Instructions for Submitting Comments

Comments on this draft report may be submitted, in writing, to amitreski@iso-ne.com on or before October 19, 2009.

The ISO's report will be filed with the FERC on or before October 28, 2009.

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October 28th, 2009

VIA HAND DELIVERY

The Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

RE: **Report of ISO New England Inc. Regarding the Technical Feasibility and Value to the Market of Smaller Demand Response Resources Providing Ancillary Services, Docket No. ER______**

Dear Secretary Bose:

This report was prepared in compliance with Order No.719 regarding the technical feasibility and value to the market of smaller demand response resources providing ancillary services. Order 719 states:

> *"The Commission will require RTOs and ISOs, in cooperation with their customers and other stakeholders, to perform an assessment, through pilot projects or other mechanisms, of the technical feasibility and value to the market of smaller demand response resources providing ancillary services, within one year from the effective date of the Final Rule, including whether (and how) smaller demand response resources can reliably and economically provide operating reserves and report their findings to the Commission. Additional issues raised here by commenters, such as the need for measurement and verification standards and a definition of what constitutes a "small demand response resource" should be addressed in the assessments. In addition, while not part of the Commission's requirement, the Commission encourages the ISO/RTO Council to continue developing a communications protocol for small demand response resources and encourages RTOs and ISOs to consider the ISO/RTO Council's work in developing their individual assessments."*

The report describes the results of the Demand Response Reserves Pilot Program (“DRR Pilot”) to date. Also, it provides ISO’s assessment of the ability of smaller demand response resources to satisfy the physical requirements to provide operating reserves, as well as participate in the Forward Reserves Market (“FRM”).

Executive Summary:

The New England region has experienced significant growth in demand response resources since the introduction of Standard Market Design in 2003. The key drivers of this growth include:

- Establishing a Demand Resources Department in 2002;
- Opening energy markets that establish day-ahead and real-time Locational Marginal Prices (“LMP”) in 2003;
- Implementing the ISO’s Load Response Program – a broad menu of demand response programs addressing system reliability and price-responsiveness – in 2003; As illustrated in Figure 1, demand response resource capability has grown from 100 MW to over 2,000 MW
- Issuing a gap Request For Proposals to maintain reliability in Southwestern Connecticut from 2004 through 2008, through which the ISO contracted 260 MW of Demand Resources;
- Establishing a winter supplemental demand-response program in reaction to the January 2004 Cold Snap;
- Implementing a Demand Response Reserves Pilot Program in 2006 to determine how small demand response resources (<5 MW) can provide a functionally equivalent reserve product;
- Commencing transition payments related to the Forward Capacity Market (“FCM”) in 2006 for which Demand Resources were eligible; and

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- Executing the first two Forward Capacity Auctions in which Demand Resources successfully competed with traditional generation resources to provide 2,500 MW during the first commitment period in 2010 and then 2,900 MW of capacity in 2011 to the New England region.

ISO New England Inc. (the "ISO") and the New England Power Pool ("NEPOOL") started working together in late 2004 to design and develop a DRR Pilot to test the capability of smaller demand response resources to provide operating reserves.[1]

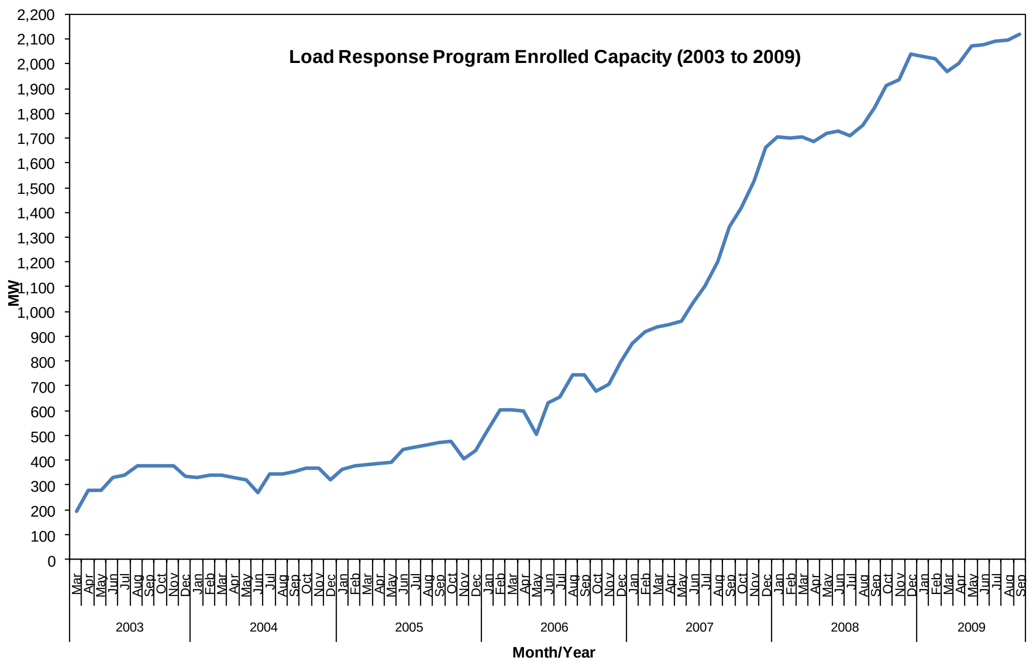

Figure 1 - Load Response Program Enrolled Capacity 2003 - 2009

The DRR Pilot was conducted because the region lacked empirical data on how demand response resources have performed under conditions in which the frequency and duration of the ISO's requested load reductions was comparable to the dispatch of traditional generation resources providing operating reserves. Prior to DRR Pilot, the frequency of demand response

[1] Any demand response resources registered in the ISO's Load Response Program as a single or aggregated group of retail customers with a maximum load reduction capability of 5 MW or less was eligible to participate in the DRR Pilot.

resource activations under the Load Response Programs was limited to regional or system wide emergency conditions, which occurred very infrequently.[2]

The DRR Pilot was implemented in October of 2006 and ran for two years (Winter 2006/07 through Summer 2008) on a system wide basis. Thereafter, as a second phase, the DRR Pilot was extended until May 31, 2010, but limited to demand response resources in the Connecticut Reserve Zone only. Over 90 different resources (retail customers) participated in the first phase of the DRR Pilot representing as much as 30 MW of load reduction capability. The frequency and duration of DRR Pilot resource activations was designed to test the resources under conditions similar to the dispatch frequency and duration of other resources providing operating reserves. The DRR Pilot resources were activated a total of 69 times over the three year period with each activation ranging from thirty minutes to one hour in duration. To test how the performance of demand resources varied across hours of the day, the activations were scheduled at different start times on weekday between 7:00 and 17:00.

In 2007, the ISO retained KEMA to analyze the performance of the demand response resources participating in the DRR Pilot. To assess the technical feasibility of demand resources providing operating reserves, KEMA conducted an analysis of the DRR Pilot performance data from all participating demand response resources over the two-year period and compared the performance data to the ISO's technical requirements of resources providing operating reserves.[3] KEMA's analysis is discussed in Section 4 of this report.

To assess the value to the market of having additional small demand response resources provide ancillary services, in particular participate in the Forward Reserve Market ("FRM"), the ISO analyzed the impact of these resources to the clearing results of the summer 2009 Forward Reserve Auction which is discussed in Section 6 of this report.

[2] Over the period March 1, 2003 through September 1, 2009 demand response resources were activated on 8 different days due to regional or system wide emergency conditions.

[3] At the time of writing this report, the full performance data was not available for the second phase, so the KEMA analysis and the entire discussion in this report focuses only on the first phase of the pilot.

The following is a summary of the major findings of the technical feasibility and value to the market analysis:

- **Small demand response resources participating in the DRR Pilot exhibit lower performance from their enrolled capacity.** When a market participant registers a demand response resource in the Load Response Program it provides an estimate of the demand resource's ability to reduce load during emergency conditions. That initial estimate is later adjusted based on how the demand response resource performs during an actual emergency activation or an ISO-initiated audit event. KEMA's analysis of the DRR Pilot demonstrates that the average hourly performance of the demand response resources participating in the DRR Pilot ranged from 17% to 44% of their enrolled capacity in the Load Response Program.[4] This finding indicates that the magnitude of load reduction that small demand resources can deliver during frequent activations (*i.e.*, dispatch frequency similar to generation resources providing operating reserves) is less than the magnitude of load reduction achieved during infrequent activations (*i.e.*, demand resources activated in the Load Response Program during emergency conditions).

