

Demand Response Reserve Pilot Evaluation

Final Report



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1. Executive Summary

1.1 Introduction

The central objective of this document is to describe performance of assets that participated in the Demand Response Reserve Pilot (DRRP). Performance was assessed by measuring how quickly and consistently participating assets, individually and as a whole, were able to reduce load in an amount relative to the quantity of interruptible capacity enrolled in the DRRP.

The DRRP was designed to test the ability of smaller demand response (DR) resources to respond to ISO dispatch instructions in a manner similar to resources providing Operating Reserve. While there is some data available from other areas on the performance of certain DR resources providing Operating Reserve, those resources are not similar to the types of DR resources participating in the New England markets. The DRRP was developed to acquire performance data for the types of DR resources that exist in New England in response to more frequent, short-duration activations like that of Operating Reserve resources. The DRRP also was intended to enable system operators to more accurately predict the likely performance of DR resources in varying system conditions, which would contribute to the analysis of contingencies and engender more confidence in the use of DR resources for enhancing system reliability at lower cost.

The Federal Energy Regulatory Commission (Commission) approved the establishment of the DRRP by letter order dated November 29, 2005 (Docket No. ER05-1450-000). The first phase of the DRRP was conducted from October 1, 2006, through September 30, 2008. To obtain further performance data from DR resources activated in a manner similar to Operating Reserve resources, the ISO proposed a second phase of the DRRP, which was approved by the Commission by letter order dated September 9, 2008 (Docket No. ER08-1313-000). The second phase commenced on October 1, 2008 and continued through May 31, 2010. Enrollment in the DRRP in both phases was limited to 50 MW per session,¹ but the enrollment in the DRRP did not reach this limit in any session.

The ISO-NE conducted six sessions of the DRRP between October of 2006 and May of 2010. The first two years of the Pilot consisted of four sessions – i.e., a winter and a summer session

¹ As used in this report, a “session” refers to a season coincident with a Forward Reserve Procurement Period. Each year consisted of two sessions: a winter session that ran from October 1 through May 31, and a summer session that ran from June 1 through September 30.

in each year. Due to lack of enrollment in the winter session, the third year of the DRRP consisted only of the summer session. This was followed by a winter session in the fourth year:

There are three types of assets that participated in the DRRP:

- **Load Reduction Assets.** Assets in this category participated in the DRRP by reducing the amount of energy their facilities used during the event time. The most common strategies were reductions in lighting and HVAC usage. Asset performance was assessed by comparing their actual metered load during the event to a calculated baseline.
- **Generation Assets.** These are assets that participated in the DRRP by starting a behind the meter generator. Generation Assets are different from Load Reduction Assets in that they do not require a baseline: their load impact is based solely on the metered generation at the time of the event.
- **Direct Load Control Assets.** These assets consisted of direct load control applied to a large number of small customers. For this pilot, Direct Load Control Assets consisted of residential air conditioner curtailment. The baselines for these assets were not estimated by the ISO. Rather, the asset owner estimates a baseline using a control group and provides these estimates to the ISO. Because of this feature – the lack of a baseline estimated by the ISO – Direct Load Control Assets are grouped with Generation Assets in some of the analysis presented in this report.

Prominent operation and enrollment statistics of the DRRP are:

- A total of 107 events were conducted.
- A total of 109 assets participated in at least one session of the DRRP. Thirty-five of the 109 assets enrolled in all sessions.
- The total Enrolled Amount varied between 47.3 MW (consisting of 37.3 MW of Load Reduction Assets, and 10 MW of Direct Load Control Assets) in summer of 2009 to 18.6 MW (consisting of 13.7 MW of Load Reduction Assets and 5 MW of Generation Assets) in winter of 2007/2008. As mentioned above, one session included 0 MW of enrolled capacity. The average Enrolled Amount was 26.4 MW per session. Generally, the Enrolled Amount reflected each asset's maximum interruptible capacity.
- In the last two sessions of the DRRP, assets were allowed to enroll an amount of capacity that was less than their declared maximum interruptible capacity. This revised

Enrolled Amount is referred to in this report as the DRR Contract Amount. On average, the DRR Contract Amount was 64 percent of the maximum interruptible capacity for Load Reduction Assets and 50 percent of the maximum interruptible capacity for Generation Assets and Direct Load Control Assets.

Also introduced in the last two sessions of the DRRP was the symmetric baseline. The symmetric baseline adjusts the calculated baseline in either direction based on the participant's actual consumption during the two hours prior to the start of the event (i.e., the baseline is reduced or increased to match the participants' load level prior to the start of the event). Prior to the introduction of this symmetric adjustment, baselines were only adjusted if the adjustment was favorable to the participant – i.e., the baseline would be increased to match the participant's load level prior to the start of the event, but not decreased if the load level was lower than the calculated baseline.

Because the amount of capacity enrolled into the pilot and the baseline calculation for Load Reduction Assets differed between the first and second phases of the DRRP, providing consistent performance statistics across the entire DRRP became a challenge. To achieve consistency, the analyses presented in this document applied the DRR Contract Amount and the symmetric baseline across all sessions of the DRRP. The DRR Contract Amount allows participants to declare a level of performance that is lower than their maximum interruptible capacity, but that they believe they can meet on a regular basis. The introduction of the DRR Contract Amount *increased* the estimated performance of the assets enrolled in the pilot. On the other hand, the introduction of the symmetric baseline *reduced* the estimated performance of Load Reduction Assets enrolled in the pilot given that the baseline would be adjusted downward on days in which a Load Reduction Asset's actual consumption was lower than the calculated baseline for the period two hours prior to the event. The net effect of these program changes on DRRP asset performance is dominated by the DRR Contract Amount, resulting in *higher* estimates of performance for the DRRP. Because generation and Direct Load Control Assets do not have an ISO-calculated baseline, the symmetric baseline adjustment does not apply to them. Accordingly, the introduction of the DRR Contract Amount only increases the performance of generation and Direct Load Control Assets.

1.2 DRRP Asset Performance

The performance of participating assets was assessed by calculating load reductions during event hours as a percentage of the assets' Enrolled Amount and DRR Contract Amount. Based on the Enrolled Amount, average performance over all sessions was 41 percent, composed of 35 percent for Load Reduction Assets and 54 percent for Generation and Direct Load Control² Assets (see Table 1-1). The highest overall performance was observed in summer of 2007, when as a group, assets achieved 49 percent of their Enrolled Amount. The highest performance of Load Reduction Assets was in summer of 2007, when they reached 49 percent of their Enrolled Amount. Generation and Direct Load Control Assets reached their highest average performance, 90 percent of their Enrolled Amount, in winter of 2006/2007. The lowest overall performance was in summer of 2009, when performance of all participating assets as a group reached an average of 33 percent of the Enrolled Amount. This low performance was driven by the Generation and Direct Load Control Assets, which performed at an average of 23 percent of their Enrolled Amount. Load Reduction Assets performed at their lowest in the winter of 2006/2007, when they performed at an average of 29 percent of their Enrolled Amount.

**Table 1-1
DRRP Performance Summary
Enrolled Amount Vs Average Performance**

DRRP Session	Load Reduction as Percent of Enrolled Amount	Generation and Direct Load Control as Percent of Enrolled Amount	Total Load Relief as Percent of Enrolled Amount
Winter 06/07	33%	92%	48%
Summer 07	42%	56%	49%
Winter 07/08	29%	80%	43%
Summer 08	37%	51%	43%
Winter 08/09	n/a	n/a	n/a
Summer 09	36%	23%	33%
Winter 09/10	34%	n/a	34%
Average	36%	54%	41%

² The baselines for Direct Load Control Assets were not estimated by the ISO. Rather, the asset owner estimates a baseline using a control group. Because of this feature -- the lack of a baseline estimated by at the ISO -- Direct Load Control Assets are grouped with Generation Assets in some of the analysis presented in this report.

Based on the DRR Contract Amount, average performance over all sessions was 68 percent, composed of 54 percent for Load Reduction Assets and 117 percent for Generation and Direct Load Control Assets (see Table 1-2). The highest overall performance was observed in summer of 2007, when assets achieved 86 percent of their estimated DRR Contract Amount. These results were driven by the over-performance of Generation Assets and Direct Load Control Assets, which delivered an average of 143 percent of their estimated DRR Contract Amount (their second highest performance). The highest performance of the Load Reduction Assets was in summer of 2007, when they reached 57 percent of their estimated DRR contract amount. The highest performance of Generation and Direct Load Control Assets was in winter 2006/2007, when performance reached 184 percent of the estimated DRR Contract Amount, which was applied to the first four sessions for the purposes of this report only. This change, introduced to facilitate comparison among sessions, artificially increases the performance of Generation and Direct Load Control Assets to levels that are undesirably high. Like performance below 100 percent, performance above 100 percent is not desirable from a system operations perspective. For example, large assets or groups of assets in a specific location that over perform can cause transmission problems and the over-scheduling of other resources, resulting in payments for unnecessary generation or demand response.

The lowest overall performance was in the summer of 2009, when performance reached 52 percent. This performance was also driven by Generation Assets, which performed at an average of 45 percent of their DRR Contract Amount.

**Table 1-2
DRRP Performance Summary
DRR Contract Amount Vs Average Performance**

DRRP Session	Load Reduction as Percent of DRR Contract Amount	Generation and Direct Load Control as Percent of DRR Contract Amount	Total Load Reduction as Percent of DRR Contract Amount
Winter 06/07	54%	184%	83%
Summer 07	57%	143%	86%
Winter 07/08	48%	160%	74%
Summer 08	50%	102%	69%
Winter 08/09	n/a	n/a	n/a
Summer 09	55%	45%	54%
Winter 09/10	56%	n/a	56%
Average	54%	117%	68%

Figure 1-1, Figure 1-2, and Figure 1-3 illustrate performance as a percent of DRR Contract Amount for DRRP events. Each of the markers on the blue line represents an event day. The green line on the first chart illustrates the average performance for the session, and the red line in the three charts is the performance's linear trend. These charts show the following:

- While a couple sessions had higher performance than the preceding session, total performance decreased over the six sessions of the DRRP.
- The performance of Load Reduction Assets stayed fairly constant, at an average of 54 percent of DRR Contract Amount – performance of these assets ranged from 48 percent in the winter of 06/07 to 57 percent in the summer of 2007.
- The total performance trend, and most of its variability, was driven by Generation and Direct Load Control Assets. These assets experienced a visible downward trend over the sessions in which they participated. They also experienced considerable fluctuation, with individual event performance ranging between zero percent and 400 percent. As mentioned in the preceding section, Generation and Direct Load Control Assets over-performed (i.e., provided more than 100 percent of the DRR Contract Amount) on average in all sessions of the DRRP except for one (summer of 09) – average performance across all sessions was 117 percent.

**Figure 1-1
Total Performance as a Percentage of the DRR Contract Amount**

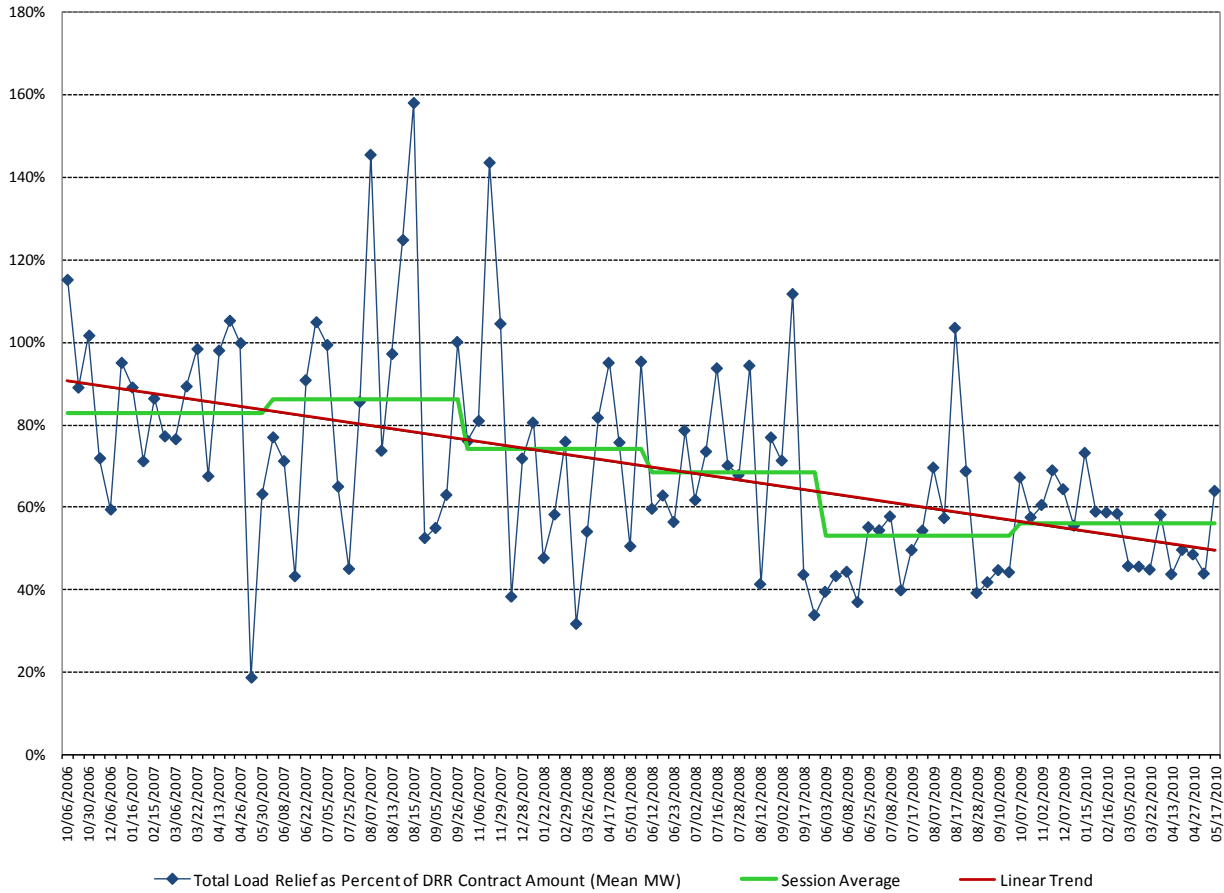


Figure 1-2
Load Reduction Performance as a Percentage of the Load Reduction DRR Contract Amount

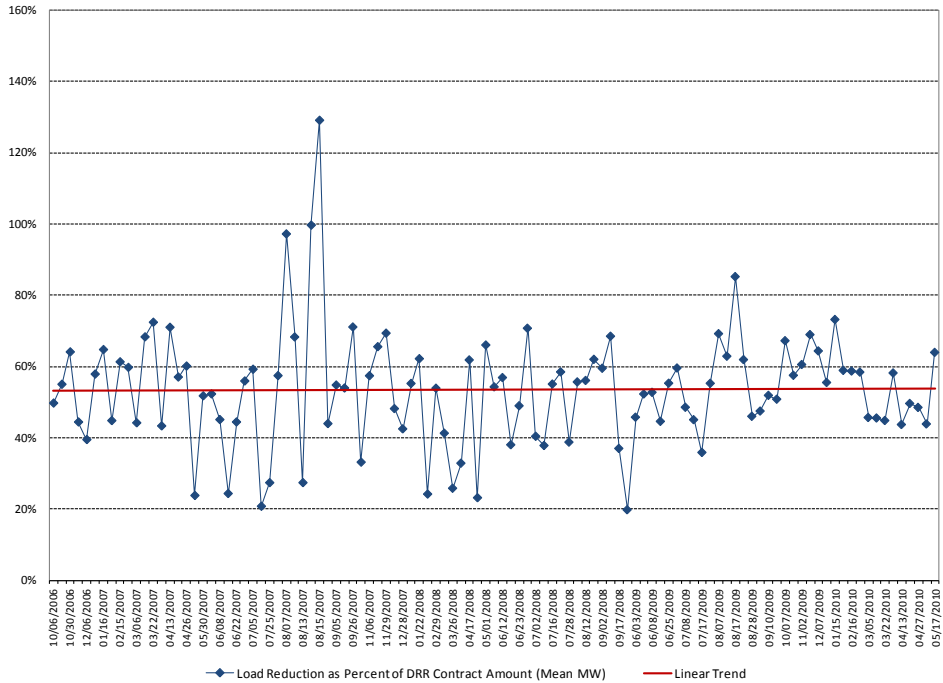
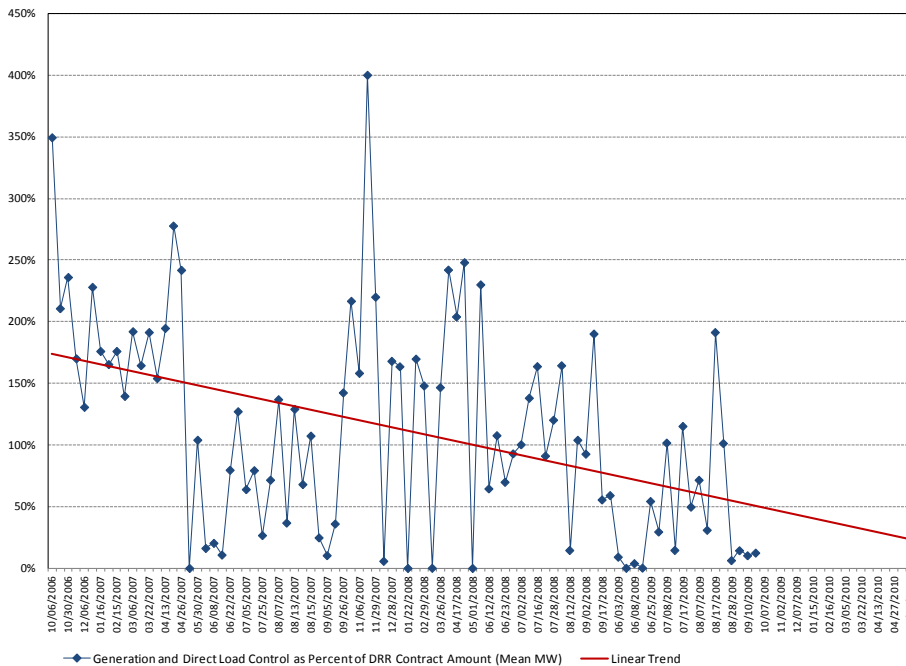


Figure 1-3
Generation and Direct Load Control Performance as a Percentage of the Generation and Direct Load Control DRR Contract Amount*



* There was no Generation or Direct Load Control in the last session of the DRRP

1.3 Comparing the Performance of Participating DRRP Assets to Generation Resources

In order to determine the viability of DRRP assets in the reserve market, their performance was compared to that of the generation resources, which provide reserve services in wholesale electricity markets today. This comparison sheds light on the question of whether allowing demand response resources to participate in reserves markets and displace generators in those markets would improve system reliability.

For the purposes of this comparison, ISO New England selected the following indicators:

- Net Output Factor (NOF) - Net Output Factor is program-level load reduction as a percentage of the DRR Contract Amount
- Starting Reliability 10%, defined as an event where the NOF was greater than 10%
- Starting Reliability 5%, defined as an event where the NOF was greater than 5%

Table 1-3 compares these indicators based on the DRR Contract Amount for DRRP Assets and NERC generator data against diesel generators, small gas turbines, and all gas turbines. As this table shows, DRRP assets exhibit less reliability than generation. Generation resources (in contrast to Generation Assets) have shown a moderate increase in reliability since the time the DRRP started, whereas the reliability of DRRP resources decreased during the same time frame.

**Table 1-3
ISO New England Demand Response Reserve Pilot
Performance Based on DRR Contract Amount Compared to Generation Resources**

Unit Statistic	Phase	Number of DRRP Events	ISO - NE		NERC Generating Availability (2008)		
			DRRP Assets		Diesel All Sizes	Gas Turbine	
			(95% confidence interval)			1-19 MW	All Sizes
Starting Reliability 10%	Winter 06/07	19	90%	(85% , 94%)	100%	96%	98%
	Summer 07	18	66%	(60% , 73%)			
	Winter 07/08	17	82%	(74% , 91%)			
	Summer 08	16	70%	(64% , 76%)			
	Winter 08/09	0	n/a				
	Summer 09	18	65%	(57% , 73%)			
	Winter 09/10	19	73%	(69% , 76%)			
	DRRP	107	75%	(72% , 78%)			
Starting Reliability 5%	Winter 06/07	19	91%	(87% , 96%)	100%	96%	98%
	Summer 07	18	72%	(66% , 78%)			
	Winter 07/08	17	87%	(79% , 95%)			
	Summer 08	16	73%	(68% , 79%)			
	Winter 08/09	0	n/a				
	Summer 09	18	74%	(67% , 81%)			
	Winter 09/10	19	80%	(77% , 83%)			
	DRRP	107	80%	(77% , 83%)			
Net Output Factor	Winter 06/07	19	120%	(98% , 142%)	85%	76%	72%
	Summer 07	18	55%	(46% , 64%)			
	Winter 07/08	17	107%	(80% , 134%)			
	Summer 08	16	67%	(57% , 77%)			
	Winter 08/09	0	n/a				
	Summer 09	18	50%	(39% , 60%)			
	Winter 09/10	19	56%	(53% , 60%)			
	DRRP	107	78%	(70% , 85%)			

2. Introduction and Background

This report summarizes the performance of the assets enrolled in the ISO New England's Demand Response Reserve Pilot (DRRP). The DRRP was designed to test the ability of smaller demand response (DR) resources to respond to ISO dispatch instructions in a manner similar to resources providing Operating Reserve. While there is some data available from other areas on the performance of certain DR resources providing Operating Reserve, those resources are not similar to the types of DR resources participating in the New England markets. The DRRP was developed to acquire performance data for the types of DR resources that exist in New England in response to more frequent, short-duration activations like that of Operating Reserve resources. The DRRP also was intended to enable system operators to more accurately predict the likely performance of DR resources in varying system conditions, which would contribute to the analysis of contingencies and engender more confidence in the use of DR resources for enhancing system reliability at lower cost.

The Federal Energy Regulatory Commission (Commission) approved the establishment of the DRRP by letter order dated November 29, 2005 (Docket No. ER05-1450-000). The first phase of the DRRP was conducted from October 1, 2006, through September 30, 2008. To obtain further performance data from DR resources activated in a manner similar to Operating Reserve resources, the ISO proposed a second phase of the DRRP, which was approved by the Commission by letter order dated September 9, 2008 (Docket No. ER08-1313-000). The second phase commenced on October 1, 2008 and continued through May 31, 2010. Enrollment in the DRRP in both phases was limited to 50 MW per session,³ but the enrollment in the DRRP did not reach this limit in any session.

The ISO-NE conducted six sessions of the DRRP between October of 2006 and May of 2010. The first two years of the Pilot consisted of four sessions – i.e., a winter and a summer session in each year. Due to lack of enrollment in the winter session, the third year of the DRRP consisted only of the summer session. This was followed by a winter session in the fourth year.

³ As used in this report, a "session" refers to a season coincident with a Forward Reserve Procurement Period. Each year consisted of two sessions: a winter session that ran from October 1 through May 31, and a summer session that ran from June 1 through September 30.

Asset Types

There are three types of assets that participated in the DRRP:

- **Load Reduction Assets.** Assets in this category participated in the DRRP by reducing the amount of energy their facilities used during the event time. The most common strategies were reductions in lighting and HVAC usage. Asset performance was assessed by comparing their actual metered load during the event to a calculated baseline.
- **Generation Assets.** These are assets that participated in the DRRP by starting a behind the meter generator. Generation Assets are different from Load Reduction Assets in that they do not require a baseline: their load impact is based solely on the metered generation at the time of the event.
- **Direct Load Control Assets.** These assets consisted of direct load control applied to a large number of small customers. For this pilot, Direct Load Control Assets consisted of residential air conditioner curtailment. The baselines for these assets were not estimated by the ISO. Rather, the asset owner estimates a baseline using a control group and provides these estimates to the ISO. Because of this feature – the lack of a baseline estimated by the ISO – Direct Load Control Assets are grouped with Generation Assets in some of the analysis presented in this report.

Timeframe

The ISO-NE conducted six sessions of the DRRP between October of 2006 and May of 2010. The first two years of the DRRP each consisted of two sessions, winter and summer. Due to lack of enrollment in the winter session, the third year of the DRRP consisted of only a summer session. This was followed by a winter session in the fourth year. The DRRP terminated on June 1, 2010. The following summarizes the six sessions of the DRRP:

- Winter of 2006/2007: October 2006 through May 2007,
- Summer of 2007: June 2007 through September 2007,
- Winter of 2007/2008: October 2007 through May 2008,
- Summer of 2008: June 2008 through September 2008,

-
- Summer of 2009: June 2009 through September 2009,⁴ and
 - Winter of 2009/2010: October 2009 through May 2010.

Performance Metrics

Performance is determined by what DRRP participants did compared to what they declared they would do when they signed up for the program.

When comparing performance across sessions, it is important to note that there were two important changes introduced in the last year of the DRRP that affected performance measurement and comparability across sessions:

1. The DRRP employed an asymmetric baseline adjustment during the first two years. The asymmetric adjustment implemented baseline adjustments only when the asset's actual load during the two hours prior to the event was higher than the calculated baseline. These adjustments resulted in higher baseline levels and thus higher estimated performance. A symmetric baseline adjustment was introduced in the third year. In addition to increasing the calculated baseline as in the asymmetric adjustment, a symmetric adjustment would also decrease the asset's baseline level if its actual load in the two hours prior to the event was lower than the calculated baseline. Because symmetric adjustments could result in lower baselines, this change had a negative effect on performance calculations for Load Reduction Assets compared to prior years. This change had no effect on Generation Assets or Direct Load Control Assets that do not provide a baseline to the ISO.

⁴ No assets enrolled for the winter session of October 2008 through May 2009.

2. Rather than enrolling their maximum interruptible capacity into the DRRP (i.e., the Enrolled Amount), demand response providers were given the opportunity to revise this amount to reflect the load reduction quantity the provider expected their assets could meet on a regular basis. This amount is referred to as the DRR Contract Amount.⁵ Compared to prior years, this change increased the performance calculations for all DRRP assets.

The central objective of this document is to describe performance of DRRP assets for the entire DRRP program. Thus, the following changes were introduced in order to ensure consistent comparisons among the pilot sessions:

1. The symmetric baseline is utilized to estimate load impacts for all sessions.
2. Proxies for the DRR Contract Amount adjustments are applied to the first two years (i.e., first four sessions of the DRRP). These proxies are the average of the adjustments that were observed during the last two sessions of the DRRP. The percentages applied are 50 percent to Generation and Direct Load Control Assets and 64 percent to Load Reduction Assets.

The performance metrics included in this report specify whether they were estimated based on the Enrolled Amount or the DRR Contract Amount.

⁵ Year 3 introduced a change regarding declared capacity. Rather than utilizing the full maximum capacity of an asset ("Enrolled Amount"), assets were given the opportunity to revise their capacity amount to be the demand response amount that they expected they could meet on a regular basis. This amount is referred to in this report as the "DRR Contract Amount." ISO New England Inc. Original Sheet No. 7900 FERC Electric Tariff No. 3 - Section III.E.8.3.1 describes the DRR Contract Amount as follows:

At the beginning of each Forward Reserve Service Period, DRR Availability Payments for participating DR Resources will be based on the amount that the Enrolling Participant agrees to provide within 30 minutes when called upon by the ISO ("DRR Contract Amount"). Each time a dispatch event occurs, the DRR Availability Payment from the event start time going forward will be based on the lower of the DRR Contract Amount or the actual performance of the DR Resource.

3. Demand Response Reserve Pilot Performance

The DRRP performance sessions described in this document are as follows:

- Winter of 2006/2007
- Summer of 2007
- Winter of 2007/2008
- Summer of 2008
- Summer of 2009 – introduced DRR Contract Amount and symmetric baseline
- Winter of 2009/2010

Prominent operation and enrollment statistics of the DRRP are:

- A total of 107 events were conducted.
- There were 109 assets that participated in at least one of the sessions of the DRRP. Of these, 35 assets enrolled in all sessions of the program.
- The total Enrolled Amount varied between 47.3 MW (consisting of 37.3 MW of Load Reduction Assets, 10 MW of Direct Load Control Assets) in summer of 2009 to 18.6 MW (consisting of 13.7 MW of Load Reduction Assets and 5 MW of Generation Assets) in winter of 2007/2008. As mentioned above, one session included 0 MW of enrolled capacity. The average Enrolled Amount was 26.4 MW per session. Generally, the Enrolled Amount reflected each asset's maximum interruptible capacity.
- In the last two sessions of the DRRP, assets were allowed to enroll an amount of capacity that was less than their declared maximum interruptible capacity. This revised Enrolled Amount is referred to in this report as the DRR Contract Amount. On average, the DRR Contract Amount was 64 percent of the maximum interruptible capacity for Load Reduction Assets and 50 percent of the maximum interruptible capacity for Generation Assets and Direct Load Control Assets.

3.1 Session Descriptions

Winter of 2006/2007

There were 19 events in the first session of the DRRP, which spanned from October of 2006 to May of 2007.

There were 19.9 MW of assets enrolled in the winter 2006/2007 session including 14.9 MW of Load Reduction Assets and 5 MW of Generation Assets.

Forty-eight assets⁶ participated in the first session of the Demand Response Reserve Pilot. Forty-seven of these participated as Load Reduction Assets, and one participated as a Generation Asset.

There were 19.9 MW of assets enrolled for the winter 06/07 season, (14.9 MW of load reduction and 5 MW of generation) in this session.

Forty-two of the Load Reduction Assets were classified as non-weather sensitive (the load being controlled was not a function of weather conditions). Five were weather sensitive (the load being controlled was function of weather and consisted of HVAC controls), and one was non-weather sensitive generation.

Assets participating in the first winter session were enrolled by six demand response providers. One of these demand response providers contributed 33 of the 48 participating assets (69 percent of all first winter pilot participants), representing 51 percent of the session's Enrolled Amount.

Summer of 2007

There were 18 events in the first summer session of the DRRP, which spanned from June to September of 2007.

There were 39.2 MW of assets enrolled in the summer 2007 session including 20.2 MW of Load Reduction Assets and 19.0 MW of Generation Assets.

⁶ Fifty-one assets enrolled in the Winter 2006/2007 of the DRRP. Three of these chose to not participate after the capability period started. They are excluded from all performance statistics and descriptions presented in this report.

Ninety-one⁷ assets participated in this session of the Demand Response Reserve Pilot, including 44 that participated in the winter of 2006/2007. Eighty-seven of the assets participated as a Load Reduction Asset, two as a Generation Asset, and two as a Direct Load Control Asset (i.e., aggregated residential air conditioning programs). Forty-two of these assets were classified as non-weather sensitive load reduction. Five were weather sensitive load reduction, and one was non-weather sensitive generation.

Assets participating in this first summer session were enrolled by six providers. One of these DR providers contributed 71 of the 91 participating assets, or 77 percent of all participants, representing 35 percent of the session's Enrolled Amount.

Winter of 2007/2008

There were 17 events in the second winter session of the DRRP, which spanned from October of 2007 to May of 2008. Seventy-eight⁸ assets participated in this session. Seventy-seven of the assets participated as a Load Reduction Asset and one as a Generation Asset.

There were 18.7 MW of assets enrolled for the winter 2007/2008 session including 13.7 MW of Load Reduction Assets and 5 MW of Generation Assets.

Thirty-eight assets that participated in the winter 2006/2007 session also participated in winter 2007/2008 session.

Summer of 2008

There were 16 events in the second summer season of the DRRP, which spanned from June to September of 2008.

There were 36.9 MW of assets enrolled for the summer 2008 session including 18.6 MW of Load Reduction Assets and 18.3 MW of Generation Assets.

⁷ Ninety-two assets enrolled in the summer of 2007 session. One of these assets withdrew after the capability period started. That asset is excluded from all performance statistics and descriptions presented in this report.

⁸ Seventy-eight assets completed all 17 events. An asset with an Enrolled Amount of 0.1 MW ceased operations in January 2008. Data for this asset were excluded from all performance statistics and descriptions presented in this report.

Ninety-two⁹ assets participated in this session. Eighty-eight of the assets participated as Load Reduction Assets, two participated as Generation Assets, and two as Direct Load Control Assets.

There were 36.9 MW of assets enrolled for the summer 2008 season, (18.6 MW of load reduction, 8.3 MW of generation, and 10 MW of direct load control.)

Eighty-eight assets that participated in the summer of 2008 session also participated in the summer of 2007 session. Assets participating in this summer session were enrolled by four providers. One of these providers contributed 81 of the 92 participating assets, or 88 percent of all session participants and 26 percent of the session's Enrolled Amount.

Summer of 2009

There were 18 events in the third summer session of the DRRP, which spanned from June to September of 2009.

Summer of 2009 introduced a symmetric baseline adjustment and a new performance metric, the DRR Contract Amount.

