Special Case Resources: Evaluation of the Performance and Contribution to Resource Adequacy

Report by the New York Independent System Operator to the Installed Capacity Subcommittee of the New York State Reliability Council

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Contents

Contributors

John Adams, David Allen, Donna Pratt
New York Independent System Operator

Introduction

The NYISO includes Special Case Resources (SCRs) in its planning and forecasting activities for resource adequacy. This report is in response to a request from the New York State Reliability Council to the NYISO and addresses two areas of interest to the New York State Reliability Council: the performance of SCRs and the contribution of SCRs to resource adequacy. At the time of the initial request, the SCR program was undergoing changes to the methodology used for the measurement of SCRs. As a result, this report was delayed until sufficient data were available under the new methodology, Average Coincident Load.

The approach to modeling the capacity impact of SCRs required the need to run General Electric's Multi-Area Reliability Simulation (MARS) model in the 8760-hour mode, which is generally not done because it requires extremely long run times and experience has shown that the differences in the LOLE results have been extremely small. The 8760-hour mode, however, is useful to determine the relative changes in SCR effectiveness when controlling the application of the SCRs using different assumptions for penetration (MW value), duration (hours of load reduction), and persistence (the number of calls). Given the number of scenarios and the number of simulation years required to conduct these evaluations in the 8760-hour mode, the NYISO contracted with GE Energy to conduct the analysis.

This report provides the results of the MARS analysis, discusses the NYISO procedures to forecast SCR enrollment for the Installed Reserve Margin (IRM) Study and presents an overview of the measurement methodologies available to evaluate the performance of SCRs. It also includes a general description of the NYISO SCR Program, information on the demand response events called since 2001 and recent data regarding the persistence of demand response.

Overview of SCR Program

Special Case Resources (SCRs) are end-use loads capable of being interrupted on demand, and Local Generators, rated 100kW or higher, that are not visible to the NYSIO's Market Information System. SCRs participate in ICAP Auctions in the same manner as other ICAP suppliers. The amount of capacity a SCR is qualified to sell in the ICAP Auction is based on the SCR's pledged load reduction and its performance factor. The performance factor reflects the historical performance of the SCR and is determined from actual performance data. Once during each Capability Period, SCRs are required to perform a test of their pledged reduction. Each SCR's performance factor is based on the load reduction achieved during tests as well as any events during the Capability Period.

Special Case Resources are required to respond to a curtailment request for a minimum of four hours. There are no restrictions on the length of a curtailment request, the time periods in which a curtailment request may be initiated, or the number of times during a month or Capability Period that a curtailment request may be executed by the NYISO.

SCRs are deployed during forecast or actual reserve shortages and other NYISO emergency conditions according to procedures defined.

Enrollment in the Special Case Resource Program continues to grow as demand side resources gain more experience in their ability to respond to a curtailment request, technology improves the automation of response, and demand response aggregators improve their business models to recruit and retain demand response resources. Since 2003, when enrollment in the NYISO's Emergency Demand Response Program (EDRP) and Special Case Resource program was made mutually exclusive and the energy payment for energy reductions during a demand response event was incorporated into the SCR program, SCR program enrollment has nearly tripled; in the Summer of 2011, SCR enrollment (1976.2 MW) represented 5.8% of NYISO's all-time system peak of 33,939 MW on August 2, 2006.

Forecasting of Special Case Resource Enrollment for the IRM Study

For the past several years, the NYISO has used a method for forecasting the growth of enrollment in the SCR program that is based on performance from prior periods and changes in historical enrollment. Based on the maturity of the program, enrollment in the Special Case Resource program is expected to grow at a somewhat slower pace than it has over the past several years. Changes to market rules that are likely to affect enrollment are also factored into the forecast for the year in which their impact is first expected. Such was the case in the 2012 IRM Study when the SCR baseline changed from the non-coincident Average Peak Monthly Demand (APMD) to the Average Coincident Load (ACL) baseline and a reduction in enrollment was expected.

Each year, a table showing the how the SCR forecast is determined for the IRM Study is included in an appendix of the Study; in the 2012 IRM Study Report, see Appendix E: Attachment F, "SCR Determinations."

The steps involved in the SCR forecasting method for the IRM Study are described below. At a high level, the calculation for each load zone is:

SCR Enrollment Basis * Historic Growth Rate * Zonal Performance * Translation Factor

Details on how response is measured and how performance is calculated, including the methods used in determining the Translation Factor, are discussed in the section of this report titled: *Measuring Demand* Response.

1. SCR Enrollment Basis

NYISO's peak load occurs during the summer months, typically in July or August, therefore SCR enrollment for the month of July has been selected to serve as the basis for the forecast used in the IRM study. July was chosen over August to accommodate the timing of the IRM Study.

The NYISO starts with the available zonal Unforced Capacity (UCAP) that has been certified for the ICAP market in July of the year prior to the year for which the IRM will be effective (i.e., July 2011 enrollment information is used to forecast the SCR MW for the 2012 IRM study). The zonal UCAP MW for each zone is divided by the corresponding zonal SCR performance factors applicable to the Summer Capability Period. This results in the zonal Installed Capacity Equivalent (ICAP) MW for SCRs.

2. Historic Growth Rate

The zonal SCR ICAP MW are multiplied by the average net growth of the NYISO's reliability programs over the past three years. This results in the *forecasted* zonal Installed Capacity Equivalent (ICAP) MW for SCRs.

3. Discounted SCR Forecast Based on Historical Performance

The forecasted zonal Installed Capacity Equivalent (ICAP) MW is discounted by the zonal performance factors. This reduction is intended to reflect the expected SCR response based on historic zonal performance.

4. Translation Factor

The Translation Factor is applied uniformly across the zones based on the difference in measured responses using the capacity response and energy response methodologies. The result is the zonal MW values that are used in the IRM Study. Details on how the Translation Factor is determined are in the section titled: *The SCR Translation Factor*.

Evaluating the Capacity Value or Contribution to Resource Adequacy of SCRs

The GE MARS model was utilized to evaluate the contribution of SCRs to resource adequacy. The primary driver of a resource's contribution to resource adequacy is its overall availability. Alternative SCR scenarios with varying levels of availability were developed. The scenarios were based on the number of hours or duration of the SCR deployment for the day on which they are called and the number of days the SCRs were available to be called. Durations of 4, 6 and 10 hours and up to 60 days of calls were evaluated. Alternative penetration levels were also evaluated.

The SCR call durations of four, six and ten hours were selected based on the current program's minimum performance requirement, actual historic performance levels, and observations from third party demand response studies, respectively.

The model assumed that the load reduction of the SCRs lasted only for the duration of the call and, that the load level of the SCR immediately returned to the pre-call level. This treatment does not reflect the historical response of SCRs during actual events, where SCRs continue to reduce load beyond the end of the called event.

The number of days evaluated in this study was determined based on prior IRM studies, which showed the expected number days the SCR would be called was approaching 20 days. This means there were some simulation years that would be well above the expected value. This resulted in study scenarios where the number of days the SCR were allowed to be used ranged from 10 days to 60 days in steps of 10 days.

Penetration levels studied ranged from 1,200 MW to 4,800 MW. Overall, the scenarios of the study involved three duration lengths (4, 6, and 10 hours) for each of six different blocks of ten days at different penetration levels. This resulted in 180 different scenarios. All the simulations were run in the 8760-mode where the SCRs were modeled deterministically and with the penetration level defined as its UCAP value. The days that SCRs would be called were based on the NYCA daily peaks. For instance, the ten-day call scenario was based on the ten highest daily NYCA peaks, likewise for 20, 30, 40, 50, and 60. The duration of the calls were centered on the hour of the NYCA peak. Given the number of scenarios and the number of simulation years required to conduct these evaluations in the 8760-hour mode, the NYISO contracted with GE Energy to conduct the analysis.

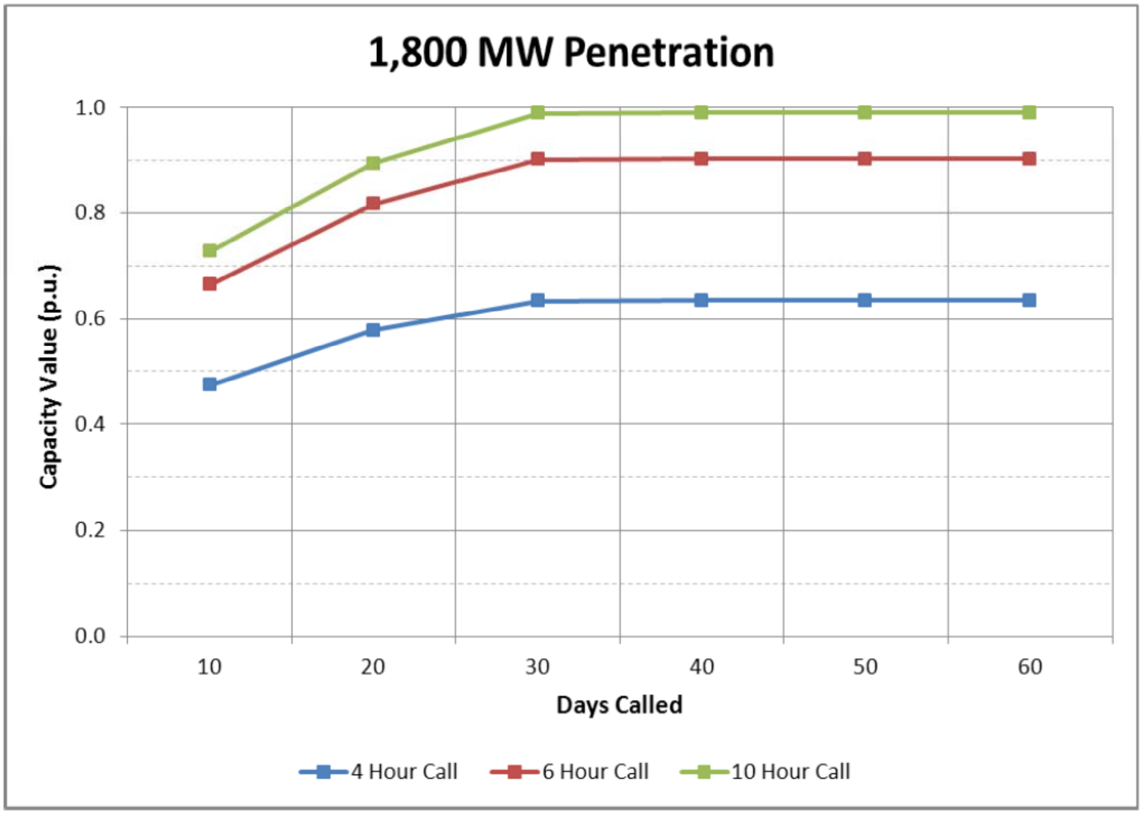
The alternative scenarios were evaluated as a ***per unit*** of their unrestricted[1] or ideal capacity value. The unrestricted or ideal capacity value for a scenario is based on the LOLE value that results from that scenario and then determines how much unrestricted capacity would be required to achieve the same LOLE. If a SCR scenario for a given MW penetration level resulted in the same LOLE value as produced by the unrestricted MW of the same value, its per-unit value would be one. A per-unit value of one indicates that the level of availability assumed for that scenario maximized the contribution of the SCR to resource adequacy.