- **Performance of small demand response resources participating in the DRR Pilot varies widely.** KEMA's analysis of the DRR Pilot also demonstrates that the performance of small demand response resources varies widely from one activation to the next. Across the tested hours (7:00 to 17:00) the hourly variance for the best performing asset ranged from 2% to 82% of the resource's enrolled capacity. The analysis indicates that a market participant may need to aggregate several small demand response resources (retail customers) into a single resource and employ portfolio style control techniques to achieve more consistent performance when providing operating reserves and avoid FRM penalties for non performance.

- **The addition of significant amount of reserve resources in certain Reserve Zones may lower the Forward Reserve Market clearing price, while the addition of small**

[4] Enrolled capacity is based on actual event performance or a market participant's estimate of performance during emergency conditions

amount of reserve resources in all Reserve Zones and the Rest of System would not have any immediate impact on the clearing price: The participation of additional low priced resources in Reserve Zones that already have an adequate supply of reserve resources would increase competition and may slightly lower the clearing price, but the economic incentive for participation is small since the clearing price is already low. On the other hand, there is a strong economic incentive for any resource capable of providing reserves to participate in the FRM in those Reserve Zones experiencing supply shortage of reserve resources where the clearing price is $14,000/MW-month (the maximum offer price allowed). Adding a small amount of demand response resources (10 MW -20 MW) in these Reserve Zones would not have an immediate impact on the clearing price, while a larger addition (200 MW or more) would. Nevertheless, addition of any amount of demand response resources would be beneficial to the reserve supply constrained Reserve Zones because it would shorten the timeframe when the supply will exceed the reserve requirement.

- **Small demand response resources could participate with lower barriers to entry.** Demand response resources can participate in the market through the Dispatchable Asset Related Demand ("DARD") infrastructure. One feature of ISO-NE's co-optimized energy and reserve dispatch is that reserves may be provided by any qualified resource that can respond to dispatch instructions, whether it is a generating resource that changes production or a demand response resource that changes consumption. Currently to participate as a DARD a demand response resources cannot be aggregated and must have a peak load of 5 MW or greater. However, allowing the aggregation of multiple customers at the same electrical location (*i.e.*, a Node) and lowering the size threshold could increase the useful potential of this infrastructure for small demand response resources.

In addition, ISO-NE is actively working with market participants to implement a new dispatch and communication system for Forward Capacity Market resources. This new system has a lower installation and operating cost than the system currently required for DARDs and traditional supply resources. Implementation of the new dispatch and communication system

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will enable all dispatchable resources, including DARDs, to benefit from the cost savings, and thereby lower the barriers to entry for all resources.

The DRR Pilot analysis shows that, through aggregation and the DARD infrastructure, a market participant may be capable of providing operating reserves with small demand response resources, albeit at a lower capability than what can be achieved during emergency conditions. Participation of additional small demand response resources in the FRM market should have both a short-term and long-term impact on operating reserve prices. The impact varies on the geographical location and the type of reserve product offered in the Forward Reserve Auction.

The remainder of this report is organized into the following sections:

- Section 1 is a summary of the technical and operational requirements of resources providing operating reserves.
- Section 2 provides a summary of the DRR Pilot, including a definition of small demand response resources.
- Section 3 describes the analysis of the DRR Pilot performance data.
- Section 4 is an assessment of the ability of small demand response resources to provide operating reserves based on the finding in Section 3.
- Section 5 provides an overview and background on the Forward Reserve Market.
- Section 6 provides an assessment of the impact on FRM from the participation of additional reserve resources in the FRM.
- Section 7 includes a discussion on the need for measurement and verification standards.

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Section 1: Operation Reserve Resource Technical and Operational Requirements

The New England wholesale market uses a joint co-optimization process to select resources to satisfy the Real-Time Energy requirements and meet Real-Time Operating Reserve requirements based on a least-cost, security-constrained economic dispatch. The core market design does not allow separate bids to be placed in the energy and real-time reserve markets for a resource. Rather, the decision to schedule a resource to either produce or consume electricity - as opposed to provide reserves - is based on how the resource offers to sell or purchase electricity in the energy market.

The ISO dispatches the most efficient combination of resources to meet both the system load and the system reserve requirements. This co-optimization is done using energy offers from suppliers (generators) and energy bids from demand customers (DARDs). Bids and offers from all resources are used to determine which particular assets are dispatched to meet total system load. At higher levels of system demand more expensive supply (generation) may be used – resulting in higher energy prices - likely encouraging price responsive buyers (DARDs) to reduce consumption.

Simultaneously, any resource may be designated as providing reserves to the extent it has available capacity that is not dispatched. A resource's reserve capability is determined from its energy offer or bid and its current output or consumption level. A fast-start generator that is off-line may be designated as providing reserves. A DARD consuming between its maximum and minimum consumption levels may be designated as providing reserves. At higher energy prices both of these resources may be dispatched, and consequently no longer capable of providing any reserve capability when fully dispatched. In other words, reserve capability may be considered as potential energy supply that may be dispatched to alleviate a contingency.

Resources must meet certain physical requirements to provide operating reserves, most notably a demonstrated ability to increase production or reduce consumption by a stated and

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measureable amount within 10 or 30 minutes. These physical requirements are not based on the characteristics, capabilities or limitations of any specific resource, rather the requirements are based on the physical needs to reliably operate the electrical grid. The requirements for operating reserve resources are system operations based and do not vary from one resource type to another. Therefore, New England system operators can have confidence that a resource providing reserves will be capable of performing like any other resource providing reserves.

Not all resources are capable of satisfying the physical requirements to provide reserves; therefore, not all resources are capable of providing reserves. For example, a resource with a limited or intermittent fuel source (*i.e.,* wind) may not be capable of satisfying the operating reserve requirements because there is no guarantee that the unit will be capable of responding to a contingency 24 hours per day, 7 days per week. Resources wishing to provide operating reserves must be able to perform within certain time limits (*e.g.*, reduce consumption to a specified level within ten minutes of the ISO's request) and must be able to maintain the level of consumption or supply for the duration of the dispatch request (*i.e.*, supply 100 MW for the next three hours). To provide operating reserves a resource must satisfy the physical requirements specified in Section III.9.5.1 of the ISO tariff, including:

- If the Resource is off-line (*i.e.*, not operating) it must demonstrate (through an audit) that it is capable of delivering a specified quantity of MWs within 10 or 30 minutes of the ISO's request (in the case of a supply resource), or reducing consumption to a specified MW level (in the case of a demand resource). This is referred to as the CLAIM10 or CLAIM30 capability respectively.
- If the Resource is expected to deliver reserves while being on-line, then the resource must be able to supply the reserves (through increasing supply or decreasing consumption) within the timeframe of the assumed reserve obligation without any ramp constraints;
- The Resource must have Electronic Dispatch Capability and be able to follow ISO dispatch instructions; [5]

[5] The Resource must meet the technical requirements specified in ISO New England Operating Procedure No. 14, Technical Requirements for Generation, Dispatchable and Interruptible Loads.

Section 1.1 Dispatchable Asset Related Demand (DARD) Infrastructure

The Dispatchable Asset Related Demand infrastructure integrates demand response resources into the wholesale market and is the mechanism by which demand resources can provide operating reserves. The DARD infrastructure was implemented in 2006 and allows market participants to purchase electricity at nodal hourly prices while simultaneously providing operating reserves by virtue of dispatchable demand bids to purchase electricity. Through dispatch instructions, the ISO can request the resource to reduce consumption, thus provide the same operating reserve product as a generator traditionally does.

It is important to note that the DARD infrastructure is different from the supply-side approach currently used to compensate demand response resources in the Load Response Programs, the DRR Pilot (described in Section 2) and the Forward Capacity Market. The supply-side approach offers payments to demand response resources for load reductions (calculated relative to a customer baseline) and allocates the costs associated with the payments to other market participants. The DARD infrastructure provides customers a means to participate as the most fundamental form of price responsive demand, with a commensurate financial incentive to alter consumption (increase or decrease) in response to real-time energy prices and ISO's dispatch instructions.

To participate as a DARD, a customer would first have to install all the necessary metering and telemetry equipment, just like any other dispatchable resource in New England.[6] These performance measurement and communication requirements are essentially the same for a generator or DARD resource and are comparable to the requirements for a Demand Resource in the Forward Capacity Market.[7] A load customer within the FCM has satisfied almost all the metering and telemetry requirements necessary to participate as a DARD.

To understand the value of a load customer participating as a DARD, it is useful to compare the load customer to the owner of a fast-start peaking generator. The owner of a fast-

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[6] An RTU is required for all assets participating in New England's wholesale markets. Recent work and advancements have made utilization of the RTU far less expensive than the RIG technology.