Participants set their DRR Contract Amounts at 39.5 MW, which consisted of 34.5 MW of Load Reduction Assets and 5 MW of Direct Load Control. This compares to a maximum interruptible capacity (the Enrolled Amount) of 47.3 MW including 37.3 MW of Load Reduction Assets, and 10.0 MW of Direct Load Control Assets.

Fifty-seven assets participated in this session - 55 of these assets participated as a Load Reduction Asset and two as Direct Load Control Assets. Forty of the assets that participated in the summer 2008 session also participated in the summer 2009 session.

Assets participating in this summer session were enrolled by four providers. One of these providers contributed 41 of the 57 participating assets, or 72 percent of all session participants and 59 percent of the Enrolled Amount.

⁹ Ninety-one assets participated in all 16 events. However, one Load Reduction Asset ceased providing data in August 2008. Data for this asset has been included in the first 12 events, but excluded in the last four events.

Winter of 2009/2010

There were 19 events in the third winter session of the DRRP, which spanned from October of 2009 to May of 2010.

The DRR Contract Amount and symmetric baseline, which were introduced in summer of 2009, were used again in winter 2009/2010. The DRR Contract Amount of the Load Reduction Assets enrolled in this session was 16 MW. By comparison the maximum interruptible capacity of these Load Reduction Assets was 26.8 MW.

Forty assets participated in this session. All of these were Load Reduction Assets – no Generation or Direct Load Control Assets participated in this session. All of these assets were enrolled by the same provider.

Thirty-five of the assets that participated in the winter 2008/2009 session also participated in the winter 2009/2010 session.

3.2 Performance Summary

As mentioned in prior sections of this report, there are three types of Assets that participated in the DRRP: Load Reduction Assets, Generation Assets, and Direct Load Control Assets.

Performance for each of these types is evaluated as follows:

- Load Reduction Assets. Performance is assessed by comparing their actual metered load during the event to an estimated baseline. The baseline of each asset is adjusted up or down depending on the load level of each asset in the two hours prior to the event.
- Generation Assets. Generation Assets are different from Load Reduction Assets in that they do not require a baseline: their load impact is based solely on the generation metered at the time of the event.
- Direct Load Control Assets. These assets applied direct load control to a large number of small customers. The only direct load control measure that participated in the DRRP consisted of residential air conditioner curtailment. The load curtailment amounts of these assets were estimated by the assets owner, comparing a metered sample of participating controlled air conditioners with a metered sample of non-participants. The demand response provider was responsible for collecting the metering samples in accordance with a measurement and verification plan reviewed by the ISO. Like

Generation Assets, load curtailment quantities of Direct Load Control Assets were reported to the ISO without the baseline or the event load information.

As mentioned in the preceding section, it is important to keep in mind that some of the performance metrics utilized in this report were recalculated (compared to prior seasonal reports) using a symmetric baseline and the DRR Contract Amount. The ISO implemented both of these changes for the last two sessions of the DRRP. However, to make sessions comparable to each other, the symmetric baseline and an estimated DRR Contract Amount are utilized in the performance metrics calculated for all sessions in this report. The DRR Contract Amount for the first four sessions of the DRRP is calculated based on the ratio of DRR Contract Amount to the Enrolled Amount that was observed in the last two sessions.

Over the life of the DRRP, the average performance of Load Reduction Assets was 54 percent, and that of Generation and Direct Load Control Assets was 117 percent based on the DRR Contract Amount. Overall average performance was 68 percent.

An overview of performance at the session level is presented in Table 3-1 (based on Enrolled Amount) and Table 3-2 (based on DRR Contract Amount). Highest and lowest performances are highlighted in yellow and green, respectively.

Table 3-1 shows that, based on Enrolled Amount, average performance over all sessions was 41 percent, composed of 35 percent for Load Reduction Assets and 54 percent for Generation Assets. The highest overall performance was observed in summer of 2007, when as a group, assets achieved 49 percent of their Enrolled Amount. The highest performance of Load Reduction Assets was in summer of 2007, when Load Reduction Assets reached 49 percent of their estimated Enrolled Amount. For Generation Assets it was in winter of 2006/2007, when Generation Assets reached an average of 90 percent of their Enrolled Amount. The lowest overall performance was in summer of 2009, when performance reached an average of 33 percent of the Enrolled Amount. This low performance was driven by Generation Assets, which had their lowest season at an average of 23 percent of their Enrolled Amount. Load Reduction Assets had their lowest season in the winter of 2006/2007, when they performed at an average of 29 percent of their Enrolled Amount.

Table 3-2 shows that, based on DRR Contract Amount, average performance over all sessions was 68 percent, composed of 54 percent Load Reduction Assets and 117 percent Generation Assets and Direct Load Control Assets. The highest overall performance was observed in

summer of 2007, when assets achieved 86 percent of their estimated DRR Contract Amount. These results were driven by the over-performance of Generation Assets and Direct Load Control Assets, which delivered an average of 143 percent of their DRR Contract Amount (their second highest performance). The best performance of Load Reduction Assets was in summer of 2007, when they reached 57 percent of their estimated DRR Contract Amount. The best performance of Generation Assets was in winter of 2006/2007, when performance reached 184 percent of the estimated DRR Contract Amount. The lowest overall performance was in summer of 2009, when performance reached 52 percent. This performance was also driven by Generation Assets and Direct Load Control Assets, which performed at an average of 45 percent of their DRR Contract Amount.

**Table 3-1
DRRP Performance Summary
Enrolled Amount Vs Average Performance**

DRRP Session	Enrolled Load Reduction (MW)	Enrolled Generation and Direct Load Control (MW)	Total Enrolled Amount (MW)
Winter 06/07	14.9	5.0	19.9
Summer 07	20.2	19.0	39.2
Winter 07/08	13.7	5.0	18.7
Summer 08	18.6	15.0	33.6
Winter 08/09	0.0	0.0	0.0
Summer 09	37.3	10.0	47.3
Winter 09/10	26.5	n/a	26.5
Average	18.7	7.7	26.4

DRRP Session	Load Reduction (Average MW)	Generation and Direct Load Control (Average MW)	Total Load Relief (Average MW)
Winter 06/07	4.9	4.6	9.5
Summer 07	8.4	10.7	19.2
Winter 07/08	3.9	4.0	7.9
Summer 08	6.8	7.6	14.4
Winter 08/09	0.0	0.0	0.0
Summer 09	13.5	2.3	15.8
Winter 09/10	9.0	n/a	9.0
Average	6.6	4.2	10.8

DRRP Session	Load Reduction as Percent of Enrolled Amount	Generation and Direct Load Control as Percent of Enrolled Amount	Total Load Relief as Percent of Enrolled Amount
Winter 06/07	33%	92%	48%
Summer 07	42%	56%	49%
Winter 07/08	29%	80%	43%
Summer 08	37%	51%	43%
Winter 08/09	n/a	n/a	n/a
Summer 09	36%	23%	33%
Winter 09/10	34%	n/a	34%
Average	36%	54%	41%

**Table 3-2
DRRP Performance Summary
DRR Contract Amount* Vs Average Performance**

DRRP Session	DRR Contract Load Reduction (MW) *	DRR Contract Generation and Direct Load Control (MW) *	Total DRR Contract Load Relief (MW)
Winter 06/07	8.9	2.5	11.4
Summer 07	14.7	7.5	22.2
Winter 07/08	8.2	2.5	10.7
Summer 08	13.6	7.5	21.1
Winter 08/09	0.0	0.0	0.0
Summer 09	24.5	5.0	29.5
Winter 09/10	16.0	n/a	16.0
Average	12.3	3.6	15.8

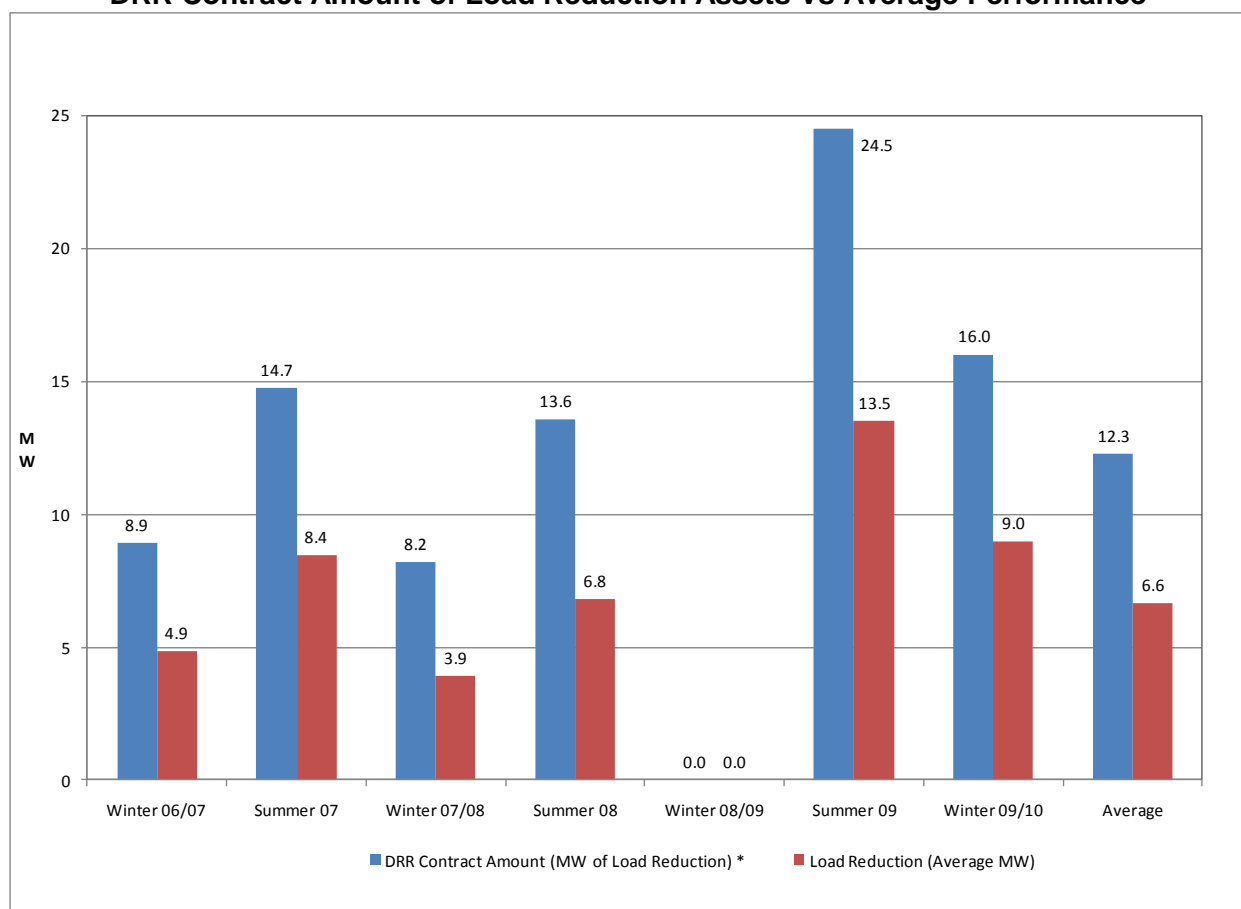
DRRP Session	Load Reduction (Average MW)	Generation and Direct Load Control (Average MW)	Total Load Relief (Average MW)
Winter 06/07	4.9	4.6	9.5
Summer 07	8.4	10.7	19.2
Winter 07/08	3.9	4.0	7.9
Summer 08	6.8	7.6	14.4
Winter 08/09	0.0	0.0	0.0
Summer 09	13.5	2.3	15.8
Winter 09/10	9.0	n/a	9.0
Average	6.6	4.2	10.8

DRRP Session	Load Reduction as Percent of DRR Contract Amount	Generation and Direct Load Control as Percent of DRR Contract Amount	Total Load Relief as Percent of DRR Contract Amount
Winter 06/07	54%	184%	83%
Summer 07	57%	143%	86%
Winter 07/08	48%	160%	74%
Summer 08	50%	102%	69%
Winter 08/09	n/a	n/a	n/a
Summer 09	55%	45%	54%
Winter 09/10	56%	n/a	56%
Average	54%	117%	68%

* The ISO-NE implemented the DRR Contract Amounts for the summer of 2009 and winter of 2009/2010 sessions. The DRR Contract Amounts reported here for all sessions prior to summer of 2009 are calculated based on the averages utilized in these two sessions.

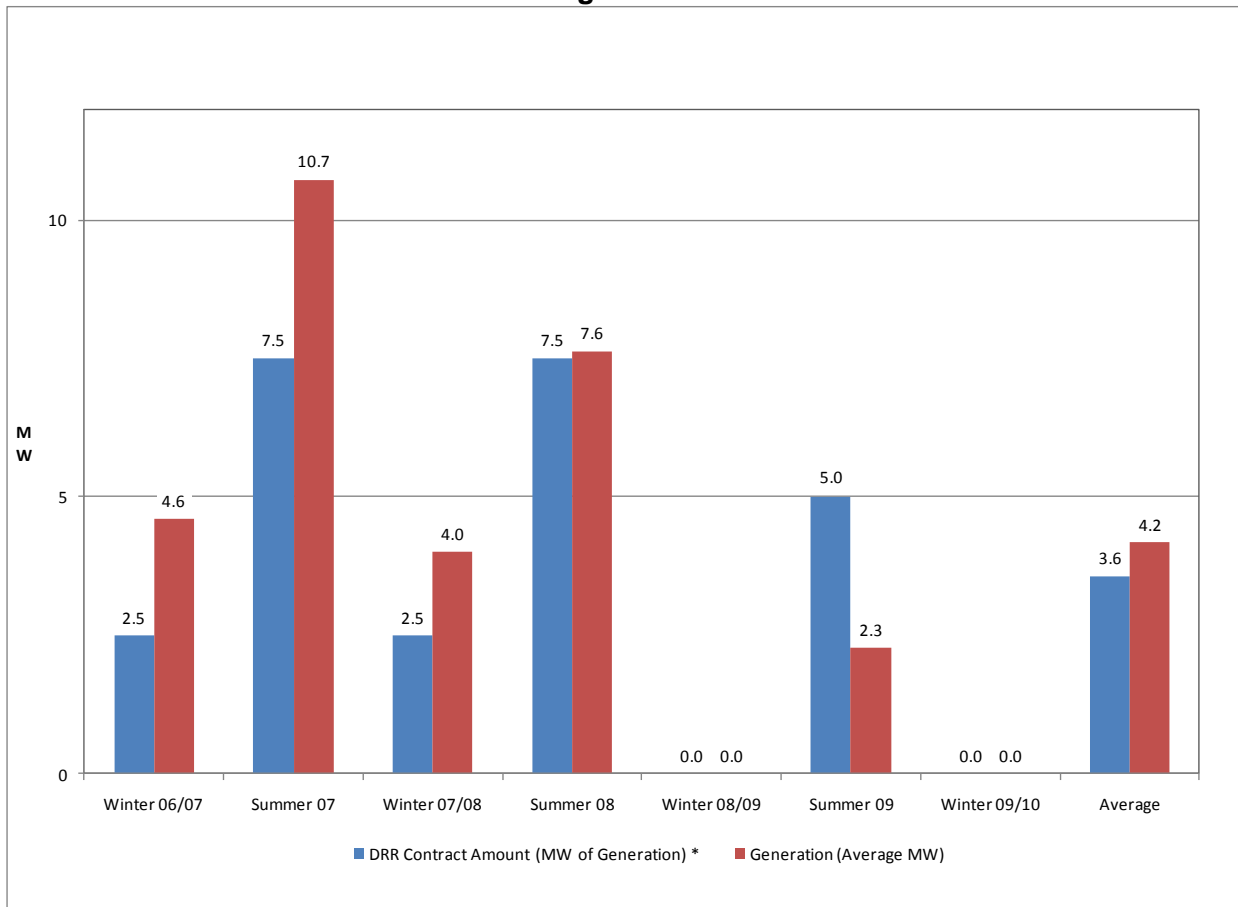
DRRP asset performance is illustrated in Figure 3-1 and Figure 3-2. These figures show that for all sessions, the performance of Load Reduction Assets was always less than the DRR Contract Amount. Generation Asset performance usually exceeded the DRR Contract Amount, except for one season (summer of 2009). Direct Load Control, which is combined with Generators in this figure, had an average performance that was less than the DRR Contract Amount.

Figure 3-1
DRR Contract Amount of Load Reduction Assets Vs Average Performance



* The ISO-NE implemented the DRR Contract Amounts for the summer of 2009 and winter of 2009/2010 sessions. The DRR Contract Amounts reported here for all sessions prior to summer of 2009 are calculated based on the averages utilized in these two sessions.

**Figure 3-2
DRR Contract Amount of Generation and Direct Load Control Assets
Vs Average Performance**



* The ISO-NE implemented the DRR Contract Amounts for the summer of 2009 and winter of 2009/2010 sessions. The DRR Contract Amounts reported here for all sessions prior to summer of 2009 are calculated based on the averages utilized in these two sessions.

3.3 Performance Trend

Figure 3-3, Figure 3-4, and Figure 3-5 illustrate performance as a percent of DRR Contract Amount for all events in the DRRP. Each of the markers on the blue line represents an event day. The green line on the first chart illustrates the average performance for the session, and the red line in the three charts is the linear trend line of asset performance.

Figure 3-3
Total Asset Performance as a Percent of DRR Contract Amount

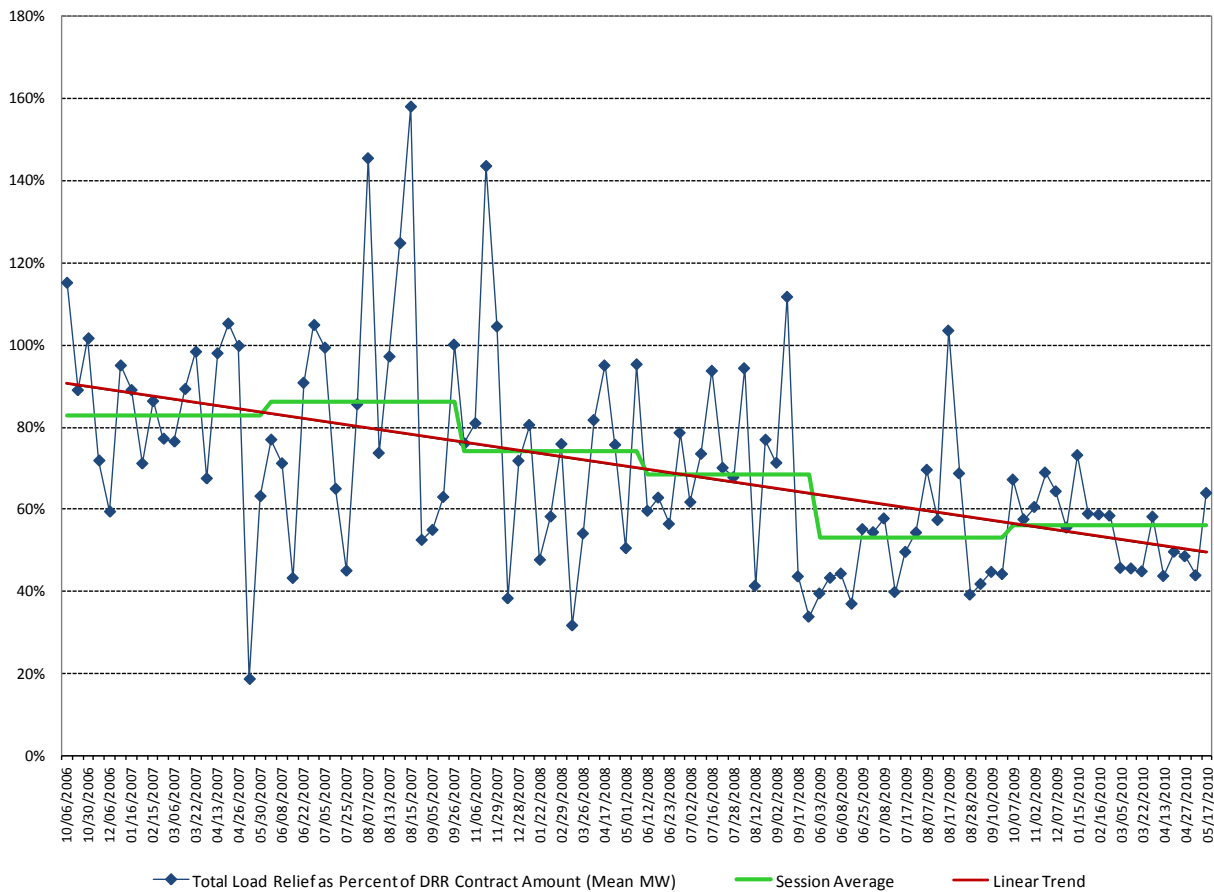


Figure 3-4
Load Reduction Asset Performance as a Percent of DRR Contract Amount

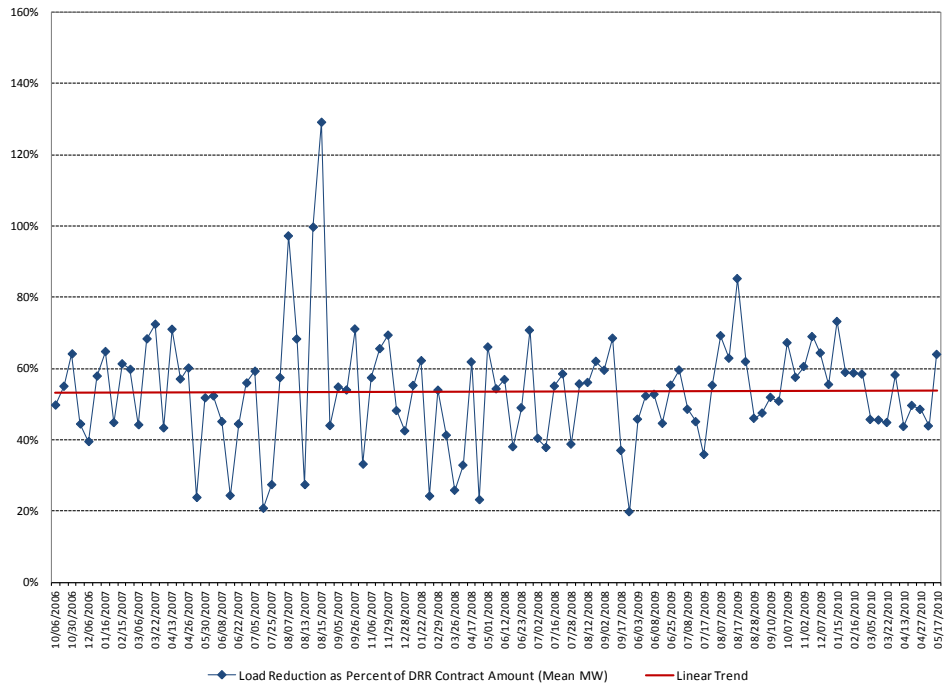
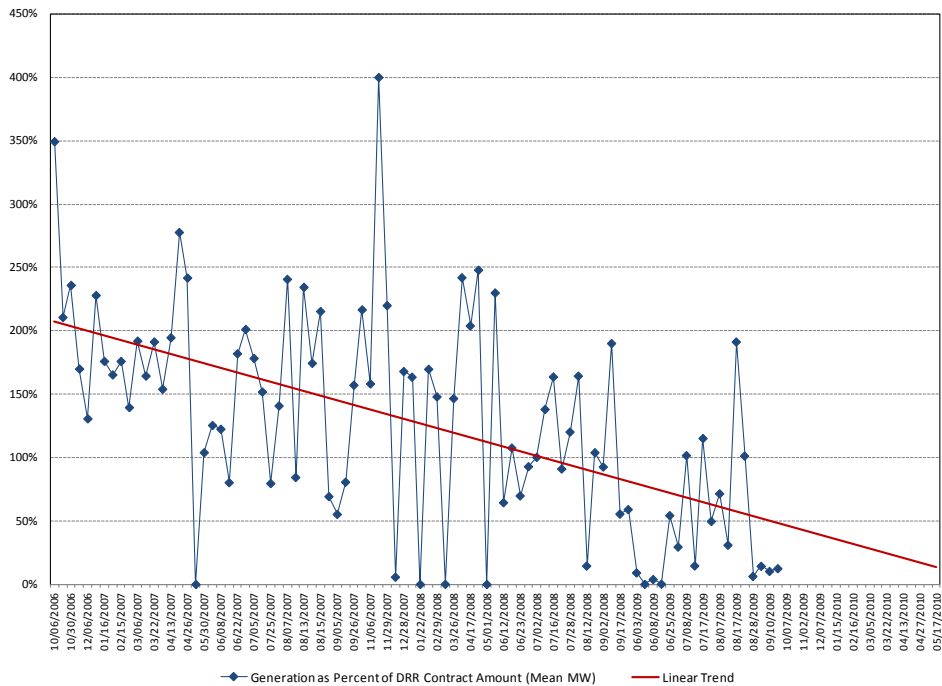


Figure 3-5
Generation and Direct Load Control Asset Performance as a Percent of DRR Contract Amount*



* There was no Generation in the last session of the DRRP

Figure 3-3, Figure 3-4, and Figure 3-5 show that:

- While a couple sessions had higher performance than the preceding session, total performance decreased over the six sessions of the DRRP.
- The performance of Load Reduction Assets stayed fairly constant, at an average of 54 percent of DRR Contract Amount. Table 3-2 shows that average performance of these assets ranged from 48 percent in the winter of 2006/2007 to 57 percent in the summer of 2007. The performance of Load Reduction Assets in an individual DRRP event ranged between 20 percent and 130 percent of the DRR Contract Amount.
- The total performance trend, and most of its variability, was driven by Generation Assets and Direct Load Control Assets. These assets experienced a visible downward trend over the sessions in which they participated. They also experienced considerable fluctuation, with individual event performance ranging between zero percent and 400 percent. As mentioned in the preceding section, Generation Assets over-performed on average in all sessions of the DRRP except for one (summer of 2009.) However, the performance of Generation Assets decreased over the sessions, even when performing at over 100 percent of the estimated DRR Contract Amount for all sessions except one. For Generation Assets, the increase in performance that resulted from applying the DRR Contract Amount to some of events in the first three sessions resulted in estimates of exaggerated over-performance for *some* of the DRRP events. For example, the performance during the first event of the pilot is 175 percent of Enrolled Amount and 349 percent of the estimated DRR Contract Amount¹⁰. This adjustment exaggerates the downward trend in the performance of Generation Assets, but it does not artificially create it – in other words, even when considering the performance metrics that were utilized in each session, Generation Assets performance decreased over time.

The performance of Direct Load Control Assets fluctuated between zero and 204 percent of the DRR Contract Amount. As discussed later in this report, these assets are highly sensitive to weather and residential schedules, which precluded responses at temperatures and times of day that are not consistent with residential air conditioner use.

¹⁰ Table 3-3 lists performance based on Enrolled Amount and DRR Contract Amount for each DRRP event.

3.4 Event Performance Statistics

Performance statistics for each individual DRRP event are presented in Table 3-3 through Table 3-8. Because Direct Load Control and Generation Assets report load reduction quantities to the ISO and do not require an ISO calculated baseline, the performance of Direct Load Control Assets are included in the Generation Asset class on these tables.



**Table 3-3
ISO-New England Demand Response Reserve Pilot Performance
Winter of 2006/2007**

Event Date	10/06/2006	10/17/2006	10/30/2006	11/01/2006	12/06/2006	12/20/2006	01/16/2007	02/01/2007	02/15/2007	02/23/2007
Notification Start	13:32	13:35	11:48	12:03	7:54	9:47	13:49	15:32	16:05	11:54
Event Start	14:00	14:00	12:00	12:15	8:15	10:00	14:00	16:00	16:30	12:15
Notification Resume	14:12	14:24	12:01	12:19	8:23	10:18	14:37	16:14	16:48	13:29
Event End	14:45	15:00	13:00	13:15	9:00	11:00	14:45	16:45	17:15	13:45
Number of Assets	48	48	48	48	48	48	48	48	48	48
Number of Assets that reached their individual DRR Contract Amount (a)	21	23	20	23	19	19	20	21	23	21
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	14	14	17	14	9	12	10	11	16	15
Enrolled Load Reduction (MW)	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
Enrolled Generation (MW)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Enrolled Amount (MW)	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
DRR Contract Amount of Load Reduction (MW) (c)	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
DRR Contract Amount of Generation (MW) (c)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total DRR Contract Amount (MW) (c)	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
Adjusted Baseline (Mean MW - Symmetric Adjustment)	31.4	31.8	31.6	31.8	30.5	30.2	30.9	30.7	31.5	29.1
Observed Load (Mean MW)	27.0	26.9	25.9	27.9	27.0	25.1	25.1	26.7	26.0	23.8
Observed Load Reduction (Mean MW)	4.4	4.9	5.7	4.0	3.5	5.2	5.8	4.0	5.5	5.3
Observed Generation (Mean MW)	8.7	5.3	5.9	4.3	3.3	5.7	4.4	4.1	4.4	3.5
Total Observed Load Relief (MW)	13.2	10.2	11.6	8.2	6.8	10.9	10.2	8.1	9.9	8.8
Load Reduction as Percent of Enrolled Load Reduction	30%	33%	38%	27%	24%	35%	39%	27%	37%	36%
Generation as Percent of Enrolled Generation	175%	105%	118%	85%	65%	114%	88%	83%	88%	70%
Total Load Relief as Percent of Enrolled Amount	66%	51%	58%	41%	34%	55%	51%	41%	50%	44%
Load Reduction as Percent of DRR Contract Amount	50%	55%	64%	44%	39%	58%	65%	45%	61%	60%
Generation as Percent of DRR Contract Amount	349%	211%	236%	170%	131%	228%	176%	165%	176%	140%
Total Load Relief as Percent of DRR Contract Amount	115%	89%	102%	72%	59%	95%	89%	71%	86%	77%

(a) Asset reached enrolled level for at least one 5-min interval during the event

(b) Asset average load reduction for the entire event was at enrolled level or better

(c) There was no DRR Contract Amount utilized in this session. These numbers are estimated based on the ratio of DRR Contract Amount to the Enrolled Amount observed in the last two sessions of the DRRP

**Table 3-3
ISO-New England Demand Response Reserve Pilot Performance
Winter of 2006/2007 (continued)**

Event Date	03/06/2007	03/21/2007	03/22/2007	04/12/2007	04/13/2007	04/18/2007	04/26/2007	05/07/2007	05/30/2007
Notification Start	9:39	8:50	13:51	12:58	14:46	13:43	14:46	7:57	13:48
Event Start	10:00	9:00	14:00	13:00	15:00	14:00	15:00	8:00	14:00
Notification Resume	10:16	9:34	14:27	13:47	15:28	15:30	15:37	8:31	14:15
Event End	10:30	9:45	15:00	14:00	15:45	15:45	15:45	8:45	15:00
Number of Assets	48	48	48	48	48	48	48	48	48
Number of Assets that reached their individual DRR Contract Amount (a)	15	23	21	21	26	21	21	12	33
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	2	11	13	5	14	13	8	2	6
Enrolled Load Reduction (MW)	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
Enrolled Generation (MW)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Enrolled Amount (MW)	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
DRR Contract Amount of Load Reduction (MW) (c)	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
DRR Contract Amount of Generation (MW) (c)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total DRR Contract Amount of Load Relief (MW) (c)	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
Adjusted Baseline (Mean MW - Symmetric Adjustment)	29.1	29.3	31.0	29.0	31.1	30.3	31.5	25.3	45.0
Observed Load (Mean MW)	25.3	23.3	24.6	25.2	24.7	25.3	26.2	23.4	40.4
Observed Load Reduction (Mean MW)	3.9	6.1	6.5	3.9	6.3	5.1	5.4	2.1	4.6
Observed Generation (Mean MW)	4.8	4.1	4.8	3.9	4.9	6.9	6.0	0.0	2.6
Total Observed Load Relief (MW)	8.7	10.2	11.3	7.7	11.2	12.0	11.4	2.1	7.2
Load Reduction as Percent of Enrolled Load Reduction	27%	41%	43%	26%	43%	34%	36%	14%	31%
Generation as Percent of Enrolled Generation	96%	82%	96%	77%	97%	139%	121%	0%	52%
Total Load Relief as Percent of Enrolled Amount	44%	51%	57%	39%	56%	61%	57%	11%	36%
Load Reduction as Percent of DRR Contract Amount (c)	44%	68%	72%	43%	71%	57%	60%	24%	52%
Generation as Percent of DRR Contract Amount	192%	164%	191%	154%	195%	278%	242%	0%	104%
Total Load Relief as Percent of DRR Contract Amount	77%	89%	98%	68%	98%	105%	100%	19%	63%

(a) Asset reached enrolled level for at least one 5-min interval during the event

(b) Asset average load reduction for the entire event was at enrolled level or better

(c) There was no DRR Contract Amount utilized in this session. These numbers are estimated based on the ratio of DRR Contract Amount to the Enrolled Amount observed in the last two sessions of the DRRP



