time for the summer 2001 peak load season. The Emergency Demand Response Program began accepting registrations in mid-May; as of the end of August, a total of 24 CSPs had registered for the program, bringing a total of 290 end-use resources to the program. The end use resources registered,

classified by zone and demand reduction type, are shown in the Table I.

TABLE I – EDRP RESOURCES REGISTERED IN 2001

Zone	*TOTAL MW*	*Interruptible Load*	*On-Site Generation*	*Load + Generation*
All (A-K)	679.1	520.6	120.5	38
A	295.3	294.8	0.5	0
B	12.7	12.2	0.5	0
C	77.2	68.9	3.9	4.4
D	0.7	0.5	0	0.2
E	41.2	37.3	3.9	0
F	98.9	76.3	3.9	18.7
G	25.4	18.7	6.4	0.3
H	6.8	1.8	5	0
I	12.4	1.4	6.3	4.7
J	83.3	8.7	65.4	9.2
K	25.3	0	24.8	0.5

In Table I, resources are categorized according to the type of load reduction provided, either interruptible load, on-site generation, or a combination of interruptible load and on-site generation.

During the week of August 6, 2001, the New York Control Area experienced a heat wave that resulted in record demand levels reached on three successive days. From August 7-9, the New York electricity grid established three new historical peak loads, culminating on August 9, when a peak hourly demand of 30,983 MW was measured, eclipsing the previous record of 30,311 MW set in 1999. Table II summarizes the estimated load reduction provided through the EDRP program on each of the four days activated. Estimated load reductions are classified according to transmission owner (TO)-sponsored programs and all other CSP-sponsored programs. As this paper is being prepared, the actual load reduction measurements are being processed by the NYISO. It is expected that total payments to CSPs for this period will be in the range of $4M-5M.

TABLE II – EDRP EVENTS IN AUGUST, 2001

Date	*Hours*	*MW estimated from non-TO CSPs*	*MW estimated from TOs*	*Total MW estimated*
8/7	1500-1900	233	200	433
8/8	1300-1900	229	200	429
8/9	1100-1900	276	200	476
8/10	(Zones F-K), 1330-1800**	82	62	144

*out of 18 registered non-TO CSPs

**August 10 data reflects estimates from only those CSPs with demand side resources in Zones F-K

The Day-Ahead Demand Response Program was activated in mid-July with a total of 24 participants sponsored by LSEs. In most cases, participants were large (5-100 MW) industrial loads.

Figure 1 plots the daily Mwhr scheduled through DADRP; Figure 2 shows the peak coincident megawatts scheduled through the day-ahead program. Of the 24 program registrants, fewer than half were actively submitting bids in the day-ahead market during the period July through September. Participation may have been affected by many factors, including program complexity, insufficient time to market the program at the retail level, and generally low wholesale energy prices seen during the period.