[7] Operating Procedure No. 14 – *Technical Requirements for Generator, Demand Resources and Asset Related Demands.*

start peaking generator does not derive substantial profit from its energy sales. The reason is, the fast-start peaking generator's energy output is expensive and, therefore, it will be dispatched, based on price, only during a few high priced hours per year. The fast-start generating unit's value (beyond its value as a capacity resource) is in its stand-by reserve capability – its ability to come on-line quickly in response to a system contingency. A load customer participating as a DARD will have a similar value objective. For many load customers, frequent load reductions may become expensive or impractical. For example, an industrial customer will likely incur additional costs for curtailing an industrial process or shifting work from one time period to another. Consequently, similar to the fast-start generator a load customer participating as a DARD will find value in its stand-by capability – its ability to reduce load quickly in response to a system contingency.[8]

The reserve designation for the fast-start peaking generator depends on the particulars of its energy offer and its demonstrated capability. The energy offer depicts how fast the generator can come on-line and how much energy it can produce within that timeframe. A demonstration audit confirms the generator's capability to meet those parameters. The reserve designation for the DARD similarly depends on the particulars of its energy bid and its demonstrated capability. The bid depicts how fast the resource can reduce its consumption and by how much, while a demonstration audit confirms the DARD parameters.

The generator's energy offer is a supply curve; beginning from zero output, the generator provides increasing price-quantity pairs up to its rated output. The higher the energy price, the more energy the generator is willing to produce. In contrast, the DARD's energy bid is a demand curve of decreasing price-quantity pairs; the bid begins at its normal consumption level (termed its maximum consumption level) and ends at its reduced consumption level (termed its minimum consumption level). The higher the energy price, the greater the amount of consumption the customer is willing to curtail.

[8] System contingencies are not synonymous with periods of peak demand. Reserves are intended to provide a response to a system contingency, which may occur at any time. Reserves are maintained to restore the system to control limits within prescribed timeframes. In contrast, Demand Resources (an FCM resource type) are primarily intended to provide capacity during times of peak demand. Demand Resources do not have the same performance timeframes or the same participation requirements as reserve resources.

Thus, the DARD participates as price-responsive demand. Participating this way allows the resource to control its wholesale energy purchase exposure by bidding the energy prices above the level at which it would prefer to reduce consumption rather than continuing to buy energy. In addition to controlling its energy purchases and providing reserve capability, the customer also reduces its capacity obligation. Because this load is dispatchable (*i.e.*, willing to interrupt when requested by the ISO) it is only necessary to procure capacity for the remaining portion of the load that is not dispatchable. Conceptually, a load customer participating as a DARD that bids its entire demand (consumption) as dispatchable would have no capacity load obligation (*i.e.*, no capacity payment to make).

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Section 2: Demand Response Reserves Pilot Program

The ISO and NEPOOL collaborated to design, develop and implement the DRR Pilot because the region lacked empirical data on how small demand response resources perform under frequent activation. Prior to the DRR Pilot, demand response resources participating in the Load Response Programs were activated during regional or system wide emergency conditions and for annual testing. Over the 5 ½ year period from March 2003 through September 2009 demand response resources were activated a total of 8 times. A table describing the Load Response Programs is included in the Appendix.

The DRR Pilot was implemented on October 1, 2006 with the goal of determining how small demand response resources (with a maximum load reduction of less than 5 MW) would perform under frequent dispatch conditions similar to that of generators dispatched for system contingencies. The first phase of the DRR Pilot commenced on October 1, 2006 and continued through September 30, 2008. Under the DRR Pilot, the ISO separately solicited DR resources for each winter and summer season in the same timeframes as the Forward Reserve Procurement Period occurs. A variety of small demand response resources were selected to represent the population of resources that would likely participate in a competitive market. Specifically, the DRR Pilot program allowed for an enrollment of up to 50 MW of small demand response resources from the following categories:

1. Customers with behind the meter generation and weather independent load;
2. Customers with behind the meter generation and weather-dependent load;
3. Weather-independent load reduction resources; and
4. Weather-dependent load reduction resources.

Actual participation in the DRR Pilot remained below the limit of 50 MW throughout all seasons. The table below provides the number of resources that participated in each season, the total capacity rating of those resources, and the number of activations during that season. The mean capacity rating of resources participating in the DRR Pilot was 0.29 MW.

Season	Number of Activations	Load Interruption		Direct Load Control	
		Assets	MW	Assets	MW
Winter 06-07	19	47	14.9		
Summer 07	17	88	20.3	2	10.0
Winter 07-08	17	77	13.7		
Summer 08	16	88	18.6	2	10.0

Table 1 - Demand Response resources participating in the DRR Pilot program

Market participants with resources participating in the DRR Pilot were compensated based on the Forward Reserve Clearing Price of the Reserve Zone in which they participated. Comparable payment was deemed necessary to ensure that resources participating in the DRR Pilot program would respond to the same price signals as resources providing operating reserves in the FRM. To further encourage participation, not all FRM penalties were applicable in the DRR Pilot. A comparison of the incentives and penalties of the DRR Pilot versus the FRM is included as Appendix B.

Resources participating in the DRR Pilot program were required to register in the Real-Time 30-Minute Demand Response Program and not use emergency generation as the means of reducing load[9]. Participation in the DRR Pilot was primarily from supermarkets, big box retailers and aggregation of residential air conditioning direct load control. From October 2006 through September 2008, the DRR Pilot was open to resources throughout New England. However, only demand response resources located in the Connecticut and the greater Boston area participated, most likely due to the high clearing prices of the FRM for those areas at the time.

On July 28, 2008, ISO-NE and NEPOOL filed with the Commission a proposal to extend the duration of the DRR Pilot program. The Commission accepted this proposal, which revised and extended the DRR Pilot program for the period from October 1, 2008 through May 31, 2010. This extended phase of the program allowed ISO-NE to collect additional data to develop

[9] Small demand response resources with emergency generation were excluded from the DRR Pilot because local and state environmental regulations prohibit their operation outside of emergency conditions.

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responsiveness metrics for demand resources and enabled ISO-NE to better model the likely real-time performance of smaller demand response resources providing reserves. This phase was only open to demand response resources located in the Connecticut Reserve Zone because the reserve requirement in other zones was either zero, or there was already an adequate supply of reserves.

The ISO consulted with representatives from the E.O. Lawrence Berkley National Laboratories ("LBL") and the Consortium for Electric Reliability Technology Solutions ("CERT") to develop the DRR Pilot's experimental design. It was determined that several parameters would affect the likely performance of the demand response resources, in terms of: a) achieving the contracted amount of load reduction within the time requirements after dispatch by the ISO, b) maintaining the load reduction over the activation event, and c) reconnecting the load at the ISO's direction. The experimental approach included performance tests designed to capture the variability in performance of different demand response resources as functions of:

1. <u>Dispatch Frequency:</u> The time between two consecutive load dispatches may affect the performance of some demand response resources, as customer loads may either take time to rebound or may rebound beyond baseline values as loads recovers from an end-use energy deficit. Furthermore, frequent dispatch may impact a customer's ability to reduce load, due to reduced occupancy comfort or simply customer fatigue given the logistics of performing frequent load reductions.
2. <u>Duration of Dispatch.</u> Event duration may affect performance of certain types of demand response resources. Some customers may have a minimum downtime threshold for equipment or processes, requiring that the load pickup be delayed until that minimum threshold time is met. For other customers, longer load reduction duration could reduce performance, particularly if the load reduction impacts comfort conditions in facilities. Duration of load reduction and time between load dispatches together may have a compounding effect on customers' core business and/or comfort.
3. <u>Season:</u> The winter season may significantly affect the potential load reductions for weather dependent load because this type of load is expected to be attributable to air-conditioning end-uses. Backup generators may have different cold start behavior between summer and winter conditions.

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Table 2 below is a summary of the parameters used in the DRR Pilot:

Key parameters	Value range tested
Dispatch frequency	Once a week
	Within one day
	Daily
Duration of dispatch	15 min
	30 -60 min
	Two hours
Season	Summer
	Fall and Winter

Table 2 - Parameters used during the DRR Pilot

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Testing all combinations of these three key parameters required an experimental design comprising 18 different conditions (3 variations of dispatch frequency, 3 variations of dispatch duration, and 2 seasons). Because at least two independent tests of each parameter condition were needed, the ISO scheduled additional test events to allow for two independent tests of each parameter combination.

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Section 3: Analysis of the Demand Response Reserves Pilot Program

The ISO retained KEMA to analyze the performance data from the DRR Pilot program. The evaluation was based on 5-minute interval meter data from the demand response resources participating in the DRR Pilot during the period from October 2006 to September 2008 encompassing four seasons (*i.e.*, a winter and summer season per each year).[10] Load reductions were calculated for each demand response resource as the difference between the resource's customer baseline consumption and the actual facility metered load. The customer baseline represents the resource's expected energy consumption had the load reduction not occurred.[11]

Section 3.1 Historical Enrollment in the DRR Pilot:

The participation of resources across the four seasons of the DRR Pilot is summarized in Table 3 below. Eighty two out of ninety eight resources (84%) participated in at least three of the four seasons of the DRR Pilot.