**Table 3-4
ISO-New England Demand Response Reserve Pilot Performance
Summer of 2007**

Event Date	06/06/2007	06/08/2007	06/15/2007	06/22/2007	06/27/2007	07/05/2007	07/17/2007	07/25/2007	08/01/2007	08/07/2007
Notification Start	12:49	10:09	15:03	13:50	9:37	12:50	14:55	8:57	9:24	12:05
Event Start	13:00	10:15	15:15	14:00	10:00	13:00	15:00	9:00	10:00	12:15
Notification Resume	13:43	10:49	15:22	14:34	10:10	13:32	15:17	9:37	10:06	12:19
Event End	14:00	11:00	15:45	14:45	11:00	14:00	15:30	9:45	11:00	13:15
Number of Assets	91	91	91	91	91	91	91	91	91	91
Number of Assets that reached their individual DRR Contract Amount (a)	36	20	26	37	30	35	14	14	36	38
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	4	2	4	3	10	8	3	1	9	14
Enrolled Load Reduction (MW)	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2
Enrolled Generation (MW)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Total Enrolled Amount (MW)	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2
DRR Contract Amount of Load Reduction (MW) (c)	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
DRR Contract Amount of Generation (MW) (c)	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Total DRR Contract Amount (MW) (c)	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Adjusted Baseline (Mean MW - Symmetric Adjustment)	58.7	62.1	59.2	57.9	65.7	66.2	64.5	60.2	65.4	68.5
Observed Load (Mean MW)	51.0	55.8	55.9	51.4	57.6	57.6	61.8	56.4	57.0	54.4
Observed Load Reduction (Mean MW)	7.7	6.6	3.6	6.5	8.2	8.7	3.1	4.0	8.5	14.3
Observed Generation (Mean MW)	9.4	9.2	6.0	13.7	15.1	13.4	11.4	6.0	10.6	18.1
Total Observed Load Relief (MW)	17.1	15.8	9.6	20.2	23.3	22.1	14.4	10.0	19.0	32.4
Load Reduction as Percent of Enrolled Load Reduction	38%	33%	18%	32%	41%	43%	15%	20%	42%	71%
Generation as Percent of Enrolled Generation	50%	48%	32%	72%	79%	70%	60%	31%	56%	95%
Total Load Relief as Percent of Enrolled Amount	44%	40%	25%	52%	60%	56%	37%	26%	49%	83%
Load Reduction as Percent of DRR Contract Amount	52%	45%	24%	44%	56%	59%	21%	27%	57%	97%
Generation as Percent of DRR Contract Amount	99%	97%	63%	144%	159%	141%	120%	63%	111%	190%
Total Load Relief as Percent of DRR Contract Amount	71%	65%	40%	83%	96%	91%	60%	41%	79%	134%

(a) Asset reached enrolled level for at least one 5-min interval during the event

(b) Asset average load reduction for the entire event was at enrolled level or better

(c) There was no DRR Contract Amount utilized in this session. These numbers are estimated based on the ratio of DRR Contract Amount to Enrolled Amount observed in the last two sessions of the DRRP



**Table 3-4
ISO-New England Demand Response Reserve Pilot Performance
Summer of 2007(continued)**

Event Date	08/09/2007	08/13/2007	08/14/2007	08/15/2007 (d)	08/21/2007	09/05/2007	09/20/2007	09/26/2007
Notification Start	8:42	13:54	12:48	11:49	9:55	10:31	13:33	15:38
Event Start	9:00	14:00	13:00	12:00	10:00	10:45	14:00	15:45
Notification Resume	9:18	14:56	13:18	13:43	10:20	10:53	15:01	16:04
Event End	9:45	15:00	13:45	14:30	10:30	11:45	15:15	16:30
Number of Assets	91	91	91	91	91	91	91	91
Number of Assets that reached their individual DRR Contract Amount (a)	42	38	72	41	26	32	29	41
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	13	10	48	20	2	5	5	5
Enrolled Load Reduction (MW)	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2
Enrolled Generation (MW)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Total Enrolled Amount (MW)	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2
DRR Contract Amount of Load Reduction (MW) (c)	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
DRR Contract Amount of Generation (MW) (c)	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Total DRR Contract Amount (MW) (c)	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Adjusted Baseline (Mean MW - Symmetric Adjustment)	61.6	61.5	66.1	65.8	59.1	50.5	59.9	60.5
Observed Load (Mean MW)	51.6	58.9	51.5	46.8	52.7	42.4	53.4	50.1
Observed Load Reduction (Mean MW)	10.1	4.0	14.7	19.0	6.5	8.1	7.9	10.5
Observed Generation (Mean MW)	6.3	17.6	13.1	16.2	5.2	4.1	6.1	11.8
Total Observed Load Relief (MW)	16.4	21.6	27.8	35.2	11.7	12.2	14.0	22.3
Load Reduction as Percent of Enrolled Load Reduction	50%	20%	73%	94%	32%	40%	39%	52%
Generation as Percent of Enrolled Generation	33%	93%	69%	85%	27%	22%	32%	62%
Total Load Relief as Percent of Enrolled Amount	42%	55%	71%	90%	30%	31%	36%	57%
Load Reduction as Percent of DRR Contract Amount	68%	27%	100%	129%	44%	55%	54%	71%
Generation as Percent of DRR Contract Amount	67%	185%	138%	170%	55%	44%	64%	124%
Total Load Relief as Percent of DRR Contract Amount	68%	89%	115%	145%	48%	50%	58%	92%

(a) Asset reached enrolled level for at least one 5-min interval during the event. (b) Asset average load reduction for the entire event was at enrolled level or better.

(c) There was no DRR Contract Amount utilized in this session. These numbers are estimated based on the ratio of DRR Contract Amount to the Enrolled Amount observed in the last two sessions of the DRRP.

(d) August 15 of 2007 was an Audit Day.



**Table 3-5
ISO-New England Demand Response Reserve Pilot Performance
Winter of 2007/2008**

Event Date	10/24/2007	11/06/2007	11/08/2007	11/29/2007	12/13/2007	12/28/2007	01/18/2008	01/22/2008	02/21/2008	02/29/2008
Notification Start	13:37	12:06	11:44	14:26	9:45	9:16	13:04	13:26	15:46	11:54
Event Start	14:00	12:15	12:00	14:45	10:00	10:00	13:15	13:45	16:00	12:00
Notification Resume	14:45	12:41	12:23	15:34	10:15	10:12	13:32	13:58	16:10	12:17
Event End	15:00	13:00	13:00	15:45	11:00	10:45	14:00	14:45	16:45	13:00
Number of Assets	78	78	78	78	78	78	78	78	78	78
Number of Assets that reached their individual DRR Contract Amount (a)	25	17	16	12	10	9	8	7	7	8
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	5	2	5	3	2	2	2	3	2	2
Enrolled Load Reduction (MW)	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Enrolled Generation (MW)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Enrolled Amount (MW)	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7
DRR Contract Amount of Load Reduction (MW) (c)	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
DRR Contract Amount of Generation (MW) (c)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total DRR Contract Amount (MW) (c)	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
Adjusted Baseline (Mean MW - Symmetric Adjustment)	31.2	32.1	31.1	31.6	29.6	29.4	30.6	30.1	26.3	29.9
Observed Load (Mean MW)	30.3	27.4	25.7	26.0	25.7	26.0	26.1	25.0	25.1	25.5
Observed Load Reduction (Mean MW)	2.7	4.7	5.4	5.7	3.9	3.5	4.5	5.1	2.0	4.4
Observed Generation (Mean MW)	5.4	4.0	10.0	5.5	0.1	4.2	4.1	0.0	4.2	3.7
Total Observed Load Relief (MW)	8.1	8.7	15.4	11.2	4.1	7.7	8.6	5.1	6.2	8.1
Load Reduction as Percent of Enrolled Load Reduction	20%	34%	39%	42%	29%	25%	33%	37%	15%	32%
Generation as Percent of Enrolled Generation	108%	79%	200%	110%	3%	84%	82%	0%	85%	74%
Total Load Relief as Percent of Enrolled Amount	44%	46%	82%	60%	22%	41%	46%	27%	33%	44%
Load Reduction as Percent of DRR Contract Amount	33%	57%	66%	69%	48%	42%	55%	62%	24%	54%
Generation as Percent of DRR Contract Amount	217%	158%	400%	220%	6%	168%	164%	0%	170%	148%
Total Load Relief as Percent of DRR Contract Amount	76%	81%	144%	105%	38%	72%	81%	48%	58%	76%

(a) Asset reached enrolled level for at least one 5-min interval during the event

(b) Asset average load reduction for the entire event was at enrolled level or better

(c) There was no DRR Contract Amount utilized in this session. These numbers are estimated based on the ratio of DRR Contract Amount to the Enrolled Amount observed in the last two sessions of the DRRP



**Table 3-5
ISO-New England Demand Response Reserve Pilot Performance
Winter of 2007/2008 (continued)**

Event Date	03/11/2008	03/26/2008	03/27/2008	04/17/2008	04/23/2008	05/01/2008	05/21/2008
Notification Start	9:32	11:05	12:35	12:12	14:01	12:30	13:12
Event Start	10:00	11:15	13:00	13:00	14:15	13:00	14:00
Notification Resume	10:17	11:48	13:33	13:21	14:15	13:21	14:26
Event End	10:45	12:00	14:00	14:00	14:45	13:45	15:00
Number of Assets	78	78	78	78	78	77	78
Number of Assets that reached their individual DRR Contract Amount (a)	10	7	7	8	7	10	7
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	2	2	3	5	1	3	2
Enrolled Load Reduction (MW)	13.7	13.7	13.7	13.7	13.7	13.6	13.7
Enrolled Generation (MW)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Enrolled Amount (MW)	18.7	18.7	18.7	18.7	18.7	18.6	18.7
DRR Contract Amount of Load Reduction (MW) (c)	8.2	8.2	8.2	8.2	8.2	8.1	8.2
DRR Contract Amount of Generation (MW) (c)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total DRR Contract Amount (MW) (c)	10.7	10.7	10.7	10.7	10.7	10.6	10.7
Adjusted Baseline (Mean MW - Symmetric Adjustment)	31.5	30.5	30.2	30.6	33.7	30.2	30.5
Observed Load (Mean MW)	28.2	28.4	28.1	25.6	32.1	24.9	26.1
Observed Load Reduction (Mean MW)	3.4	2.1	2.7	5.1	1.9	5.4	4.4
Observed Generation (Mean MW)	0.0	3.7	6.1	5.1	6.2	0.0	5.8
Total Observed Load Relief (MW)	3.4	5.8	8.7	10.2	8.1	5.4	10.2
Load Reduction as Percent of Enrolled Load Reduction	25%	15%	20%	37%	14%	40%	33%
Generation as Percent of Enrolled Generation	0%	73%	121%	102%	124%	0%	115%
Total Load Relief as Percent of Enrolled Amount	18%	31%	47%	55%	43%	29%	55%
Load Reduction as Percent of DRR Contract Amount	41%	26%	33%	62%	23%	66%	54%
Generation as Percent of DRR Contract Amount	0%	147%	242%	204%	248%	0%	230%
Total Load Relief as Percent of DRR Contract Amount	32%	54%	82%	95%	76%	51%	95%

(a) Asset reached enrolled level for at least one 5-min interval during the event

(b) Asset average load reduction for the entire event was at enrolled level or better

(c) There was no DRR Contract Amount utilized in this session. These numbers are estimated based on the ratio of DRR Contract Amount to the Enrolled Amount observed in the last two sessions of the DRRP



**Table 3-6
ISO-New England Demand Response Reserve Pilot Performance
Summer of 2008**

Event Date	06/12/2008	06/19/2008	06/23/2008	06/24/2008	07/02/2008	07/10/2008	07/16/2008	07/25/2008	07/28/2008	08/01/2008
Notification Start	12:30	14:27	11:51	15:38	13:45	15:50	11:04	14:38	9:21	(d)
Event Start	13:00	15:00	12:00	16:00	14:00	16:00	11:30	15:00	10:00	13:00
Notification Resume	13:35	15:33	12:32	16:42	14:26	16:32	11:32	15:04	10:52	(d)
Event End	13:45	15:45	12:45	17:00	15:00	17:00	12:30	16:00	11:00	14:00
Number of Assets	92	92	92	92	92	92	92	92	92	92
Number of Assets that reached their individual DRR Contract Amount (a)	11	12	10	33	21	14	14	17	6	17
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	5	7	2	13	4	6	5	4	3	6
Enrolled Load Reduction (MW)	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6
Enrolled Generation (MW)	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6
Total Enrolled Amount (MW)	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2
DRR Contract Amount of Load Reduction (MW) (c)	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6
DRR Contract Amount of Generation (MW) (c)	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
Total DRR Contract Amount (MW) (c)	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4
Adjusted Baseline (Mean MW - Symmetric Adjustment)	52.2	49.1	51.1	52.7	54.8	54.4	51.9	52.1	45.6	52.8
Observed Load (Mean MW)	44.5	44.2	44.5	43.1	49.4	49.3	44.5	44.2	40.5	45.3
Observed Load Reduction (Mean MW)	7.7	5.2	6.6	9.6	5.5	5.1	7.5	7.9	5.3	7.5
Observed Generation (Mean MW)	4.8	8.1	5.2	7.0	7.5	10.4	12.3	6.8	9.0	12.3
Total Observed Load Relief (MW)	12.6	13.2	11.9	16.6	13.0	15.5	19.7	14.8	14.3	19.8
Load Reduction as Percent of Enrolled Load Reduction	42%	28%	36%	52%	30%	28%	40%	43%	28%	41%
Generation as Percent of Enrolled Generation	25%	41%	27%	36%	38%	53%	63%	35%	46%	63%
Total Load Relief as Percent of Enrolled Amount	33%	35%	31%	43%	34%	41%	52%	39%	37%	52%
Load Reduction as Percent of DRR Contract Amount	57%	38%	49%	71%	40%	38%	55%	58%	39%	56%
Generation as Percent of DRR Contract Amount	49%	82%	53%	71%	77%	106%	125%	70%	92%	126%
Total Load Relief as Percent of DRR Contract Amount	54%	57%	51%	71%	56%	66%	85%	63%	61%	85%

(a) Asset reached enrolled level for at least one 5-min interval during the event. (b) Asset average load reduction for the entire event was at enrolled level or better

(c) There was no DRR Contract Amount utilized in this session. These numbers are estimated based on the ratio of DRR Contract Amount to the Enrolled Amount observed in the last two sessions of the DRRP

(d) The e-mail trace for this event was blank. Notification times are unknown.



**Table 3-6
ISO-New England Demand Response Reserve Pilot Performance
Summer of 2008 (continued)**

Event Date	08/12/2008	08/20/2008 (d)	09/02/2008	09/05/2008	09/17/2008	09/24/2008
Notification Start	11:07	12:44	12:16	12:51	11:57	12:07
Event Start	11:15	13:00	13:00	13:00	12:00	12:15
Notification Resume	11:47	14:02	13:19	13:10	13:14	12:23
Event End	12:00	15:30	13:45	14:00	13:15	13:15
Number of Assets	92	92	91	91	91	91
Number of Assets that reached their individual DRR Contract Amount (a)	7	33	11	21	5	4
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	4	7	4	7	2	2
Enrolled Load Reduction (MW)	18.6	18.6	18.6	18.6	18.6	18.6
Enrolled Generation (MW)	19.6	19.6	15.0	15.0	15.0	15.0
Total Enrolled Amount (MW)	38.2	38.2	33.6	33.6	33.6	33.6
DRR Contract Amount of Load Reduction (MW) (c)	13.6	13.6	13.6	13.6	13.6	13.6
DRR Contract Amount of Generation (MW) (c)	9.8	9.8	7.5	7.5	7.5	7.5
Total DRR Contract Amount (MW) (c)	23.4	23.4	21.1	21.1	21.1	21.1
Adjusted Baseline (Mean MW - Symmetric Adjustment)	54.5	47.3	51.1	55.5	43.6	39.7
Observed Load (Mean MW)	46.9	39.2	43.1	46.2	38.7	37.3
Observed Load Reduction (Mean MW)	7.6	8.4	8.1	9.3	5.0	2.7
Observed Generation (Mean MW)	1.1	7.8	4.9	14.3	4.2	4.4
Total Observed Load Relief (MW)	8.7	16.2	12.9	23.5	9.2	7.1
Load Reduction as Percent of Enrolled Load Reduction	41%	45%	43%	50%	27%	14%
Generation as Percent of Enrolled Generation	6%	40%	32%	95%	28%	30%
Total Load Relief as Percent of Enrolled Amount	23%	42%	39%	70%	27%	21%
Load Reduction as Percent of DRR Contract Amount	56%	62%	60%	69%	37%	20%
Generation as Percent of DRR Contract Amount	11%	80%	65%	190%	56%	59%
Total Load Relief as Percent of DRR Contract Amount	37%	69%	61%	112%	44%	34%

(a) Asset reached enrolled level for at least one 5-min interval during the event. (b) Asset average load reduction for the entire event was at enrolled level or better

(c) There was no DRR Contract Amount utilized in this session. These numbers are estimated based on the ratio of DRR Contract Amount to the Enrolled Amount observed in the last two sessions of the DRRP

(d) August 20 of 2008 was an Audit Day.



**Table 3-7
ISO-New England Demand Response Reserve Pilot Performance
Summer of 2009**

Event Date	06/03/2009	06/04/2009	06/08/2009	06/17/2009	06/25/2009	07/01/2009	07/08/2009	07/13/2009	07/17/2009	07/24/2009
Notification Start	14:49	9:46	15:55	11:53	10:58	14:36	10:51	9:54	15:46	14:49
Event Start	15:00	10:00	16:00	12:00	11:00	15:00	11:00	10:00	16:00	15:00
Notification Resume	15:18	10:56	16:41	12:09	11:37	15:42	11:31	10:26	16:13	15:18
Event End	15:45	11:00	17:00	13:00	11:45	16:00	11:45	11:00	16:45	15:45
Number of Assets	57	57	57	57	57	57	57	57	57	57
Number of Assets that reached their individual DRR Contract Amount (a)	5	4	1	6	5	5	3	6	7	5
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	4	3	1	3	2	2	2	3	3	4
Enrolled Load Reduction (MW)	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3
Enrolled Generation (MW)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Enrolled Amount (MW)	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3
DRR Contract Amount of Load Reduction (MW) (c)	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5
DRR Contract Amount of Generation (MW) (c)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total DRR Contract Amount (MW) (c)	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5
Adjusted Baseline (Mean MW - Symmetric Adjustment)	69.8	50.6	40.0	48.0	52.7	51.3	47.6	49.1	52.2	69.8
Observed Load (Mean MW)	80.3	39.3	29.5	34.5	38.8	40.5	36.5	40.9	38.5	80.3
Observed Load Reduction (Mean MW)	15.9	13.5	10.8	13.5	14.7	11.7	11.2	9.3	13.8	15.9
Observed Generation (Mean MW)	0.0	0.2	0.0	2.7	1.5	5.1	0.7	5.8	2.5	0.0
Total Observed Load Relief (MW)	15.9	13.7	10.8	16.2	16.2	16.8	11.9	15.1	16.3	15.9
Load Reduction as Percent of Enrolled Load Reduction	43%	36%	29%	36%	40%	31%	30%	25%	37%	43%
Generation as Percent of Enrolled Generation	0%	2%	0%	27%	15%	51%	7%	58%	25%	0%
Total Load Relief as Percent of Enrolled Amount	34%	29%	23%	34%	34%	36%	25%	32%	35%	34%
Load Reduction as Percent of DRR Contract Amount	65%	55%	44%	55%	60%	48%	46%	38%	56%	65%
Generation as Percent of DRR Contract Amount	0%	4%	0%	54%	30%	102%	15%	115%	50%	0%
Total Load Relief as Percent of DRR Contract Amount	54%	46%	37%	55%	55%	57%	40%	51%	55%	54%

(a) Asset reached enrolled level for at least one 5-min interval during the event

(b) Asset average load reduction for the entire event was at enrolled level or better

**Table 3-7
ISO-New England Demand Response Reserve Pilot Performance
Summer of 2009 (continued)**

Event Date	08/07/2009	08/13/2009	08/17/2009 (d)	08/20/2009	08/28/2009	09/08/2009	09/10/2009	09/18/2009
Notification Start	13:54	12:54	13:51	10:46	13:44	10:47	13:48	14:56
Event Start	14:00	13:00	14:00	11:00	14:00	11:00	14:00	15:00
Notification Resume	14:49	13:14	16:05	11:40	14:32	11:20	14:58	15:16
Event End	15:00	13:45	16:30	11:45	14:45	11:45	15:00	15:45
Number of Assets	57	57	57	57	57	57	57	57
Number of Assets that reached their individual DRR Contract Amount (a)	7	6	17	6	2	2	5	1
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	2	3	7	3	2	1	1	1
Enrolled Load Reduction (MW)	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3
Enrolled Generation (MW)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Enrolled Amount (MW)	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3
DRR Contract Amount of Load Reduction (MW) (c)	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5
DRR Contract Amount of Generation (MW) (c)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total DRR Contract Amount (MW) (c)	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5
Adjusted Baseline (Mean MW - Symmetric Adjustment)	53.6	53.0	60.4	58.0	48.1	50.0	48.3	46.7
Observed Load (Mean MW)	36.9	37.7	39.3	42.9	37.6	38.5	36.2	34.5
Observed Load Reduction (Mean MW)	17.0	15.5	21.1	15.3	11.1	11.8	12.6	12.5
Observed Generation (Mean MW)	3.6	1.5	9.6	5.1	0.3	0.7	0.5	0.6
Total Observed Load Relief (MW)	20.6	17.1	30.7	20.4	11.5	12.5	13.1	13.1
Load Reduction as Percent of Enrolled Load Reduction	46%	42%	57%	41%	30%	32%	34%	34%
Generation as Percent of Enrolled Generation	36%	15%	96%	51%	3%	7%	5%	6%
Total Load Relief as Percent of Enrolled Amount	44%	36%	65%	43%	24%	26%	28%	28%
Load Reduction as Percent of DRR Contract Amount	69%	63%	86%	62%	45%	48%	52%	51%
Generation as Percent of DRR Contract Amount	72%	31%	191%	101%	6%	14%	10%	12%
Total Load Relief as Percent of DRR Contract Amount	70%	58%	104%	69%	39%	42%	45%	44%

- (a) Asset reached enrolled level for at least one 5-min interval during the event
 (b) Asset average load reduction for the entire event was at enrolled level or better
 (d) August 17 of 2009 was an Audit Day.



**Table 3-8
ISO-New England Demand Response Reserve Pilot Performance
Winter of 2009/2010**

Event Date	10/07/2009	10/16/2009	11/02/2009	11/20/2009	12/07/2009	01/13/2010	01/15/2010	02/03/2010	02/16/2010	02/24/2010
Notification Start	13:51	13:50	13:51	14:50	7:53	13:52	13:21	12:22	15:50	12:48
Event Start	14:00	14:00	14:00	15:00	8:00	14:00	14:00	13:00	16:00	13:00
Notification Resume	15:01	14:22	14:22	15:45	8:48	14:49	14:22	13:40	16:41	13:36
Event End	15:15	14:45	15:00	15:45	9:00	15:00	15:00	14:00	17:00	13:45
Number of Assets	40	40	40	40	40	40	40	40	40	40
Number of Assets that reached their individual DRR Contract Amount (a)	3	0	1	1	1	1	1	1	0	1
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	1	0	1	1	1	0	1	1	0	0
Enrolled Load Reduction (MW)	26.5	26.5	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8
Enrolled Generation (MW)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Enrolled Amount (MW)	26.5	26.5	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8
DRR Contract Amount of Load Reduction (MW) (c)	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
DRR Contract Amount of Generation (MW) (c)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total DRR Contract Amount (MW) (c)	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Adjusted Baseline (Mean MW - Symmetric Adjustment)	27.8	27.5	27.1	27.3	25.4	27.1	27.2	35.2	25.8	27.3
Observed Load (Mean MW)	17.0	18.3	17.4	16.3	15.3	18.2	15.6	25.8	16.6	18.0
Observed Load Reduction (Mean MW)	10.8	9.2	9.7	11.0	10.3	8.9	11.7	9.4	9.4	9.3
Observed Generation (Mean MW)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Observed Load Relief (MW)	10.8	9.2	9.7	11.0	10.3	8.9	11.7	9.4	9.4	9.3
Load Reduction as Percent of Enrolled Load Reduction	41%	35%	36%	41%	38%	33%	44%	35%	35%	35%
Generation as Percent of Enrolled Generation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Load Relief as Percent of Enrolled Amount	41%	35%	36%	41%	38%	33%	44%	35%	35%	35%
Load Reduction as Percent of DRR Contract Amount	67%	58%	61%	69%	64%	56%	73%	59%	59%	58%
Generation as Percent of DRR Contract Amount										
Total Load Relief as Percent of DRR Contract Amount	67%	58%	61%	69%	64%	56%	73%	59%	59%	58%

(a) Asset reached enrolled level for at least one 5-min interval during the event

(b) Asset average load reduction for the entire event was at enrolled level or better



**Table 3-8
ISO-New England Demand Response Reserve Pilot Performance
Winter of 2009/2010 (continued)**

Event Date	03/05/2010	03/15/2010	03/22/2010	03/23/2010	04/13/2010	04/19/2010	04/27/2010	05/06/2010	05/17/2010
Notification Start	9:55	17:08	8:58	12:50	12:35	13:47	12:54	7:59	13:52
Event Start	10:00	17:15	9:00	13:00	13:00	14:00	13:00	8:00	14:00
Notification Resume	11:16	17:36	9:23	13:22	13:13	14:17	13:23	8:19	14:46
Event End	11:30	18:15	10:00	14:00	14:00	15:00	14:00	9:00	15:00
Number of Assets	40	40	40	40	40	40	40	40	40
Number of Assets that reached their individual DRR Contract Amount (a)	1	0	0	0	1	0	0	0	0
Number of Assets that reached an event average reduction better or equal to their DRR Contract Amount (b)	0	0	0	0	0	0	0	0	0
Enrolled Load Reduction (MW)	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8
Enrolled Generation (MW)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Enrolled Amount (MW)	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8
DRR Contract Amount of Load Reduction (MW) (c)	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
DRR Contract Amount of Generation (MW) (c)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total DRR Contract Amount (MW) (c)	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Adjusted Baseline (Mean MW - Symmetric Adjustment)	23.9	24.4	25.3	25.9	22.2	25.9	26.3	26.0	28.1
Observed Load (Mean MW)	16.8	17.1	18.1	16.6	15.6	18.0	18.5	19.5	17.9
Observed Load Reduction (Mean MW)	7.3	7.3	7.2	9.3	7.0	7.9	7.8	7.0	10.2
Observed Generation (Mean MW)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Observed Load Relief (MW)	7.3	7.3	7.2	9.3	7.0	7.9	7.8	7.0	10.2
Load Reduction as Percent of Enrolled Load Reduction	27%	27%	27%	35%	26%	30%	29%	26%	38%
Generation as Percent of Enrolled Generation	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Load Relief as Percent of Enrolled Amount	27%	27%	27%	35%	26%	30%	29%	26%	38%
Load Reduction as Percent of DRR Contract Amount	46%	46%	45%	58%	44%	50%	49%	44%	64%
Generation as Percent of DRR Contract Amount									
Total Load Relief as Percent of DRR Contract Amount	46%	46%	45%	58%	44%	50%	49%	44%	64%

(a) Asset reached enrolled level for at least one 5-min interval during the event
 (b) Asset average load reduction for the entire event was at enrolled level or better

4. Baseline Assessment

KEMA conducted an assessment of the symmetric baseline to gauge the baseline's predictive power. This is accomplished by comparing the baseline calculated pursuant to the DRRP rules to the actual asset's load on days when there is no event. The reader is reminded that this analysis applies only to assets with baselines (i.e., Load Reduction Assets only, not Generation Assets or Direct Load Control Assets).

The measure utilized to compare an asset's calculated baseline to its actual load on days when there is no event is the Theil's U.¹¹ The Theil's U is a measure of forecast accuracy – where the estimated baseline is a forecast of the actual load – that estimates the magnitude of error relative to the actual value, calculated as the ratio of the root-mean-square error to the root-mean-square of the difference between the estimated baseline and the actual load. A Theil's U of 0 indicates a perfect match – the higher the number the less perfect the match. The Theil's U value at which a baseline is deemed to adequately represent the observed load depends on a number of factors, including the tolerance to risk of both the ISO and the program participant. For the purposes of this section, we deem a value of 20 percent or less to constitute a good fit, and a value of 21 percent or more to constitute a poor fit. There is a substantial difference in fit between an asset with a score of 21 percent and an asset with a score of 50 percent or more, even though they are both considered a “poor fit”.

Table 4-1 shows the distribution of the DRRP's individual Theil's U statistics, by session. Assets with a Theil's U statistic of 10 percent or less include a low of 71 percent of all assets in the summer of 2007, to a high of 96 percent in the winter of 2007/2008. Assets with a Theil's U statistic of 20 percent or less include a low of 82 percent in the summer of 2009, to 99 percent in the winter of 2007/2008.

¹¹ The use of the Theil's U to determine baseline adequacy for demand response applications is documented in *Goldberg, M. and Ken Agnew. Protocol Development for Demand Response Calculations. California Energy Commission. Report number 400-00-062. February, 2003.* Below is an excerpt from this report explaining the statistic:

As a key measure of the total magnitude of error, we consider Theil's U statistic for each account. This statistic is a “relative root-mean-square error.” It is calculated for each account as the ratio of the root-mean-square error to the root-mean-square load. The root-mean-square error is like a standard deviation, and represents the typical error magnitude for the account. This root-mean-square error reflects both systematic error, or bias, and the level of variability around the typical error. The root-mean-square load is a corresponding “typical” load level. Normalizing the root-mean square error by the root-mean-square load is something like calculating a correlation coefficient. However, the U statistic may be greater than 1, since errors can be greater than the loads they estimate.

There were only two DRRP sessions where individual assets had Theil's U statistics of 40 percent or more: in the summer of 2008 two assets had scores of 70 and 83 percent, and in the summer of 2009 two assets had scores of 43 percent and one had a score of 55 percent.

**Table 4-1
Baseline Assessment
Theil's U by DRRP Session**

Session	Theil's U	Percent of Load Reduction Assets
Winter 06-07	< 5%	32%
	6-10%	55%
	11-15%	4%
	16-20%	4%
	26-30%	2%
	35-40%	2%
Summer 07	< 5%	2%
	6-10%	69%
	11-15%	13%
	16-20%	9%
	21-25%	3%
	26-30%	2%
Winter 07-08	35-40%	1%
	< 5%	61%
	6-10%	35%
	11-15%	3%
Summer 08	31-35%	1%
	< 5%	3%
	6-10%	82%
	11-15%	7%
	16-20%	2%
	21-25%	1%
	26-30%	1%
	31-35%	1%
Summer 09	66-70%	1%
	81-85%	1%
	< 5%	4%
	6-10%	75%
	11-15%	2%
	16-20%	2%
	21-25%	2%
	26-30%	2%
	31-35%	4%
35-40%	5%	
Winter 09-10	41-45%	4%
	51-55%	2%
	< 5%	60%
	6-10%	35%
Winter 09-10	16-20%	3%
	31-35%	3%

Overall, the symmetric baseline methodology that was adopted in the last two sessions of the DRRP provides good fit for most assets. For the few assets where the symmetric baseline did not match the daily load well, it is possible that a good baseline cannot be estimated. That is, no baseline methodology can adequately capture the highly irregular load pattern of these assets. These assets are difficult to incorporate into demand response programs, and both the ISO and the assets undertake risks when these assets participate in such programs. The financial risk is clear – an under-estimated baseline will result in underpayment to the asset, and an over-estimated baseline will result in overpayment by the ISO. The reliance on under- or over-estimated performance at the time of an event is a risk that should also be considered.

Figure 4-1 shows the average baseline and observed weekday, non-event load for a participating large retail store in the summer of 2008. For this particular session, this asset had a Theil's U score of 11 percent. This is a good score, slightly over the session's average of 10 percent. Figure 4-2 shows another participating large retail store, belonging to the same chain as the first one. For this particular session, this asset had a Theil's U score of 83 percent – the worst of the entire DRRP. The large difference between the average baseline (represented by the green line) and the average load (represented by the purple line) is visible.

The next couple of figures illustrate why. They include the same averages as the prior two figures, plus the minimum and maximum loads for these assets in this session. The minimum is depicted by the blue line and the maximum by the orange line. It is important to note that these minimums and maximums do not necessarily correspond to the same day – they are the minimums and maximums available for each of the weekday non-event load intervals, regardless of the date.

Figure 4-3, corresponding to Store 1, shows minimums and maximums that are very close to the average load and baseline. The ratio of maximum load to average load ranges between 1.3 and 2.5, depending on the time of day. This low variability results in a good fit between baseline and observed load.