Figure 1 is a plot of the per unit capacity value curves for the four-, six- and ten-hour duration scenarios compared to the number of days available for the 1,800 MW penetration level. It demonstrates that as the availability of the SCRs increases, as defined by the duration and the number of days called, the per-unit value or the contribution of the SCR to resource adequacy increases. Further, Figure 1 shows that the capacity value of the SCR saturated at about thirty days per year of implementation. Increasing the available days beyond this value had no additional benefit in terms of reliability. At thirty days, the NYCA peak load is less than 85% of the annual peak, and so these results would indicate that there is less likelihood of outages at or below this load level.

[1] Unrestricted capacity which is often referred to as perfect capacity is a resource that is available 8760 hours at a constant level of MW. It would be equivalent to a resource with zero forced outage rate which means its UCAP would be equivalent to its nameplate. This type of resource sets an upper bound for evaluating the relative contribution to resource adequacy for alternative levels of availability of a resource.

The capacity value of the four-hour and six-hour duration calls saturate at a 0.63 and 0.9, respectively, while the 10-hour calls saturate at almost 1 per unit. This is because four-hour and six-hour durations result in new peaks being created in shoulder hours (i.e., the so-called demand fangs) while this does not occur for the ten-hour duration until much higher penetrations.[2] In general, the per-unit values decline as penetration increases. The full range of results for four-, six- and ten- hour durations and all penetration levels can be found in Appendix B: Results of MARS 8760-mode Analysis. In general, the capacity value as a per unit decreases as the penetration level increases due to the increased likelihood of new peak loads appearing outside of the SCR window of use.

Figure 1. Capacity Value Based on Duration of Call and Number of Calls



Performance of Special Case Resources

The performance of Special Case Resources is used to determine the amount of capacity a SCR may offer in future auctions and for computing any deficiency penalty of

[2] As mentioned above, the model's treatment of response during an SCR call is not consistent with the NYISO's experience with how SCRs respond to an event. With the historical average event duration of six hours and SCR load reductions extending through the end to the event, the NYISO believes that the capacity value of SCRs under the current program rules is closer to the six-hour call level than the four-hour call level.

the Responsible Interface Party (RIP) that sells the capacity of the Special Case Resource. Performance factors for SCRs derate the claimed capability of the Special Case Resource (ICAP) to the capacity that the SCR has demonstrated in actual events and tests (UCAP). To establish the performance of a SCR, it is beneficial to understand how the available capacity is determined and how the response of a SCR is measured.

Measuring Demand Response

For demand response, the market product defines how the reduction is valued and measured. For many demand response programs, response is measured using a baseline to estimate what the load would have otherwise been without the request to curtail. Actual metered load data from the demand response event is compared to the estimate to provide the response level for the event and determine whether the demand resource provided the committed reduction amount and to calculate payment.

In 2008, the North American Energy Standards Board (NAESB) published its first set of Business Practice Standards on Measurement and Verification for Demand Response; an update in 2010 completed the work on those Business Practice Standards which FERC incorporated into regulation by reference. In the Business Practice Standards for Measurement and Verification of Demand Response, terms for product/service categories, evaluation of performance, and other categories were developed to establish common terminology and criteria that could be used when describing measurement and verification for demand response across North America. The terms used in this section of the report are based on those NAESB Standards and terms.

Performance evaluation methodology refers to the approach taken to estimate the demand reduction value of the product/service provided by a demand response resource. Five different performance evaluation methodology types have been defined:

- Maximum Base Load: A performance evaluation methodology based solely on a Demand Resource’s ability to maintain its electricity usage at or below a specified level during a Demand Response Event.
- Meter Before / Meter After: A performance evaluation methodology where electricity Demand over a prescribed period of time prior to Deployment is compared to similar readings during the Sustained Response Period.
- Baseline Type-I: A Baseline performance evaluation methodology based on a Demand Resource’s historical interval meter data which may also include other variables such as weather and calendar data.
- Baseline Type-II: A Baseline performance evaluation methodology that uses statistical sampling to estimate the electricity usage of an Aggregated Demand Resource where interval metering is not available on the entire population.

- Metering Generator Output: A performance evaluation methodology in which the Demand Reduction Value is based on the output of a generator located behind the Demand Resource's revenue meter.

Figure 2 shows the applicability of each performance evaluation type for products and services provided by demand response.

Figure 2. NAESB's Performance Evaluation Types for Demand Response

Performance Evaluation Type	Valid For Service Type			
	Energy	Capacity	Reserves	Regulation
Maximum Base Load	✓	✓	✓	
Meter Before / Meter After	✓	✓	✓	✓
Baseline Type-I	✓	✓	✓	
Baseline Type-II	✓	✓	✓	
Metering Generator Output	✓	✓	✓	✓

For each performance evaluation methodology in the NAESB Business Practice Standards, applicable criteria were defined as shown below in Figure 3.

Figure 3. NAESB's Performance Evaluation Criteria

Baseline Information	Baseline Window
	Calculation Type
	Sampling Precision and Accuracy
	Exclusion Rules
	Baseline Adjustments
	Adjustment Window
Event Information	Use of Real-Time Telemetry
	Use of After-The-Fact Metering
	Performance Window
	Measurement Type
Special Processing	Highly-Variable Load Logic
	On-Site Generation Requirements

Each of the NYISO's baselines for its reliability programs fit into one of the performance evaluation methodologies defined by NAESB for demand response:

Reliability Demand Response Programs:

SCR (Capacity): Maximum Base Load

SCR (Energy): Baseline Type 1

EDRP (Energy): Baseline Type 1

Each year since 2009, the ISO/RTO Council has prepared a comparison of all demand response programs in wholesale electricity markets across North America. The comparison illustrates the variety of performance evaluation methodologies in use today for different market products. This comparison is updated annually and is available on the ISO/RTO Council's website.[3]

Baselines

A critical step in defining the baseline is determining what is being measured. Only then can the criteria associated with how it is measured be defined. During the design of a demand response program, each aspect of the measurement and verification rules are worked through to ensure consistency with the objective of the demand response program and alignment with other suppliers or market products. Most of the baselines in demand response programs today are based on practices that have been used in retail utility rates or statistical analysis with roots in utility load research.

The baselines used for NYISO's demand response program are no exception. There is a correlation between the way capacity response in the SCR program is measured and the interruptible retail rates that predate the existence of the NYISO, which were typically based on the maximum non-coincident demand of a load. To estimate the coincident load in the SCR program today, the NYISO's ACL is based on an average of the SCR's highest coincident loads. The NYISO's energy CBL is based on the way energy reductions have been measured in several retail dynamic pricing rates where historical data was used to estimate what the load levels would have been without a price signal or instruction to curtail.

As more demand response programs have developed, variations on basic concepts have resulted in a multitude of performance evaluation methodologies that meet the local requirements of the products being measured and the performance of the resources delivering the products. Studies, almost all of which focus on estimating the energy response, are regularly conducted by interested parties to compare collections of performance evaluation methodologies in an attempt to determine the methodology that provides the least amount of bias for the product being measured. No single methodology has conclusively proven to be the most accurate, however, several performance evaluation criteria, such as the Baseline Window and the Baseline Adjustments, do seem to affect how closely the calculated baseline estimates load more than others. Even within those criteria, there are many modifications that can improve or degrade the bias and some might argue that each resource should have the baseline that best matches its pattern of use. For simplicity, many demand response programs limit the number of performance evaluation methodologies that are implemented, which

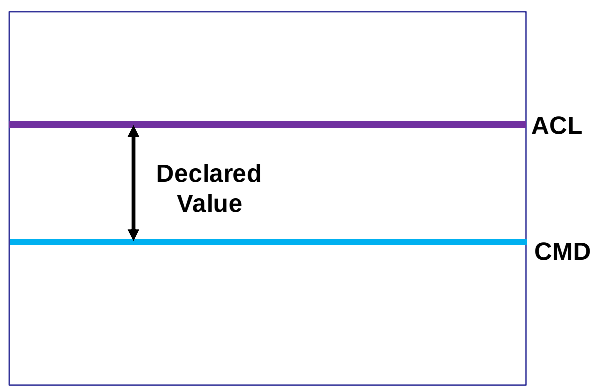
[3] 2011 Comparison: http://www.isorto.org/atf/cf/%7B5B4E85C6-7EAC-40A0-8DC3-003829518EBD%7D/IRC%20DR%20M&V%20Standards%20Implementation%20Comparison%20(2012-01-20).xls

also introduces bias that cannot be addressed solely by the design because the load usage patterns of resources can vary greatly, even within the same business classification.

Capacity Response

For the SCR program, NYISO measures the capacity response of the resource. In NAESB's terms, the NYISO uses the Maximum Base Load performance evaluation methodology to determine the amount of available capacity that a SCR has to offer. This method provides a standardized way to estimate the coincident load of a resource so that the resource can make a commitment for the amount of capacity it has available. The following components go into determining the available capacity of a SCR: Average Coincident Load (ACL) and Committed Maximum Demand (CMD).

- The ACL establishes the upper boundary of a SCR's capacity based on the average of its load during the top 20 hours out of the top 40 NYCA peak load hours during the applicable Capability Period.
- The CMD is the specified level that the SCR commits to maintain during a demand response event.



The difference between the ACL and the CMD is the available capacity that the SCR has to offer, referred to as the Declared Value in the figure above.

The NYISO believes that this method of estimating available capacity from demand response is appropriate because it aligns with the basis for determining the load forecast as well as the Installed Capacity Requirements for loads since it uses the coincidence of load from a SCR during NYCA peak hours in the Prior Equivalent Capability Period. When a demand response event is called during the NYCA peak hour, the NYISO reconstitutes the load for that hour, based on the demand response measured, as part of the load forecast used for determining Installed Capacity Requirements for the next year. The SCR is also required to commit to a demand level that it will sustain during the event, which provides an estimate of expected load from the enrolled demand resources.

The NYISO further adjusts the available capacity of a resource to account for transmission losses and then derates the available capacity based on the SCR's performance in prior capability periods. New SCRs are derated based on the performance of the Responsible Interface Party that enrolls them.

Metered load data during the period of an event or test is required from all SCRs obligated to perform during the event or test. It is reported to the NYISO within 75 days of the event or test. The difference between the ACL baseline for each SCR and its hourly metered load data during the event or test is the response based on the Installed Capacity Equivalent of the SCR.

Energy Response

To measure energy response, the NYISO uses the Baseline-Type 1 performance evaluation methodology for all demand response programs where an energy payment is made. The NYISO's CBL method is based on historical loads from the highest five of the last ten similar day types: weekdays for events occurring on a weekday; or the highest two of the last three same weekend day types (Saturday or Sunday) for events that occur on the same type of weekend day.