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[10] Performance data after the Summer 2008 season was not available at the time the analysis was conducted.

[11] Customer baselines were calculated using the methodology for the 30-Minute Real-Time Demand Response Program as described in ISO Manual M-LRP.

	Winter 06/07	Summer 07	Winter 07/08	Summer 08
Number of Assets Per Combination of Seasons Participating				
36	x	x	x	x
40	-	x	x	x
5	x	x		x
1	x	x	x	-
5	-	x	-	x
1	x	x	-	-
4	-	-	-	x
4	x	-	-	-
2	-	x	-	-
Total Per Season	47	90	77	90

Table 3 - DRR Pilot Participation across Seasons

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Section 3.2 Hourly Performance Analyses:

To evaluate the actual performance in the DRR pilot program, KEMA's analysis compared the observed load reduction against the resource's enrolled capacity in the 30-Minute Real-Time Demand Response Program. The enrolled capacity of a resource is the actual demonstrated performance during emergency conditions or an ISO initiated audit. For resources that have not demonstrated performance, the enrolled capacity is based on the market participant's engineering estimate of the resource's load reduction capability. To normalize the analysis, KEMA measured the performance of the individual resources in terms of observed load reduction as a percent of enrolled capacity. For aggregated resources (the whole pilot, or some smaller group) performance was measured as the sum of all resources' load reduction as a percent of the sum of all resources' enrolled capacity.

Load reduction as a percentage of the resources' enrolled capacity is used to illustrate variability across events and hours and different grouping scenarios. An important observation relates to the lower limit of the range of performance. Load reduction variability, when grouped, is reduced and minimum load reductions become less extreme.

The DRR Pilot analysis determined load reduction levels and variability across events over the hours of the day. To display these findings KEMA developed figures containing multiple box plots. There is one box plot for each hour of the day. Each box plot (illustrated in Figure 2 below) visually represents the distribution of performance across all of the events in that hour. The median is represented by the line within the box. The top and bottom of the boxes indicate the 25th and 75th percentile. The tips or "whiskers" emanating from the top and bottom of the box show the minimum and maximum values for that hour. In the figures, number values above the box plots indicate the number of events in each hour.

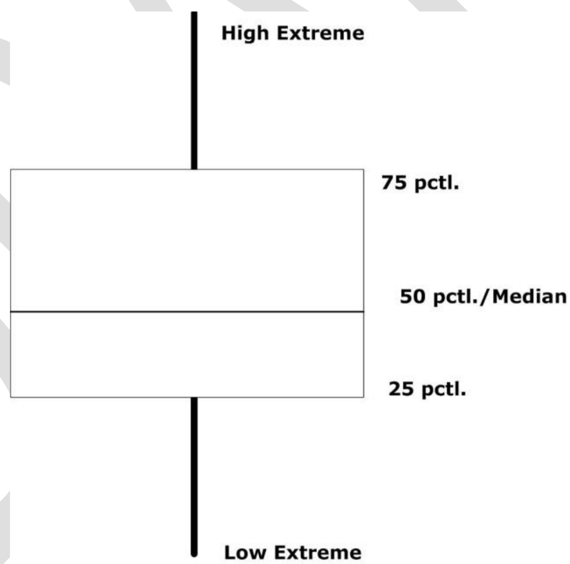

Figure 2 – Box plot schematic

Figure 3 below is a box plot chart for one of the best performing resources in the DRR Pilot. On average, the resource performed approximately 50% of the enrolled capacity across all hours of the day. During three events (*e.g.,* hour ending 12, 13 and 15) the resource provided reduction below 10% of its enrolled capacity. An important observation from this analysis relates to the lower limit of the range of performance. For some events, the asset's load reductions approached zero. Thus, despite the substantial median load reduction, in some cases the load reduction was very little.

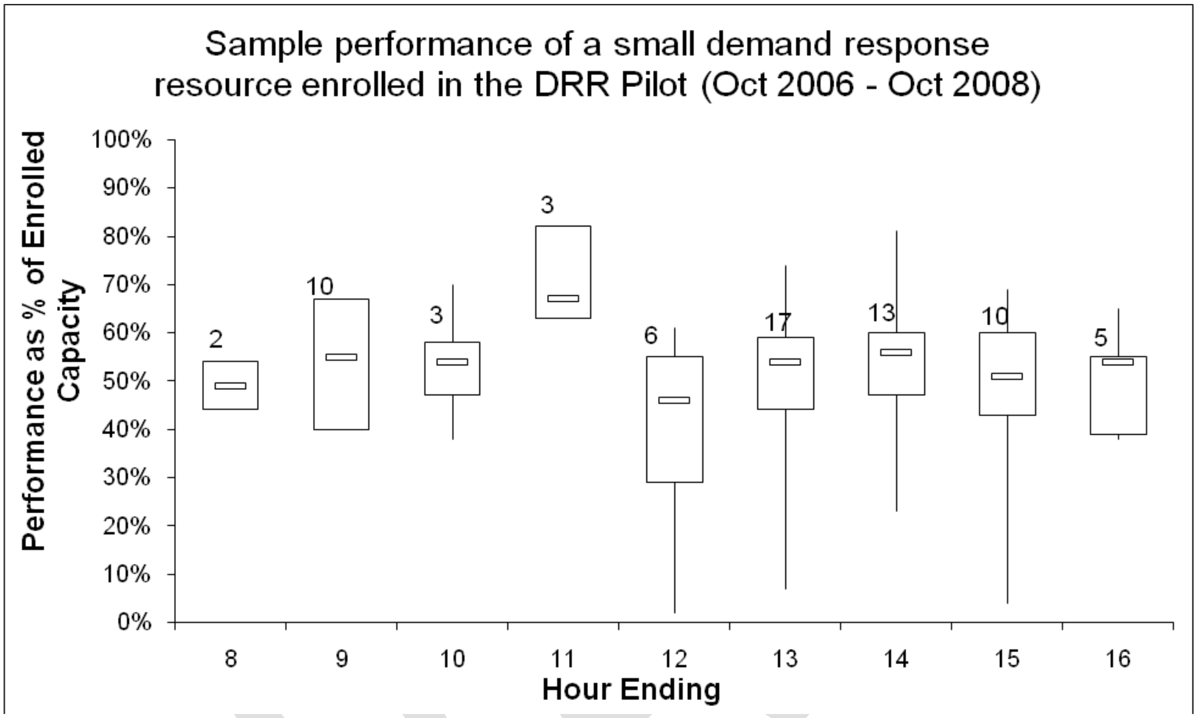

Figure 3 - Performance of a small demand response resource in the DRR Pilot

When KEMA aggregated the performance of the individual resources into a single group the performance variance was reduced, as illustrated in Figure 4 below.

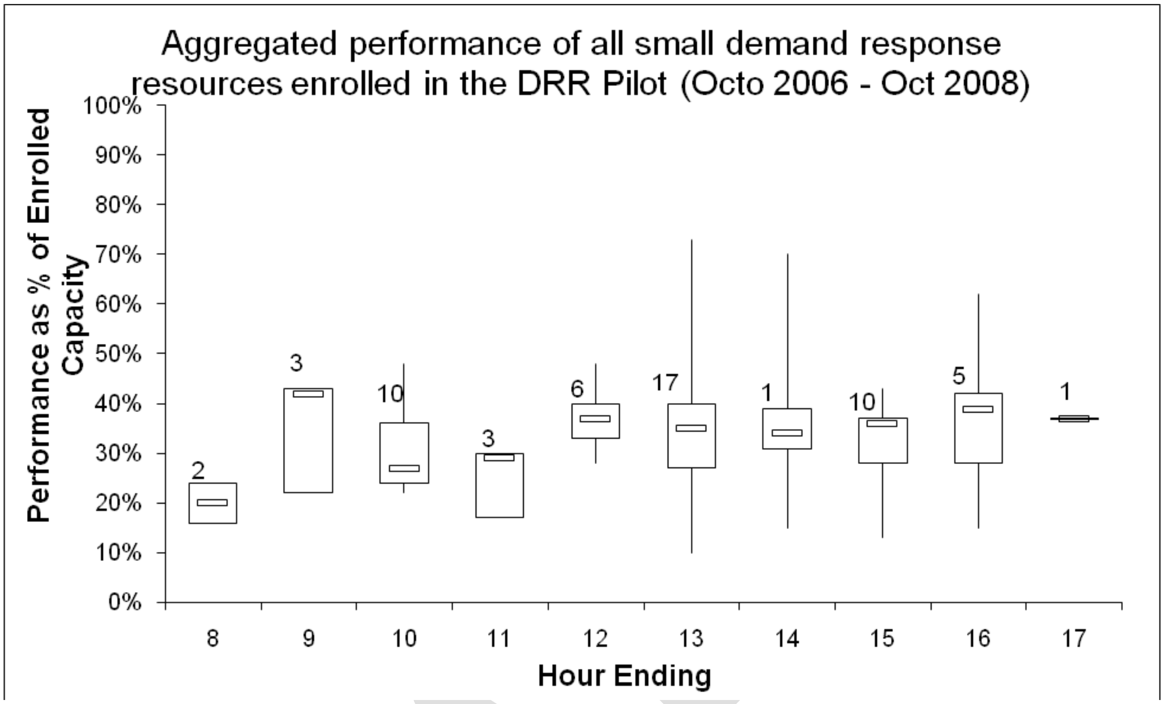

Figure 4 - Aggregated performance for all small demand response resources enrolled in the DRR Pilot