Figure 4-4 corresponds to Store 2. It shows that the minimums are similar to those for Store 1, but that the maximums are very high. The ratio of maximum load to average load ranges between 4.5 and 12.1, depending on the time of day. This high variability results in a poor fit between baseline and load. For this particular asset, the high loads correspond to two days that are about two weeks apart. Because the baseline's main component is the average of ten days, the days with the high loads influence the baseline for many days, which is in turn reflected in an average baseline that is high compared to the average load.

Figure 4-1 – Example of a DRRP asset with a good fit between baseline and load (summer of 2008)

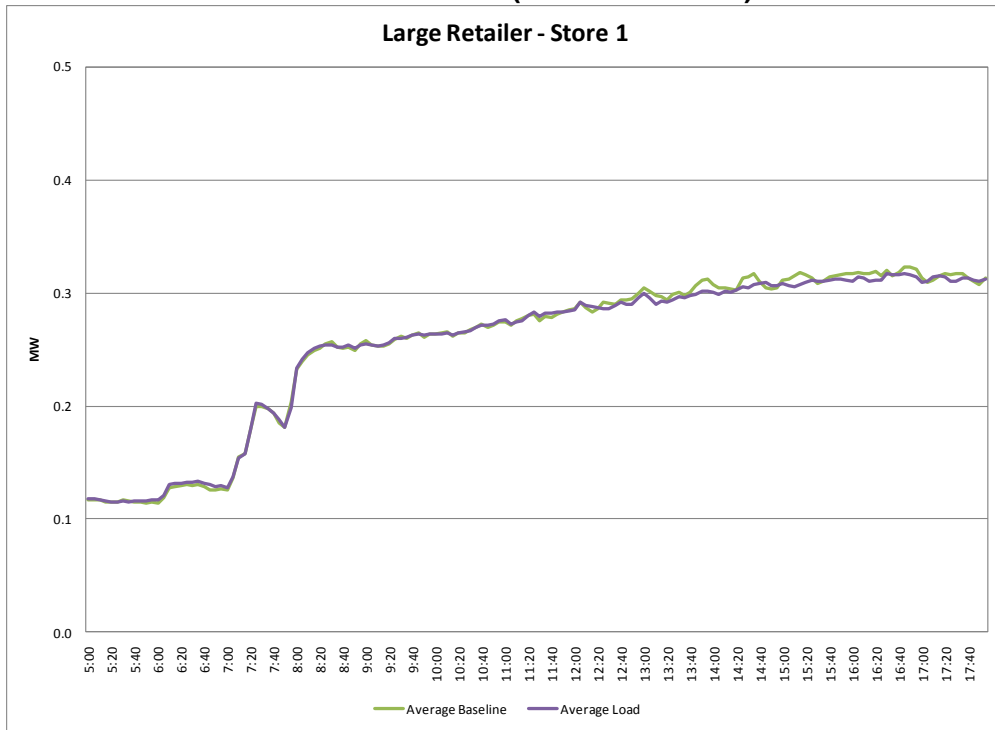


Figure 4-2 – Example of a DRRP asset with a poor fit between baseline and load (summer of 2008)

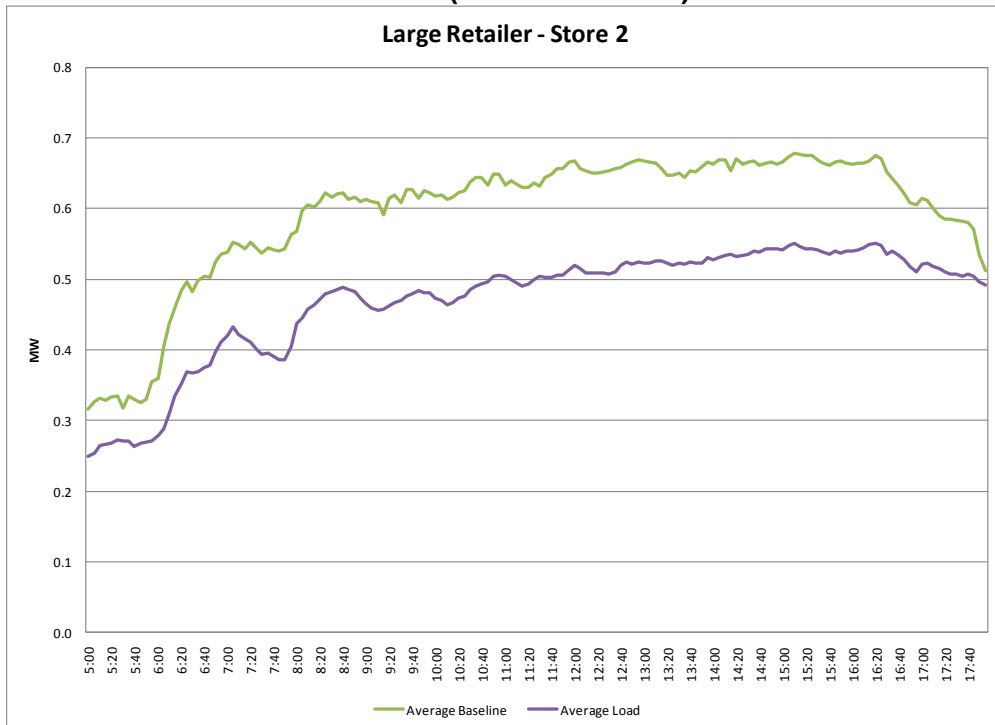


Figure 4-3 – Example of a DRRP asset with good fit between baseline and load and its corresponding extreme values (summer of 2008)

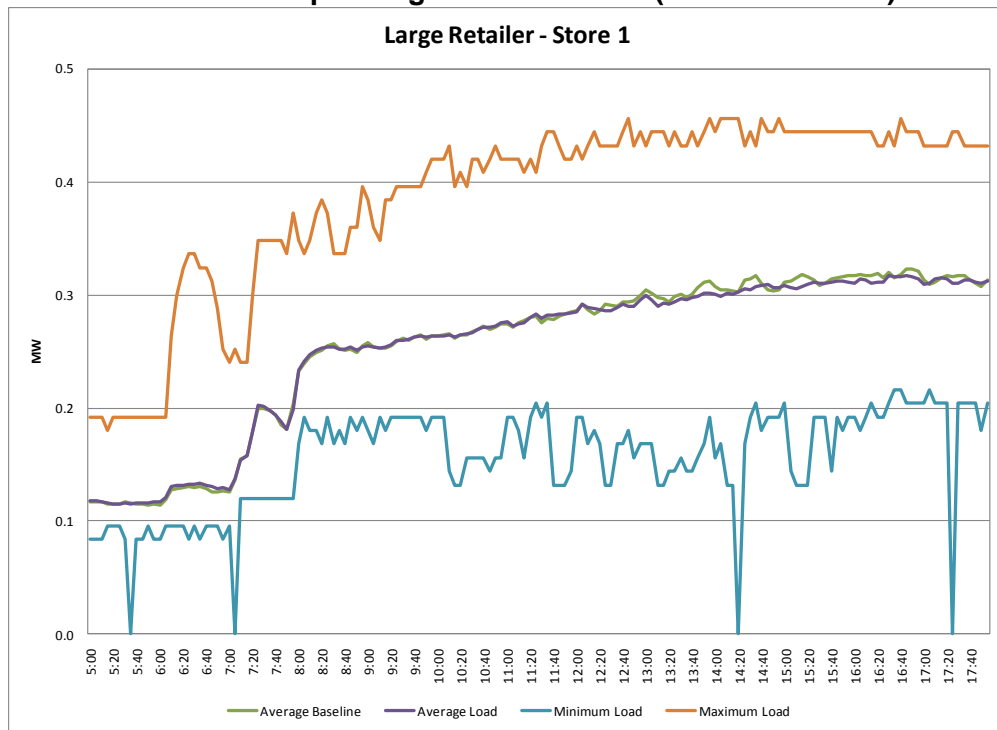
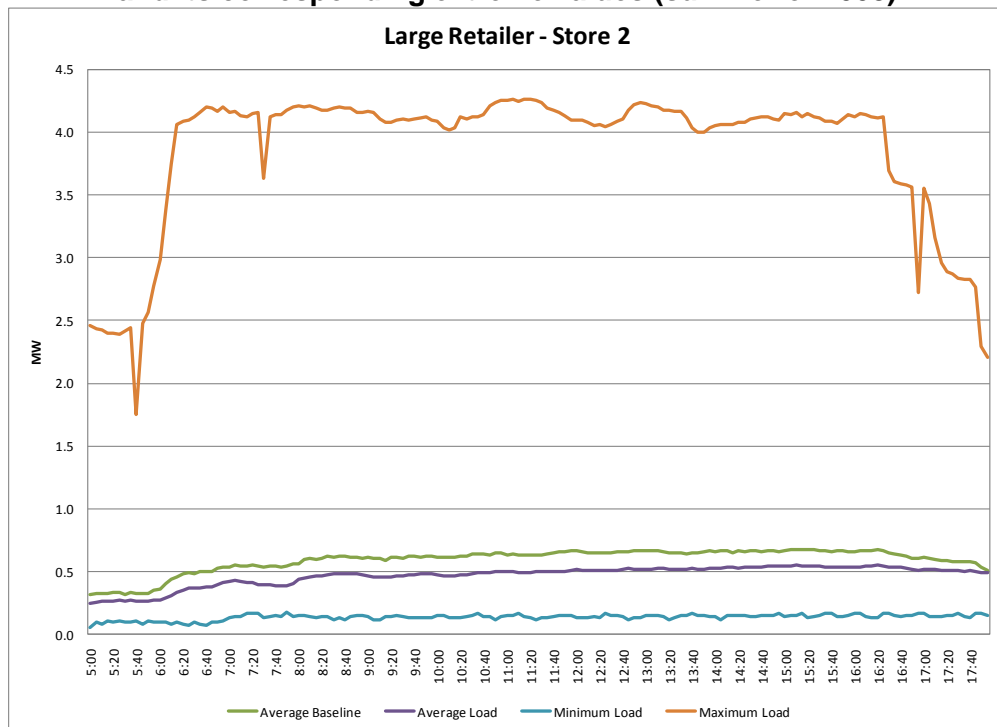


Figure 4-4 – Example of a DRRP asset with a poor fit between baseline and load and its corresponding extreme values (summer of 2008)



5. Statistical Significance of DRRP Load Reductions

A statistical significance test was designed to assess whether measured load reductions were different from what is expected from the natural load variability of the participating assets.

For Load Reduction Assets, demand response is measured as a load reduction relative to a calculated baseline. This baseline is calculated based on past load¹² and serves as an estimate of what the load would have been at the time of the event if the demand response event had not been called. The baseline calculation varies according to the natural variability of load in the absence of an event. The statistical significance test measures the probability that observed load reductions happened as a result of the DRRP event call, and not due to baseline error – the difference between the baseline and the actual load during non-event hours.

For Generation Assets, demand response is simply the positive generation during the event. Because we assume that Generation Assets do not run in the absence of an event, the baseline condition for Generation Assets is assumed to be zero. Whatever positive generation is observed is assumed to be in response to the event. For this reason, we exclude Generation Assets from the statistical significance tests.

Lastly, Direct Load Control Assets calculate their own baselines and load at the time of the event and do not provide the information necessary to conduct a statistical significance test.

¹² ISO-New England's algorithm for baseline estimation is posted at http://www.iso-ne.com/genrtion_resrcs/dr/index.html

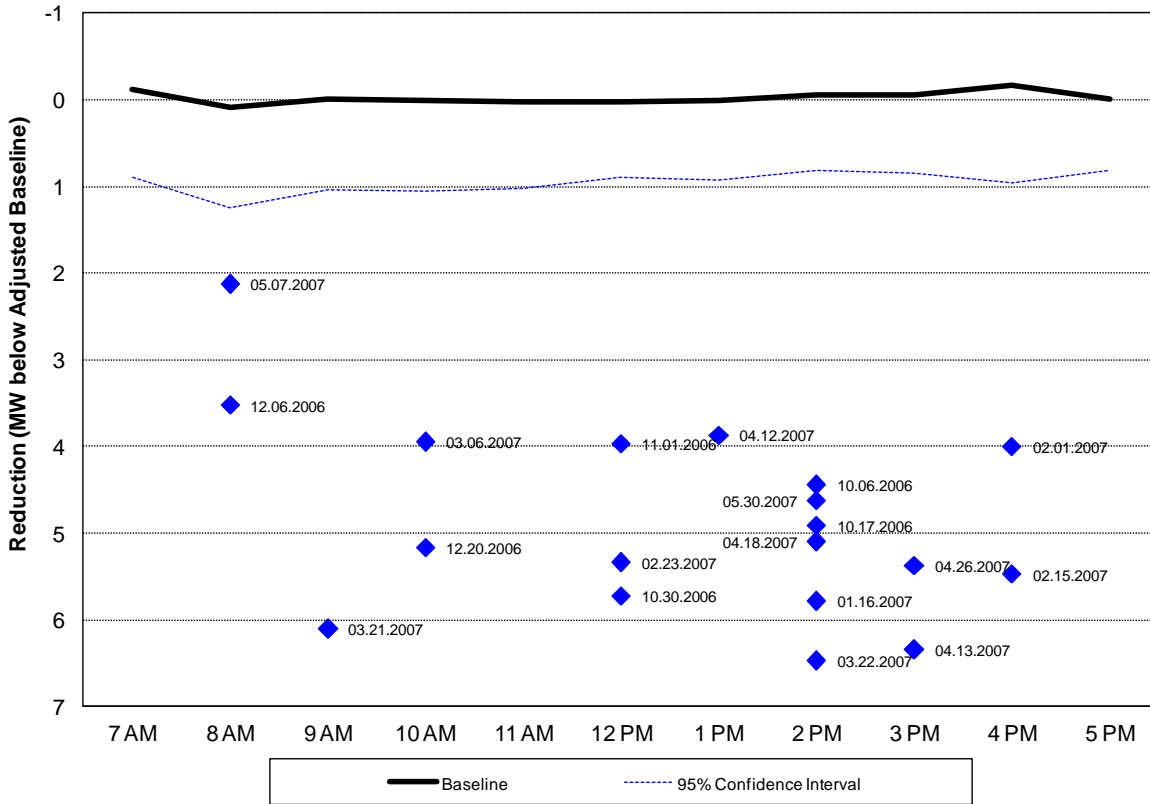
The statistical significance of the load reduction provided by pilot assets was tested in the following manner:

- For all pilot resources and using data from all non-event days, estimate the Adjusted Symmetric Customer Baseline for a set of test hours during which events occur
- For each test hour, compute ΔL_h – the difference between observed load and the estimated Adjusted Customer Baseline in hour h (baseline error)
- Estimate the variance of ΔL_h and use that variance to estimate a 95% confidence interval for the estimated Adjusted Customer Baseline _{h}
- For each test hour, determine whether actual load falls outside of the 95% confidence interval around the estimated Adjusted Customer Baseline _{h}

The figures in this section illustrate the mean baseline error, the corresponding uncertainty bound, and DRRP event performance for all DRRP sessions.

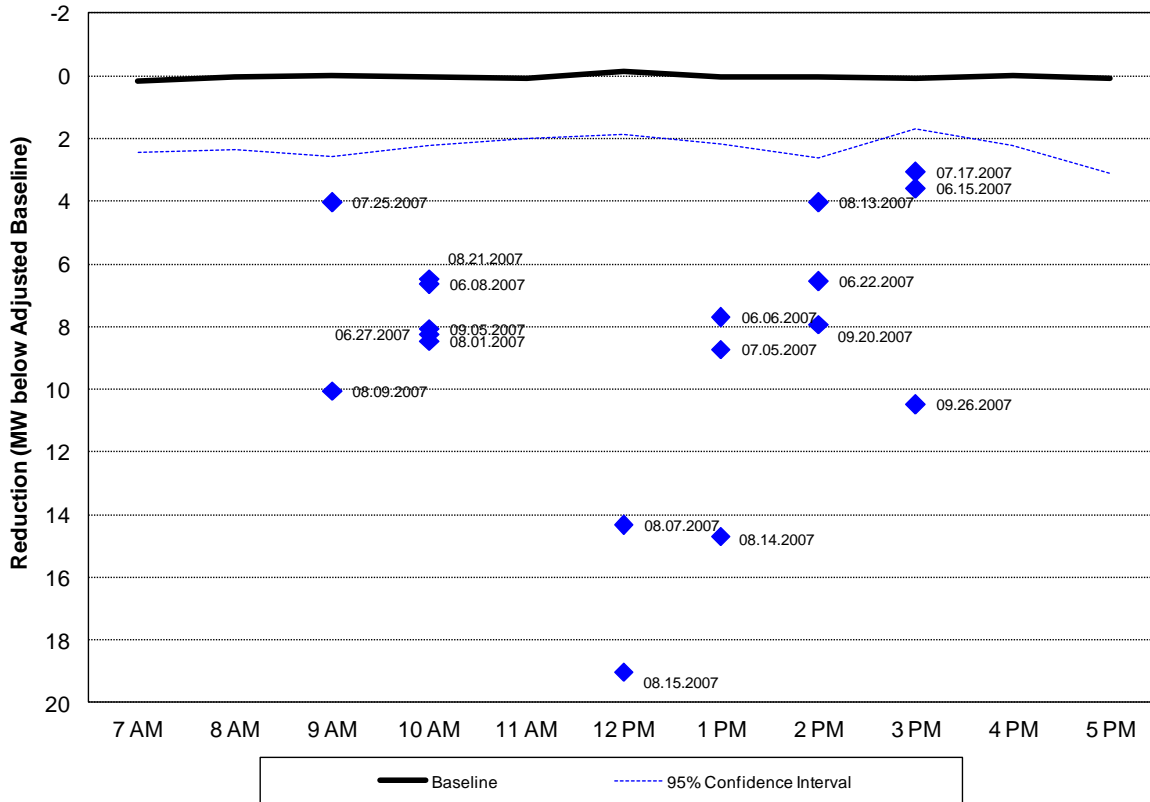
As with other results presented in this report, these figures are based on each Load Reduction Asset's DRR Contract Amount, not its Enrolled Amount. For example, in the summer of 2007 five of the eighteen events did not yield statistically significant load reductions when compared to the Enrolled Amount. However, all events of the DRRP are statistically significant when using DRR Contract Amount instead of the Enrolled Amount.

**Figure 5-1
DRRP Statistical Significance of Observed Load Reductions
Based on DRR Contract Amount*
Winter of 2006/2007**



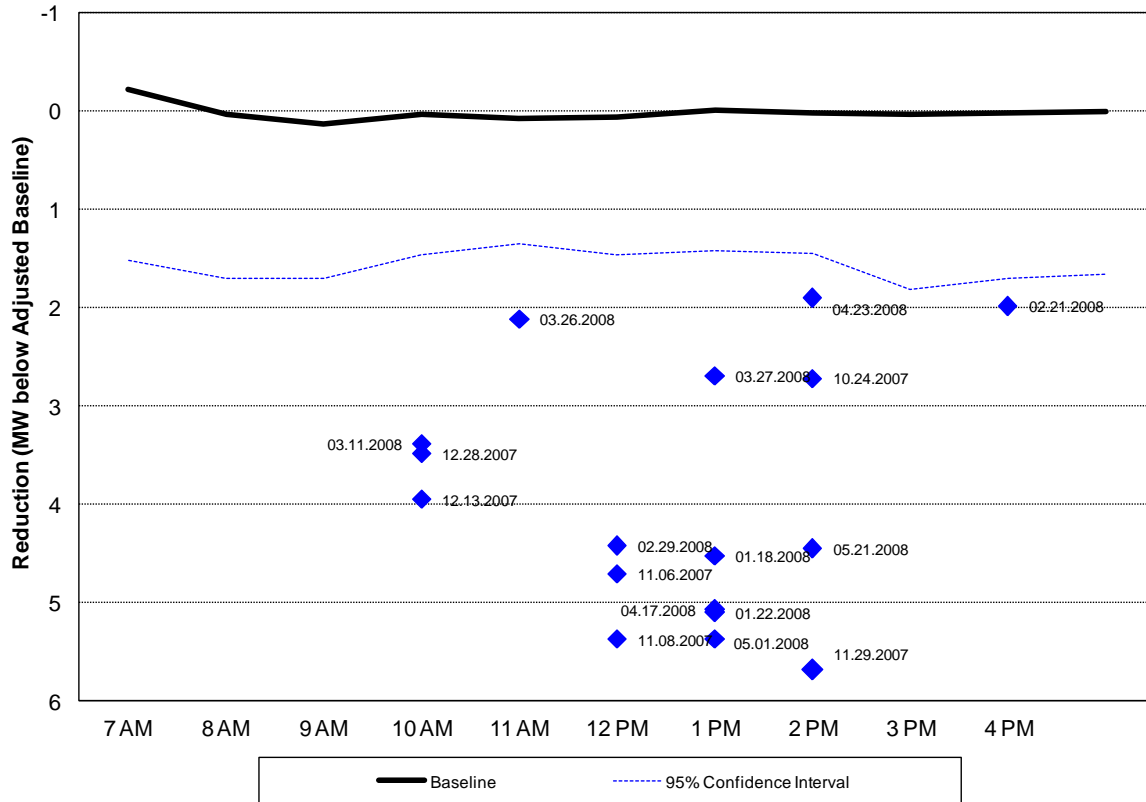
* DRR Contract Amount was not used in this session. The numbers utilized in this Figure assume a similar ratio of DRR Contract Amount to Enrolled Amount that was observed in the last two sessions of the pilot.

**Figure 5-2
DRRP Statistical Significance of Observed Load Reductions
Based on DRR Contract Amount*
Summer of 2007**



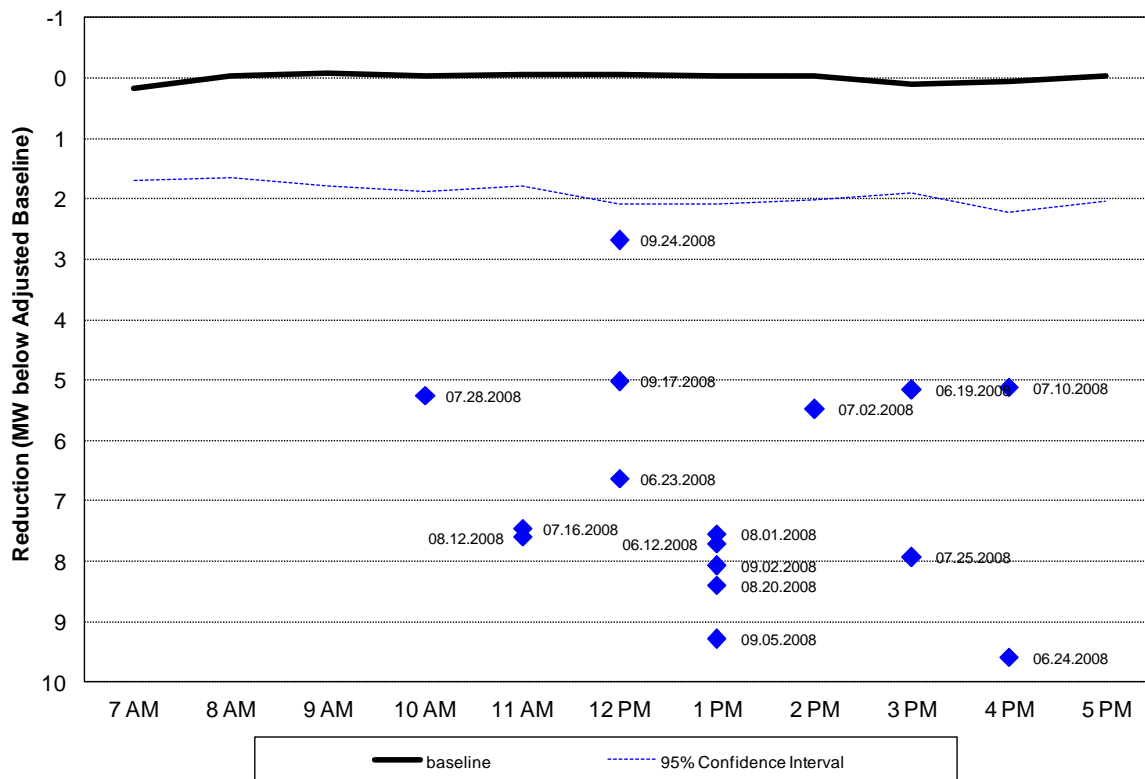
* DRR Contract Amount was not used in this session. The numbers utilized in this Figure assume a similar ratio of DRR Contract Amount to Enrolled Amount that was observed in the last two sessions of the pilot.

**Figure 5-3
 DRRP Statistical Significance of Observed Load Reductions
 Based on DRR Contract Amount*
 Winter of 2007/2008**



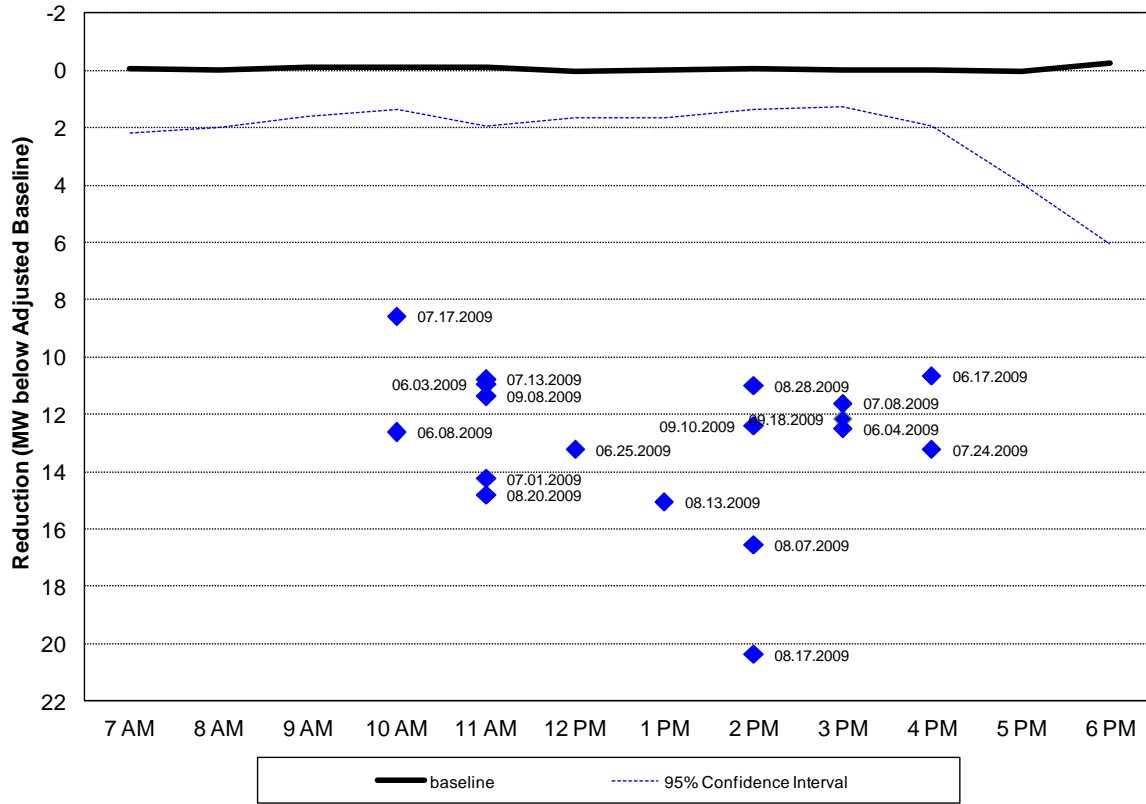
* DRR Contract Amount was not used in this session. The numbers utilized in this Figure assume a similar ratio of DRR Contract Amount to Enrolled Amount that was observed in the last two sessions of the pilot.

**Figure 5-4
DRRP Statistical Significance of Observed Load Reductions
Based on DRR Contract Amount*
Summer of 2008**

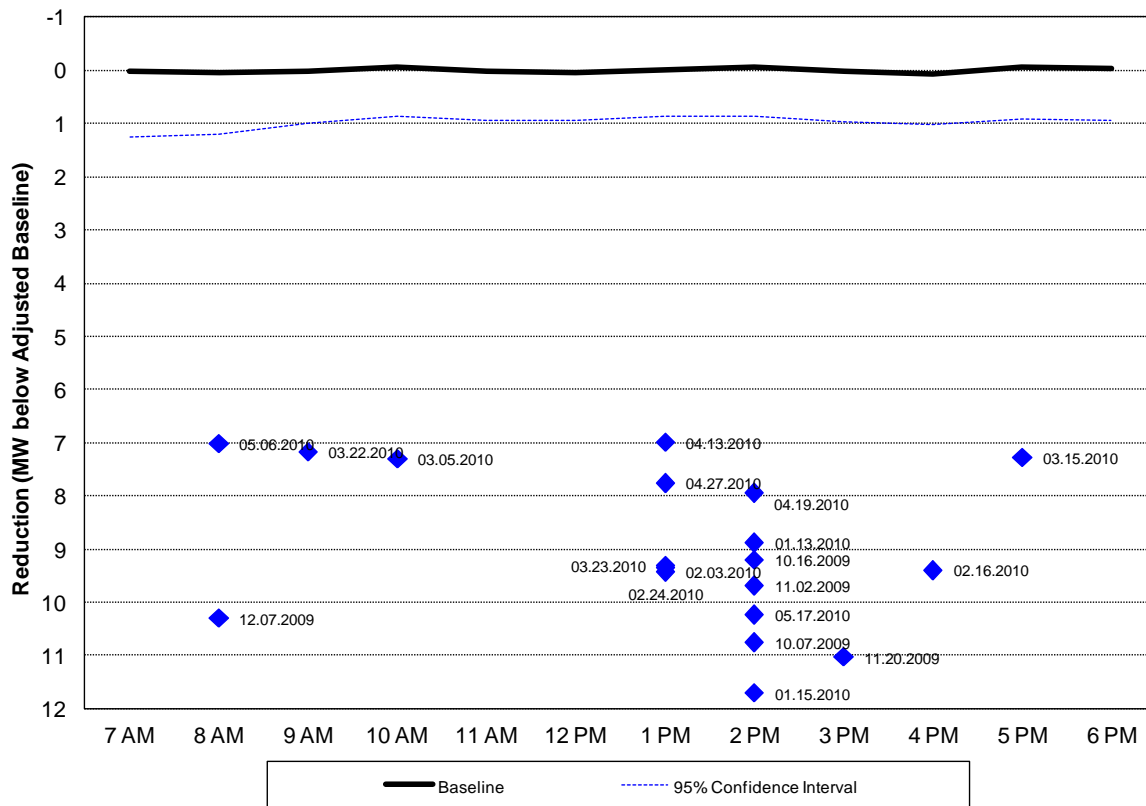


* DRR Contract Amount was not used in this session. The numbers utilized in this Figure assume a similar ratio of DRR Contract Amount to Enrolled Amount that was observed in the last two sessions of the pilot.

**Figure 5-5
DRRP Statistical Significance of Observed Load Reductions
Based on DRR Contract Amount
Summer of 2009**



**Figure 5-6
 DRRP Statistical Significance of Observed Load Reductions
 Based on DRR Contract Amount
 Winter of 2009/2010**



6. Comparing the Performance of Participating DRRP Assets to Generation Resources

In order to determine the viability of DRRP assets in the reserve market, their performance was compared to that of the generation resources which provide reserve services in wholesale electricity markets. This comparison sheds light on the question of whether allowing demand response resources to participate in reserves markets and displacing generators in those markets would improve system reliability.

For the purposes of this comparison, ISO New England selected the following indicators:

- Net Output Factor (NOF) - Net Output Factor is program level load reduction as a percentage of Enrolled Amount and DRR Contract Amount, calculated as follows:

$$\frac{\sum_{a \in A} \sum_{h \in E} \Delta L_{ah}}{n_E C_A}$$

where A is all assets, E is Event hours, n_E is the number of event hours and C_A is the Enrolled Amount for assets A .

- Starting Reliability 10%, defined as an event where the NOF was greater than 10 percent
- Starting Reliability 5%, defined as an event where the NOF was greater than 5percent

Table 6-1 compares these indicators for the Enrolled Amount of DRRP Assets against and NERC generator data for diesel generators, small gas turbines, and all gas turbines. Table 6-2 does the same for the DRR Contract Amount.

DRRP assets show less reliability than generation resources using either the Enrolled Amount or the DRR Contract Amount as the benchmark. Generation resources (in contrast to Generation Assets) showed a moderate increase in reliability since the DRRP started, while DRRP assets showed a decrease in reliability during the same time frame.

Table 6-3 through Table 6-6 present the indicators listed above, for Load Reduction Assets and Generation/Direct Load Control Assets separately. Consistent with other findings in this report, Generation Assets' performance was higher than Load Reduction Assets' in most sessions. While Load Reduction Assets consistently under-perform when comparing their DRR Contract Amount indicators to NERC statistics (Table 6-4), Generation Assets are very close to or over-perform the NERC indicators for generation resources in most sessions (Table 6-6).