The historic baseline average hourly load for each hour of the event is compared to the metered load during the event and the difference is the energy reduction for which the demand response resource is paid. The NYISO allows for an adjustment to the hourly CBL values of +/- 20%, based on load levels two hours prior to the notification of a demand response event. This adjustment is intended to capture a change in load levels due to the load's reaction to weather conditions on the day of the event.

Reporting of metered load data for the payment of the energy delivered during the period of an event or test is optional for SCRs. It is reported, along with the calculated CBL, by the RIP to the NYISO within 75 days of the event or test. The difference between the CBL and the hourly metered load data during the event or test is the energy response of the SCR and is the basis for the energy payment for that event or test.

At the request of the NYSRC, the NYISO conducted additional analysis to compare the hourly response of SCRs that reported energy data to their response based on ICAP measures as described above in the section on Capacity Response; these results are illustrated in the charts below in the section on *Historical Event Response*.

The energy CBL was designed to estimate load over a brief period in the recent past as a proxy for what the load levels would have been with no event and not to estimate the maximum demand of the resource during the Capability Period. For this reason, the NYISO believes that this approach to evaluating the capacity response of SCRs for purposes of determining resource adequacy may lead to flawed conclusions about the ability of SCRs to respond to demand response events.

Factors such as weather conditions within the two to three weeks prior to an event, the period used to compute the CBL, can produce a CBL that is significantly lower than the load level at the time of an event, especially for weather-sensitive loads when an event during a heat wave is preceded by a brief period of low temperatures.

Based on meter data provided for the Summer 2010 events, approximately 8% of obligated SCR MW reported load levels during the events that exceeded their APMD by as much as 16%. It is not known whether the loads of these resources may have been even higher or whether they had taken actions to reduce but could not achieve their committed obligation due to the extreme weather conditions that warranted deployment of demand response in Zone J during the summer of 2010. Because the CBL was even lower than the APMD due to the low temperatures in the period preceding the 2010 events, these resources did not show any energy response either.

Since the NYISO's energy CBL was developed in 2001, when the Emergency Demand Response and Day-Ahead Demand Response Programs were implemented, improvements to the energy CBL may be needed. In fact, in its compliance filing in the summer of 2011 on FERC's recent order on demand response compensation, the NYISO proposed an alternative energy CBL for the Day-Ahead Demand Response Program that would not degrade over time and result in inaccurate performance measurement that could occur with the increased frequency of scheduling that may occur in the energy market. Earlier in 2011, when the NYISO proposed a change to the SCR baseline from APMD to ACL, it committed to conduct a study to compare different CBL methods to the ACL. The scope of that study is currently under development.

Data Reporting

Demand response resources are required to report the meter data for performance from the event or test within 75 days of the event or test. This data reporting requirement was put in place because the NYISO does not require telemetry for demand response resources enrolled in its reliability programs and therefore relies on meter data collection on the cycles of the relevant meter authority to provide the data to the Responsible Interface Party that enrolls the resource. The 75-day reporting requirement is a NYISO tariff requirement and is necessary because some meter authorities are on a bi-monthly collection cycle and the data is not available earlier. In addition, RIPs that choose to request the energy payment for the event must also collect extra meter data for the period necessary for the CBL calculation and the RIP must calculate the CBL prior to reporting the CBL and meter data to the NYISO within the same 75-day period after the event.

RIPs upload the meter data for the calculation of event performance and the optional CBL data through the NYISO's Demand Response Information System, which restricts access for uploads after the 75-day window closes.

Historical Event Response

Since 2001, the NYISO has deployed demand response to support the NYISO 20 times for a total of 129 hours, including 22 hours during system restoration after the 2003 Northeast blackout (see *Table 1*). The overall average duration of the demand response events called since 2001 is six and a half hours, with 2003 reflecting the most extreme circumstances in the history of the NYISO's demand response programs, where demand response resources were deployed for up to 11 hours per day. Without the 2003 events, the overall average duration of a demand response event is six hours.

In addition, the NYISO has deployed its reliability demand response resources under the Targeted Demand Response Program (TDRP), which allows NYISO to deploy SCR and EDRP resources in Zone J at the request of Con Edison to support local reliability events in load pockets; response to TDRP events is voluntary. TDRP was activated for two days each in 2007 and 2010, for 20 hours and 19 hours, respectively. TDRP events are not included in the table below.

Table 1. NYISO Demand Response Events

Year	Number of NYISO Event Days	Total Number of NYISO Event Hours	Average Number of NYISO Event Hours per Event Day
2001	4	23	5.8
2002	4	22	5.5
2003	2	22	11.0
2004	0	0	
2005	1	4	4.0
2006	5	35	7.0
2007*	0	0	
2008	0	0	
2009	0	0	
2010*	2	12	6.0
2011	2	11	6.5
Total	20	129	6.5

The NYISO reports details on the response during demand response events to FERC its year-end semi-annual compliance filing each year, filed in mid-January after the summer Capability Period. The report provides information on summer enrollment in all of the NYISO's demand response programs and provides detailed response and energy payment information for any reliability events that occur during the previous summer.[4]

The figures below illustrate SCR event response based on ICAP measures for the 2010 and 2011 events. Each chart contains a thick red line that shows the hourly response and a dashed blue line to indicate the Installed Capacity Equivalent of all SCRs that were obligated to respond to the event. The Obligated ICAP MW shown on these charts

[4] The 2011 year-end FERC report that includes response to the Summer 2011 demand response events is available on the NYISO's website at:
http://www.nyiso.com/public/webdocs/documents/regulatory/filings/2012/01/2012-1-25_NYISO_DR_Report_Errata_complete.pdf
Reports for other years are available under Legal and Regulatory - > FERC Filings on the NYISO's website.

is the total obligated for the event, regardless of whether or not response was positive. For charts that show event response based on the energy CBL, the Obligated ICAP MW shown is only for the resources that reported CBL data and the energy CBL shows as a dashed green line. Hourly data used to develop these charts are provided in Appendix A: Hourly SCR Event Response.

In 2010, when event response was measured based on APMD, fewer resources reported CBL data for energy payments than in 2011. For the 2010 events, just over 50% of obligated MW reported CBL data for energy payments; 52% for July 6, 2010, (Figure 5), and 50% for July 7, 2010 (Figure 7).

In 2011, 76% of obligated MW reported CBL data for energy payments on July 21, and 81% of obligated MW reported CBL data for energy payments on July 22; approximately a 50% increase over each 2010 event, relative to the obligated MW for each event.[5]

Average hourly response across all hours under both measures also improved in 2011 over 2010. In 2010, average hourly response based on ICAP measures was between 83% and 86% and in 2011, increased to between 90% and 93%. Average hourly response based on energy CBL measures also improved from approximately 43% in 2010, to between 76% (July 21, 2011) and 103% (July 22, 2011).

[5] The 2010 events were limited to zone J. A comparison of reported CBL data for zone J in 2011 as a percentage of obligated ICAP MW shows that 76% of obligated MW in zone J reported CBL data for July 21, 2011 and 78% of obligated MW in zone J reported CBL data for July 22, 2011; which is consistent with assessment of the overall increase in reporting of CBL data for 2011, relative to the obligated MW for each event.

Figure 4. July 6, 2010 Hourly SCR Response Based on APMD Baseline and ICAP Measures

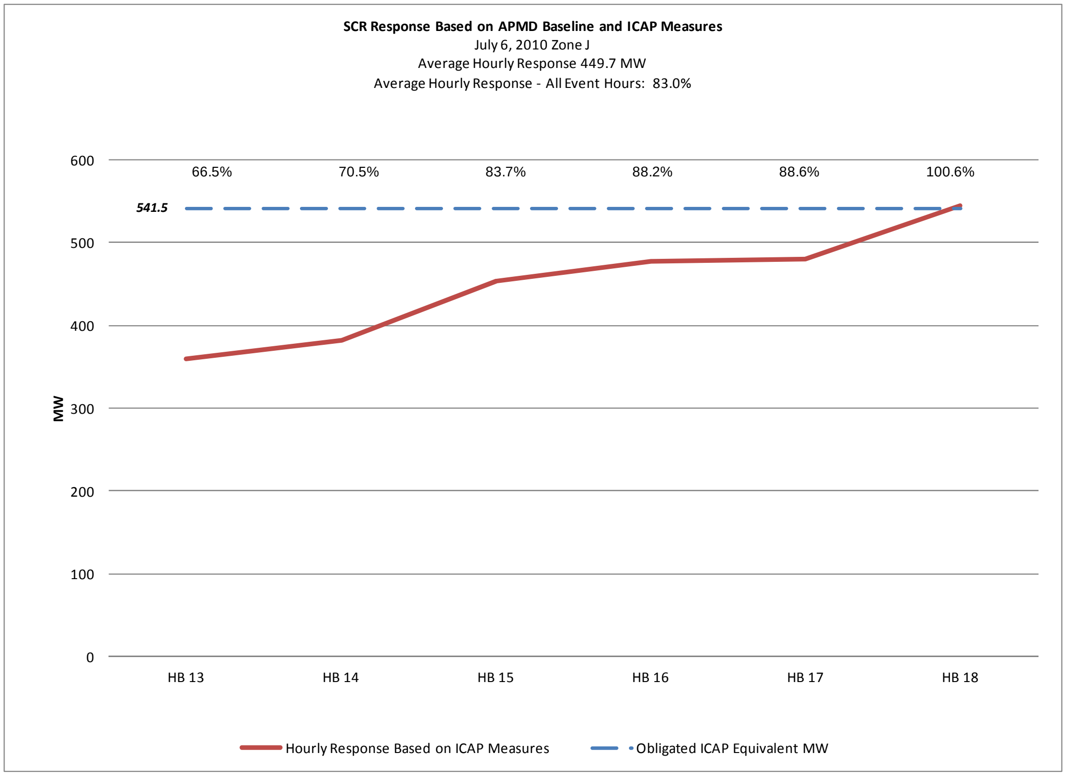


Figure 5. July 6, 2010 Hourly SCR Response Based on APMD Baseline and Hourly Energy CBL