While the variance in performance decreases with aggregation, the analysis shows that the magnitude of consistent load reduction provided by the small demand response resources is significantly below their enrolled capacity in the 30-Minute Real-Time Demand Response Program. The mean enrolled capacity of the aggregated resources was 21.67 MW. KEMA calculated the mean load reduction for the entire pilot to be 7.68 MW or 35% of the mean enrolled capacity as can be seen from Table 4 below. Therefore, without taking into consideration the magnitude of the variations, the analysis indicates that the mean load reduction of the aggregated resources during frequent activations is significantly less than the resource's load reduction capability during infrequent activations (*i.e.*, emergency conditions).

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DRR Pilot Statistical Performance Overview				
	Pilot		Resource	
Size (mean baseline)	43.42	MW	0.59	MW
Mean Load Reduction	7.68	MW	0.10	MW
Mean Enrolled Capacity	21.67	MW	0.29	MW
Mean Unrealized Commitment	13.99	MW	0.19	MW
Mean 'Underperformance'	64.57	%	64.57	%

Table 4 - Statistical Performance overview of the small demand response resources participating in the DRR Pilot

Section 4: Assessment of Small Demand Resources Ability to Reliability and Economically Provide Operating Reserves.

KEMA's analysis of the DRR Pilot performance data suggests that through aggregation and portfolio management small demand response resources may be able to provide an operating reserve product through the DARD infrastructure. However, the quantity (MW) of operating reserves offered by small demand response resources will likely be less than the quantity of load reduction capability available from the same resources during infrequent emergency conditions.

While there are currently two noted barriers to entry for smaller customers as a DARD[12], presuming the barriers can be lowered or removed, it is conceivable that a group of customers could collectively participate as a single DARD. To administer the DARD through aggregation and portfolio management, it would be necessary for one of the customers or their administrator to be designated as the Lead Market Participant for the DARD asset. [13] The same arrangements are common for generators. Contractual arrangements are often made so that some other entity, instead of the owner, is the generator's Lead Market Participant.

This type of an arrangement with a Lead Market Participant is also true for load customers. Load customers not participating in the wholesale market have at some point in their supply chain an entity serving their wholesale energy demand; either a utility or a competitive energy supplier. This supplier is in effect the Lead Market Participant for this load, and consequently is responsible for the demand at the wholesale level. Reasonably, this energy supplier would have some expectation or forecast of the customer's normal energy demand and include in any fixed price charged to the customer a premium for assuming the price risk at the wholesale level.

[12] Mentioned elsewhere in this report is the current requirement that a DARD be at least 5MW and cannot be formed by aggregating load customers.

[13] The primary responsibility of the Lead Market Participant is to offer or bid the asset into the market each day, and administer the subsequent settlement functions with the ISO.

The DARD infrastructure provides an opportunity for the customer that can react to real-time wholesale energy prices. By being price-responsive the customer can avoid any price risk premium associated with a fixed rate.[14] The DARD's energy bid is a price-responsive demand bid; hence there is no need for price risk premium; because the customer controls its own energy costs by curtailing consumption when prices are higher than its bid.

For example, a customer willing to reduce its lighting may determine that it can reduce its energy costs by reducing its consumption by turning off some lights at modest energy prices. In contrast, a customer that must stop a manufacturing process would need to offset the costs involved in stopping and restarting the process against a much higher energy price. This comparison between a customer's energy cost and its opportunity cost is the essence of price-responsive demand.

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[14] The price risk premium is intended to capture and monetize the volatility of wholesale prices. Hypothetically, a perfect prediction of volatility would yield the same total payments whether paying a fixed rate or the variable wholesale price. To the extent the volatility is less than anticipated the total fixed price payments would exceed the total of variable wholesale price payments, and vice versus. For DARDs the total payments from variable wholesale pricing may be further reduced as the demand bid reduces the amount purchased at higher energy prices.

Section 5: Overview and Background on the Forward Reserve Market

The Forward Reserve Market was implemented in December 2003 and revised in October 2006. It is a market based method for forward procurement of two types of operating reserve products; Ten-Minute Non-Spinning Reserves ("TMNSR") and Thirty Minute Operating Reserves ("TMOR"). TMNSR can be provided by off-line resources (*i.e.*, not synchronized to the electricity grid) that can supply electricity or reduce consumption within ten minutes of receiving dispatch instructions from the ISO. TMOR can be provided by either on-line or off-line resources that are capable of supplying electricity or reducing consumption within thirty minutes of receiving instructions from the ISO.

The FRM is a forward financial market in which the market participants can take a Forward Reserve Obligation to deliver operating reserves in real time with a compensation set at the Forward Reserve Clearing Price. The performance payments and penalties in the FRM design provide sufficient incentive for market participants to deliver their reserve obligations. This balance of financial risk and reward in the FRM helps instill confidence in the system operator that forward procured reserves will be available when needed in real time.

The Forward Reserve Market procures TMNSR and TMOR through a cost-minimizing uniform-price auction held twice a year, one per each Forward Reserve Procurement Period (*i.e.*, summer and winter). The quantity of TMOR and TMNSR procured varies by product and region depending on the calculated reserve requirements. TMNSR is procured for the entire New England system, while TMOR is procured system-wide or on a zonal basis to ensure that adequate resources are available for the Reserve Zones Southwest Connecticut (SWCT), Connecticut (CT), the greater Boston area (NEMA/Boston) or in the Rest of System (ROS).

Market participants submit offers in the Forward Reserve Auction on a portfolio basis. The ability to submit portfolio offers provides flexibility and improves the likelihood that reserves will be available in real-time. Further, the portfolio feature allows the market participants to aggregate different resources(*e.g.*, supply and demand) to meet their obligations and manage their portfolios as needed to accommodate unit outages, operating characteristics, economics, etc. For example, several resources may be used to fulfill an obligation in a given day, or in a given hour. As discussed in Section 6 of this report, the portfolio feature is important to market participants with small demand response resources looking to provide operating reserves. As additional level of flexibility, market participants can bilaterally trade their reserve obligation with other market participants as an additional level of flexibility.

Market Participants with a Forward Reserve Obligation must designate for every weekday between 07:00 and 23:00 (excluding weekdays that are NERC designated holidays) some combination of online or offline resources capable of satisfying their reserve obligation type (*i.e.*, 10 or 30 minutes). The ISO uses a joint optimization process to serve the real-time energy requirements and satisfy operating reserve requirements based on a least-cost, security-constrained economic dispatch. Therefore, resources that are assigned to satisfy the auction obligation in real-time must submit Supply Offers or Demand Bids into the Real-Time Energy Market. These energy offers or bids must be at or above the pre-determined threshold price to decrease the probability that they will be called on to provide energy.

The introduction of three import constrained Reserve Zones in October 2006 added geographical valuation to the FRM procurement process. With this change, a reserve requirement is calculated for each Reserve Zone. Reserves that are offered within a Reserve Zone are more valuable because they cascade up, such that not only can they satisfy the reserve requirements of the zone, but they can also be applied toward meeting the system-level requirement. For instance, one megawatt of TMNSR in SWCT contributes to meeting four distinct requirements: the system-level TMNSR requirement, the system-level TMOR requirement, the SWCT TMOR requirement, and the CT TMOR requirement (SWCT Reserve Zone is nested within the CT Reserve Zone so any reserves offered in SWCT count toward meeting the reserve requirement of CT).

The Forward Reserve Clearing Price provides a very important indicator about the locational reserve needs of the system. When the offered reserves in a Reserve Zone are less than the reserve requirements then the Forward Reserve Clearing Price of that zone for that product is administratively set equal to the Forward Reserve Offer Cap of $14,000/MW-month. This high clearing price signals shortage of supply and encourages increased participation in that Reserve Zone. Conversely, when the clearing price is low or zero, the price indicates that adequate reserve resources exist in the Reserve Zone and future investment in reserve resources in that zone for that product may not be economic. For example, recent transmission upgrades have reduced the reserve requirement in the greater Boston area from 1,050 MW in 2007 to 0 MW in 2009, which has resulted in reduction of the reserve clearing price from $14,000/MW-month to $0/MW-month. The decrease of reserve requirements in the greater Boston area is an example of how sometimes transmission upgrades, instead of building reserve resources can change the reserve needs of the system.