**Table 6-1
ISO-New England Demand Response Reserve Pilot
Performance Comparison to Generation Resources
Based on Enrolled Amount for
ALL DRRP ASSETS**

Unit Statistic	Phase	Number of DRRP Events	ISO - NE		NERC Generating Availability (2008)		
			DRRP Assets		Diesel All Sizes	Gas Turbine	
			(95% confidence interval)			1-19 MW	All Sizes
Starting Reliability 10%	Winter 06/07	19	87%	(82% , 92%)	100%	96%	98%
	Summer 07	18	62%	(55% , 69%)			
	Winter 07/08	17	79%	(70% , 88%)			
	Summer 08	16	67%	(61% , 74%)			
	Winter 08/09	0	n/a				
	Summer 09	18	51%	(42% , 59%)			
	Winter 09/10	19	62%	(58% , 65%)			
	DRRP	107	69%	(65% , 72%)			
Starting Reliability 5%	Winter 06/07	19	91%	(86% , 95%)	100%	96%	98%
	Summer 07	18	68%	(61% , 74%)			
	Winter 07/08	17	83%	(74% , 92%)			
	Summer 08	16	71%	(65% , 78%)			
	Winter 08/09	0	n/a				
	Summer 09	18	67%	(59% , 75%)			
	Winter 09/10	19	74%	(71% , 77%)			
	DRRP	107	76%	(73% , 79%)			
Net Output Factor	Winter 06/07	19	63%	(52% , 73%)	85%	76%	72%
	Summer 07	18	34%	(28% , 40%)			
	Winter 07/08	17	56%	(43% , 69%)			
	Summer 08	16	39%	(35% , 44%)			
	Winter 08/09	0	n/a				
	Summer 09	18	29%	(24% , 34%)			
	Winter 09/10	19	34%	(32% , 36%)			
	DRRP	107	43%	(40% , 47%)			

**Table 6-2
ISO-New England Demand Response Reserve Pilot
Performance Comparison to Generation Resources
Based on DRR Contract Amount (*) for
ALL DRRP ASSETS**

Unit Statistic	Phase	Number of DRRP Events	ISO - NE		NERC Generating Availability (2008)		
			DRRP Assets		Diesel All Sizes	Gas Turbine	
			(95% confidence interval)			1-19 MW	All Sizes
Starting Reliability 10%	Winter 06/07	19	90%	(85% , 94%)	100%	96%	98%
	Summer 07	18	66%	(60% , 73%)			
	Winter 07/08	17	82%	(74% , 91%)			
	Summer 08	16	70%	(64% , 76%)			
	Winter 08/09	0	n/a				
	Summer 09	18	65%	(57% , 73%)			
	Winter 09/10	19	73%	(69% , 76%)			
	DRRP	107	75%	(72% , 78%)			
Starting Reliability 5%	Winter 06/07	19	91%	(87% , 96%)	100%	96%	98%
	Summer 07	18	72%	(66% , 78%)			
	Winter 07/08	17	87%	(79% , 95%)			
	Summer 08	16	73%	(68% , 79%)			
	Winter 08/09	0	n/a				
	Summer 09	18	74%	(67% , 81%)			
	Winter 09/10	19	80%	(77% , 83%)			
	DRRP	107	80%	(77% , 83%)			
Net Output Factor	Winter 06/07	19	120%	(98% , 142%)	85%	76%	72%
	Summer 07	18	55%	(46% , 64%)			
	Winter 07/08	17	107%	(80% , 134%)			
	Summer 08	16	67%	(57% , 77%)			
	Winter 08/09	0	n/a				
	Summer 09	18	50%	(39% , 60%)			
	Winter 09/10	19	56%	(53% , 60%)			
	DRRP	107	78%	(70% , 85%)			

(*) The reader is reminded that the DRR Contract Amount was introduced in the last two sessions of the DRRP. The DRR Contract Amount figures for the first four sessions presented in this table are calculated based on the ratio of DRR Contract Amount to Enrolled Amount from the last two sessions.

**Table 6-3
ISO-New England Demand Response Reserve Pilot
Performance Comparison to Generation Resources
Based on Enrolled Amount for
LOAD REDUCTION ASSETS**

Unit Statistic	Phase	Number of DRRP Events	ISO - NE		NERC Generating Availability (2008)		
			DRRP Assets		Diesel All Sizes	Gas Turbine	
			(95% confidence interval)			1-19 MW	All Sizes
Starting Reliability 10%	Winter 06/07	19	79%	(77% , 82%)	100%	96%	98%
	Summer 07	18	81%	(76% , 85%)			
	Winter 07/08	17	81%	(79% , 83%)			
	Summer 08	16	72%	(62% , 81%)			
	Winter 08/09	0	n/a				
	Summer 09	18	57%	(53% , 61%)			
	Winter 09/10	19	62%	(58% , 65%)			
	DRRP	107	72%	(69% , 74%)			
Starting Reliability 5%	Winter 06/07	19	86%	(84% , 88%)	100%	96%	98%
	Summer 07	18	87%	(83% , 90%)			
	Winter 07/08	17	89%	(88% , 91%)			
	Summer 08	16	78%	(69% , 88%)			
	Winter 08/09	0	n/a				
	Summer 09	18	70%	(66% , 74%)			
	Winter 09/10	19	74%	(71% , 77%)			
	DRRP	107	81%	(79% , 83%)			
Net Output Factor	Winter 06/07	19	33%	(30% , 36%)	85%	76%	72%
	Summer 07	18	42%	(34% , 50%)			
	Winter 07/08	17	29%	(25% , 33%)			
	Summer 08	16	37%	(33% , 41%)			
	Winter 08/09	0	n/a				
	Summer 09	18	35%	(32% , 38%)			
	Winter 09/10	19	34%	(32% , 36%)			
	DRRP	107	35%	(33% , 37%)			

**Table 6-4
ISO-New England Demand Response Reserve Pilot
Performance Comparison to Generation Resources
Based on DRR Contract Amount (*) for
LOAD REDUCTION ASSETS**

Unit Statistic	Phase	Number of DRRP Events	ISO - NE		NERC Generating Availability (2008)		
			DRRP Assets		Diesel All Sizes	Gas Turbine	
			(95% confidence interval)			1-19 MW	All Sizes
Starting Reliability 10%	Winter 06/07	19	85%	(83% , 87%)	100%	96%	98%
	Summer 07	18	84%	(80% , 88%)			
	Winter 07/08	17	88%	(87% , 90%)			
	Summer 08	16	75%	(65% , 85%)			
	Winter 08/09	0	n/a				
	Summer 09	18	66%	(62% , 70%)			
	Winter 09/10	19	73%	(69% , 76%)			
	DRRP	107	78%	(76% , 81%)			
Starting Reliability 5%	Winter 06/07	19	88%	(86% , 90%)	100%	96%	98%
	Summer 07	18	88%	(85% , 91%)			
	Winter 07/08	17	92%	(90% , 93%)			
	Summer 08	16	81%	(72% , 89%)			
	Winter 08/09	0	n/a				
	Summer 09	18	74%	(70% , 78%)			
	Winter 09/10	19	80%	(77% , 83%)			
	DRRP	107	84%	(82% , 85%)			
Net Output Factor	Winter 06/07	19	55%	(51% , 60%)	85%	76%	72%
	Summer 07	18	58%	(47% , 69%)			
	Winter 07/08	17	49%	(42% , 55%)			
	Summer 08	16	51%	(45% , 56%)			
	Winter 08/09	0	n/a				
	Summer 09	18	54%	(50% , 58%)			
	Winter 09/10	19	56%	(53% , 60%)			
	DRRP	107	54%	(51% , 56%)			

**Table 6-5
ISO-New England Demand Response Reserve Pilot
Performance Comparison to Generation Resources
Based on Enrolled Amount for
GENERATION AND DIRECT LOAD CONTROL ASSETS**

Unit Statistic	Phase	Number of DRRP Events	ISO - NE		NERC Generating Availability (2008)		
			DRRP Assets		Diesel All Sizes	Gas Turbine	
			(95% confidence interval)			1-19 MW	All Sizes
Starting Reliability 10%	Winter 06/07	19	95%	(86% , 103%)	100%	96%	98%
	Summer 07	18	43%	(34% , 52%)			
	Winter 07/08	17	76%	(59% , 94%)			
	Summer 08	16	63%	(55% , 71%)			
	Winter 08/09	0	n/a				
	Summer 09	18	44%	(28% , 61%)			
	Winter 09/10	0	n/a				
	DRRP	88	65%	(58% , 71%)			
Starting Reliability 5%	Winter 06/07	19	95%	(86% , 103%)	100%	96%	98%
	Summer 07	18	49%	(40% , 57%)			
	Winter 07/08	17	76%	(59% , 94%)			
	Summer 08	16	65%	(57% , 72%)			
	Winter 08/09	0	n/a				
	Summer 09	18	64%	(48% , 80%)			
	Winter 09/10	0	n/a				
	DRRP	88	70%	(64% , 76%)			
Net Output Factor	Winter 06/07	19	92%	(79% , 106%)	85%	76%	72%
	Summer 07	18	26%	(19% , 33%)			
	Winter 07/08	17	85%	(64% , 106%)			
	Summer 08	16	42%	(34% , 50%)			
	Winter 08/09	0	n/a				
	Summer 09	18	23%	(13% , 33%)			
	Winter 09/10	0	n/a				
	DRRP	88	54%	(46% , 61%)			

**Table 6-6
ISO-New England Demand Response Reserve Pilot
Performance Comparison to Generation Resources
Based on DRR Contract Amount (*) for
GENERATION AND DIRECT LOAD CONTROL ASSETS**

Unit Statistic	Phase	Number of DRRP Events	ISO - NE		NERC Generating Availability (2008)		
			DRRP Assets		Diesel All Sizes	Gas Turbine	
			(95% confidence interval)			1-19 MW	All Sizes
Starting Reliability 10%	Winter 06/07	19	95%	(86% , 103%)	100%	96%	98%
	Summer 07	18	49%	(40% , 57%)			
	Winter 07/08	17	76%	(59% , 94%)			
	Summer 08	16	65%	(57% , 72%)			
	Winter 08/09	0	n/a				
	Summer 09	18	64%	(48% , 80%)			
	Winter 09/10	0	n/a	(,)			
	DRRP	88	70%	(64% , 76%)			
Starting Reliability 5%	Winter 06/07	19	95%	(86% , 103%)	100%	96%	98%
	Summer 07	18	57%	(49% , 65%)			
	Winter 07/08	17	82%	(67% , 98%)			
	Summer 08	16	66%	(59% , 73%)			
	Winter 08/09	0	n/a				
	Summer 09	18	75%	(61% , 89%)			
	Winter 09/10	0	n/a	(,)			
	DRRP	88	75%	(70% , 81%)			
Net Output Factor	Winter 06/07	19	184%	(157% , 211%)	85%	76%	72%
	Summer 07	18	52%	(38% , 66%)			
	Winter 07/08	17	170%	(128% , 213%)			
	Summer 08	16	84%	(67% , 100%)			
	Winter 08/09	0	n/a				
	Summer 09	18	45%	(25% , 66%)			
	Winter 09/10	0	n/a	(,)			
	DRRP	88	107%	(92% , 122%)			

7. Weather- and Time-Dependency of Load Reductions

KEMA developed a model to assess the effect of weather, time of day, notice lead time, and industry type on Load Reduction Asset performance. Generation Assets and Direct Load Control Assets are not included in this model.

In prior reports, the modeling process was carried out for each session separately. In this report, we consolidate the data from all sessions into one model for each session type (summer and winter).

7.1 The Model

In order to combine all of the events of the DRRP into one consolidated report, we developed a random effects model. Such a model specification provides a general estimate of the relationship between the percent load impact calculated using the symmetric baseline, cooling or heating degree days, and notice lead time. Differences among times of day and industry types are also considered. This model identifies the heterogeneity among assets and event days.

KEMA tested a number of other models with different variable combinations. Akaike's Information Criterion (AIC) was used to select the best model, based on maximum likelihood and penalties for each additional parameter. In the context of multiple linear regression analysis, the AIC measures the difference between a given model and the "true" underlying model.

The final model is:

Equation 1

$$P_{id} = \mu_i + \lambda_d + \beta_1 CDD_d + \beta_2 TOD_d + \beta_3 Lead_d + \beta_4 Ind_i * CDD_d + \beta_5 TOD_d * CDD_d + \varepsilon_{id}$$

where

P_{id} = Symmetric interruption percentage on event day d for asset i ;

DD_d = Average daily cooling or heating degree-days, base 65°F, on event day d ;

TOD_d	=	Time of day of event on day d . 1: earlier than 11am, 2: between 11am and 3pm, 3: after 3pm;
$Lead_d$	=	Notice lead time on event day d . 1: 0-9 min; 2: 10-15 min; 3: ≥ 16 min;
Ind_i	=	Industry type of asset. Box: Large Retail, GStore: Grocery Store, Edu: Educational Facility, Mnfc: Manufacturing, WWTF: water pumping/water treatment facility
μ_i	=	Asset-specific base symmetric interruption percentage estimate for asset i ;
λ_d	=	Event day specific effect for event day d ;
$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$	=	Regression coefficients;
ε_{id}	=	Regression residual.

The "event days" effect $\{\lambda_d\}$ is treated as random: future event days are different from past event days – in this sense, they are a sample from the population of all event days, past and present. Thus, the "event day" in this study is a random factor. In a random effects model, random effect $\{\lambda_d\}$ is assumed to be identically and independently distributed with mean zero. By assuming that past event days are draws from a distribution of all event days, we have the ability to make inferences about future event days that are not included in the sample. The estimate of $\{\lambda_d\}$ is the deviation of an event day from the mean function.

7.2 Results

This section discusses the main findings from the summer and winter symmetric interruption percentage regressions, including the effects of weather, lead time, and industry type. Detailed description of parameter estimates and P-values can be found in the following table.

**Table 7-1
Summer and Winter Regression Results**

Effect	Value	SUMMER				WINTER			
		Estimate	Standard error	t Value	Pr > t	Estimate	Standard error	t Value	Pr > t
DDavg		2.61	0.72	3.62	<0.01	0.64	0.24	2.71	0.01
TOD	1	13.75	6.24	2.20	0.03	11.08	7.84	1.41	0.16
TOD	2	0.49	4.99	0.10	0.92	12.86	6.57	1.96	0.05
TOD	3	0				0			
Lead	1	-5.41	4.20	-1.29	0.20	-0.35	2.45	-0.14	0.89
Lead	2	-0.85	4.55	-0.19	0.85	4.69	2.24	2.09	0.04
Lead	3	0				0			
DDavg*ind	Box	-1.03	0.54	-1.91	0.06	-0.19	0.15	-1.21	0.23
DDavg*ind	Cstore	-1.21	0.52	-2.32	0.02	-0.25	0.13	-1.91	0.06
DDavg*ind	Edu	-0.99	0.85	-1.17	0.24	-0.29	0.17	-1.76	0.08
DDavg*ind	Mnfc	-1.00	0.60	-1.68	0.09	-0.15	0.15	-1.01	0.31
DDavg*ind	WWTF	0				0			
DDavg*TOD	1	-3.16	0.62	-5.08	<0.01	-0.31	0.24	-1.27	0.20
DDavg*TOD	2	-0.44	0.57	-0.76	0.45	-0.33	0.21	-1.58	0.11
DDavg*TOD	3	0				0			

Individual asset intercepts and event day effects estimates are not reported here because of their low forecasting value. While the effects of each asset's differences are reflected in the model, these differences do nothing to predict the load reduction of assets that have never enrolled in the DRRP.

7.2.1 Temperature effects

Outdoor temperature plays an important role in load reductions in both summer and winter. It appears in the model twice: as a stand-alone term, and as an interaction to the time of day effect.

In summer, cooling degree days base 65 (CDD) has a positive influence on load reduction: the higher the temperature, the higher the load reduction. The parameter estimate for CDD is 2.61 – that is, if the average daily temperature is greater than 65°F, an increase of 1°F would result in a 2.61 percent increase in the symmetric interruption percentage. If daily average temperature is less than 65°F, temperature does not affect the load reduction.

In the summer, the interaction between CDD and time of day is negative and significant earlier in the day: warmer days result in undesirable reductions in the percent of load reduction in the mornings. There is further explanation about the effect of the interaction between temperature and time of day in the following section.

Of the five industry types considered, grocery stores have the highest expected decrease in load reduction when temperature increases, and Water Pumping/Water Treatment has the lowest.

For example: for a water treatment facility, when a summer event happens after 3 PM, with a lead time of more than 15 minutes, and the average daily temperature is 70°F, the expected symmetric interruption percentage is 15.1 percent. At an average daily temperature of 71°F, the expected symmetric interruption percentage is: $15.1\% + 2.61\% = 17.7\%$.

In the winter, heating degree days (base 65) (i.e., HDD) has a positive influence on symmetric interruption percentage. A lower daily average temperature results in a larger symmetric interruption percentage. The parameter estimate of HDD is 0.64 – that is, if the average daily temperature is less than 65°F, a 1°F decrease in temperature results in a 0.64 percent increase in the symmetric interruption percentage. But if the daily average temperature is greater than 65°F, then temperature does not affect the symmetric interruption percentage.

For example: for a water treatment facility, when a winter event happens after 3 PM, with a lead time of more than 15 minutes, and the average daily temperature is 35°F, the expected symmetric interruption percentage is 7.2 percent. At an average daily temperature of 34°F, the expected symmetric interruption percentage is: $7.2\% + 0.64\% = 7.8\%$.

7.2.2 Time of day effects

Time of day effects appear twice in the model: as a stand-alone term, and as interactions with temperature variables. In the summer, the stand-alone term is positive and larger than the other two, meaning that morning events result in higher load impacts compared to the other two time-of-day categories. The interaction of temperature and time of day has a negative effect in the load impact estimates, indicating that higher average temperatures reduce morning load reductions more than proportionally compared to the other two time-of-day categories.

In winter, both morning and early afternoon have significant load reductions compared to the late afternoon hours. As with summer, the interaction of temperature and time of day has a negative effect in the load impact estimates, indicating that lower average temperatures reduce

morning and early afternoon load reductions more than proportionally compared to the late afternoon.

In winter, afternoon events have the biggest symmetric interruption percentage, regardless of other factors.

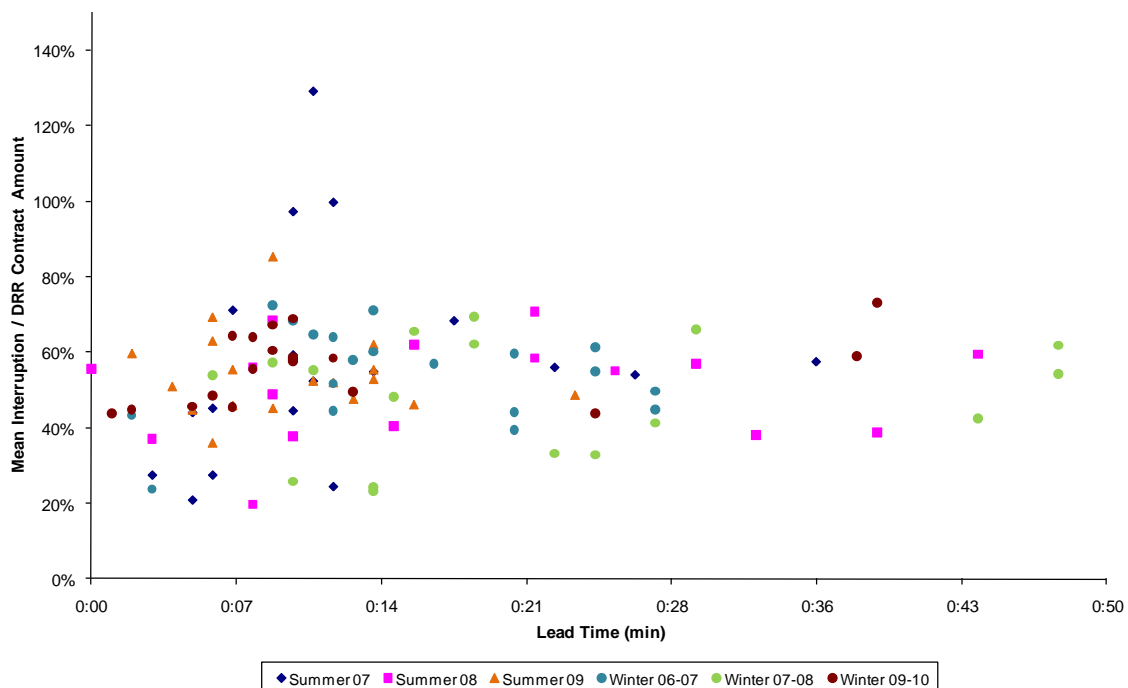
7.2.3 Lead time effects

Figure 7-1 charts event performance and the corresponding notification lead times. For the purposes of this model, lead time effects were analyzed in three different groups: Group 1: 0-9 minutes, Group 2: 10-15 minutes, and Group 3: 16 minutes or more. The impacts of groups 1 and 2 are measured relative to group 3 (the reference group for lead time).

In the summer, the effect of lead time is not statistically significant. However, the regression coefficients suggest that longer lead time results in better load reductions.

In winter, the medium lead time contributes to an increase in load reduction. The effects of short lead time and long lead time are both close to zero.

**Figure 7-1
Load Reduction Assets - DRRP Performance Vs Notification Lead Time**



7.2.4 Industry type effects

Industry type effects were analyzed by categorizing participants into five groups:

- Large Retail (Box)
- Grocery Stores (GStore)
- Educational Facilities (Edu)
- Manufacturing (Mnfc)
- Water pumping/water treatment facility (Wwtf)

In the regression, Wwtf is the reference industry type.

Industry type is used in the model as an interaction term with CDD or HDD.

In the summer season, water treatment facilities have the highest, and grocery stores have the lowest, symmetric interruption of all the industry types, regardless of time of day, lead time, or temperature. For example, a summer event with a long lead time on a day that is 70°F average, the expected symmetric load reduction percentage is 15.1% for water treatment facilities, 10.1% for educational facilities and for manufacturing, 10% for large retailers, and 9% for grocery stores.

Winter shows a similar conclusion. All other factors constant, grocery stores have a symmetric interruption percentage that is significantly lower than that of any other industry type. For example, a winter evening event with long lead time, on a day that is 35°F average, the expected symmetric load reduction is 7.2% for water treatment facilities, 2.7% for manufacturing, 1.5% for large retailers, and about 0 for grocery stores and educational facilities.

8. Performance by Industry

This section describes DRRP asset performance based on their main business activity. Due to the limited number of participants in each session, this analysis should not be construed as an indication of future performance – especially of potential assets that did not participate in the DRRP. The analysis, however, indicates that some industries are more likely to perform better than others.

For the purposes of this analysis, DRRP assets were grouped into the following classifications:

- Grocery Stores
- Manufacturing
- Large Retail
- Education Sector
- Wastewater Treatment Facilities
- Aggregated Air Conditioning Curtailment
- Generators (regardless of their industry of origin)

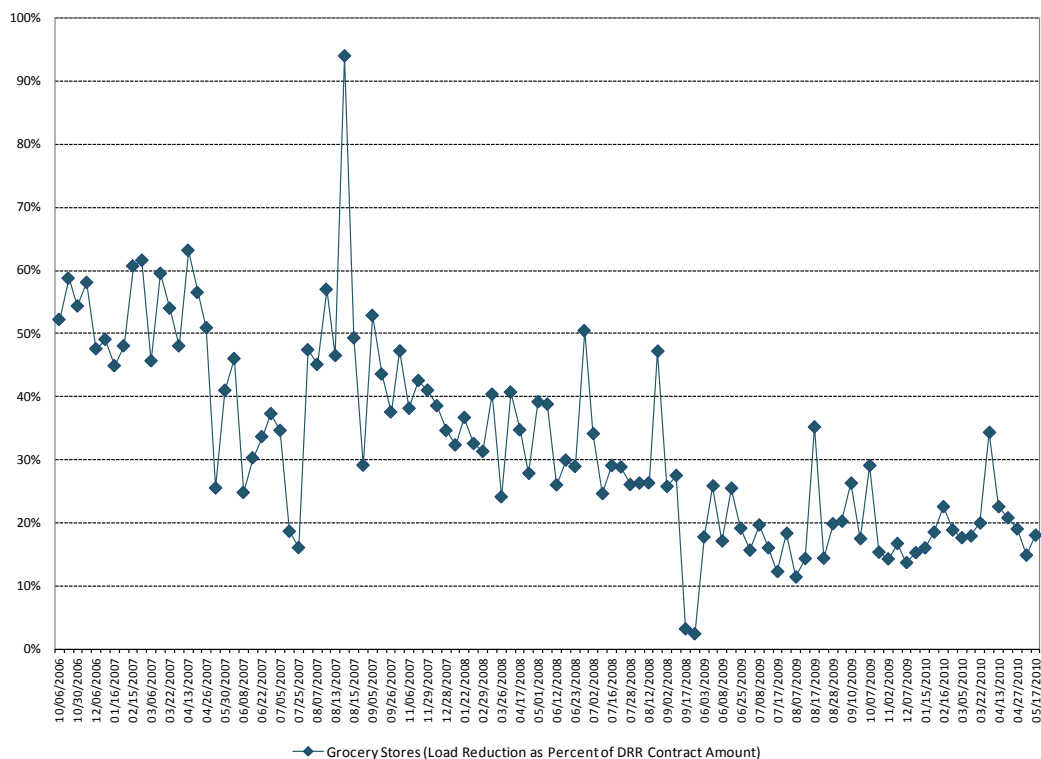
8.1 Grocery Stores

Grocery stores participated in all sessions of the DRRP. Their numbers ranged from 35 stores in the first session of the DRRP, to 76 stores in the fourth session (summer of 2008). Figure 8-1 reflects their average event performance over the 107 events. Their performance follows a downward trend across the first four sessions and relatively stable performance in the last two.

Their highest performance corresponds to the audit day in the summer of 2007. Their lowest performances correspond to two consecutive events in September of 2008. For this sector, these are the only two events where the sector's performance was not statistically different than zero.

As a group, grocery stores have the lowest average Theil's U values of the DRRP, averaging about 6 percent over all sessions. This means that in general, their calculated baseline is a very good representation of their load. More information about the use of the Theil's U is provided in Section 4 - Baseline Assessment.

Figure 8-1
DRRP Performance of Grocery Stores



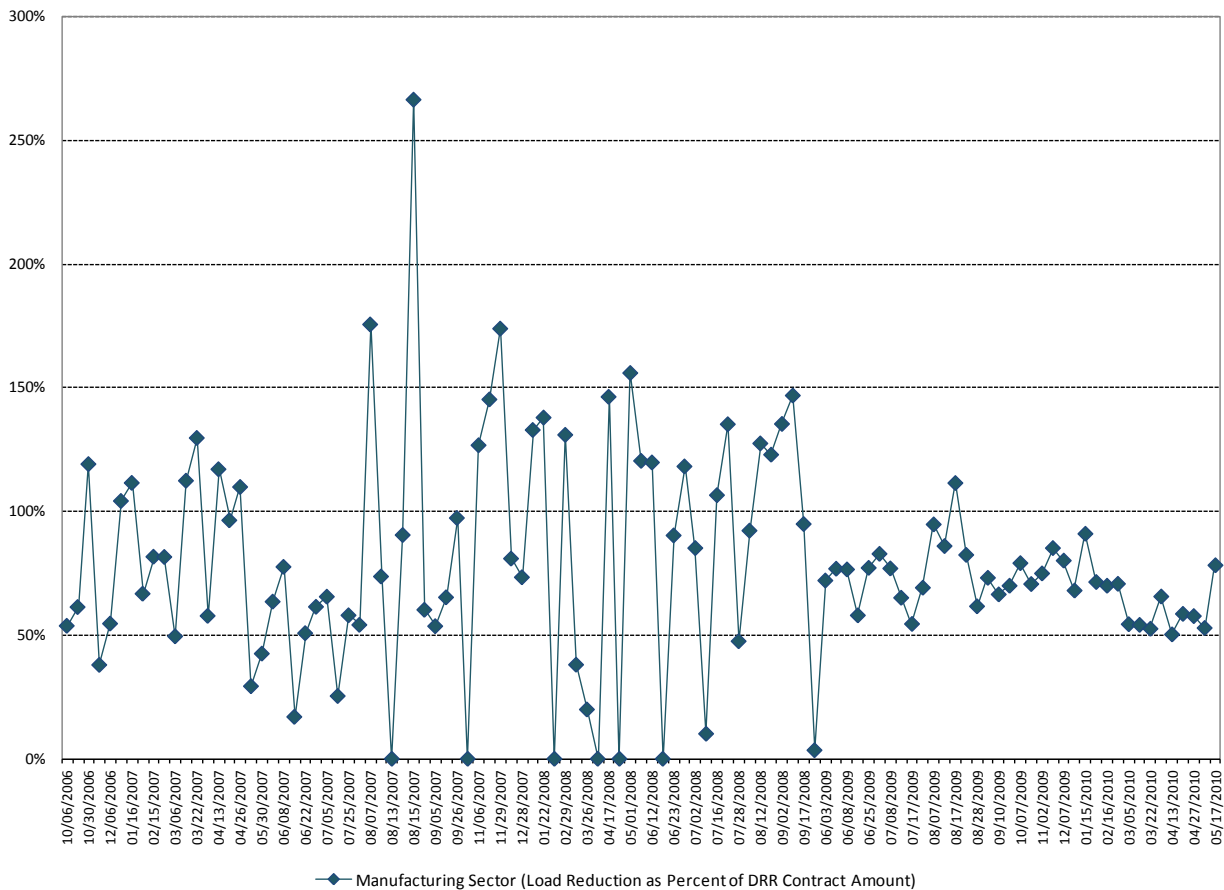
8.2 Manufacturing

There were one, two, or four manufacturing facilities participating in each session of the DRRP. Figure 8-2 reflects this sector's average event performance over the 107 events. Performance is erratic in the first four sessions and more stable in the last two.

As with grocery stores, these facilities had their highest performance on the audit day in the summer of 2007. At the time there were two manufacturing facilities participating in the DRRP. This sector also had several events with zero performance.

The Theil's U values for these participants range between 8 and 38 percent. Their average over all sessions is around 25 percent, meaning that the calculated baseline is a poor representation of their actual load. More information about the use of the Theil's U is provided in Section 4 - Baseline Assessment.

Figure 8-2
DRRP Performance of Manufacturing Facilities



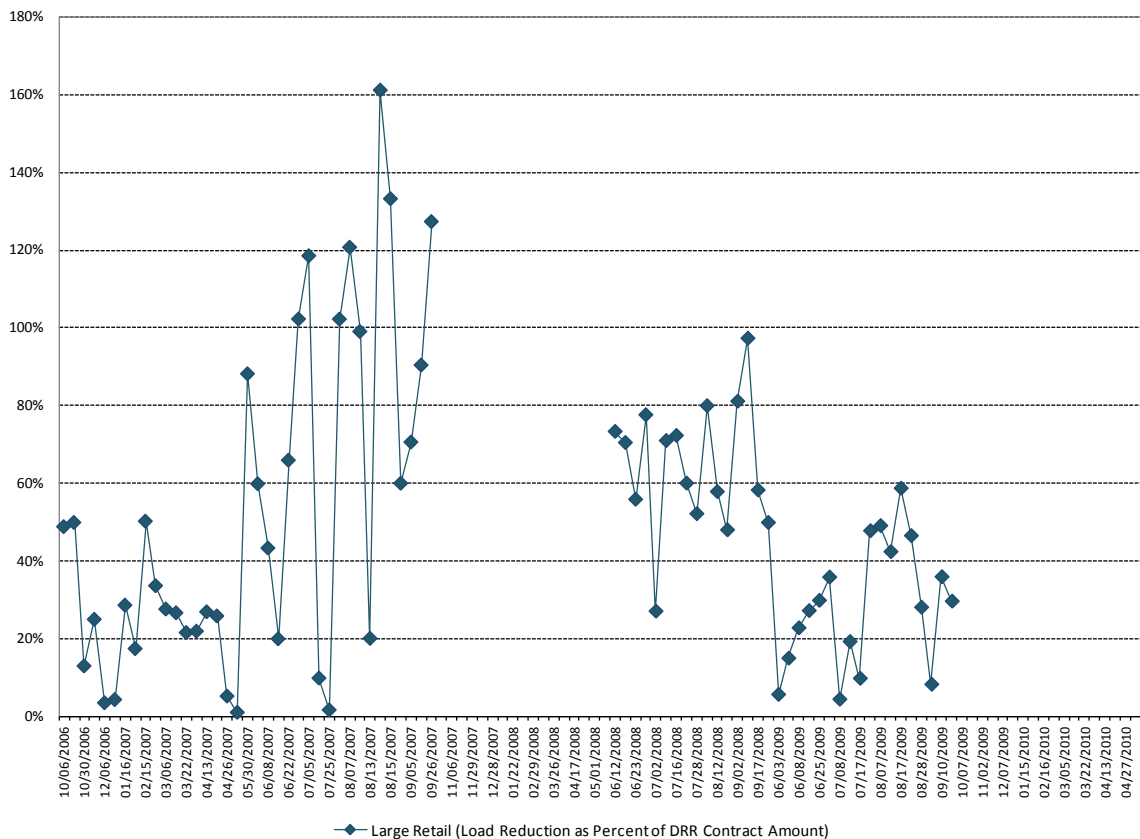
8.3 Large Retail

The DRRP had large retail facilities in its first two sessions (winter of 06/07 and summer of 2007), in the summer of 2008, and in the summer of 2009. Assets enrolled ranged from 5 stores in the first session to 13 stores in the summer of 2009. These facilities belong to major national chains that are often described as “big box” stores. Figure 8-3 reflects their average event performance of this group of assets.