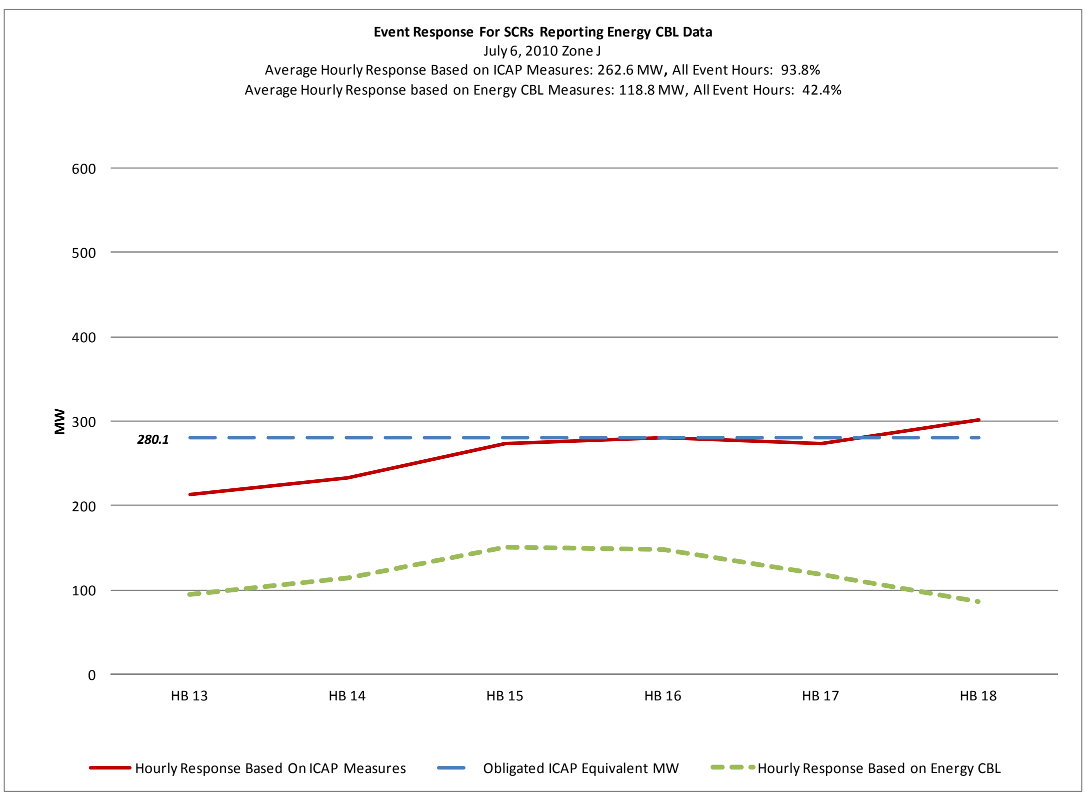


Figure 6. July 7, 2010 Hourly SCR Response Based on APMD Baseline and ICAP Measures

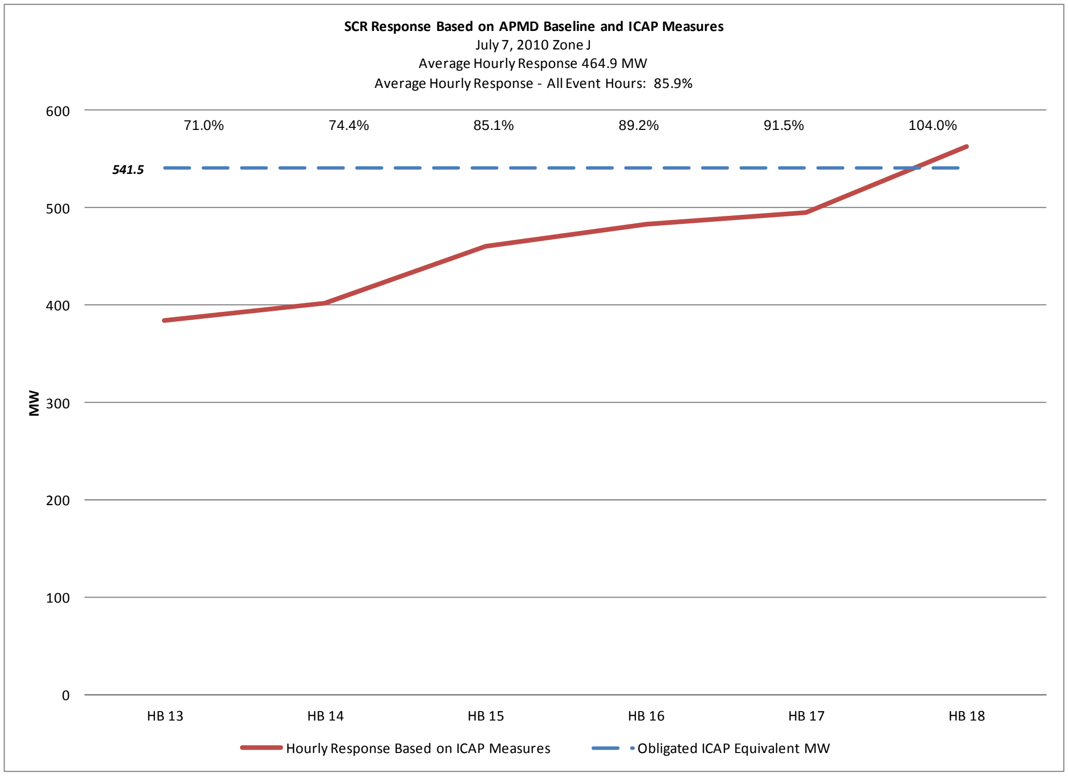


Figure 7. July 7, 2010 Hourly SCR Response Based on APMD Baseline and Hourly Energy CBL

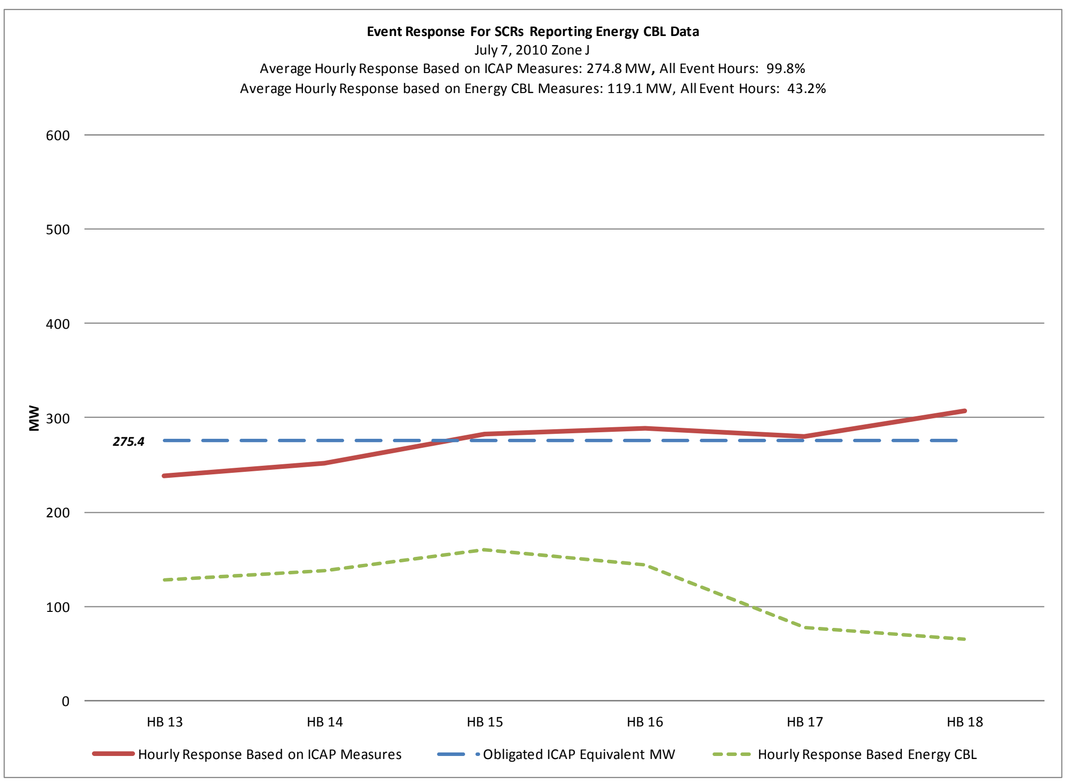


Figure 8. July 21, 2011 - SCR Response Based on ACL Baseline and ICAP Measures

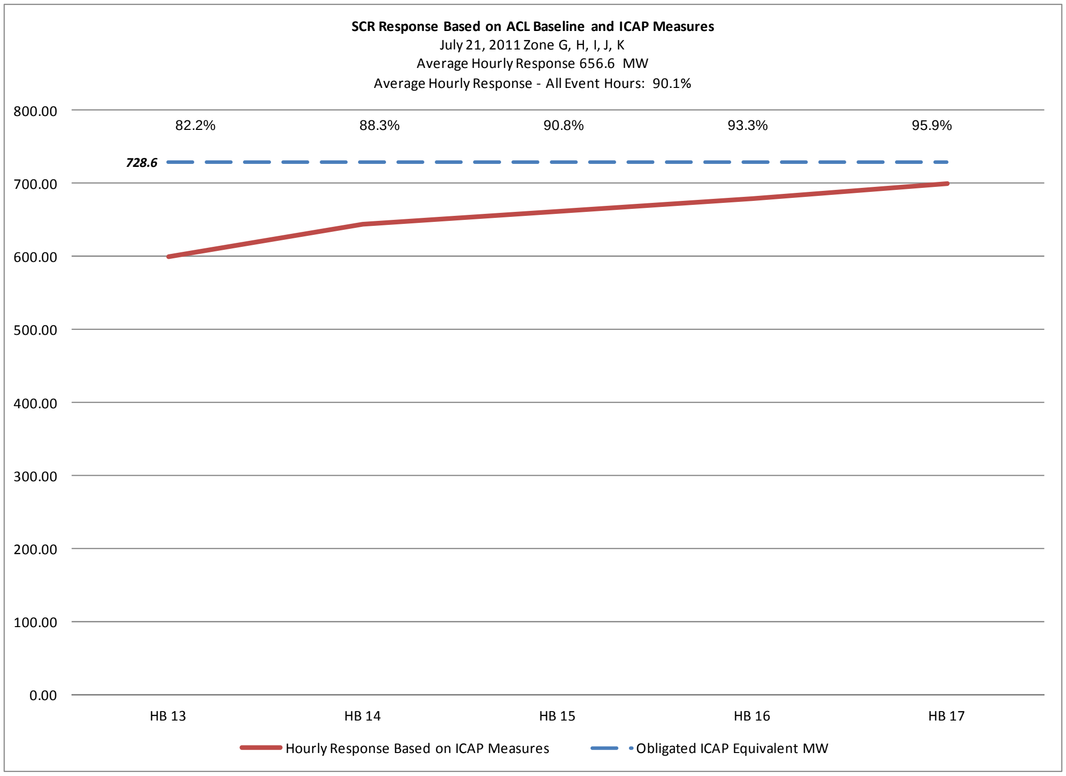


Figure 9. July 21, 2011 Hourly SCR Response Based on ACL Baseline and Hourly Energy CBL