A market participant that fulfills its Forward Reserve Obligation will receive compensation based on the Forward Reserve Clearing Price. A market participant that fails to fulfill its reserve obligation will not only forfeit its FRM compensation, but will also receive associated penalties. There are two types of penalties: Failure-to-Reserve and Failure-to-Activate.

The Failure-to-Reserve penalty is imposed when the resource's delivered megawatts in an hour are less than its auction obligation for that Reliability Zone for that hour. The Failure-to-Reserve penalty for each hour is 1.5 multiplied by the auction clearing price times the failed MWh. The Failure-to-Activate penalty is assessed when an offline resource fails to start or reduce load to its minimum consumption level upon a request by ISO or a resource fails to reach its CLAIM10 or CLAIM30 capability in the required 10 or 30 minute interval. The Failure-to-Activate penalty per each hour is the maximum of the 2.25 multiplied by the auction clearing price or the nodal LMP of the applicable resource, times the amount of MWh that was not activated. These penalties provide a financial incentive for resources to fulfill their auction obligation in real time, thereby minimizing the periods of operating reserve shortage.

In addition, every time a resource is dispatched, its performance is evaluated to ensure that the resource meets its capability to provide reserves within 10 or 30 minutes. Failure to provide the claimed reserve capability twice in a row would result in de-rating the reserve capability of the resource by 25%. Each subsequent performance failure would de-rate the claimed reserve capability by an additional 25%. A resource that has failed to meet its claimed capability can request a test to re-audit its capability and avoid potential de-rating.

Section 6: Assessment of the Added Value when Small Demand Response Resources Participate in the FRM

The Forward Reserve Clearing Price reflects the cost to serve the next increment of reserve based on submitted offers and is calculated separately for each reserve product in each Reserve Zone or the Rest of System. When submitted offers are not adequate to meet the reserve requirement, the clearing price for that product is set to the Forward Reserve Offer Cap of $14,000/MW-month.

Currently, there are no demand response resources participating in the FRM. To evaluate the impact of small demand response resources participating in the FRM, the ISO considered two scenarios of demand response resources providing reserves in the Summer 2009 FRM auction. Scenario 1 evaluated the impact of additional 10 MW of demand response resources, while scenario 2 evaluated the addition of 200 MW of demand response resources participating in the FRM. The goal in scenario 1 was to evaluate how a small amount of small demand response resources offered in the FRM would impact the clearing of the auction. The amount of reserves selected in scenario 2 was estimated to be approximately 10% of the demand response resources currently participating in the Load Response Programs.

The addition of small demand response resources was reviewed sequentially per Reserve Zone or Rest of System and per product type[15]. To estimate the impact on the Forward Reserve Clearing Price, the ISO analyzed the "bid stack" of the actual submitted offers and approximated the expected clearing (attempting at the same time to not divulge sensitive information regarding past submitted offers) had the offers from the small demand response resources been submitted as price takers.[16]

[15] While Table 5 shows an addition of 40MW of reserves in total, the assessment was performed assuming 10 MW was added in each of the 4 areas.

[16] We assumed the Market Participants of these small demand response resources submitted offers with price of $0/MW-month

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Section 6.1 Scenario 1 - 10 MW of demand response resources participating in the FRM

When observing the results of the Summer 2009 Forward Reserve Auction we see that almost all TMNSR reserves are offered in the Rest of System with a minimal amount offered in the NEMA/Boston Reserve Zone. Having 10 MW of TMNSR capable small demand response resources offered in the Summer 2009 Forward Reserve Auction in any Reserve Zone or Rest of System would not impact the clearing price of the auction as we can see in Table 5 below. The 10 MW of small demand response reserves offered in CT and SWCT as a price of zero would clear at the ceiling price of $14,000/MW-month because of the existing shortage of supply in these Reserve Zones. The addition of an additional 10 MW of reserves offered in the Rest of System or NEMA/Boston Reserve Zone as a price taker would have no significant impact on the overall clearing price.

Comparative FRM Auction Clearing Results (Summer 2009) for TMNSR					
		Rest of System	CT	SWCT	NEMA/ Boston
Summer 2009 Auction	Reserves Offered (MW)	1,432.4	0	0	25
	Reserves Required (MW)	850	850	850	850
	Reserves Cleared (MW)	825	0	0	25
	Clearing Price ($/MW-month)	$ 6,297	$ 14,000	$ 14,000	$6,297
Predicted Summer 2009 Auction with 10MW small demand response resource participation	Reserves Offered (MW)	1,442.4	10	10	35
	Reserves Required (MW)	850	850	850	850
	Reserves Cleared (MW)	825	10	10	35
	Clearing Price ($/MW-month)	$ 6,297	$ 14,000	$ 14,000	$ 6,297
	Impact	None	None	None	None

Table 5 – Comparison of FRM auction clearing with additional 10MW of TMNSR small demand response resource participation

Having 10 MW of TMOR capable small demand response resources offered in the Summer 2009 Forward Reserve Auction in any of the Reserve Zones or the Rest of System would have no impact on the clearing price of the auction as illustrated in Table 6. The reserve requirements for Rest of System and the NEMA/Boston Reserve Zone are 0 MW, while adding 10 MW of reserves in the CT or SWCT Reserve Zone would still not be sufficient to meet the

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CT reserve requirements. Hence the clearing price in CT and SWCT Reserve Zone would remain at the Forward Reserve Offer Cap of $14,000/MW-month.

It is important to note that while there is adequate supply of reserves to meet the reserve requirement for the SWCT Reserve Zone (which is nested within the CT Reserve Zone), there is a shortage of supply in the parent Reserve Zone (CT). Hence, the clearing price for the SWCT Reserve Zone would equal the clearing price of the parent Reserve Zone (CT).

Comparative FRM Auction Clearing Results (Summer 2009) for TMOR					
		Rest of System	CT	SWCT	NEMA/ Boston
Summer 2009 Auction	Reserves Offered (MW)	377.5	597	401.7	25
	Reserves Required (MW)[17]	798	1,145	22	0
	Reserves Cleared (MW)	0	597	401.7	0
	Clearing Price ($/MW-month)	$0	$ 14,000	$ 14,000	$0
Predicted Summer 2009 Auction with 10MW small demand response resource participation	Reserves Offered (MW)	387.5	607	411.7	35
	Reserves Required (MW)	798	1,145	22	0
	Reserves Cleared (MW)	0	607	411.7	0
	Clearing Price ($/MW-month)	$0	$ 14,000	$ 14,000	$0
	Impact	None	None	None	None

Table 6 Comparison of FRM auction clearing with additional 10MW of TMOR small demand response resource participation

Section 6.2 Scenario 2 - 200 MW of Demand Response Resources participating in the FRM

An additional 200 MW of TMNSR capable small demand response resources offered in the Summer 2009 Forward Reserve Auction would impact the clearing price in all Reserve Zones. Most notably, these additional reserves would result in having more supply than demand in the historically reserve deficient CT Reserve Zone. The clearing price in the CT Reserve Zone (and consequently in SWCT due to the nested configuration) would be lower than the

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[17] TMOR Requirements can always be substituted by clearing the higher quality reserve product TMNSR (as was the case for Rest of System where 825 MW of TMNSR reserves were already cleared)

administratively set Forward Reserve Offer Cap of $14,000/MW-month. The clearing price in the Rest of System and the NEMA/Boston Reserve Zone would also decrease, but not as much as in CT due to the abundance of supply and the fact that the clearing price is already depressed. Table 7 below contains the projected results of the FRM auction under this scenario:

Comparative FRM Auction Clearing Results (Summer 2009) for TMNSR					
		Rest of System	CT	SWCT	NEMA/Boston
Summer 2009 Auction	Reserves Offered (MW)	1,432.4	0	0	25
	Reserves Required (MW)	850	850	850	850
	Reserves Cleared (MW)	825	0	0	25
	Clearing Price ($/MW-month)	$ 6,297	$ 14,000	$ 14,000	$0
Predicted Summer 2009 Auction with 200MW small demand response resource participation	Reserves Offered (MW)	1,632.4	200	200	225
	Reserves Required (MW)	850	850	850	850
	Reserves Cleared (MW)	825	200	200	225
	Clearing Price ($/MW-month)	$ 6,000	$ 13,000	$ 13,000	$ 6,000
	Impact	Small	Medium	Medium	Small

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Table 7 Comparison of FRM auction clearing with additional 200MW of TMNSR small demand response resource participation