The performance of this group is not stable. The sector’s best performance was on August 14, 2007 – one day prior to the audit day. Their second best performance was on the audit day. This group had several events with performance that was not statistically different than zero.

As a group, large retail has a very high Theil’s U. Their average over all sessions is around 22 percent, the second highest sector in the DRRP, meaning that the calculated baseline is a poor representation of their actual load. Individually, Theil’s U scores range from 5 to 83 percent. More information about the use of the Theil’s U is provided in Section 4 - Baseline Assessment.

Figure 8-3
DRRP Performance of Large Retail Facilities



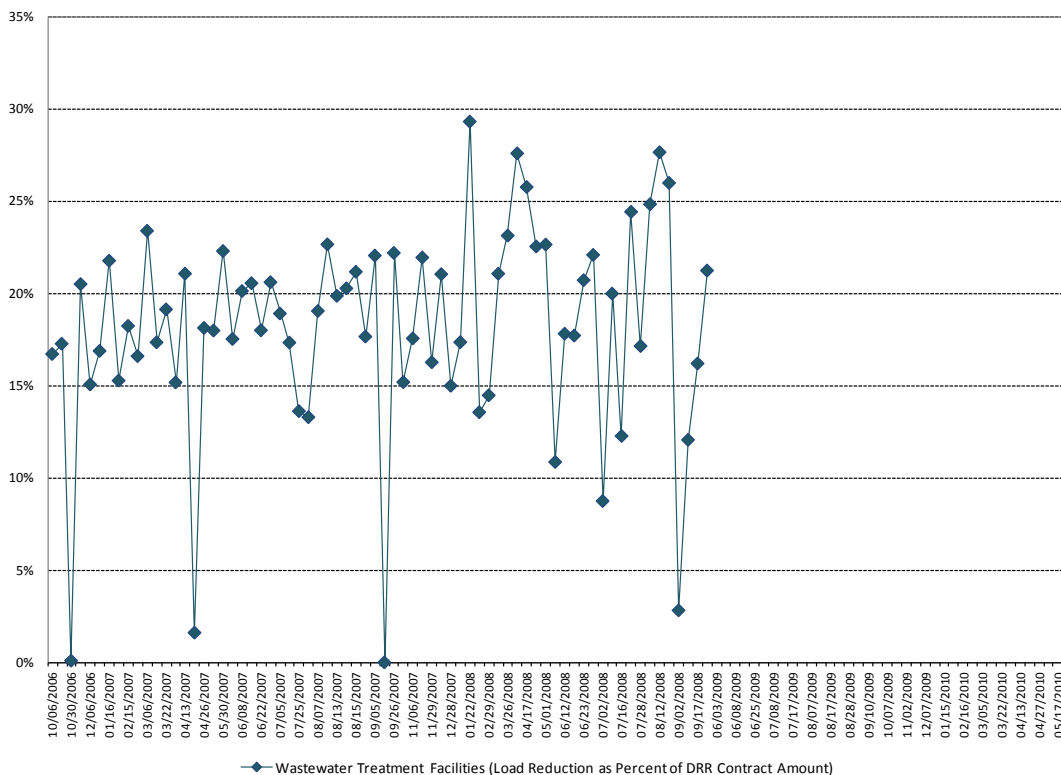
8.4 Wastewater Treatment

The DRRP had a wastewater treatment facility participating in the first four sessions of the DRRP. Figure 8-4 reflects its event performance.

The facility's best performance was at 29 percent of the estimated DRR Contract Amount¹³ in the winter of 07/08. Also, there were several events with performance that was not statistically different from zero.

The Theil's U for this facility ranged from 4 percent in one of the sessions to 30 percent in another. The average over all sessions is 12 percent, indicating that in general, the calculated baseline describes the load for this facility adequately. More information about the use of the Theil's U is provided in Section 4 - Baseline Assessment.

Figure 8-4
DRRP Performance of a Wastewater Treatment Facility



¹³ The reader is reminded that this facility did not have a DRR Contract Amount. The DRR Contract Amount was introduced in the last two sessions of the DRRP, when this facility was no longer participating. The DRR Contract Amount for it was calculated by applying the average percent of DRR Contract Amount to Enrolled Amount of other DRRP participants.

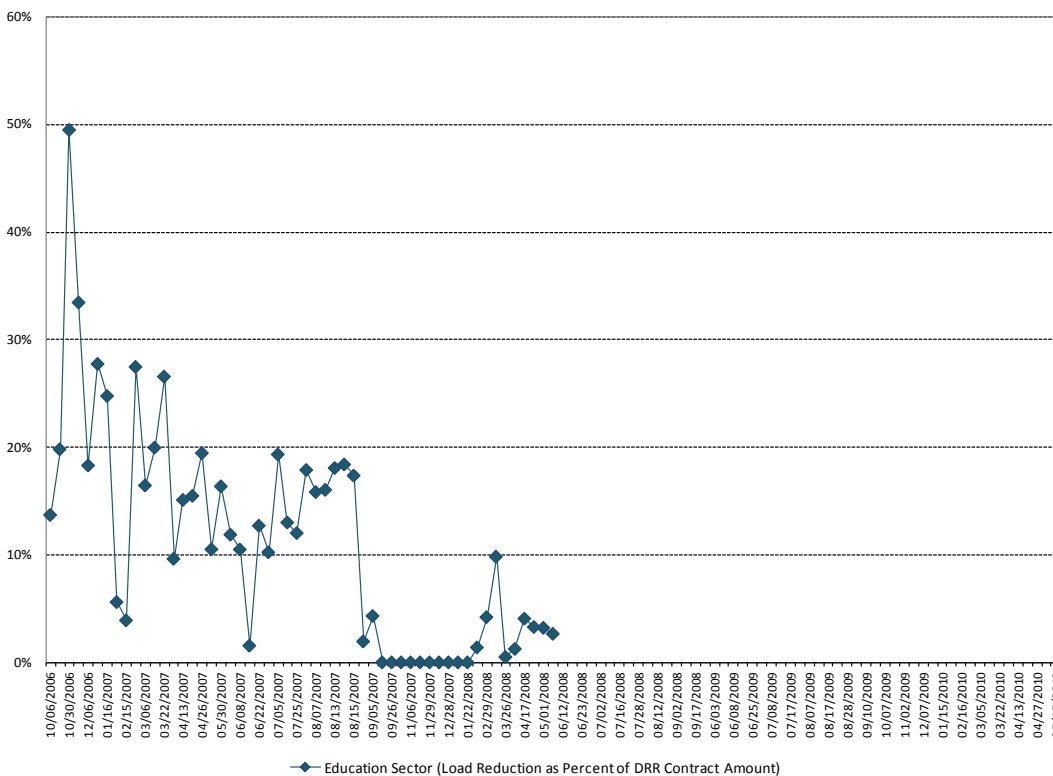
8.5 Education Sector

The DRRP had two Education Sector facilities in the first session of the DRRP, and one in the second and third sessions. Figure 8-5 reflects their event performance.

These facilities' best performance was at 50 percent of the estimated DRR Contract Amount¹⁴ in the winter of 06/07. This sector had many events with performance not statistically different from zero.

The Theil's U for this facility ranged from 8 to 17 percent. The average over all sessions is 13 percent, indicating that in general, the calculated baseline describes the load for these assets well. More information about the use of the Theil's U is provided in Section 4 - Baseline Assessment.

Figure 8-5
DRRP Performance of Education Sector Facilities



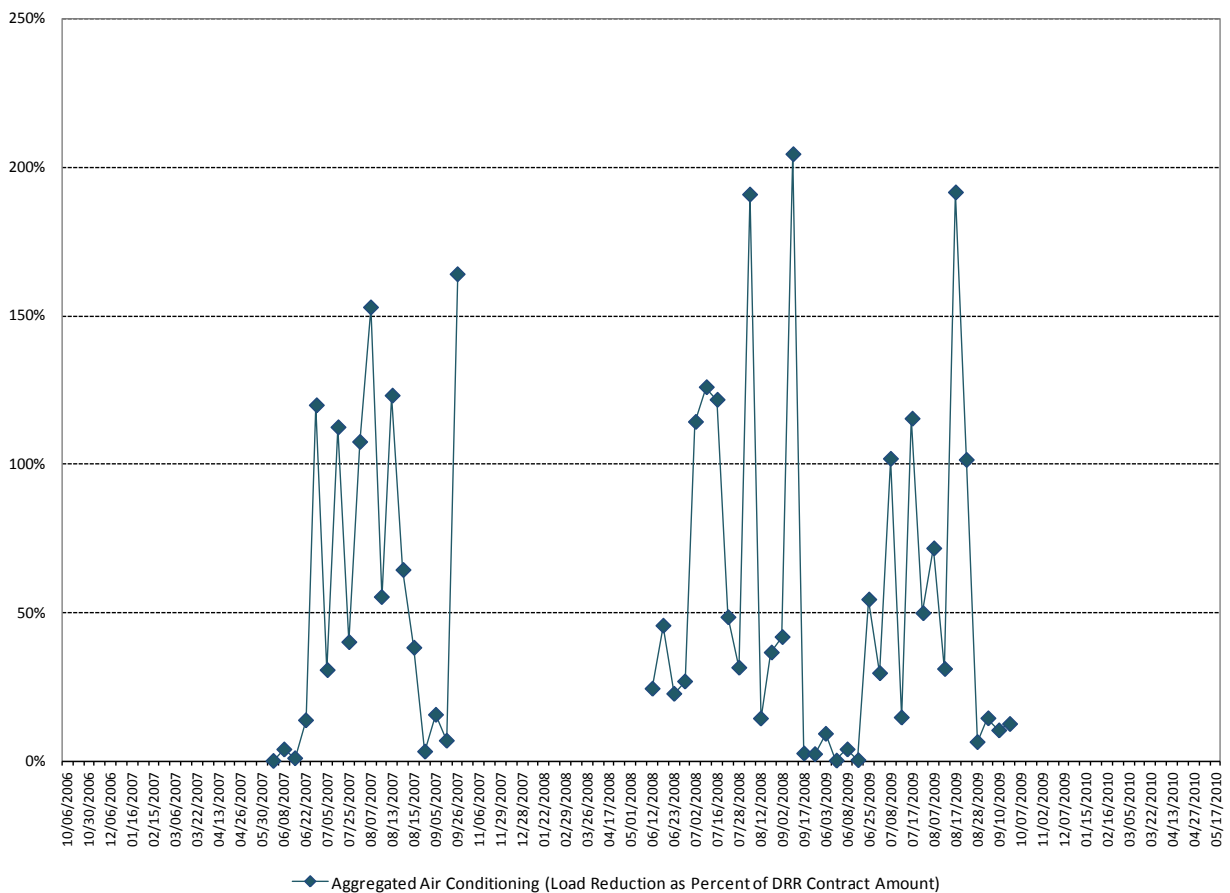
¹⁴ The reader is reminded that these facilities did not have a DRR Contract Amount while they were participating in the DRRP. The DRR Contract Amount was introduced in the last two sessions of the DRRP, when this facility was no longer participating. The DRR Contract Amount for it was calculated by applying the average percent of DRR Contract Amount to Enrolled Amount of other DRRP participants.

8.6 Direct Load Control

The DRRP had two Direct Load Control (aggregated residential air conditioning curtailment) assets in the three summer sessions of the DRRP. Figure 8-5 reflects their event performance.

These assets' highest performance was at 204 percent of the estimated DRR Contract Amount in the summer of 2008. There were also many events with performance that was not statistically different from zero. The nature of these assets makes them entirely weather-dependent – events in mild temperatures or events early in the day will result in little to no load reductions.

Figure 8-6
DRRP Performance of Direct Load Control
(Aggregated Residential Air Conditioning Curtailment)



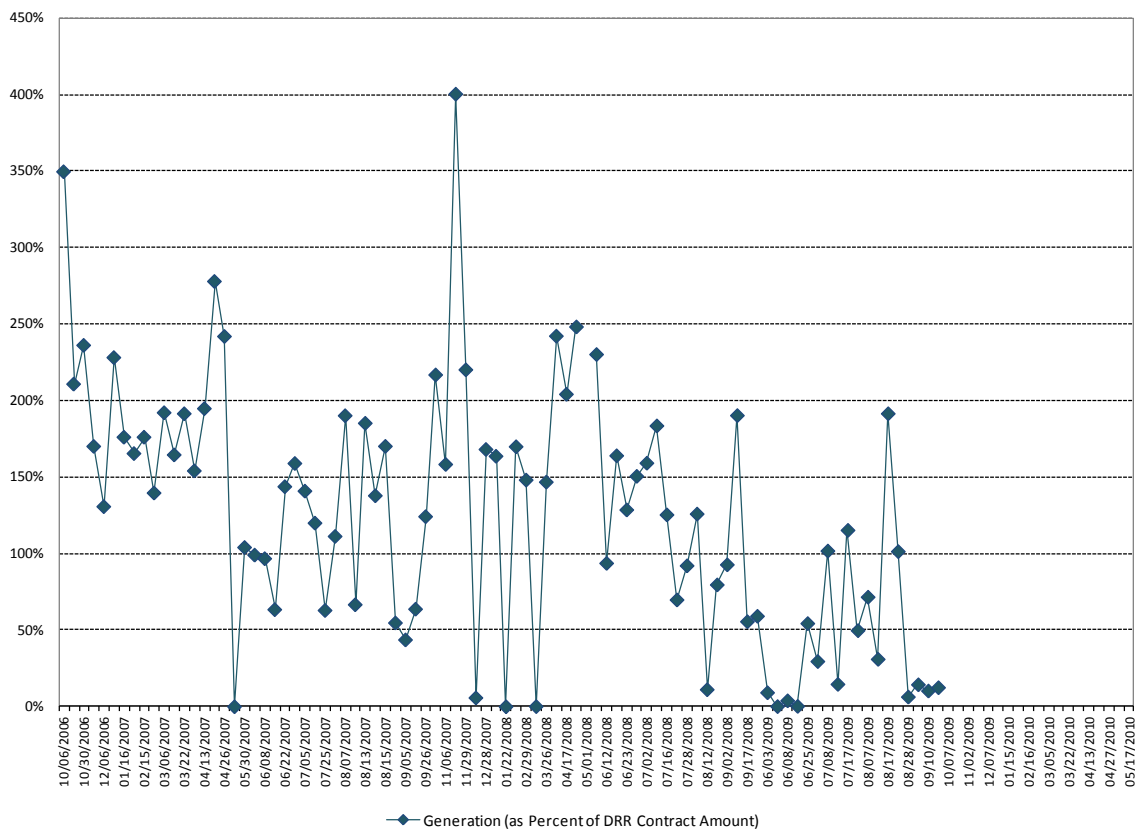
8.7 Generators

The DRRP had one or two behind-the-meter generators enrolled in the first five sessions of the DRRP. Figure 8-7 reflects their event performance.

These assets' highest performance was at 400 percent of the estimated DRR Contract Amount¹⁵ in the winter of 2007/2008. They have many events with performance that is not statistically different from zero.

Since these assets do not have baselines, the Theil's U is not calculated for them.

Figure 8-7
DRRP Performance of Generators



¹⁵ The reader is reminded that these assets did not have a DRR Contract Amount in the first five sessions of the DRRP. The DRR Contract Amount was introduced in the last two sessions of the DRRP. The DRR Contract Amount, applied to the first five sessions of the DRRP in order to facilitate comparisons, was calculated by applying the average percent of DRR Contract Amount to Enrolled Amount that was used in the summer of 2009.

9. Data Quality

An important criterion in determining whether DRRP assets can function effectively in the reserves market is whether they can provide high quality interval load data within the time frame specified by the ISO. Maintaining system reliability is dependent upon the submission of reliable interval load data in near real-time by resources providing reserves. Such data is used by the ISO to determine the response of reserve resources to dispatch instructions and, as a result of that response, to determine what other steps the ISO must take to preserve system reliability. If a resource is under- or over-responding, the ISO may need to take other actions within minutes or even seconds (e.g., issuing dispatch instructions to other resources) to address the likely deepening reliability problem that caused reserve resources to be dispatched in the first place. Making the best decisions for the situation at hand is a function of the data being submitted at each moment in time from the resources in the field. This section provides statistics regarding the reliability of the data provided by DRRP assets, and examples of the types of data issues encountered.

For the purposes of this report, the data is considered reliable, or of good quality, if it does not change with subsequent data submissions. Put another way, the term “reliability” as used in this section of the report does not refer to the accuracy of the load measurement. Rather, it refers to the submission of initial meter data values that do not change. Because the assets are obligated to submit settlement-ready data on the day of the event, it is assumed that the data is accurate and thus the accuracy of the load measurement was not within the scope of this project, though any future projects should assess load measurement accuracy.

Data quality was analyzed at two levels: (1) the event day, which considers all five-minute intervals between 6 AM and 8 PM on days in which there was a DRRP event, and (2) the time of event, which considers only the five-minute intervals during each event.

9.1 Summary of Event Day Data Changes

This section summarizes the number of assets that changed their event day data (as determined by the comparison of their first and last data submissions between the hours of 6 AM and 8 PM), and the respective impact on the day’s load. For the purposes of this analysis, we assessed changes in event day data resubmissions that were different from previous submissions by one percent or more, in one five-minute interval or more.

Table 9-1 presents detailed statistics comparing the impact of the first and last data submissions for each event day on the day's load and the customer baseline. These statistics measure whether the aggregated load calculated using the first data submission from all DRRP assets is a good estimate of the aggregated load calculated using the last data submission from all assets. Most assets did not resubmit data, or the data that they resubmitted is the same as the data they submitted the first time (in other words, the resubmission does not reflect a change). The statistics in Table 9-1 measure the impact of the assets that submitted data changes on the total event day load for all participating assets, including those that did not submit data changes.

The statistics presented in Table 9-1 are the following:

- Mean Percentage Error (MPE) is the average difference between the first and last data submissions as a percentage of the last data submission.
- Mean Absolute Percentage Error (MAPE) is the average absolute difference between the first and last data submissions as a percentage of the last data submission.
- Theil's U Statistic is the magnitude of error relative to the actual value, calculated as the ratio of the root-mean-square error to the root-mean-square of the difference between the first data submission and the last data submission.
- Number of Assets with Change $\geq 1\%$ indicates the percent of assets that had at least one data interval change by 1 percent or more between 6 AM and 8 PM.

Figure 9-1 shows the number of assets submitting changes (on the left axis), and the overall impact of those changes as represented by the Theil's U (on the right axis). It is apparent that there is no direct relationship between the two. Large changes by a few large assets will have a greater impact than many small changes.

Table 9-1 (DRRP Event Day Load Data Changes Summary) is discussed in the following subsection, in comparison to Table 9-2 (DRRP Time of Event Load Data Changes Summary).

Figure 9-1
Number of Assets with Data Changes on the Day of DRRP Event Vs Theil's U Statistic
(comparing first and last data submissions for all assets)

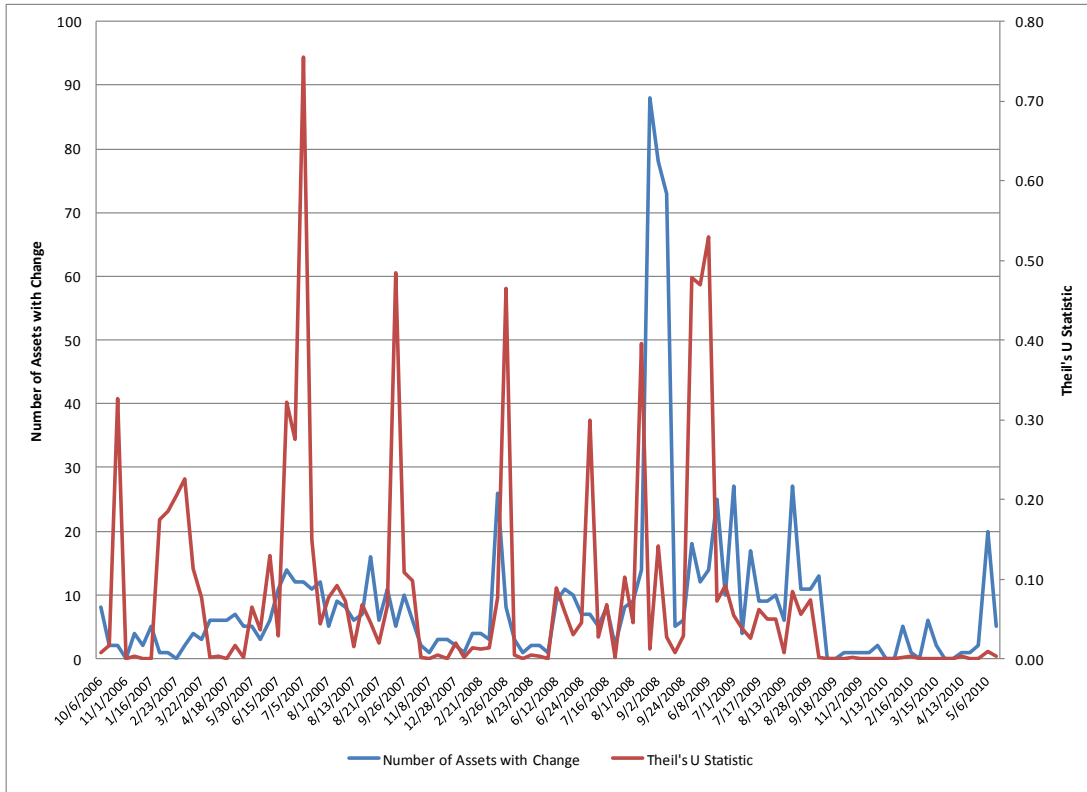


Table 9-1 - DRRP Event Day Load Data Changes Summary
Comparison of First and Last Data Submissions

Date	Event Day Load				Customer Baseline			
	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Percent of Assets with Change $\geq 1\%$	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Number of Assets with Change $\geq 1\%$
10/6/2006	-0.5%	0.5%	0.8%	4%	6.4%	7.4%	18.2%	15%
10/17/2006	-0.8%	0.8%	1.7%	2%	3.2%	4.2%	9.7%	4%
10/30/2006	0.2%	-0.7%	32.6%	4%	0.0%	0.0%	0.0%	0%
11/1/2006	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
12/6/2006	0.0%	0.0%	0.3%	4%	0.0%	0.1%	0.2%	4%
12/20/2006	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.1%	4%
1/16/2007	0.0%	0.0%	0.0%	0%	-1.9%	1.9%	14.0%	10%
2/1/2007	-0.5%	0.1%	17.4%	2%	0.0%	0.0%	0.3%	2%
2/15/2007	-0.5%	0.0%	18.5%	2%	-0.1%	0.1%	0.8%	2%
2/23/2007	-0.4%	-0.4%	20.5%	0%	0.0%	0.0%	0.0%	0%
3/6/2007	-2.5%	1.8%	22.6%	4%	-0.3%	0.3%	0.6%	2%
3/21/2007	-0.3%	0.4%	11.3%	6%	-1.4%	1.4%	2.9%	2%
3/22/2007	-0.6%	0.6%	7.7%	4%	-1.4%	1.4%	2.9%	2%
4/12/2007	0.0%	0.0%	0.2%	2%	-1.2%	1.2%	7.5%	13%
4/13/2007	0.0%	0.0%	0.2%	2%	-1.2%	1.2%	7.5%	13%
4/18/2007	0.0%	0.0%	0.0%	0%	-1.0%	1.0%	6.0%	13%
4/26/2007	0.0%	0.1%	1.7%	4%	-0.6%	0.6%	3.5%	13%
5/7/2007	0.0%	0.0%	0.2%	2%	-0.2%	0.2%	1.9%	10%
5/30/2007	-0.9%	1.0%	6.4%	10%	-0.5%	0.5%	3.6%	10%
6/6/2007	1.9%	-2.6%	3.6%	2%	0.1%	0.1%	0.2%	1%
6/8/2007	1.0%	-2.6%	13.0%	6%	0.1%	0.1%	0.2%	1%
6/15/2007	-0.1%	-0.3%	2.9%	11%	0.0%	0.0%	0.1%	1%
6/22/2007	1.4%	-3.1%	32.3%	9%	0.0%	0.1%	4.7%	9%
6/27/2007	0.1%	-1.7%	27.6%	6%	0.0%	0.1%	3.8%	9%
7/5/2007	-0.4%	1.1%	75.5%	10%	0.1%	0.2%	2.7%	6%
7/17/2007	0.1%	0.4%	14.8%	7%	0.1%	0.1%	0.8%	8%
7/25/2007	-0.3%	0.3%	4.3%	8%	0.1%	0.1%	0.5%	9%
8/1/2007	-0.9%	-0.2%	7.7%	6%	0.0%	0.0%	0.0%	1%
8/7/2007	-0.2%	-0.5%	9.2%	7%	0.0%	0.1%	0.3%	6%
8/9/2007	-0.3%	-0.2%	7.3%	6%	0.0%	0.1%	0.4%	6%
8/13/2007	-0.3%	0.4%	1.4%	3%	0.0%	0.1%	0.2%	6%
8/14/2007	-1.0%	0.3%	6.7%	4%	0.0%	0.0%	0.2%	4%
8/15/2007 *	-0.2%	-0.2%	4.5%	14%	0.0%	0.0%	0.2%	4%
8/21/2007	0.0%	0.0%	2.0%	4%	0.0%	0.0%	0.4%	4%
9/5/2007	-0.1%	0.7%	6.6%	11%	0.0%	0.1%	0.2%	6%
9/20/2007	-1.1%	0.5%	48.4%	3%	0.0%	0.1%	0.6%	2%

Table 9-1 - DRRP Event Day Load Data Changes Summary
Comparison of First and Last Data Submissions

Date	Event Day Load				Customer Baseline			
	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Percent of Assets with Change >= 1%	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Number of Assets with Change >= 1%
9/26/2007	10.1%	10.1%	10.8%	10%	0.2%	0.3%	0.8%	3%
10/24/2007	0.4%	0.4%	9.7%	5%	0.0%	0.0%	0.3%	4%
11/6/2007	0.0%	0.0%	0.2%	3%	0.0%	0.0%	0.0%	1%
11/8/2007	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	1%
11/29/2007	0.0%	0.0%	0.4%	3%	0.0%	0.0%	1.2%	1%
12/13/2007	0.0%	0.0%	0.1%	4%	0.0%	0.0%	0.0%	0%
12/28/2007	0.0%	0.1%	2.0%	3%	0.0%	0.0%	0.5%	1%
1/18/2008	0.0%	0.0%	0.2%	1%	0.0%	0.0%	0.1%	1%
1/22/2008	0.0%	0.1%	1.4%	4%	0.0%	0.0%	0.1%	3%
2/21/2008	0.2%	0.2%	1.2%	5%	0.1%	0.1%	1.1%	1%
2/29/2008	0.0%	0.2%	1.4%	4%	0.1%	0.1%	1.0%	1%
3/11/2008	0.0%	0.3%	7.7%	33%	0.0%	0.0%	0.0%	3%
3/26/2008	-0.1%	-0.1%	46.6%	8%	-0.3%	0.3%	1.0%	3%
3/27/2008	0.0%	0.0%	0.4%	4%	0.0%	0.0%	0.0%	0%
4/17/2008	0.0%	0.0%	0.0%	1%	0.0%	0.0%	0.0%	0%
4/23/2008	0.0%	0.0%	0.4%	1%	-0.4%	0.4%	2.6%	1%
5/1/2008	0.0%	0.0%	0.3%	1%	-0.3%	0.3%	1.6%	3%
5/21/2008	0.0%	0.0%	0.0%	0%	-0.1%	0.1%	0.6%	1%
6/12/2008	-0.4%	0.5%	8.9%	9%	0.0%	0.2%	1.6%	4%
6/19/2008	0.1%	0.5%	5.9%	10%	-0.2%	0.3%	1.9%	5%
6/23/2008	0.6%	-0.1%	3.0%	8%	-0.1%	0.2%	1.7%	4%
6/24/2008	0.1%	0.0%	4.6%	4%	-0.1%	0.2%	1.7%	4%
7/2/2008	1.9%	-1.3%	29.9%	8%	0.0%	0.1%	0.4%	3%
7/10/2008	-0.2%	0.1%	2.7%	4%	0.0%	0.0%	0.0%	1%
7/16/2008	-0.1%	0.2%	6.7%	9%	0.0%	0.0%	0.1%	0%
7/25/2008	0.0%	0.0%	0.1%	2%	0.0%	0.0%	0.0%	0%
7/28/2008	-0.2%	0.3%	10.2%	9%	0.0%	0.0%	0.0%	0%
8/1/2008	-0.2%	-0.1%	4.5%	8%	-1.5%	1.5%	6.6%	2%
8/12/2008	-1.6%	1.9%	39.6%	7%	-0.9%	0.9%	8.2%	10%
8/20/2008 *	0.2%	0.3%	1.3%	10%	-16.8%	16.8%	25.8%	96%
9/2/2008	2.0%	2.2%	14.1%	5%	-2.6%	2.6%	18.7%	84%
9/5/2008	0.0%	0.0%	2.8%	2%	-1.7%	1.7%	9.8%	78%
9/17/2008	0.1%	-0.1%	0.7%	2%	1.2%	1.3%	4.7%	3%
9/24/2008	0.0%	0.0%	2.9%	3%	0.8%	0.9%	3.4%	4%
6/3/2009	-2.9%	17.5%	47.8%	31%	33.5%	52.9%	44.4%	22%
6/4/2009	-3.7%	17.6%	46.9%	22%	33.5%	52.8%	44.3%	20%
6/8/2009	-2.9%	17.9%	53.0%	24%	38.3%	56.2%	42.1%	20%

Table 9-1 - DRRP Event Day Load Data Changes Summary
Comparison of First and Last Data Submissions

Date	Event Day Load				Customer Baseline			
	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Percent of Assets with Change >= 1%	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Number of Assets with Change >= 1%
6/17/2009	4.9%	5.0%	7.2%	45%	7.3%	7.3%	7.4%	4%
6/25/2009	6.0%	5.8%	9.1%	13%	4.5%	8.8%	7.5%	11%
7/1/2009	-4.2%	4.2%	5.3%	44%	2.0%	5.9%	6.6%	13%
7/8/2009	-2.3%	2.3%	3.8%	5%	-1.4%	1.4%	1.1%	5%
7/13/2009	0.2%	0.2%	2.6%	29%	-0.5%	0.5%	0.4%	9%
7/17/2009	-1.3%	1.3%	6.2%	13%	-0.3%	0.3%	0.4%	5%
7/24/2009	-2.0%	2.0%	4.9%	13%	-0.7%	0.7%	0.9%	7%
8/7/2009	-0.7%	1.6%	4.9%	11%	-1.2%	1.3%	1.7%	18%
8/13/2009	0.0%	0.0%	0.7%	2%	-0.2%	0.5%	0.6%	9%
8/17/2009 *	-0.4%	0.3%	8.5%	38%	-0.3%	0.5%	0.6%	11%
8/20/2009	-2.7%	2.7%	5.5%	13%	-0.5%	0.7%	2.4%	16%
8/28/2009	0.7%	2.6%	7.4%	11%	-0.7%	0.7%	3.2%	13%
9/8/2009	0.0%	0.0%	0.1%	24%	0.0%	0.0%	0.0%	0%
9/10/2009	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
9/18/2009	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
10/7/2009	0.0%	0.0%	0.0%	3%	0.0%	0.0%	0.0%	0%
10/16/2009	0.1%	0.1%	0.1%	3%	0.0%	0.0%	0.0%	0%
11/2/2009	0.0%	0.0%	0.0%	3%	0.0%	0.0%	0.0%	0%
11/20/2009	0.0%	0.0%	0.0%	3%	0.0%	0.0%	0.0%	0%
12/7/2009	0.0%	0.0%	0.0%	5%	0.0%	0.0%	0.0%	0%
1/13/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
1/15/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
2/3/2010	0.0%	0.2%	0.2%	13%	0.0%	0.0%	0.0%	0%
2/16/2010	0.1%	0.1%	0.3%	3%	0.0%	0.0%	0.0%	0%
2/24/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
3/5/2010	0.0%	0.0%	0.0%	15%	0.0%	0.0%	0.0%	0%
3/15/2010	0.0%	0.0%	0.0%	5%	0.0%	0.0%	0.0%	0%
3/22/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
3/23/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
4/13/2010	0.1%	0.1%	0.4%	3%	0.0%	0.0%	0.0%	0%
4/19/2010	0.0%	0.0%	0.0%	3%	0.0%	0.0%	0.0%	0%
4/27/2010	0.0%	0.0%	0.0%	5%	0.0%	0.0%	0.0%	0%
5/6/2010	0.4%	0.4%	0.9%	43%	0.0%	0.0%	0.0%	18%
5/17/2010	0.1%	0.1%	0.3%	13%	0.0%	0.0%	0.0%	0%

9.2 Summary of Time of Event Data Changes

Table 9-2 presents detailed statistics estimating the impact of the first and last data submissions for each event day at the time of the event only on the entire day's load and the customer baseline. These statistics measure whether the aggregated load calculated with the data from the first submission of all DRRP assets is a good estimate of the aggregated load that is calculated from the last data submission of all assets. Most assets did not resubmit data, or the data that they resubmitted is the same as the data they submitted the first time (in other words, the resubmission does not reflect a change). The statistics in Table 9-2 measure the impact of the assets that submitted data changes on the total event day load for all participating assets, including those that did not submit data changes.