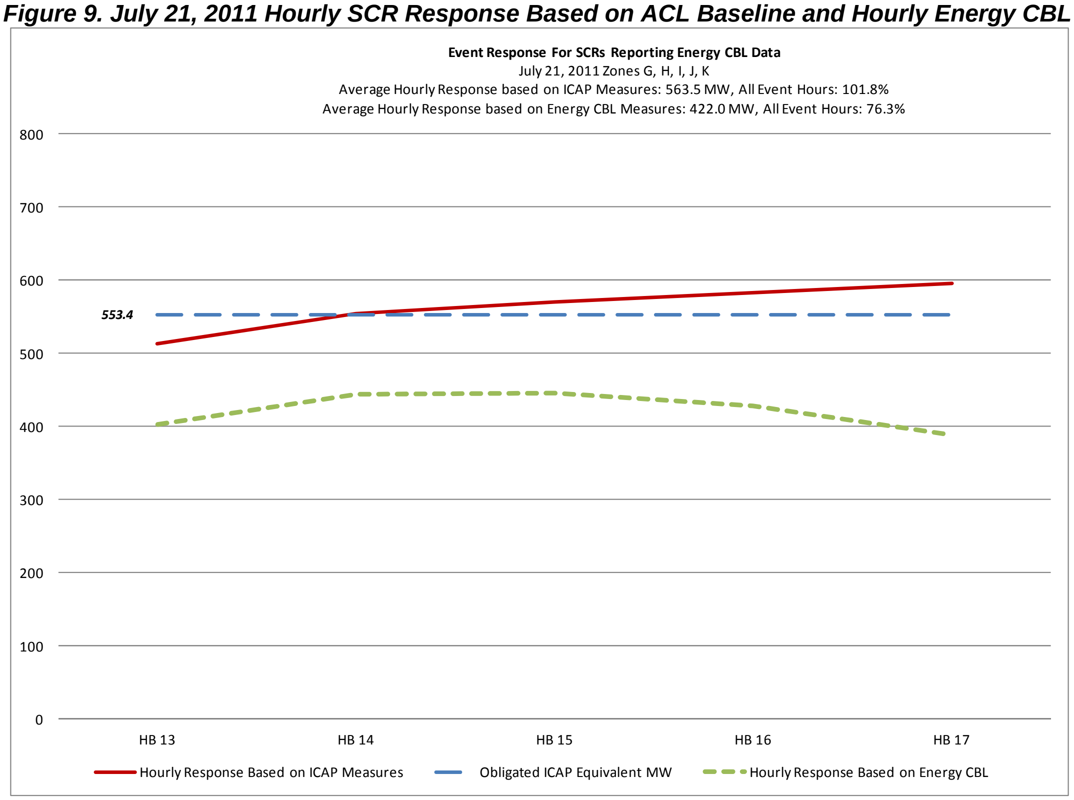


Figure 10. July 22, 2011 Hourly SCR Response Based on ACL Baseline and ICAP Measures

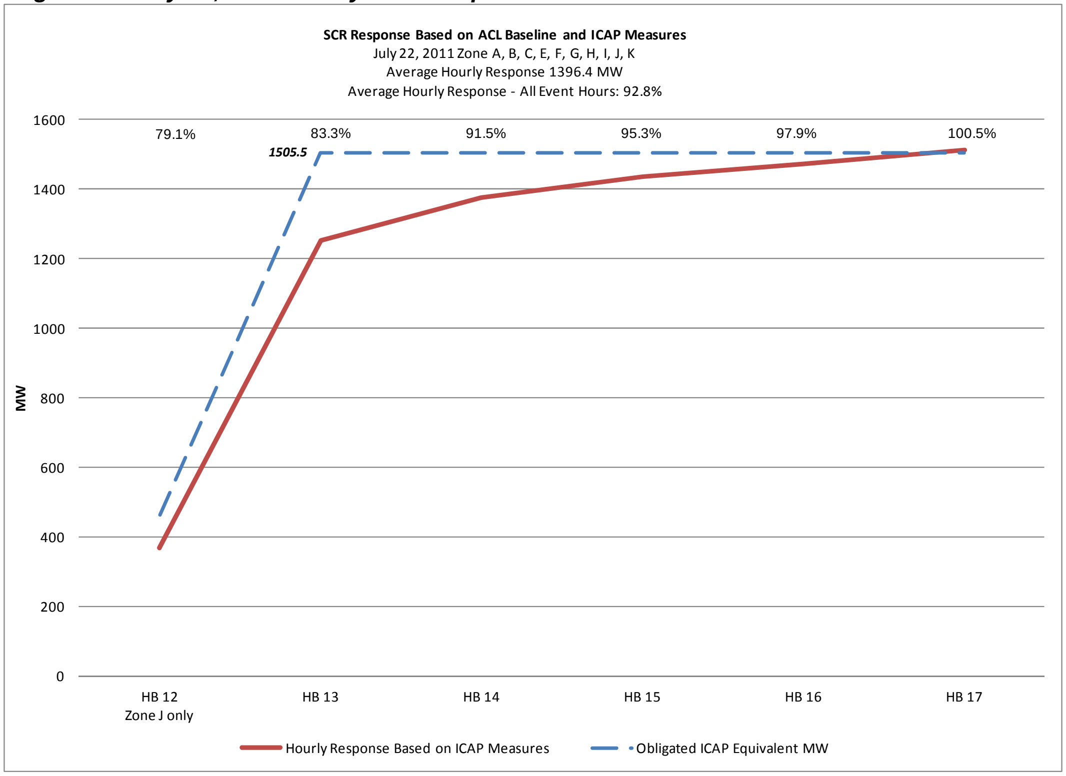
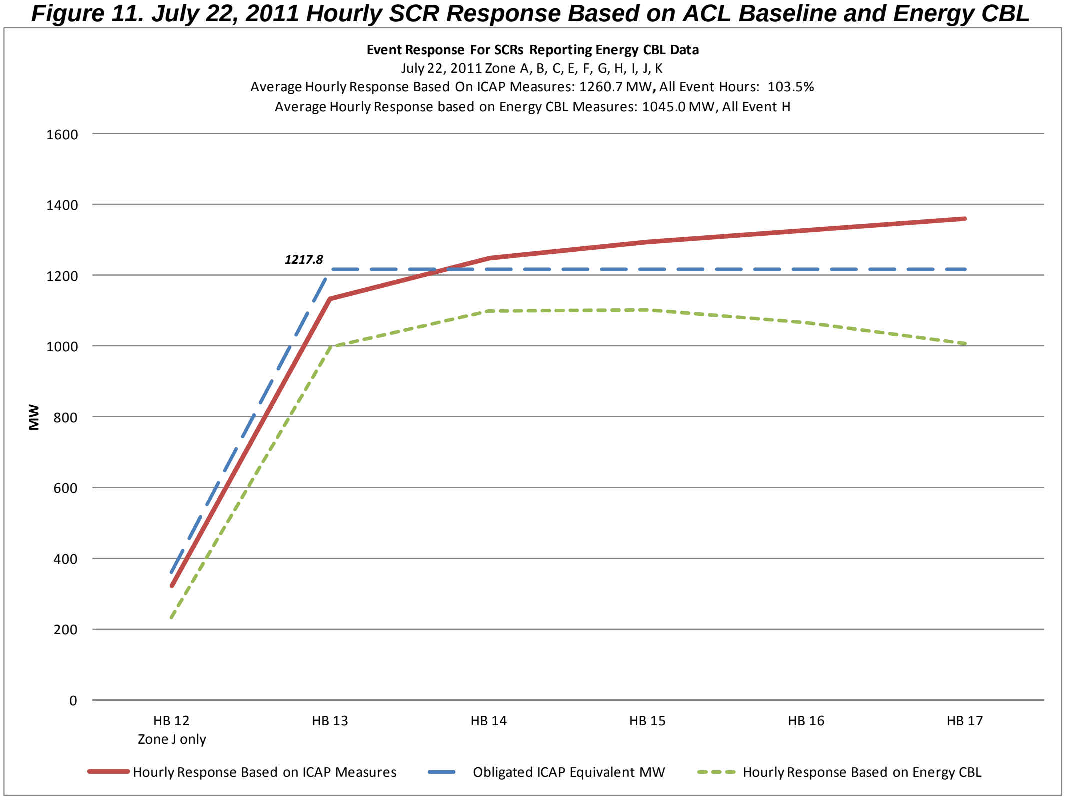
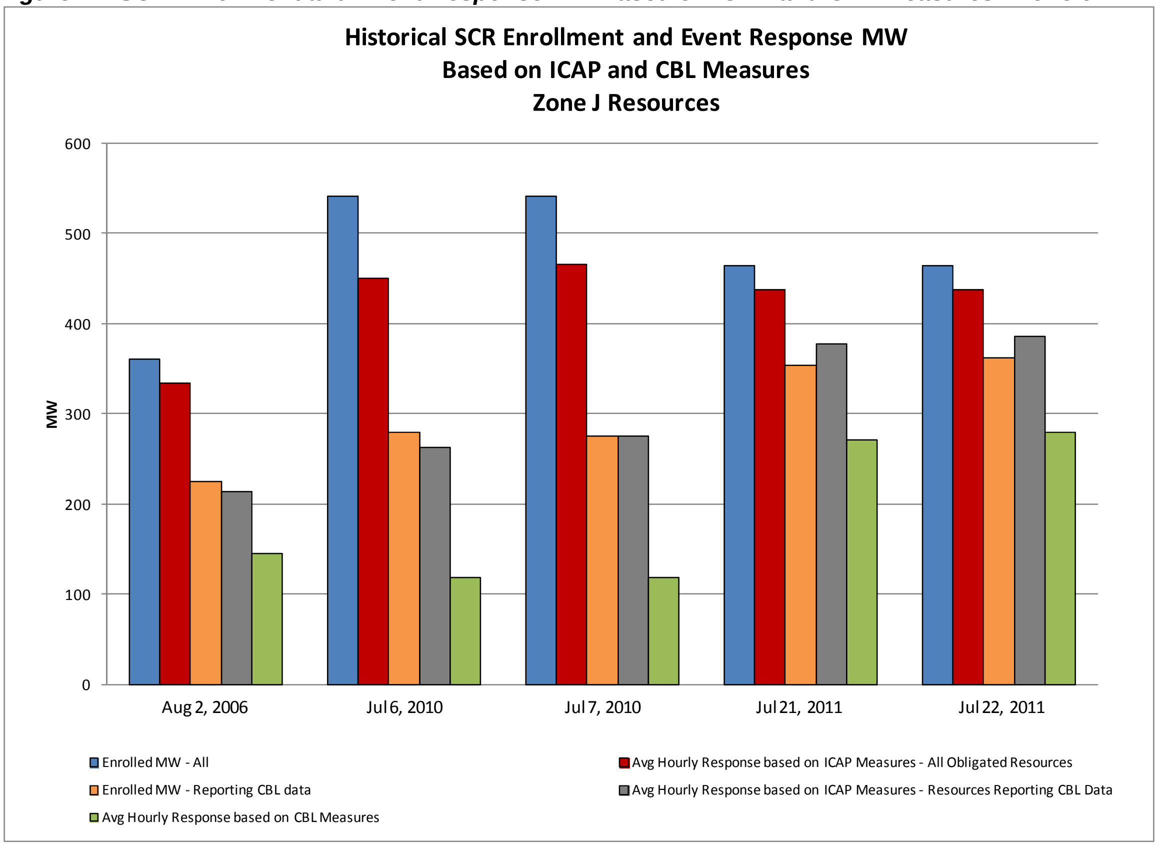


Figure 11. July 22, 2011 Hourly SCR Response Based on ACL Baseline and Energy CBL



The NYISO further evaluated the SCRs reporting CBL data for energy payments in Zone J over the most recent five events where SCRs were deployed.[6]
For each event shown in Figure 12,[7] the enrolled MW of all SCRs in Zone J is shown in the first column, followed by the average hourly response of all obligated SCRs based on ICAP measures. The third column shows the enrolled MW of SCRs that reported CBL data for energy payments in the event, while the fourth and fifth columns show the average hourly response based on ICAP measures and CBL measures, respectively, for the SCRs the reported CBL data for energy payments. The data table with the values used in this chart is provided in Appendix A: Hourly Data for SCR Events.