The addition of 200 MW of TMOR capable small demand response resources in the FRM would have a similar impact on the clearing prices in the CT and SWCT Reserve Zones because there will be more supply than the reserve requirement, for the first time since the introduction of the FRM in 2006. The auction clearing price in these two Reserve Zones would be below the administratively set Forward Reserve Offer Cap of $14,000/MW-month. The clearing price in the Rest of System and the NEMA/Boston Reserve Zone would remain at $0 because there is no reserve requirement. Table 8 below contains the projected results of the auction under this scenario:

Comparative FRM Auction Clearing Results (Summer 2009) for TMOR				
	Rest of System	CT	SWCT	NEMA/Boston

Summer 2009 Auction	**Reserves Offered (MW)**	377.5	597	401.7	25
	Reserves Required (MW)	798	1,145	22	0
	Reserves Cleared (MW)	0	597	401.7	0
	Clearing Price ($/MW-month)	$0	$ 14,000	$ 14,000	$0
Predicted Summer 2009 Auction with 200MW small demand response resource participation	**Reserves Offered (MW)**	577.5	797	601.7	225
	Reserves Required (MW)	798	1,145	22	0
	Reserves Cleared (MW)	0	797	601.7	0
	Clearing Price ($/MW-month)	$0	$ 13,000	$ 13,000	$0
	Impact	None	Medium	Medium	None

Table 8 Comparison of FRM auction clearing with additional 200MW of TMOR small demand response resource participation

An additional participation in the Forward Reserve Auction of 200 MW of small demand response resources in the CT Reserve Zone is significant to the FRM because building new generation in this part of New England has been historically difficult. Having met the reserve requirement for this Reserve Zone is significant because with each new reserve provider (either generator or demand response resources) submitting offers in the CT and SWCT Reserve Zone the clearing prices should continue to decrease (long as reserve requirements do not increase proportionally).

From an economical standpoint for the small demand response resource, it is most lucrative to provide reserves (either TMOR or TMNSR) in the supply constrained Reserve Zone CT (or SWCT due to the nesting configuration) because of the supply shortage and high clearing prices. On the other hand, providing TMNSR reserves in the Rest of System or NEMA/BOSTON would yield a compensation of approximately $6,000/MW-month. Providing TMOR in Rest of System or NEMA/Boston is not practical because the reserve requirements for that product in zero at this time.

It is important to note that the ISO’s analysis and conclusions are not unique to small demand response resources. The addition of any resource – demand or supply – participating in the FRM as a price taker will produce the same results as described above. What may differentiate small demand response resources from generating resources is the expeditious manner with which the small demand response resources can enter the market. The ISO’s experience with small demand response resources to date is that that they can begin participating

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in the program rather quickly, since they are not subject to the same siting and environmental restrictions that traditional generation resources are facing. This benefit is especially valuable in the geographic regions where reserves are most needed. Therefore, through aggregation and portfolio management, small demand response resources may prove to be a valuable addition to New England's fleet of operating reserve resources.

Section 6.3 Overview of the Comparability of Small Demand Response Resources to Participate in the FRM

The KEMA analysis on the performance of small demand response resources in the DRR Pilot demonstrated that resources, participating as a DARD, can provide operating reserves, albeit their capability as an operating reserve resource is generally bellow their enrolled capacity in the 30-Minute Real-Time Demand Response Program and there is a variance in the amount of reduction provided in each activation.

Market participant taking on an obligation in the FRM are required to provide 100% of its Forward Reserve Obligation. The performance incentive and penalty structure of the FRM allows market participants to manage their performance risks and rewards by creating a portfolio of resources to satisfy their Forward Reserve Obligation. KEMA developed a model, using performance data from the DRR Pilot, to evaluate how a market participant with a portfolio of small demand response resources could participate in the FRM and manage performance risks versus rewards. Given the variability in small demand response resource performance, KEMA's model analyzed a resource's performance to ensure they can meet at least 90% of the claimed capability within 10 or 30 minutes depending on the type of reserves provided (*i.e.,* TMNSR or TMOR) in order to avoid de-rate penalties. Reaching 90% of its claimed reserve capability is significant because resources that fail to meet the 90% threshold within the claimed timeframe in two consecutive dispatch activations will have their reserve capability de-rated by 25%. Each subsequent performance failure would de-rate the claimed reserve capability by an additional 25%. Hence, while reaching 90% of the capability will avoid de-ration penalties, the Failure-to-Activate and/or Failure-to-Reserve penalties will still apply and can significantly impact a market participant's revenue.

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The graphs in Figure 5 below illustrate how a market participant could estimate the MW quantity they would offer in the FRM so that the observed reductions will correspond to a particular level of performance in the market. The plot on the left side shows the historic load reductions (10 minute or 30 minute) from a number of events. The horizontal line represents the level of the lowest load reduction produced by this resource. If this level of load reduction had been offered in the FRM then this market participant would have met its Forward Reserve Obligation at all times. A market participant that is more risk tolerable could increase its enrolled FRM capability to the 90% performance level. As discussed earlier, this strategy would avoid de-rating performance penalties, but would incur Failure-to-Activate and/or Failure-to-Reserve penalties in the hours when not providing 100% of the Forward Reserve Obligation.[18]

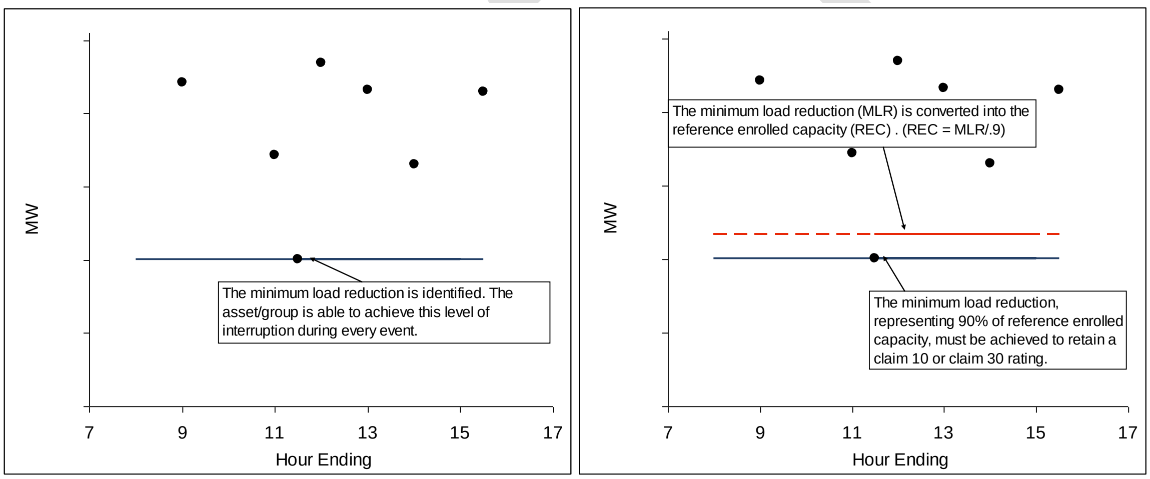

Figure 5 FRM Enrolled Capacity Heuristic

To better illustrate the correlation between the amount of reserves that small demand response resources can provide and their penalty exposure, KEMA developed a matrix of reserve capability as function of potential failed activations. Table 9 below indicates that the amount of 30 Minute capable reserves that can participate in the FRM proportionally increases with the number of increased unsuccessful activations. For example, if the grouped resources have zero risk tolerance and want 100% performance in the FRM then KEMA estimates that only 3.1 MW

[18] The ISO is not recommending or endorsing any specific strategy on how a market participant with small demand response resources should or should not participate in the FRM. This analysis is presented solely for illustrative purposes.

of the thirty minute capable resources can meet the FRM requirements, approximately 10% of the 28.6 MW enrolled capacity in Season 4 of the DRR Pilot. On the other hand, if the grouped resources have higher risk tolerance and can accept 2 potential failed activations then KEMA estimates that the market participant would be willing to offer as much as 7.2 MW of thirty minute capable reserves or 25% of the enrolled capacity in the FRM.