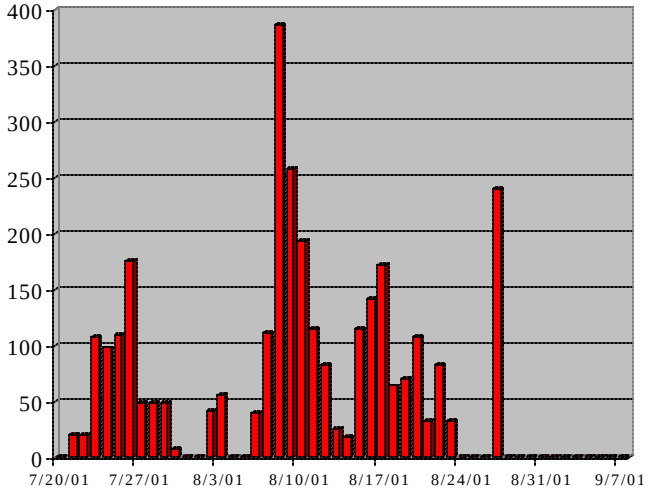

Figure 1 – Demand Side Resource Energy Scheduled

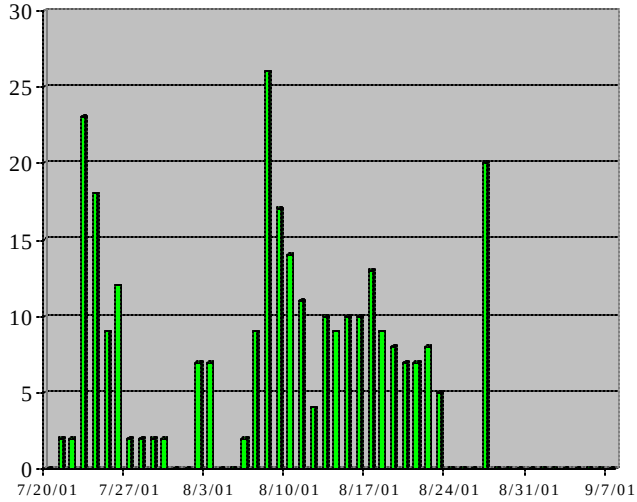

Figure 2 – Demand Side Resource Coincident MW

V. THE FUTURE OF DEMAND RESPONSE PROGRAMS IN NEW YORK

In August 2001, the NYISO began a formal evaluation of the EDRP and DADRP programs, including extensive surveys of CSPs, end-use participants, and informed non-participants. The demand response evaluation project is intended to provide answers to the following questions:

- What impact do demand response programs have on market-clearing prices?
- What inducements do customers need to provide load curtailments when the NYISO needs them?

- How many demand response resources are required to mitigate price spikes? Who benefits from price spike mitigation? Who pays?
- What procedures and processes were put into place to facilitate subscribing customers to participate in programs and inducing them to curtail loads?
- How well did the curtailment service providers responsible for implementing the programs carry out these processes?
- What changes in the current programs designs are warranted in light of customer experiences from this summer's programs?

The NYISO is committed to run the Emergency Demand Response Program through October 2002, and the Day-Ahead Demand Response Program through October 2003. In 2002, the DADRP will take a major step by permitting non-load-serving entities to sponsor and bid demand side load reductions in the day-ahead energy market. Load-serving entities will also be permitted to sign up program participants for whom the LSE is not the commodity provider.

In the longer term, true demand response requires retail customers to be exposed to market prices. Customers who are made aware of the hourly fluctuations in energy prices will adjust their behavior accordingly; even day-ahead prices provide a sufficient signal to change behavior. There will always be a need to protect those who are economically disadvantaged from extreme price swings, but fixed retail rates in general provide the wrong incentive for all parties.

New metering technologies, including those that take advantage of the internet, can greatly improve the timeliness of energy readings and allow customers to get valuable feedback on energy consumption. Linked to information on real-time electricity prices, these technologies will greatly improve the ability of industrial, commercial and, ultimately, residential loads to alter their consumption in response to the real price of electricity.

Building additional generating capacity answers the longer-term needs for electricity in New York State. Implementing price-responsive mechanisms for interruptible loads will result in many of the same system benefits, will increase participation in the energy markets, and can provide relief in time for the summer of 2002. There is broad agreement among all stakeholders that increased participation by interruptible loads is essential to a fully competitive market.

This report concludes with a number of questions that New York electricity market participants, and those looking to implement demand response programs, should ponder.

- What is the proper role for an ISO / RTO relative to demand response programs – should they offer distinct programs or act as program facilitator for LSE programs?
- What role should PUCs play in facilitating demand response?
- Should participant demand response be voluntary or mandatory (e.g., via price penalties)?
- How should emergency diesel generation be treated in demand response programs?
- What are the metering requirements for demand response programs?
- What are the specifics of the load shaping / customer baseline calculation method?

VI. ACKNOWLEDGEMENT

The author would like to recognize the efforts of all those who participated in the NYISO Price Responsive Load Working Group, in particular its Chairman, Laurence DeWitt of Pace University. Significant program contributions were made by many individuals too numerous to name. Developing the demand response programs described above was truly a collaborative effort among all New York market participants. The author also acknowledges the technical input from the NYISO's project consultant, Mr. Bernard Neenan and his team at Neenan and Associates.

VII. REFERENCES

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3) Day-Ahead Demand Response Program Manual, available on the NYISO website at www.nyiso.com.

4) Dept. of Environmental Conservation, Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York: Part 200, General Provisions, Part 201, Permits and Registration, Subpart 225-1, Fuel Composition and Use- Sulfur Limitations and Subpart 227-2, Reasonably Available Control Technology (RACT) for Oxides of Nitrogen (NO_x).

Biography – David J. Lawrence joined the New York Independent System Operator as a Senior Engineer in the Analysis and Planning Dept. in April of 2000. He is responsible for developing and implementing demand response programs in collaboration with New York market participants. He also assisted in formulating the NYISO interconnection study criteria and procedures, and currently serves on the inter-ISO MOU Planning Working Group.

Prior to joining the NYISO, Mr. Lawrence spent 24 years at Power Technologies, Inc., where he most recently served as the Director of the Instrumentation and Energy Management Dept.

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