Figure 12. SCR Enrollment and Event Response MW Based on ICAP and CBL Measures - Zone J



This chart shows that, at least for Zone J, the average hourly response based on ICAP measures has improved between the time when APMD was in effect (through Summer 2010) and the first summer with the ACL method. In addition, the number of MW reporting CBL data for energy payments has increased and the difference between response based on ICAP measures and CBL measures has decreased.

[6] Zone J was selected because it was the zone that was activated all of the events used in the analysis.
[7] It should be noted that the analysis for the chart in Figure 12 did not limit the data to only those resources that participated in all five events. Resource enrollment changes on a month-to-month basis and it is likely that the number of available resources for the analysis would have limited the usefulness of the analysis.

It is important to note that the impacts associated with changes in the reporting of CBL data cannot be entirely attributed to the change from APMD to ACL. The CBL uses meter data from the period preceding the event and weather does play a significant role in the CBL calculation, especially in Zone J. For example, the period immediately preceding the July 2010 events was unseasonably cool, followed by extreme temperatures of 100 degrees or more during the two days of events. As a result, the CBL currently used for determining the load reduction for energy payments was less accurate at estimating the load of individual SCRs during the events, even with the weather-sensitive adjustment. In 2011, however, the events followed several days of high temperatures and thus the CBL was more likely to provide a better estimate of what the load might have been on the event days, resulting in more SCRs that may have been eligible for energy payments.

The NYISO also evaluated whether there may be other factors that could affect whether a SCR reported CBL data or not. Using event response data from July 2010 and July 2011 events in Zone J, a comparison was made of SCRs that did not report CBL data for any of the events in which they were obligated to perform. These SCRs did report event response data for purposes of performance, but did not provide the optional CBL data for energy payment. In total, 230 SCRs in Zone J were enrolled in both years at the time of the events.

Table 2. Comparison of SCRs in Zone J that did not report CBL data for energy payments in 2010 or 2011

Size Range of SCRs and ICAP MW for Common SCRs not reporting CBL data for 2010 and 2011 Events in Zone J	**2010**		**2011**	
Total ICAP MW	**230**	**35.6**	**230**	**19.8**
	#	MW	#	MW
ICAP MW <= 100 kW	62	2.5	68	1.7
ICAP MW >100 kW and <= 1 MW	126	16.0	129	9.9
ICAP MW > 1 MW	42	17.1	33	8.2

Table 2 shows that for SCRs with less than 1 MW of ICAP, the number of resources increased while the amount of ICAP MW decreased between 2010 and 2011; SCRs with 1MW or more of ICAP that did not report CBL data decreased in both quantity and size. The average ICAP of a SCR under 1 MW in this group shrank by approximately 40% from 0.1 MW in 2010 to 0.06 MW in 2011 and the average ICAP of a SCR over 1 MW in this group in reduced from 2.8 MW in 2010 to 2.1 MW in 2011. One reason that SCRs do not report CBL data for energy payments may be that the benefit derived from reporting CBL data for is small compared to the effort required to calculate the CBL for smaller resources.

Performance Factors

The performance of Special Case Resources is used to determine the amount of capacity they can sell in future auctions and for determining any deficiency penalty of the Responsible Interface Party (RIP) that sells the capacity of the Special Case Resource. To determine a SCR's performance during an event, the NYISO uses the best four contiguous hours of response in the calculation of the performance factor.

Prior to the beginning of each Capability Period, a Capability Period Performance Factor is calculated for each SCR using any obligated event response and the mandatory test from the Prior Equivalent Capability Period and the Capability Period immediately preceding the Prior Equivalent Capability Period. For example, for the Summer 2012 Capability Period, the performance factor calculation used event response and test data from the Summer 2011 Capability Period ("Prior Equivalent Capability Period") and the Winter 2010-2011 Capability Period ("the Capability Period immediately preceding the Prior Equivalent Capability Period").

Figure 13. Illustration of the Capability Periods used in the Performance Factor Calculation for SCRs

<table>
<tr><td>M</td><td>J</td><td>J</td><td>A</td><td>S</td><td>O</td><td>N</td><td>D</td><td>J</td><td>F</td><td>M</td><td>A</td><td>M</td><td>J</td><td>J</td><td>A</td><td>S</td><td>O</td></tr>
<tr><td colspan="6">Summer 2011</td><td colspan="6">Winter 2011-2012</td><td colspan="6">Summer 2012</td></tr>
<tr><td colspan="12">Event Response and Test Data Used in Calculation of Performance Factor for Winter 2012-2013</td><td colspan="6"></td></tr>
<tr><td colspan="6"></td><td colspan="12">Event Response and Test Data Used in Calculation of the Performance Factor for Summer 2013</td></tr>
</table>

The SCR's response for each test is compared to the maximum enrolled value for the entire Capability Period, and response for each event hour is compared to the enrolled value in the month in which the event occurs. These calculations result in a "raw" performance factor for each hour of response to events or tests in each Capability Period. Hourly performance factors are limited to the range between zero and one. Thus, a "raw" performance factor greater than one in any event or test hour is adjusted to the maximum of one before the Capability Period Performance Factor is computed. The average of the "adjusted" performance factors from the top four consecutive hours of each event and test hours across the two Capability Periods becomes the Capability Period Performance Factor of the SCR. Performance factors for SCRs that participate in only one Capability Period used in the calculation will be based on performance in the events and/or tests of the single season.

Each RIP's Capability Period Performance Factor is based on the overall performance of all resources in its portfolio during the Capability Periods used for individual SCRs. New Special Case Resources are assigned the Capability Period Performance Factor of the Responsible Interface Party (RIP) that enrolls them. If a new RIP registers for the SCR program, it receives the overall Capability Period Program Performance Factor, which is based on all resources enrolled in the SCR program during the Capability Periods used for individual SCRs.

The SCR Translation Factor

The Translation Factor used to further adjust the load reduction capability of SCRs for the IRM Study was first used in 2008 after the NYSRC requested that the NYISO evaluate SCR event response under both the Average Peak Monthly Demand (APMD) and the Customer Baseline Load (CBL) baseline methods.

The analysis provided to NYSRC prior to establishing the Translation Factor showed that for the August 2, 2006 demand response event, the average response under the CBL method was 70.5% of obligated ICAP MW, whereas the average response under ICAP measures (APMD at the time) was just above 100%. The 14% of SCRs that utilized the optional weather-sensitive adjustment for the CBL showed better response of 78.2% and one zone showed CBL response as high as 81%.

Due to the discrepancy in the estimated response under each method in the analysis, the ICS established the Translation Factor as a way to adjust for the apparent overstatement of SCR capacity for the IRM Study. For the 2008 – 2011 IRM Studies, the Translation Factor was set at 20%.

In 2011, when the NYISO changed from the Average Peak Monthly Demand baseline to the Average Coincident Load baseline, the NYISO proposed a revised Translation Factor of 5% for the 2012 IRM Study. This revised Translation Factor was based on the difference between the new ACL baseline and the CBL of metered load data from the 229 SCRs used in the SCR baseline study that was the basis for the change from APMD to ACL.

Measuring Persistence

Persistence can be considered from two different perspectives: performance over the duration of an event or performance over multiple events during a specific period of time.

Most demand response events are brief, typically lasting a few hours. Due to the limited deployments of the SCR program, using historical data to make any assessments about persistence over extended event periods or to increased frequency of calls was not practical. There are no actual examples available of demand response resources being deployed at the frequency identified in the IRM study or the MARS model analysis performed by GE because both model the system under stress and with limited resources throughout the study period. The market rules that govern the use of demand response resources for emergencies are based on the premise that the system operator deploys the demand response resources infrequently when anticipating a system under extreme stress.

The NYISO also conducted a literature search to identify research or event information to inform the issue of persistence for this study. Of the papers that were available, almost all were related to persistence related to price-based energy response, which is very different from the dynamics under which the SCR program is deployed; data on emergency response was limited to situations similar to the SCR program.

The most recent relevant example of performance of emergency demand response resources over time is how ERCOT's demand resources in the Emergency Interruptible Load Service (EILS) program responded to ERCOT's 28-hour event that occurred when extreme weather conditions in Texas resulted in the unexpected loss of over 8,000 MW of generation overnight on February 2, 2011 and the emergency event continued until 10am on February 3, 2011.[8]

ERCOT's EILS program is similar to NYISO's SCR program. ERCOT procures the commitment of the demand resources for a fixed period of time. ERCOT uses a procurement-style bidding process that allows the demand resources to offer reductions in up to four fixed time periods: three distinct business hour periods and an overnight and weekend time period.

Because ERCOT is also the central meter authority for Texas, it has access to all the interval data of the resources that are eligible for the EILS program and an extensive load research team to help estimate the best baseline approach for individual resources. ERCOT makes the recommendation to the aggregator on the best baseline after evaluating a minimum of a year's worth of interval data.

Figure 14 below shows a comparison of the actual load (blue line) of the EILS resources and the composite baseline (red line) for a non-event day. This provides a reference on how close the composite baseline for ERCOT's EILS resources is to a normal day's load to provide a basis for the accuracy of the level of response it received a week later during the emergency event.

Figure 15 shows the actual load of the EILS resources compared to the baseline during the emergency event from just before 6 a.m. on February 2, 2011 through 10 a.m. on February 3, 2011. Verbal Dispatch Instructions (VDI) were provided to demand response aggregators at 5:46 am and 8:53 am on February 2, 2011 and the Recall notice to terminate the event was given to aggregators at 10:01 on February 3, 2011.