The statistics presented in Table 9-2 are the following:

- Mean Percentage Error (MPE) is the average difference between the first and last data submissions as a percentage of the last data submission, for the time of the event only.
- Mean Absolute Percentage Error (MAPE) is the average absolute difference between the first and last data submissions as a percentage of the last data submission, for the time of the event only.
- Theil's U Statistic is the magnitude of error relative to the actual value, calculated as the ratio of the root-mean-square error to the root-mean-square of the difference between the first data submission and the last data submission, for the time of the event.
- Number of Assets with Change $\geq 1\%$ indicates the number of assets that had at least one 5-minute interval change 1 percent or more during the time of the event.

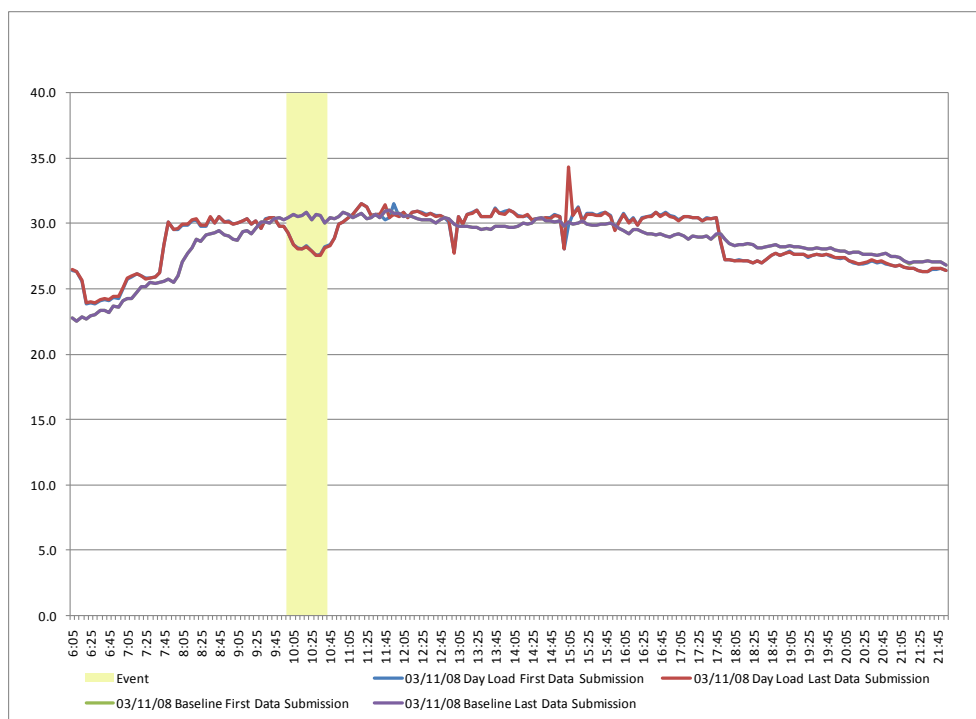
Tables 9-1 and 9-2 illustrate the following:

- Of the 107 DRRP events conducted:
 - Ninety-three (93) had event day load data changes by at least one asset, and 77 had event day baseline data changes by at least one asset (implying that the resubmitted data changed the calculated baseline).
 - Of these, 79 events had load data changes that affected the measured energy consumption during the time of the event, and 71 had load data changes that affected the baseline at the time of the event.

- The event with most event day load data changes is March 11, 2008. Twenty-six assets revised their data for this day. These changes resulted in a modest overall impact, resulting in a Theil's U of 7.7 percent.

Of these 26 assets, only 20 submitted changes that affected the time of the event. These also resulted in a modest impact, resulting in a Theil's U of 3.9 percent.

Figure 9-2
Data Changes for the DRRP Event of March 11, 2008



- The event with most baseline data changes is August 20, 2008 – an audit day. Eighty-seven assets submitted changes that resulted in a revised baseline for this day. These changes are significant: the corresponding Theil's U is 25.8 percent, and the mean absolute percentage error is 16.8 percent.

Of these 87 assets, 86 submitted changes that affected the baseline at the time of the event. These changes are significant: the Theil's U for the time of the event is 26.1 percent, and the mean absolute percentage error is 14.6 percent.

Figure 9-11, in one of the following sub-sections, illustrates these changes.

- The highest impact of event day load data changes (as determined by the Theil's U) was on July 5, 2007, when 9 assets submitted changes resulting in a Theil's U score of almost 76 percent. This is illustrated in Figure 9-3.

The mean percentage error is highest on September 26, 2007 (Figure 9-4). On this day, three large spikes were removed from the final data submission. However, the data changes had almost no impact at the time of the event. The mean absolute percentage error points to June 8, 2009 as the day when the data changes had the highest impact – 13 assets submitted data changes, resulting in a MAPE of 18 percent. This is illustrated in Figure 9-9.

The highest impact of load data changes at the time of the event was on March 26, 2008, when one asset submitted changes resulting in a Theil's U score of almost 85 percent. This is illustrated in Figure 9-5. Based on the mean absolute percentage error, September 2, 2008 is the day when the data changes had the highest impact – 3 assets submitted data changes, resulting in a MAPE of 20 percent. This is illustrated in Figure 9-6.

- The highest impact of baseline data changes (as determined by the Theil's U) was on June 3, 2009, when 12 assets submitted data changes that resulted in a Theil's U value of 44 percent. This is illustrated in Figure 9-7.

As with event day load, the MAPE indicates that changes to the baseline were highest on June 8, 2009. Eleven assets changed submitted changes that resulted in baseline changes with a MAPE of 56 percent. The corresponding Theil's U is also very high on this day, at about 42 percent. This is illustrated in Figure 9-9.

The highest impact of load data changes that resulted in baseline changes at the time of the event were on June 4, 2009 (based on the Theil's U, illustrated in Figure 9-8) and on June 8, 2009 based on the MAPE (Figure 9-9).

Only 16 of the 107 DRRP events have load data changes at the time of the event that result in a Theil's U statistic of 20 percent or more. While some of the data changes may have represented large changes for individual assets, most of them did not have a large effect on the aggregated data for all DRRP assets.

Figure 9-3
Data Changes for the DRRP Event of July 5, 2007

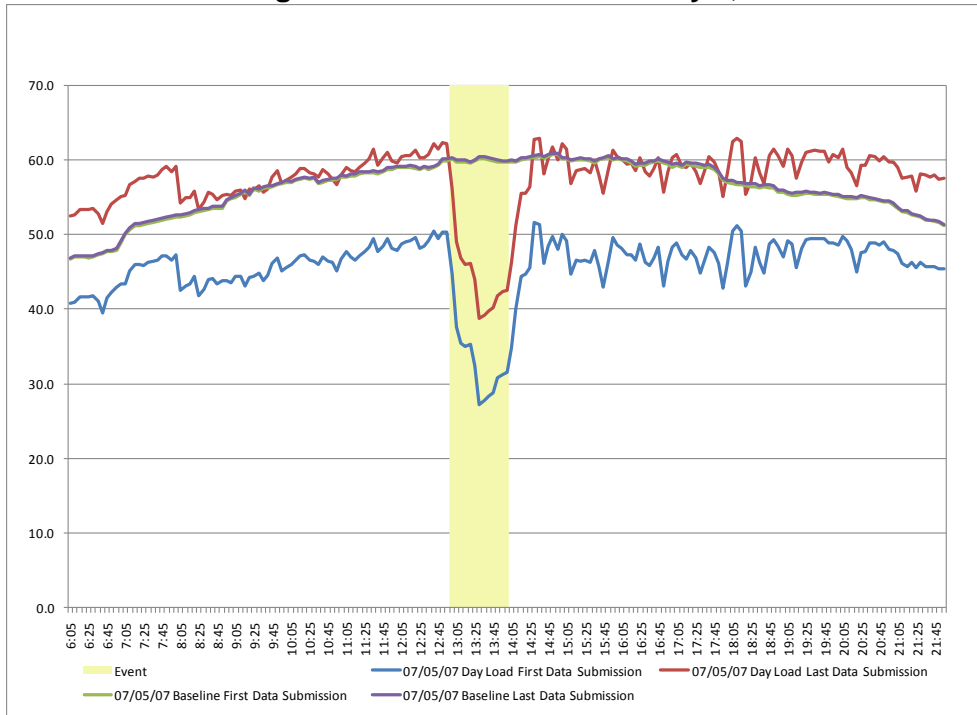


Figure 9-4
Data Changes for the DRRP Event of September 26, 2007

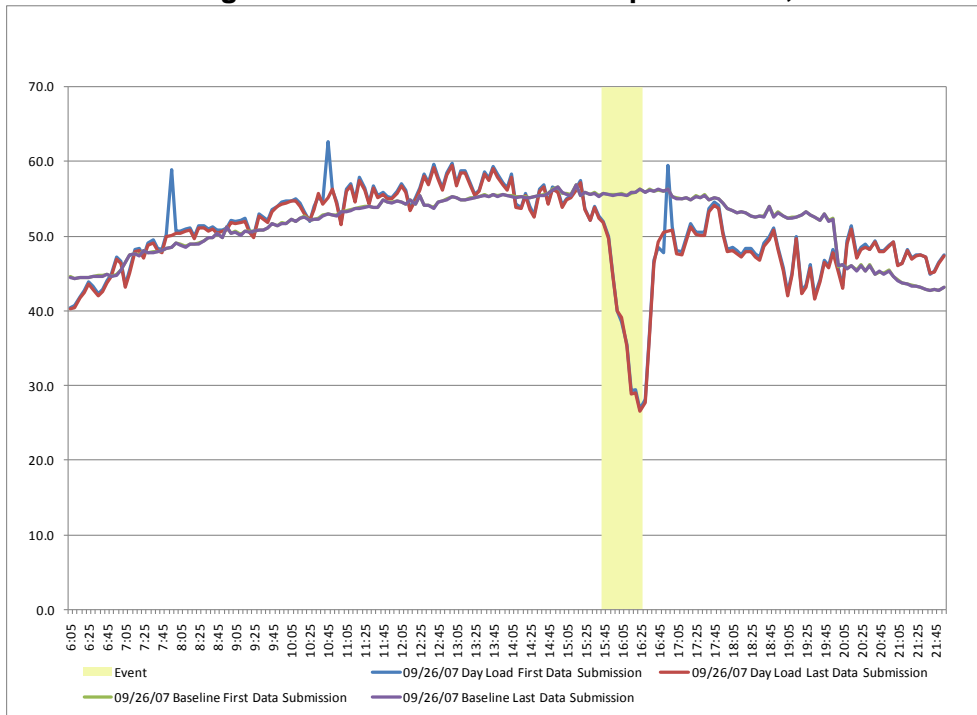


Figure 9-5
Data Changes for the DRRP Event of March 26, 2008



Figure 9-6
Data Changes for the DRRP Event of September 2, 2008

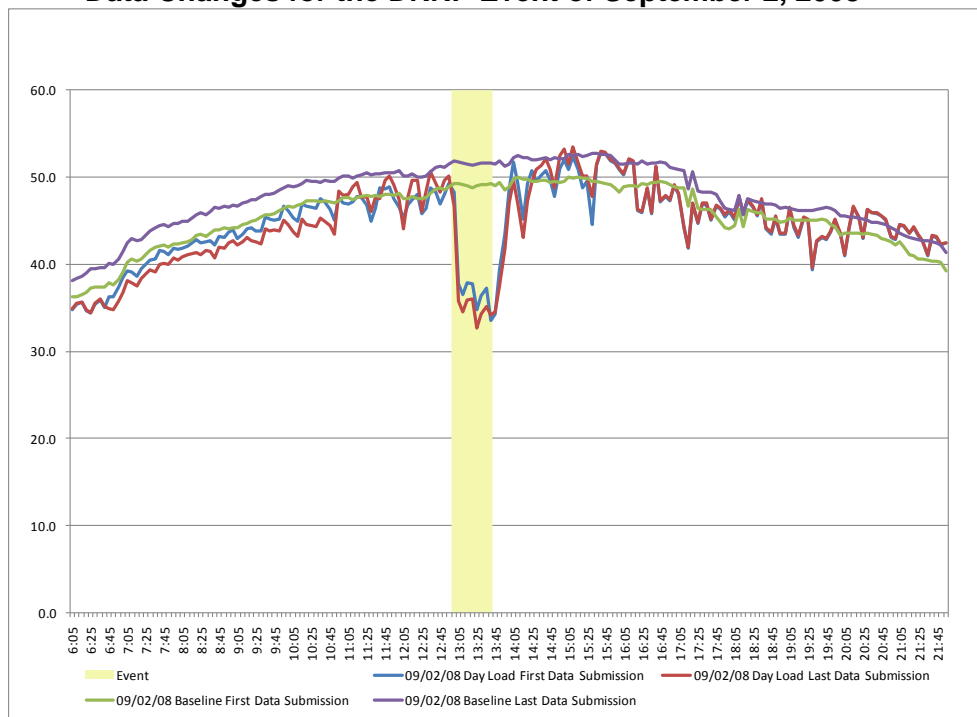


Figure 9-7
Data Changes for the DRRP Event of June 3, 2009

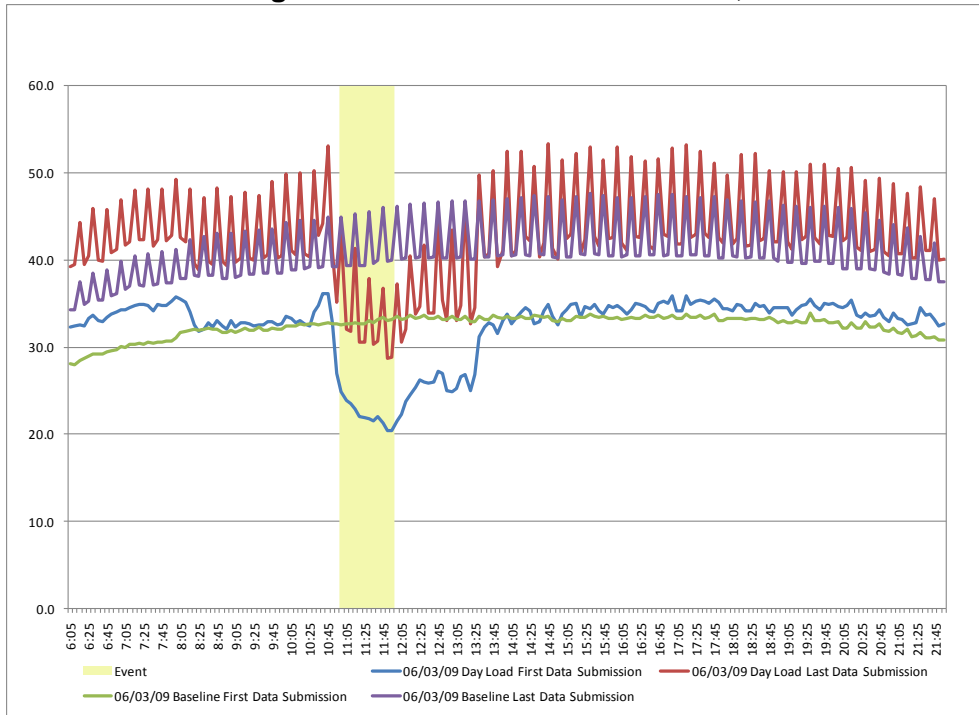


Figure 9-8
Data Changes for the DRRP Event of June 4, 2009

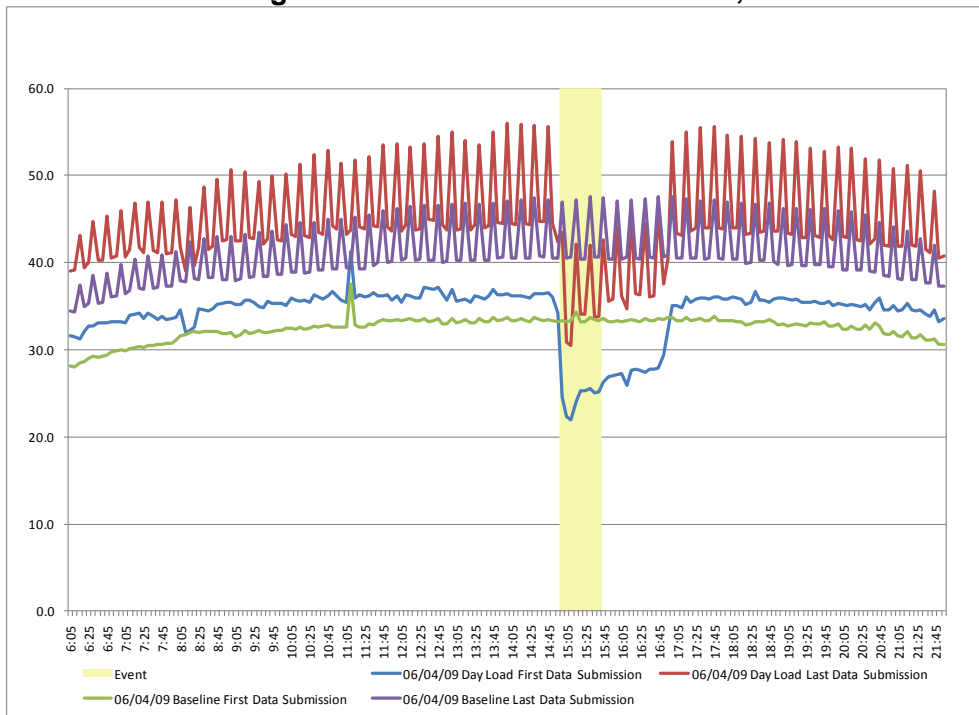


Figure 9-9
Data Changes for the DRRP Event of June 8, 2009

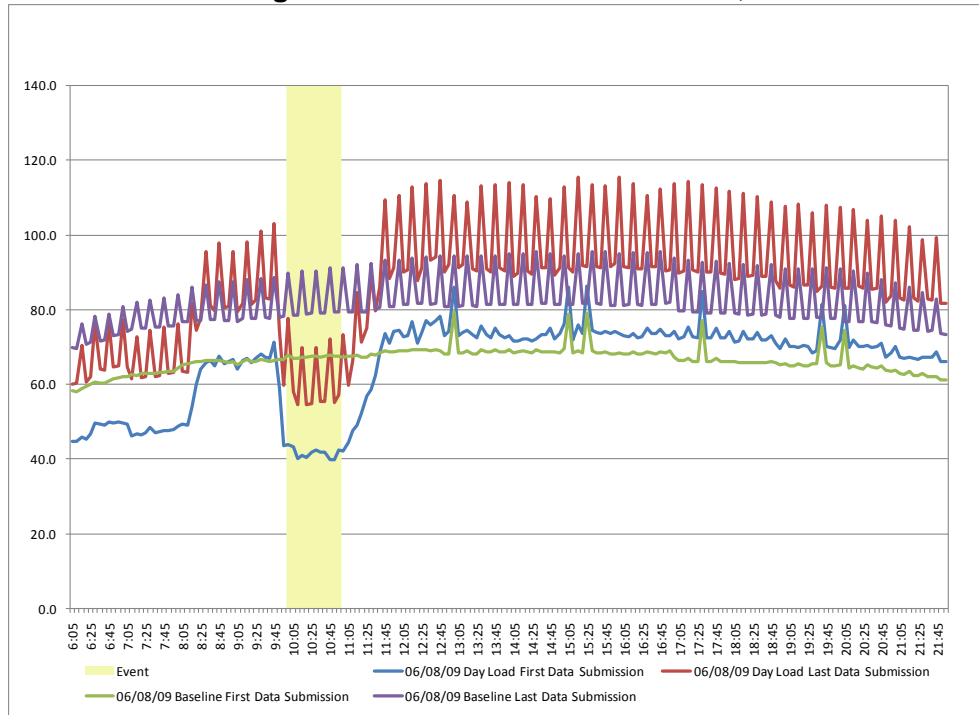


Table 9-2 - DRRP Time of Event Load Data Changes Summary
Comparison of First and Last Data Submissions

Date	Event Day Load				Customer Baseline			
	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Percent of Assets with Change >= 1%	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Percent of Assets with Change >= 1%
10/6/2006	-0.5%	0.5%	0.6%	2%	6.1%	6.9%	17.2%	4%
10/17/2006	-0.8%	0.8%	1.4%	2%	3.0%	4.0%	9.3%	4%
10/30/2006	-2.1%	-2.1%	68.7%	0%	0.0%	0.0%	0.0%	0%
11/1/2006	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
12/6/2006	0.0%	0.0%	0.1%	2%	-0.2%	0.2%	0.5%	2%
12/20/2006	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.1%	2%
1/16/2007	0.0%	0.0%	0.0%	0%	-2.0%	2.0%	13.9%	10%
2/1/2007	-2.4%	-1.8%	55.2%	2%	0.0%	0.0%	0.3%	2%
2/15/2007	-2.2%	-1.6%	55.2%	2%	-0.1%	0.1%	0.8%	2%
2/23/2007	-2.0%	-2.0%	54.2%	0%	0.0%	0.0%	0.0%	0%
3/6/2007	-4.3%	0.0%	62.1%	0%	-0.2%	0.2%	0.5%	2%
3/21/2007	-0.3%	0.4%	36.9%	6%	-1.5%	1.5%	3.2%	2%
3/22/2007	-0.3%	0.3%	7.6%	2%	-1.4%	1.4%	2.9%	2%
4/12/2007	0.0%	0.0%	0.0%	0%	-1.1%	1.1%	6.1%	13%
4/13/2007	0.0%	0.0%	0.0%	0%	-1.1%	1.1%	5.9%	13%
4/18/2007	0.0%	0.0%	0.0%	0%	-0.9%	0.9%	4.8%	13%
4/26/2007	0.2%	0.2%	3.5%	2%	-0.5%	0.5%	2.7%	13%
5/7/2007	0.0%	0.0%	0.0%	0%	-0.3%	0.3%	2.7%	10%
5/30/2007	-0.3%	1.1%	6.1%	10%	-0.7%	0.7%	4.3%	10%
6/6/2007	0.0%	0.0%	2.6%	2%	0.1%	0.1%	0.2%	1%
6/8/2007	-0.2%	-0.2%	2.9%	1%	0.1%	0.1%	0.2%	1%
6/15/2007	0.0%	0.0%	0.2%	6%	0.0%	0.0%	0.1%	1%
6/22/2007	-0.4%	-2.4%	17.6%	3%	0.0%	0.1%	4.3%	2%
6/27/2007	-1.9%	-1.9%	36.7%	2%	0.0%	0.1%	3.1%	2%
7/5/2007	0.2%	-0.2%	66.0%	4%	0.1%	0.2%	2.3%	3%
7/17/2007	-0.4%	0.1%	17.7%	6%	0.1%	0.1%	0.2%	3%
7/25/2007	-0.3%	0.3%	1.0%	2%	0.1%	0.1%	0.3%	2%
8/1/2007	-1.2%	-0.6%	11.8%	3%	0.0%	0.0%	0.0%	0%
8/7/2007	0.2%	-1.0%	10.3%	3%	0.0%	0.1%	0.2%	2%
8/9/2007	-1.1%	-0.4%	11.5%	3%	-0.1%	0.1%	0.3%	2%
8/13/2007	-0.3%	0.3%	1.1%	1%	0.0%	0.1%	0.2%	3%
8/14/2007	-1.4%	0.1%	8.8%	3%	0.0%	0.0%	0.1%	2%
8/15/2007 *	-0.4%	-0.4%	7.3%	3%	0.0%	0.0%	0.1%	2%
8/21/2007	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.1%	2%
9/5/2007	-0.4%	0.0%	2.1%	4%	0.0%	0.1%	0.2%	2%
9/20/2007	-0.8%	0.8%	51.3%	2%	0.0%	0.1%	0.7%	2%
9/26/2007	9.1%	9.1%	4.0%	4%	0.2%	0.3%	0.8%	3%
10/24/2007	0.0%	0.0%	0.3%	1%	0.0%	0.0%	0.0%	1%

Table 9-2 - DRRP Time of Event Load Data Changes Summary
Comparison of First and Last Data Submissions

Date	Event Day Load				Customer Baseline			
	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Percent of Assets with Change >= 1%	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Percent of Assets with Change >= 1%
11/6/2007	0.0%	0.0%	0.2%	1%	0.0%	0.0%	0.0%	0%
11/8/2007	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
11/29/2007	0.0%	0.0%	0.0%	0%	0.0%	0.0%	1.0%	1%
12/13/2007	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
12/28/2007	-0.1%	0.1%	0.1%	1%	0.0%	0.0%	0.3%	1%
1/18/2008	0.0%	0.1%	0.3%	1%	0.0%	0.0%	0.1%	1%
1/22/2008	-0.2%	0.2%	1.1%	1%	0.0%	0.0%	0.1%	3%
2/21/2008	0.3%	0.3%	0.9%	3%	0.2%	0.2%	1.5%	1%
2/29/2008	0.0%	0.1%	0.6%	1%	0.1%	0.1%	1.0%	1%
3/11/2008	0.2%	0.2%	0.8%	9%	0.0%	0.0%	0.0%	0%
3/26/2008	-0.9%	-0.9%	84.7%	1%	-0.3%	0.3%	1.0%	3%
3/27/2008	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
4/17/2008	0.0%	0.0%	0.0%	1%	0.0%	0.0%	0.0%	0%
4/23/2008	0.0%	0.0%	0.0%	0%	-0.4%	0.4%	2.5%	1%
5/1/2008	0.0%	0.0%	0.0%	0%	-0.3%	0.3%	1.5%	3%
5/21/2008	0.0%	0.0%	0.0%	0%	-0.1%	0.1%	0.6%	1%
6/12/2008	-0.5%	0.8%	9.8%	8%	0.0%	0.2%	1.7%	3%
6/19/2008	-0.1%	0.5%	5.6%	4%	-0.2%	0.3%	2.0%	4%
6/23/2008	0.9%	-0.6%	4.2%	5%	-0.1%	0.2%	1.6%	3%
6/24/2008	0.3%	0.0%	4.9%	4%	-0.1%	0.2%	1.6%	3%
7/2/2008	-0.1%	0.5%	9.6%	8%	0.0%	0.1%	0.3%	3%
7/10/2008	-0.1%	0.1%	2.2%	3%	0.0%	0.0%	0.0%	0%
7/16/2008	-0.4%	0.4%	2.9%	2%	0.0%	0.0%	0.1%	0%
7/25/2008	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
7/28/2008	-0.6%	0.3%	14.6%	5%	0.0%	0.0%	0.1%	0%
8/1/2008	-0.1%	-0.1%	4.2%	2%	-1.5%	1.5%	6.6%	2%
8/12/2008	-1.6%	2.0%	49.7%	5%	-0.7%	0.7%	7.6%	3%
8/20/2008 *	0.1%	0.1%	0.4%	2%	-14.6%	14.6%	26.1%	95%
9/2/2008	19.4%	20.0%	20.3%	3%	-2.2%	2.2%	19.7%	5%
9/5/2008	0.0%	0.0%	0.9%	1%	-1.1%	1.1%	8.7%	31%
9/17/2008	0.1%	-0.1%	0.7%	2%	1.3%	1.4%	5.1%	3%
9/24/2008	0.0%	0.0%	2.7%	3%	0.9%	1.0%	3.6%	4%
6/3/2009	-2.3%	19.3%	80.0%	24%	31.0%	51.0%	45.4%	18%
6/4/2009	-2.5%	19.0%	76.6%	22%	32.4%	51.9%	47.2%	18%
6/8/2009	-0.7%	17.3%	81.4%	20%	36.2%	54.6%	41.9%	18%
6/17/2009	5.1%	5.5%	12.5%	24%	7.2%	7.2%	8.0%	2%
6/25/2009	5.2%	5.2%	17.7%	5%	4.5%	8.8%	8.1%	11%
7/1/2009	-4.0%	4.0%	5.4%	15%	1.9%	5.9%	6.9%	9%

Table 9-2 - DRRP Time of Event Load Data Changes Summary
Comparison of First and Last Data Submissions

Date	Event Day Load				Customer Baseline			
	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Percent of Assets with Change >= 1%	Mean Percentage Error (MPE)	Mean Absolute Percentage Error (MAPE)	Theil's U Statistic	Percent of Assets with Change >= 1%
7/8/2009	-2.2%	2.3%	6.2%	5%	-1.3%	1.3%	1.3%	4%
7/13/2009	0.7%	-0.7%	3.7%	15%	-0.6%	0.6%	0.4%	4%
7/17/2009	-1.5%	1.5%	7.1%	7%	-0.3%	0.3%	0.4%	2%
7/24/2009	-2.1%	1.9%	4.7%	7%	-0.7%	0.7%	1.0%	5%
8/7/2009	0.9%	2.4%	21.1%	11%	-1.5%	1.5%	2.0%	13%
8/13/2009	0.0%	0.0%	0.2%	2%	0.0%	0.4%	0.6%	5%
8/17/2009 *	-0.6%	0.1%	3.9%	36%	-0.1%	0.5%	0.7%	9%
8/20/2009	-3.0%	3.0%	7.5%	7%	-0.8%	0.8%	2.4%	11%
8/28/2009	-1.3%	1.3%	11.5%	9%	-0.6%	0.6%	3.4%	11%
9/8/2009	0.0%	0.0%	0.1%	2%	0.0%	0.0%	0.0%	0%
9/10/2009	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
9/18/2009	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
10/7/2009	0.0%	0.0%	0.2%	3%	0.0%	0.0%	0.0%	0%
10/16/2009	0.1%	0.1%	0.3%	3%	0.0%	0.0%	0.0%	0%
11/2/2009	0.0%	0.0%	0.1%	3%	0.0%	0.0%	0.0%	0%
11/20/2009	0.0%	0.1%	0.2%	3%	0.0%	0.0%	0.0%	0%
12/7/2009	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
1/13/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
1/15/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
2/3/2010	0.1%	0.4%	0.3%	10%	0.0%	0.0%	0.0%	0%
2/16/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
2/24/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
3/5/2010	0.0%	0.0%	0.2%	3%	0.0%	0.0%	0.0%	0%
3/15/2010	0.0%	0.0%	0.2%	3%	0.0%	0.0%	0.0%	0%
3/22/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
3/23/2010	0.0%	0.0%	0.0%	0%	0.0%	0.0%	0.0%	0%
4/13/2010	-0.2%	0.2%	1.2%	3%	0.0%	0.0%	0.0%	0%
4/19/2010	0.0%	0.0%	0.1%	3%	0.0%	0.0%	0.0%	0%
4/27/2010	0.0%	0.0%	0.1%	3%	0.0%	0.0%	0.0%	0%
5/6/2010	0.1%	0.2%	0.3%	18%	0.0%	0.0%	0.0%	0%
5/17/2010	0.1%	0.2%	0.8%	8%	0.0%	0.0%	0.0%	0%

9.3 Data Changes Affecting Audit Days

Data changes affecting audit days are of interest because they may entail financial repercussions to the assets and the ISO, since part of the compensation for participating in the DRRP was set on these days. There were three audit days – one for each summer session of the DRRP. None of the data resubmissions for these events resulted in major changes in the event day load. However, data resubmissions resulted in a major change in the baseline load for one of the audit days.

The details regarding each audit day are as follows:

- **August 15, 2007** is illustrated in Figure 9-10. Thirteen assets submitted changes to their event day load. Of these, only three submitted changes that affected their event time load. The changes for both the day's load and the event load are modest, resulting in Theil's U scores of 4.5 percent and 7.3 percent, respectively.

There were four assets that submitted changes that affected their baseline. Of these, only two submitted changes that affected their baseline during the event period. The changes to both are minimal, resulting in Theil's U Scores of less than 0.5 percent each.

- **August 20, 2008** is illustrated in Figure 9-11. Nine assets submitted changes to their event day load. Of these, only two submitted changes that affected their event time load. The changes for both the day's load and the event load are modest, resulting in Theil's U scores of 1.3 and 0.4 percent, respectively.