KEMA's Estimate of Reserve Capability per Number of Failed Events for 30 Minute Capable Small Demand Response Resource											
Period	Number of Assets	Number of Events	Pilot Enrolled Capacity (MW)	Reserve Capability in MW per number of failed events							
				0	1	2	3	4	5	6	7
Season 1	47	19	14.9	**3.0**	**4.3**	**4.3**	**4.6**	**5.0**	**5.1**	**5.1**	**5.2**
Season 2	90	18	30.2	**8.0**	**9.2**	**9.5**	**9.7**	**9.9**	**10.6**	**11.7**	**12.9**
Season 3	77	17	13.7	**2.2**	**2.2**	**2.7**	**2.9**	**3.9**	**4.2**	**4.2**	**4.7**
Season 4	90	16	28.6	**3.1**	**6.1**	**7.2**	**8.1**	**8.4**	**10.1**	**10.3**	**11.0**

Table 9 - DRR Pilot Estimate of 30 Minute Reserve Capability per number of failed events

KEMA's analysis indicates that a market participant with a portfolio of small demand response resources participating as a DARD could manage the portfolio in a way that will enable participation in the FRM. However, given that the DRR Pilot did not evaluate performance during the entire Forward Reserve Delivery Period of the FRM (7:00 to 23:00), the market participant would need to have confidence that their demand response resources could respond to the ISO's dispatch instructions in all hours, not just during the DRR Pilot hours (7:00 to 18:00).

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Section 7: Discussion of Measurement and Verification Standards:

ISO has been actively involved in the development of measurement and verification standards for demand response resources through the North American Energy Standards Board ("NAESB"). ISO continues to support NAESB's ongoing development work and believes that the establishment of industry standards can help lower costs and reduce barriers to entry for many types of demand-side resources, as well as facilitate the advancement of Smart Grid enhancements.

The NAESB standards which were filed with the Commission in April of 2009 address the measurement and verification characteristics of demand response products and services to be used in the wholesale electricity market. They are intended to provide a common framework for transparency, accountability and consistency. The demand response standards developed by the Wholesale Electric Quadrant ("WEQ") include forty definitions and thirty-one business practice standards. These standards address the measurement and verification characteristics of demand response products and services administered for application in the wholesale electricity market. They are intended to provide a common framework for transparency (accessible and understandable measurement and verification requirements for demand response products and services), accountability (criteria that will enable the system operator to accurately measure the performance of demand response resources), and consistency (standards applicable across all wholesale electricity markets). The standards address four product/service categories (energy, capacity, reserve and regulation), and establish criteria for the use of equipment, technology and procedures to quantify the demand reduction value delivered. The standards are accessible from the NAESB web site.

As a follow-up, NAESB's Demand Side Management and Energy Efficiency ("DSM-EE") subcommittee has begun efforts to scope the development of more detailed technical standards for the measurement and verification of demand response products and services in ISO-RTO footprint areas. The ISO continues to be involved in this stakeholder process.

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Appendix A: Forward Reserve Market Auction results 2006 – 2009 (offered reserves, results and LRR assumptions)

FRM Auction Period	Reserve Zone Name	TMNSR Offered	TMSNR Cleared	TMNSR Clearing Price	TMOR Offered	TMOR Cleared	TMOR Clearing Price	LRR
Winter 2006	ROS	948.5	565.6	$ 4,200	735.4	232.4	$ 4,200	N/A
Winter 2006	SWCT	90.0	90.0	$ 14,000	304	304	$ 14,000	550
Winter 2006	CT	0.0	0.0	$ 14,000	265	265	$ 14,000	1340
Winter 2006	NEMA/ BOSTON	60.0	60.0	$ 14,000	257	257	$ 14,000	910
Summer 2007	ROS	1001.0	691.2	$ 10,800	299.4	106.8	$ 3,550	N/A
Summer 2007	SWCT	0.0	0.0	$ 14,000	515	515	$ 14,000	520
Summer 2007	CT	0.0	0.0	$ 14,000	210	210	$ 14,000	1055
Summer 2007	NEMA/ BOSTON	8.8	8.8	$ 14,000	379	379	$ 14,000	1050
Winter 2007	ROS	1192.3	805.0	$ 9,050	448	0	$ -	N/A
Winter 2007	SWCT	0.0	0.0	$ 14,000	324.5	324.5	$ 14,000	611
Winter 2007	CT	0.0	0.0	$ 14,000	625	625	$ 14,000	1366
Winter 2007	NEMA/ BOSTON	45.0	45.0	$ 14,000	395.5	235	$ 8,500	280
Summer 2008	ROS	1281.1	743.0	$ 8,888	183	55	$ 6,500	N/A
Summer 2008	SWCT	0.0	0.0	$ 14,000	301.35	301.35	$ 14,000	520
Summer 2008	CT	0.0	0.0	$ 14,000	572.5	572.5	$ 14,000	1155
Summer 2008	NEMA/ BOSTON	57.0	57.0	$ 14,000	225	225	$ 14,000	300
Winter 2008	ROS	1385.0	750.0	$ 6,740	262	48	$ 4,990	N/A
Winter 2008	SWCT	0.0	0.0	$ 14,000	323	323	$ 14,000	610
Winter 2008	CT	0.0	0.0	$ 14,000	703.1	703.1	$ 14,000	1300
Winter 2008	NEMA/ BOSTON	89.0	50.0	$ 7,300	277.7	85	$ 5,550	135
Summer 2009	ROS	1432.4	825.0	$ 6,297	377.5	0	$ -	N/A
Summer 2009	SWCT	0.0	0.0	$ 14,000	401.7	401.7	$ 14,000	22
Summer 2009	CT	0.0	0.0	$ 14,000	597	597	$ 14,000	1145
Summer 2009	NEMA/ BOSTON	25.0	25.0	$ 6,297	25	0	$ -	0

Appendix B: Comparison of the incentives and penalties of the Demand Response Reserve Pilot and the Forward Reserve Market

Criteria		Demand Response Reserve Pilot	Forward Reserve Market
Eligibility	Eligibility	Must be a small demand response resource approved by the ISO. Total participation in the pilot capped at 50MW.	Any resource that meets FRM criteria III.9.5.1 of ISO tariff. For example, must have an audited capability to provide reserves within 10 or 30 minutes
Compensation	Compensation Rate	FRM Auction results	FRM Auction results
	Eligible for Real-Time reserve prices?	No	No
	How is enrolled capacity determined?	Lower of the enrolled capacity or the actual performance during an activation	Must have a valid audit of its 10 or 30 minute reserve capability. Can be de-rated for non performance.
	Eligible for ICAP Payment?	Yes	Yes
	Participates in the energy market?	No - but receives energy payment during interruptions at higher of Threshold Price or LMP	Yes
Resource requirements	Availability	Every weekday between 07:00 and 17:00	Every weekday between 07:00 and 23:00
	How are reserves dispatched?	Subject to ISO's unannounced activation requests	Can be dispatched at any time subject to ISO's co-optimizing dispatch algorithm
	Must offer energy on a daily basis at or above the threshold price?	No	Yes
Penalties	Subject to CLAIM10 and CLAIM30 audits for potential duration due to lack of performance?	No	Yes
	Subject to Failure-to-Activate Penalty?	Yes, but without the 2.25 multiplier	Yes, with the 2.25 multiplier
	Subject to Failure-to-Reserve Penalty?	No	Yes

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Appendix C: Load Response Program Summary Table

	Real Time Demand Response (RTDRP)	Real Time Profiled Response	Real Time Price Response (RTPR)	Day Ahead Load Response (DALRP)
Primary Purpose	Reliability	Reliability	Economic	Economic
Product Type	Capacity and Energy	Capacity and Energy	Energy	Energy
Effective Dates	Present to June 2010	Present to June 2010	Present to June 2012	Present to June 2012
Customer Type (all programs require 100 kW min. reduction)	Individual/Group	Individual/Group	Individual/Group	Dispatchable Customers enrolled in a Reliability or Economic program
Response Required?	Mandatory	Mandatory	Voluntary	Mandatory
Penalty for Non-performance	Monthly Capacity Payment is reduced	Monthly Capacity Payment is reduced	No Penalty	Deviations charged at the Real-Time LMP
Event Trigger	ISO NE Request - address Capacity Deficiency condition	ISO NE Request - address Capacity Deficiency condition	ISO NE Request - Real-Time LMP forecasted to exceed $100/MWh	Customer submits offers concurrent with DA Market.
Response Time	30 Minutes or 2 Hours	2 Hours	Voluntary - Customer Decides	Load reduction must occur during cleared hours
Duration of Demand Response Event	Min 2 Hour Guaranteed interruption	Min 2 Hour Guaranteed interruption	Event "window" opens as early as 7am and closes at 6 pm	Based on cleared offers - Customer can specify a minimum interruption duration
Energy Payment	Greater of Real Time Price or Guaranteed Minimum of $500/MWh for 30-minute notice programs; $350/MWh for 2-hour notice program	Greater of Real-Time LMP or Guaranteed Minimum of $100/MWh	Greater of Real-Time LMP or Guaranteed Minimum of $100/MWh	Greater of Offer Price or Day-Ahead LMP
Capacity Payment	Based on ICAP Transition Rate (presently $4.10/kW-month)	Based on ICAP Transition Rate (presently $4.10/kW-month)	N/A	Customers enrolled in a Reliability program receive capacity payment associated with that program