[8] ERCOT's presentations on the February 2-3, 2011 emergency event used as reference for this report are available at: http://ercot.com/content/meetings/board/keydocs/2011/0214/Review_of_February_2,_2011_EEA_Event.pdf and http://ercot.com/calendar/2011/04/20110429-DSWG

Figure 14. ERCOT - Comparison of EILS Demand Response Resources Actual Load to Baseline

January 25 - 26, 2011

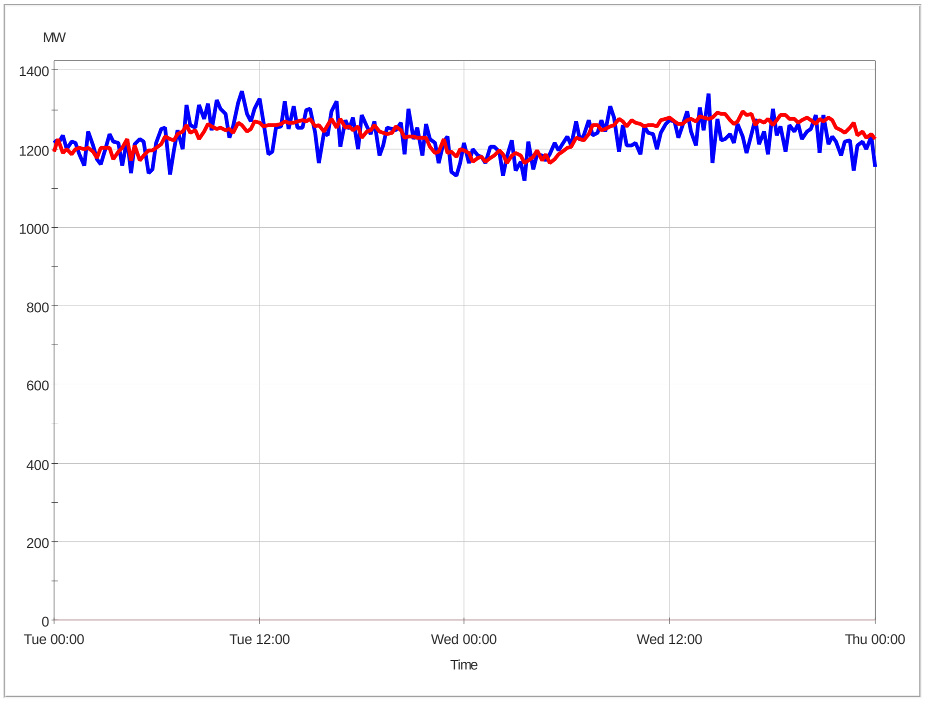
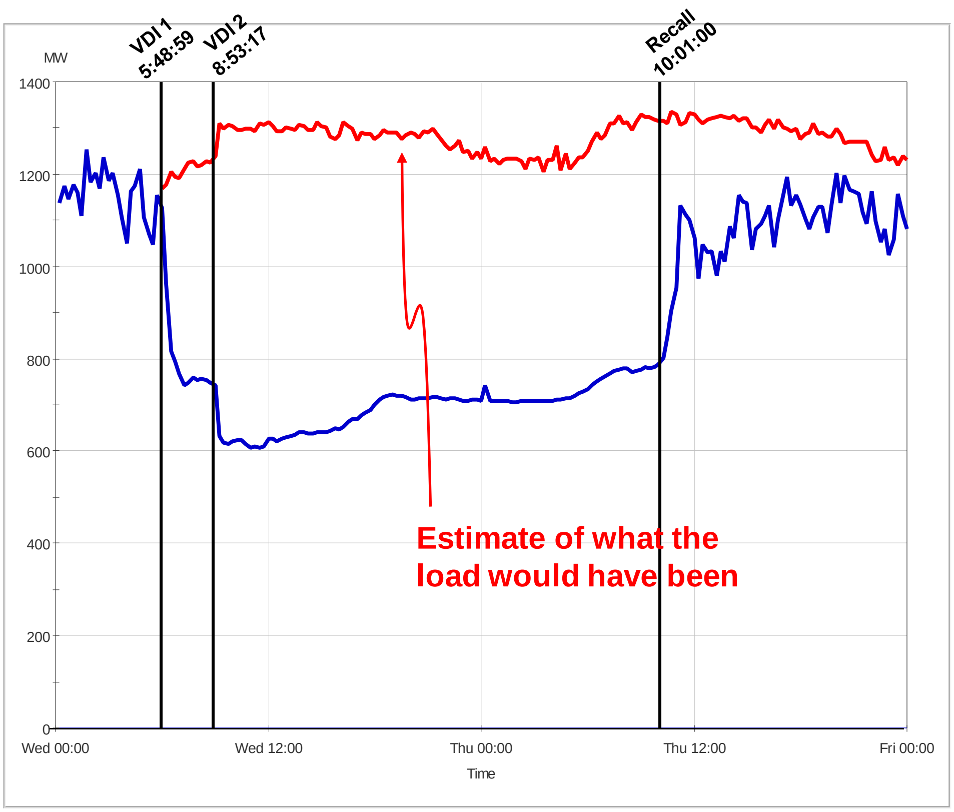


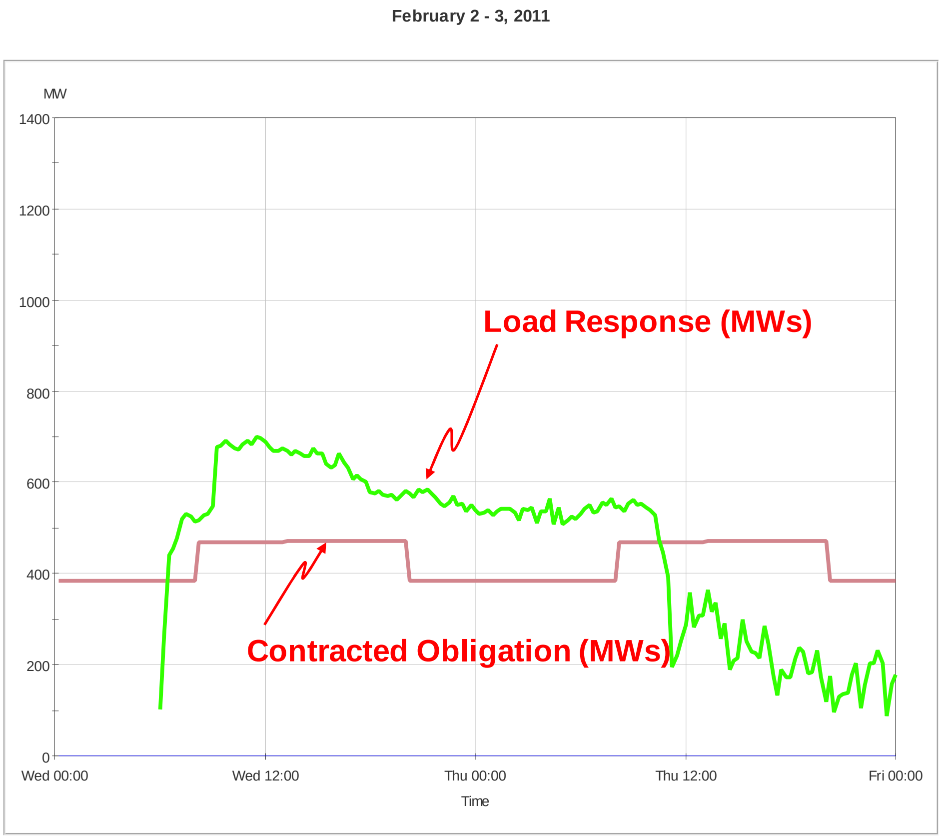
Figure 15. ERCOT - Emergency Event Response and Baseline of EILS Demand Response Resources

February 2 - 3, 2011



Finally, Figure 16 shows the response provided over the event compared to the contracted capacity of the EILS resources; the line showing Contracted MW reflects the obligated resources over the various contract periods throughout the day.

Figure 16. ERCOT - EILS Event Response - February 2-3, 2011



ERCOT's 2011 emergency event crossed all contracted time periods in which demand response resources were required to perform. Although the resources were only obligated to perform for their contracted time period, ERCOT did not release them from their obligation because the emergency state persisted beyond the initial contracted time period. ERCOT reported an average reduction of 577.7 MW against a 426.9 MW obligation of EILS resources, which was a 35.7% over-provision; the maximum load reduction during the 28-hour event was 692.2 MW.

Performance demonstrated over the duration of this ERCOT event is indicative of how emergency demand response resources respond when a system is under extreme stress.

ERCTO's analysis of the event reported that a few resources were not able to reduce to their committed load level due to metering problems and, because the aggregators have the final decision in the selection of the baseline, a few resources may not be on the most accurate baseline. ERCOT is evaluating changes to its protocols regarding its baseline assignment process and performance measurement.

Observations

The IRM Study provides the minimum installed capacity requirement needed to meet planning criteria. From a practical perspective, the amount of installed capacity that is secured in the NYISO capacity market is usually greater than the minimum installed capacity requirement. However, in the IRM Study as well as the MARS analysis included in this report, all surplus has been removed, which results in a higher frequency of SCRs calls than experienced in the past.

Market rules for SCRs are based on the premise that when the NYISO anticipates a reserve shortage or other emergency condition, consistent with its Emergency Operating Procedures, it can deploy SCRs. From a practical perspective, the NYISO has more than the minimum requirement and SCRs are called less frequently than the IRM Study shows at the minimum requirement.

The capacity value analysis conducted using MARS in 8760-mode demonstrates that as the availability of SCRs increases as measured by duration and numbers of days their capacity value or contribution increases. SCRs have historically been called for and performed for an average of six hours per call, but there are no program restrictions for calling them for more than six hours. In addition, the capacity value per unit decreases as the penetration levels increase due to the increased likelihood of new peak loads appearing outside of the SCR window of use.

The capacity analysis in this study assumed that the load reduction associated with the SCR response lasted only for the duration of the minimum requirement and that, at the end of that minimum time requirement, the load level of the SCR immediately returned to the pre-call level. As an example, in this capacity analysis, for the six-hour ELCC curve, the analysis assumed that at one minute after the sixth hour, the entire load level returned to pre-call levels even if Operations called for the resource for ten hours. This modeling assumption does reflect historical response of actual events, where SCRs continue their load reduction through the end of the event when it extends beyond the minimum period required for demonstrating performance.

Appendix A: Hourly Data for SCR Events

Supporting data for Figure 4 and Figure 5

	MWh	*Event: July 6, 2010 - Zone J*				
	HB 13	**HB 14**	**HB 15**	**HB 16**	**HB 17**	**HB 18**
Obligated ICAP Equivalent MW - All SCRs	541.5	541.5	541.5	541.5	541.5	541.5
Hourly Response Based on ICAP Measures - All SCRs	360.33	381.89	453.39	477.64	479.83	544.93
Obligated ICAP Equivalent MW - SCRs Reporting CBL Data	280.07	280.07	280.07	280.07	280.07	280.07
Hourly Response Based on ICAP Measures - SCRs Reporting CBL Data	212.82	232.48	273.72	280.75	273.49	302.19
Hourly Response based on CBL Measures - SCRs Reporting CBL Data	94.23	113.84	150.99	148.65	118.73	86.27

Supporting data for Figure 6 and Figure 7

	MWh	*Event: July 7, 2010 - Zone J*				
	HB 13	**HB 14**	**HB 15**	**HB 16**	**HB 17**	**HB 18**
Obligated ICAP Equivalent MW - All SCRs	541.5	541.5	541.5	541.5	541.5	541.5
Hourly Response Based on ICAP Measures - All SCRs	384.70	402.60	460.79	482.99	495.40	562.94
Obligated ICAP Equivalent MW - SCRs Reporting CBL Data	275.35	275.35	275.35	275.35	275.35	275.35
Hourly Response Based on ICAP Measures - SCRs Reporting CBL Data	237.96	251.73	283.01	289.06	279.87	307.21
Hourly Response based on CBL Measures - SCRs Reporting CBL Data	128.39	138.40	160.71	144.13	77.73	65.06