Of the 92 assets enrolled at the time of this event, 87 assets submitted changes that affected their baseline. Of these, 86 assets submitted changes that affected their baseline during the event period. The changes to both the event day baseline and the time of event baseline are substantial, resulting in Theil's U Scores of 25.8 and 26.1 percent, respectively. These pronounced changes are visible in Figure 9-11: the green line represents the baseline calculated with the first data submission, and the purple line represents the baseline calculated with the last data submission.

- **August 17, 2009** is illustrated in Figure 9-12. Twenty-one assets submitted changes to their event day load. Of these, 20 submitted changes that affected their event period load, making it the event period with the highest number of changes in the DRRP. The

changes for both the day's load and the event period load are modest, resulting in Theil's U scores of 8.5 percent and 3.5 percent, respectively.

There were six assets that submitted changes that affected their baseline. Of these, only five submitted changes that affected their baseline during the event period. The changes to both are minimal, resulting in Theil's U Scores of less than one percent for each.

Figure 9-10
Data Changes for the DRRP Audit Day of August 15, 2007

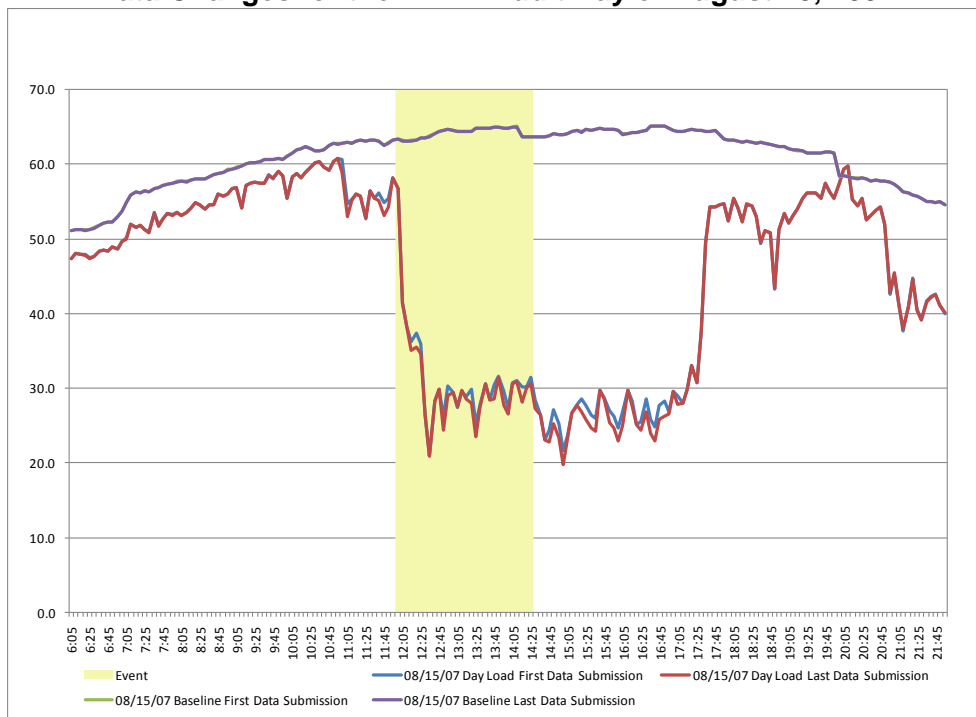


Figure 9-11
Data Changes for the DRRP Audit Day of August 20, 2008

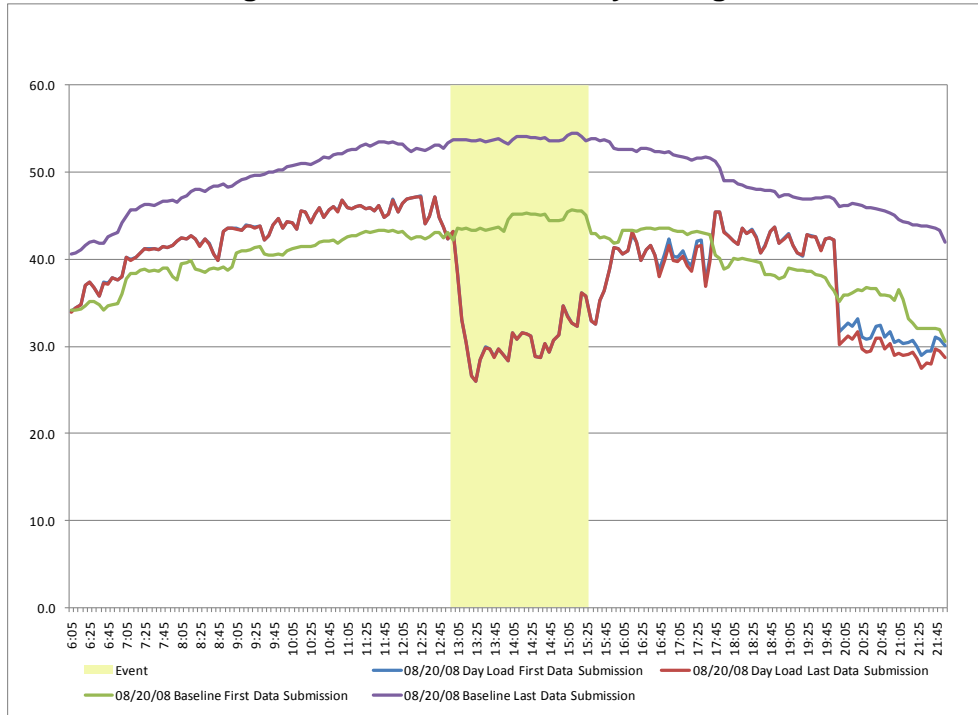
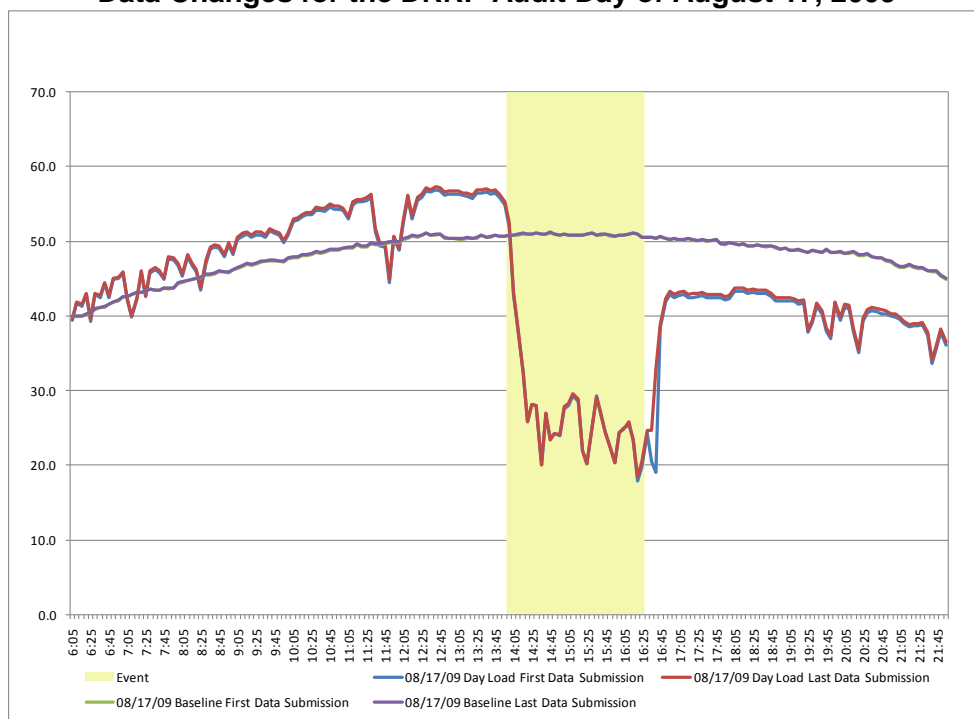


Figure 9-12
Data Changes for the DRRP Audit Day of August 17, 2009

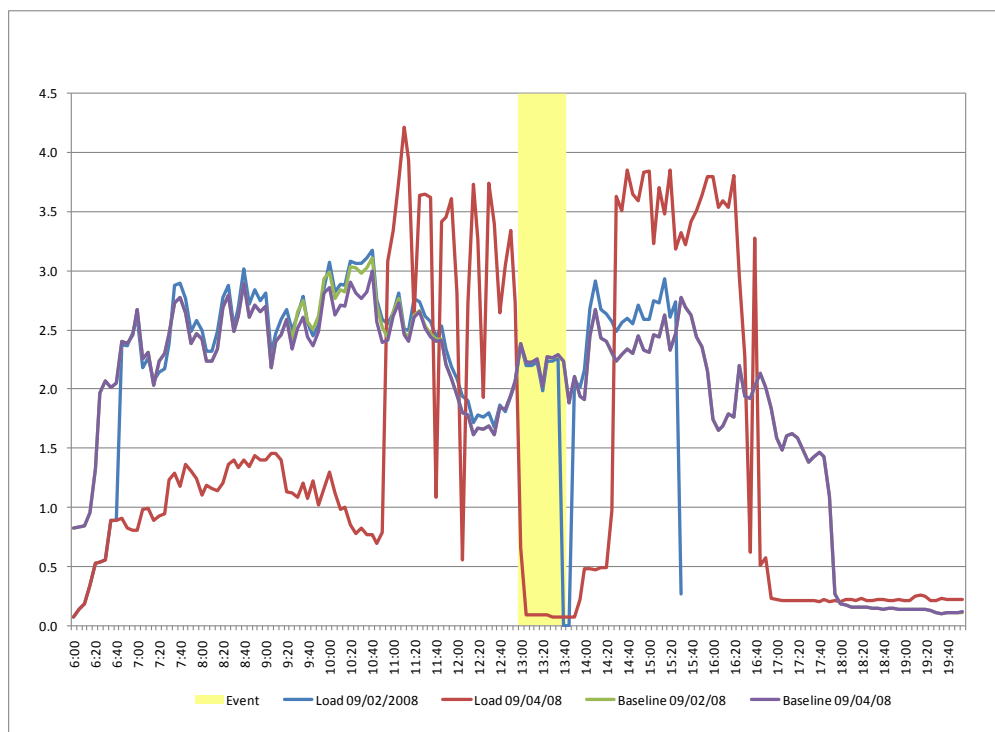


9.4 Examples of Individual Assets with Data Quality Issues

This section includes individual asset examples that illustrate data quality issues, defined as changes to data that was previously submitted. As mentioned earlier, this section does not discuss measurement accuracy of the assets' load – only whether it changed after its first submission. These examples are of extreme cases and are not representative of the majority of the assets in the DRRP – the majority of assets did not have data quality issues. The purpose of focusing on these extreme cases is to explore the data changes impact at the individual asset level, and to potentially use as a starting point for future rules regarding data submissions by assets in similar circumstances.

The following charts include a few examples of data that changed over the course of the data submission period. Each chart reflects the data for an individual asset, for one calendar day. The multiple lines on the chart (and their respective dates) reflect the number of changes to the data, and the dates on which it changed. For example, Figure 9-13 is data for September 2, 2008, for Asset 1. This data was first provided on September 2 (blue line) and overwritten on September 4 (red line.)

Figure 9-13
Data is subsequently overwritten with different data



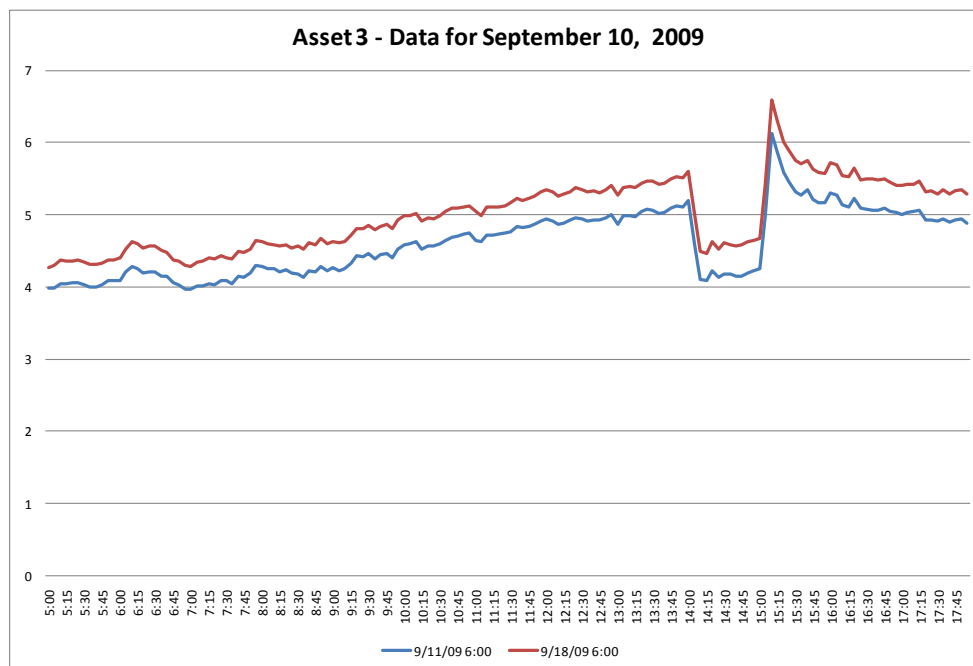
On September 2, 2008, the DRRP event ran from 1 to 1:45 PM. Figure 9-13 shows that on this day, data for this asset was provided up to about 3:30 PM. Two days later, the data was overwritten.

Some interesting discrepancies between the separate data submissions are:

- The second data submission indicates a significant difference in the energy consumption pattern from the original submission.
- The first data submission (blue line) is very similar to the customer baseline (purple line).
- The original data submission indicates no response to the event.
- The consumption during the customer baseline adjustment window (the two hours preceding the event) is higher than the same period for the original data.

- The second data submission indicates a significant response by the asset to the event.
- The second data submission results in a significant increase in the performance from an increase in the adjustment to the customer baseline and the increased reduction in load during the event.

Figure 9-14
Data is not available on the day of the event, and is subsequently scaled up



The data represented in Figure 9-14 corresponds to September 10, 2009. There was no data provided on September 10. The data provided on September 11 was scaled up on September 18, by an average of 8 percent (on a 5-minute basis, the changes range between 7 and 10 percent.)

Figure 9-15 to Figure 9-19 show five different assets belonging to the same large retail chain. The first event of the summer of 2009 session was on June 3, from 11 to noon. These five assets submitted data for this event day on four different days. They all share some characteristics:

- It is visible that these assets did not respond to this event.
- The first two submissions are identical or nearly identical, except for the last few intervals.
- The last two submissions are also identical except for the visible dip at 2:45 PM. This dip is not present in the last version of the data provided for these assets.
- For all assets and each interval, the data from the last submission is exactly 12 times more than the data from the first submission.
- The relationship between the data for each of the assets is fairly constant. The most constant of all are assets B and C. Asset B is 40 percent of Asset C for all intervals on this day, for each of the four data submissions. Asset A is 1.1. to 1.2 times larger than Asset B, for all intervals.
- The last interval of the first submission is 3:55 PM
- The last interval in the second submissions is 4:55 PM
- The last interval in the third and fourth submissions is 4:50 PM

Figure 9-15
Large Retail Chain with Five Participating Assets – Asset A

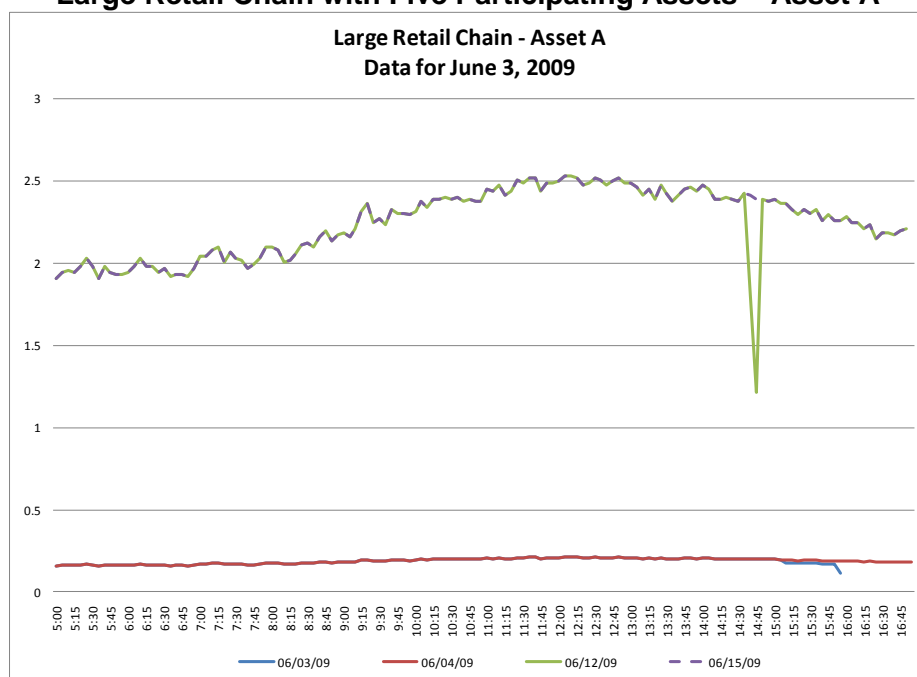


Figure 9-16
Large Retail Chain with Five Participating Assets – Asset B

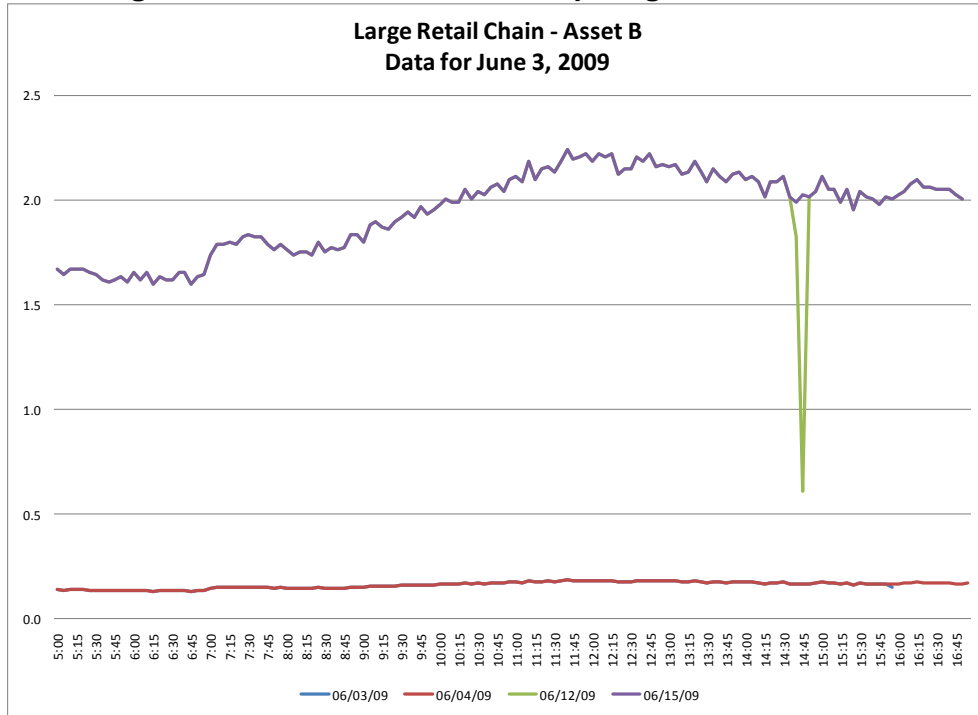


Figure 9-17
Large Retail Chain with Five Participating Assets – Asset C

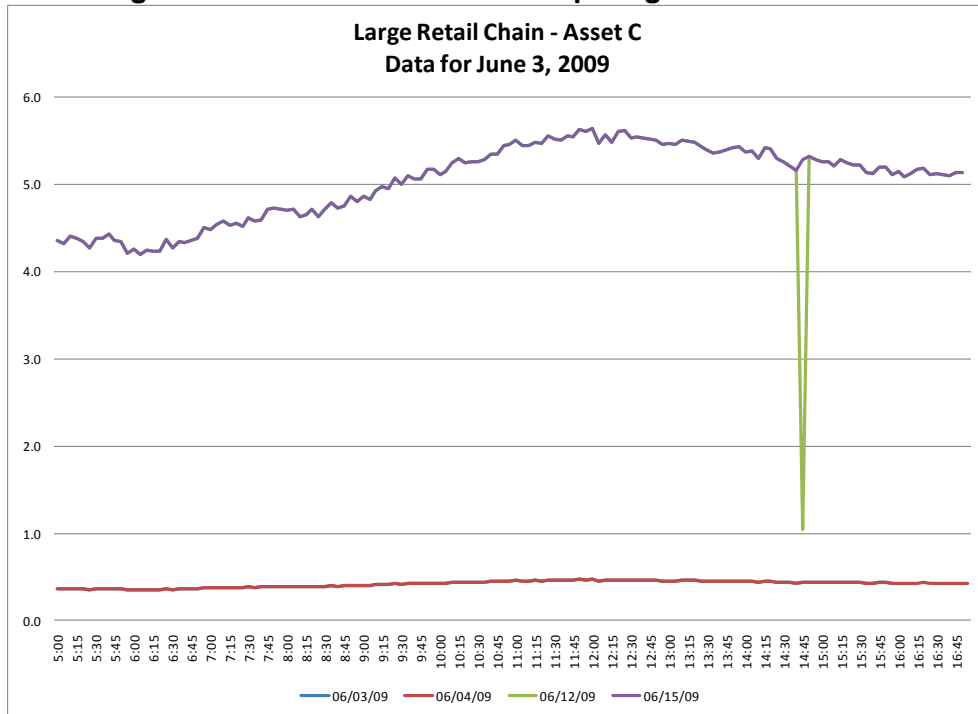


Figure 9-18
Large Retail Chain with Five Participating Assets – Asset D

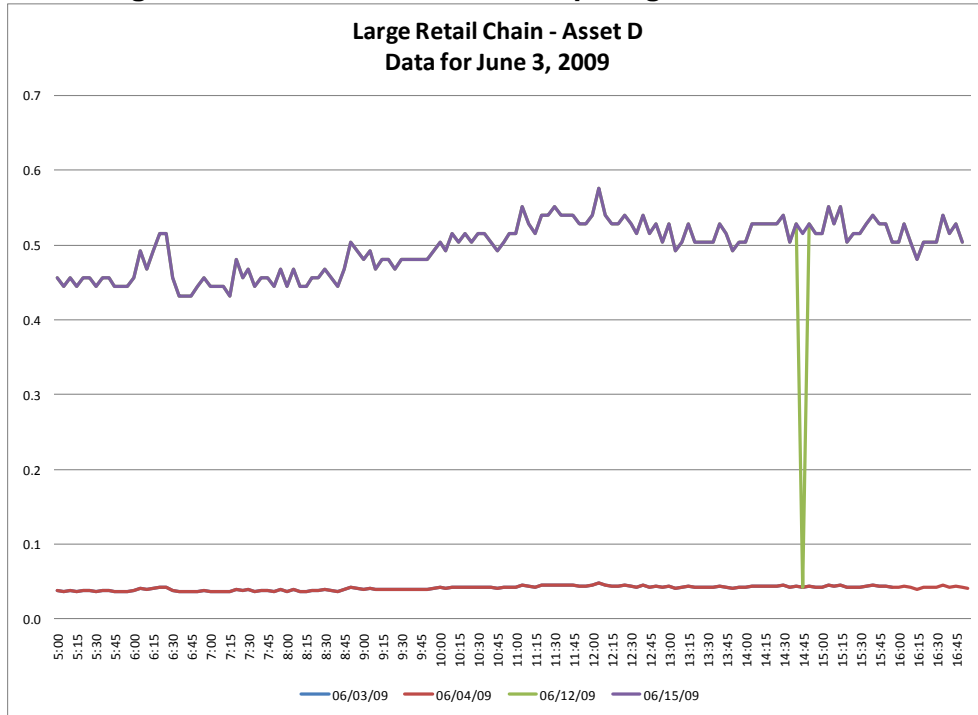


Figure 9-19
Large Retail Chain with Five Participating Assets – Asset E

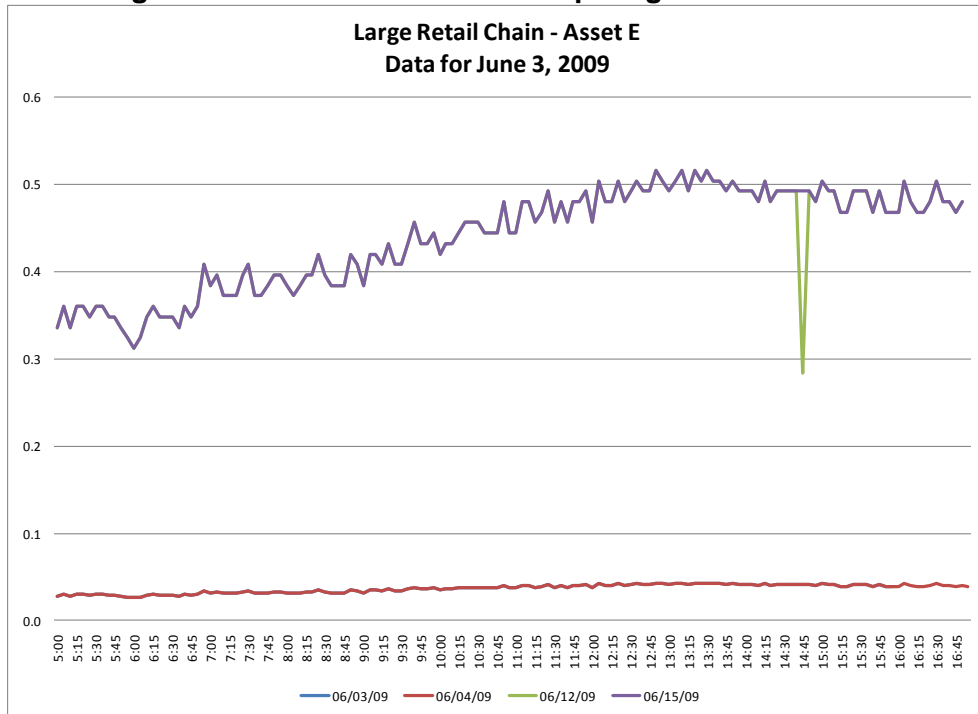
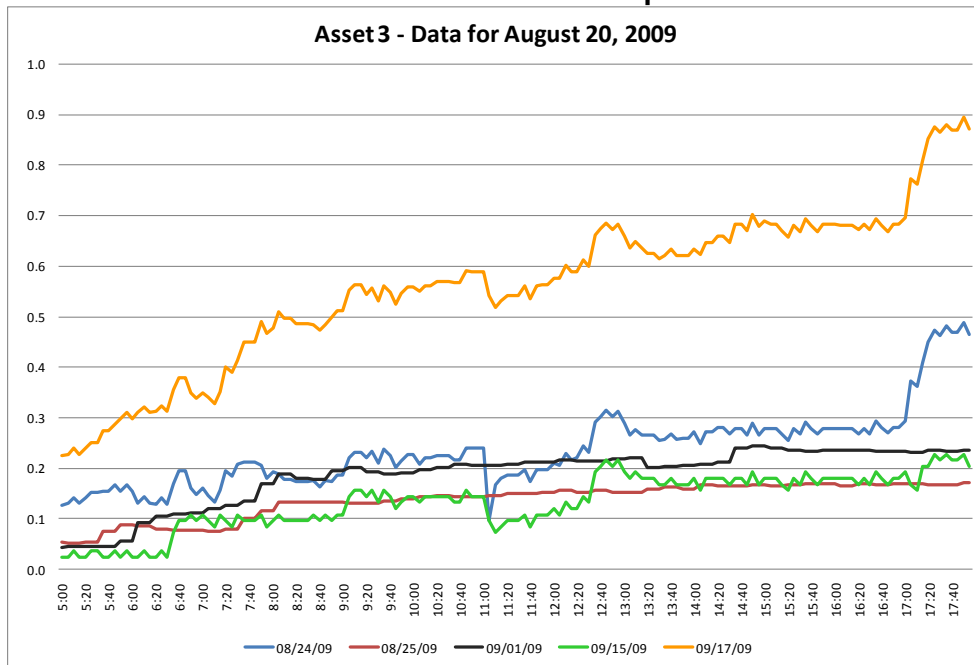


Figure 9-20 is an example of an asset that overwrote its data on multiple occasions. On this particular day (August 20 of 2009) the event took place from 11 to 11:45 AM. Three of the data versions that were submitted are lower than the first version submitted. The last version shows the highest reported level of energy usage on this day.

Figure 9-20
Data initially available four days after the event
Five different versions were posted



10. Recommendations

There are several aspects of asset performance during the DRRP that suggest that performance can be improved. These elements need to be investigated further to turn them into actionable items that have a positive effect on event execution.

- **Conduct research regarding performance erosion over time.** The grocery group is of particular interest because it is a large group of assets that participated in all events of the DRRP. The performance of this group declined over time. Survey research of the reasons behind this drop in performance could include topics such as staff knowledge of the mechanics of the event (if staff do not know or do not have feedback regarding the impact of their actions on the event results they may be less inclined to react to it), staff changes (indicating a need to educate staff as they rotate into positions that affect event performance), and equipment changes. Findings from this group are likely to be applicable to most sectors participating in future programs.

Survey research could also be used to investigate other issues that reduce asset performance for reasons that are not clear. In particular, the analysis of DRRP data shows that long lead times have a detrimental effect on the performance of some assets. We speculate that this is due to the fact that long leads make assets start curtailing load earlier, which in turn reduces their baseline through the 2-hour adjustment. If this is indeed the case, this issue would also improve by educating asset staff on the effect of their actions on event performance.

- **Conduct research regarding Audit Day behavior.** Two out of the three audit days conducted during the DRRP show performance that is clearly better than average. While this suggests that assets can perform better when there is a strong incentive to do so, the motivations and other conditions on these days should be explored further in order to support future program design and improved performance.
- **Implement weather-based performance metrics and incentives for weather-sensitive assets.** As expected, assets that participated in the DRRP by curtailing HVAC did not perform well when the weather was mild. This includes mild weather throughout the day or mild weather at the time of day of the event. For example, a morning event is likely to produce less load reductions, even if the temperature is hot later in the day. Performance metrics and an incentive structure based on temperature would recognize the nature of these assets. For example, at 65 degrees weather-

sensitive assets would not be expected to provide a load impact and can do so without penalty. At 90 degrees, these assets would be expected to provide their full enrolled amount and to not do so would entail a penalty. This implies that the DRR portfolio would have to include a mix of assets that is greater than the anticipated need. Since some of the assets can only perform under a narrow set of weather conditions, not all assets would be called to perform in all events.

- **Introduce penalties for over-performance of assets.** Program incentives that reflect the nature of the service the asset provides to the ISO, including the fact that over-performance of an asset is as undesirable as under-performance, will help align asset performance with the ISO's expectations.
- **Continue the utilization of the symmetric baseline adjustment methodology.** Compared to the non-symmetric baseline adjustment, the symmetric baseline reduces overall baseline error and provides a better estimate of assets' loads at the time of events.
- **Provide tools that assist assets in setting realistic performance goals.** These tools may include analysis of historic load data of the enrolling asset, or of other similar facilities if the asset's own data is not available, and a review of their load reduction plans. The review would focus on whether the load reduction plans are commensurate to the amount they intend to enroll in the program. For example, if a store's entire lighting fixtures represent 100 percent of the enrolled amount, and lighting is the only end-use that will be affected by the curtailment, the store would have to turn every single light off to meet its commitment. Weather-sensitive assets that have not performed analysis of their own data or do not have sufficient experience with these programs may benefit from simple plots of temperature versus load or a degree-days model to determine the impact of temperature on their load.

To have assets set a plan for ongoing training of the staff that will be directly responsible for running the event at participating facilities may be beneficial. For example, staff may not be aware that to start the event earlier than the stated performance time can reduce performance by lowering the baseline. Or new staff may not know what to do to respond to an ISO dispatch instruction.

- **Require justification for data changes over a given threshold.** Assets could be required to explain in writing why did their data changed if the change is over a certain

threshold, and especially if the new data results in an increase in performance payments or a decrease in penalties. To define such threshold is not within the scope of this report – it would be defined depending on the characteristics of any future programs.

- **Investigate the need for special metering requirements for Generation Assets.** In the DRRP, customer baselines were not established for Generation Assets, which effectively assumes that the baseline for these assets is zero and that any generation activity is in response to a DRRP event. However, because Generator Assets are behind the customer meter and their primary function is to serve the load of the facility to which they are associated, it may be necessary to implement special metering requirements to determine how much of a Generation Asset's output is in response to a DRRP event, which could be the result of increased generation and/or decreased load at the facility. Such requirements could also address the possibility of a Generation Asset receiving payment for energy output to the grid in addition to load reduction credit for the same output.