Supporting data for Figure 8 and Figure 9

	MWh	*Event: July 21, 2011 - Zones G, H, I, J, K*			
	HB 13	**HB 14**	**HB 15**	**HB 16**	**HB 17**
Obligated ICAP Equivalent MW - All SCRs	728.6	728.6	728.6	728.6	728.6
Hourly Response Based on ICAP Measures - All SCRs	599.06	643.43	661.91	679.63	699.07
Obligated ICAP Equivalent MW - SCRs Reporting CBL Data	553.44	553.44	553.44	553.44	553.44
Hourly Response Based on ICAP Measures - SCRs Reporting CBL Data	512.90	554.38	570.33	583.54	596.18
Hourly Response based on CBL Measures - SCRs Reporting CBL Data	403.59	443.73	445.20	428.26	389.25

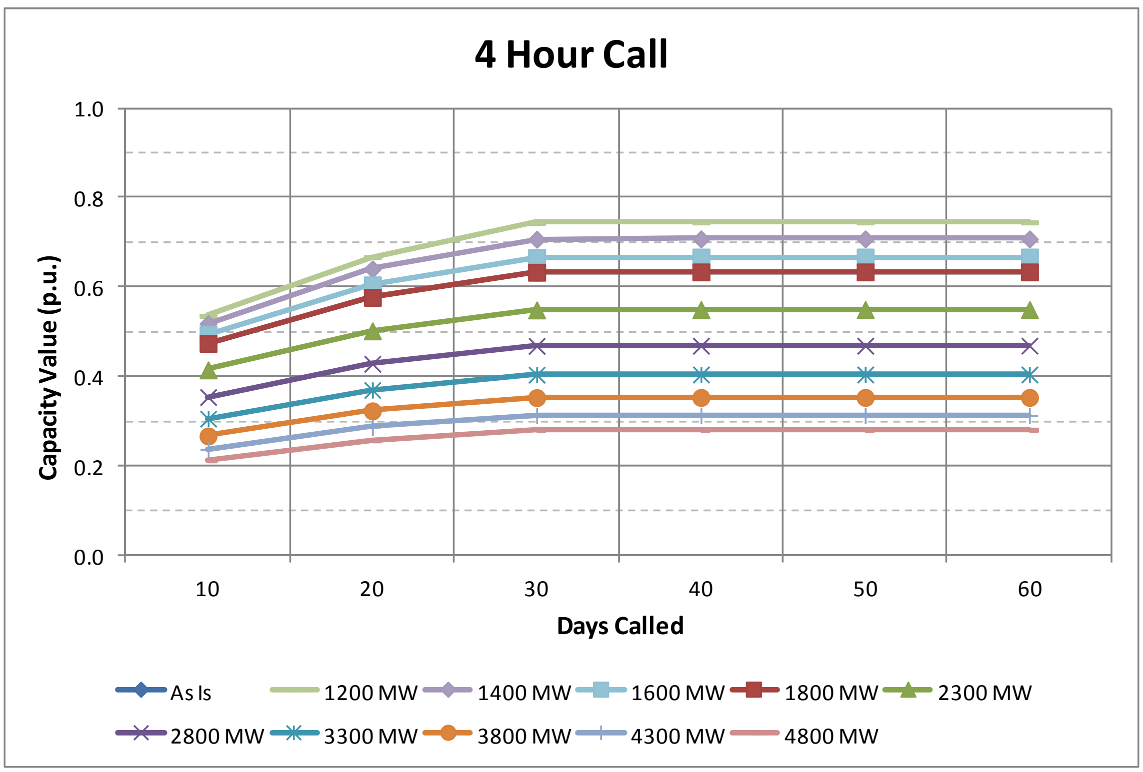
Supporting data for Figure 10 and Figure 11

	MWh	*Event: July 22, 2011 - Zones A, B, C, E, F, G, H, I, J*, K*				
	HB12*	**HB 13**	**HB 14**	**HB 15**	**HB 16**	**HB 17**
Obligated ICAP Equivalent MW - All SCRs	464.3	1505.4	1505.4	1505.4	1505.4	1505.4
Hourly Response Based on ICAP Measures - All SCRs	367.29	1253.78	1377.04	1435.06	1473.92	1512.45
Obligated ICAP Equivalent MW - SCRs Reporting CBL Data	361.83	1217.89	1217.89	1217.89	1217.89	1217.89
Hourly Response Based on ICAP Measures - SCRs Reporting CBL Data	323.02	1135.04	1248.88	1295.45	1327.78	1359.62
Hourly Response based on CBL Measures - SCRs Reporting CBL Data	233.13	996.37	1098.73	1102.33	1066.18	1007.79

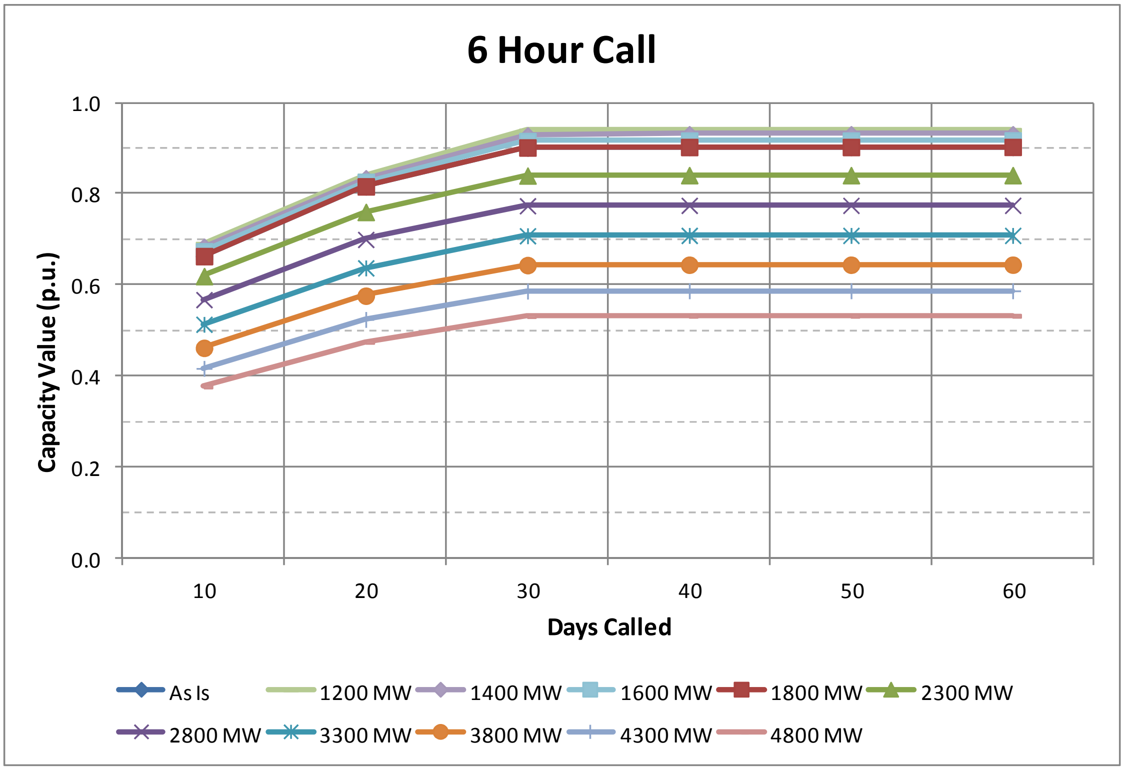
Supporting data for Figure 12

	8/2/2006	7/6/2010	7/7/2010	7/21/2011	7/22/2011
Enrolled MW - All	360.0	541.5	541.5	464.1	464.1
Avg Hourly Response based on ICAP Measures - All Obligated Resources	334.3	449.7	464.9	437.1	437.7
Enrolled MW - Reporting CBL data	225.0	280.1	275.3	353.2	361.8
Avg Hourly Response based on ICAP Measures - Resources Reporting CBL Data	214.3	262.6	274.8	377.3	386.4
Avg Hourly Response based on CBL Measures	145.5	118.8	119.1	270.8	279.4

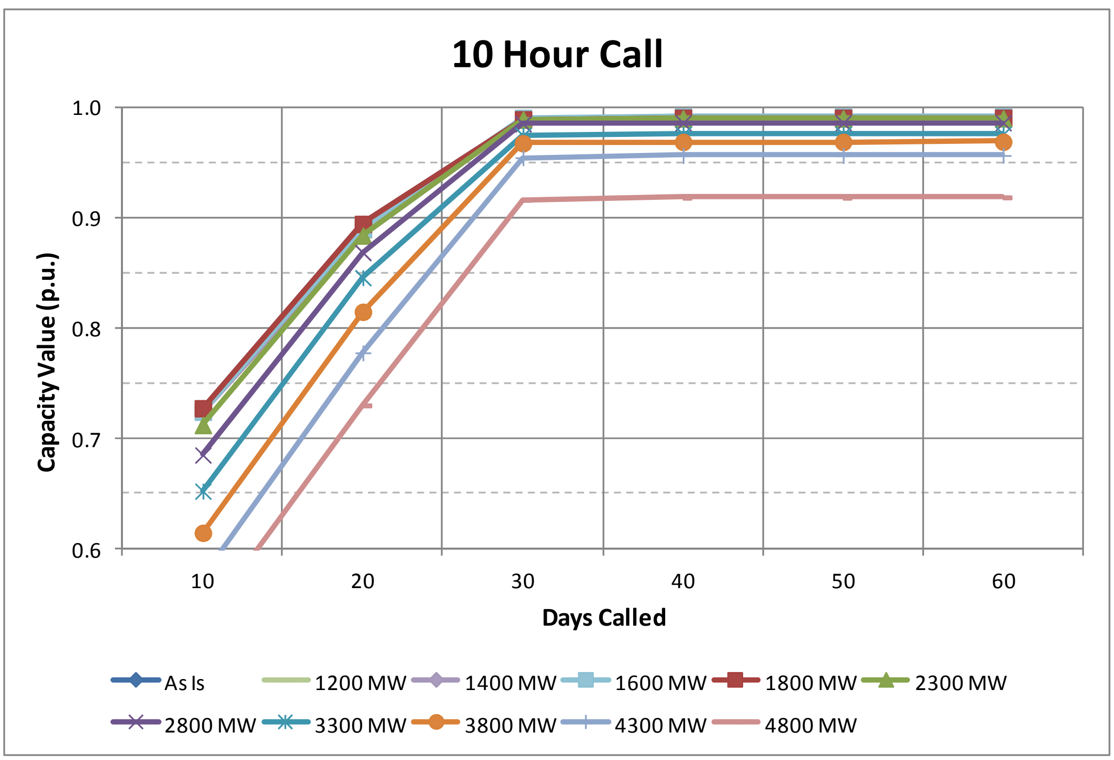
Appendix B: Results of MARS 8760-mode Analysis



Capacity Value of SCR Called for 4 Hours (NYCA Days and Hours)



Capacity Value of SCR Called for 6 Hours (NYCA Days and Hours)



Capacity Value of SCR Called for 10 Hours (NYCA Days and Hours)