

Considering Demand Resources Projects for the Forward Capacity Market

NEPPA Forward Capacity Workshop

April 24, 2007

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Introduction to Demand Resource Participation in New England's Forward Capacity Market

February 16, 2007

Sheraton Springfield Monarch Place Hotel
Springfield, MA 01144

The screenshot shows the ISO New England website. The browser address bar displays http://www.iso-ne.com/markets/othrmkts_data/fcm/index.html. The page title is "ISO new england". The main content area is titled "Forward Capacity Market" and includes the following text: "The objective of the Forward Capacity Market (FCM) is to purchase sufficient capacity for reliable system operation for a future year at competitive prices where all resources, both new and existing, can participate." Below this, there are sections for "Qualification", "Presentations", "Filings & Orders", and "Relative Documentation". A left-hand navigation menu lists various market and system operation topics. The footer contains copyright information for 2007 ISO New England Inc. and links for site updates, future initiatives, and site index.

ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources

Manual M-MVDR

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Prepared by
ISO New England Inc.

Key references:

http://www.iso-ne.com/markets/othrmkts_data/fcm/index.html

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Key Demand Resources Terms and Acronyms

- FCM – Forward Capacity Market
- FCA – Forward Capacity Auction
- SOI – Show of Interest
- “Qual Pkg” – Qualification Package
- ODR – Other Demand Resource (Transition Period only)
- RTDR – Real-Time Demand Response
- DG – Real-Time Distributed Generation
- DRV – Demand Reduction Value
- IBCS & IBCS-OS – Internet-Based Communications System (Open Solution)
- FA – Financial Assurance
- M&V – Measurement and Verification

Demand Resources—Types and Characteristics

- Market Rules define Demand Resources *by the way and time periods they reduce load – not by type of technology*
- Different technologies can reduce load in different, sometimes multiple, ways – multiple options with different potential benefits and risks

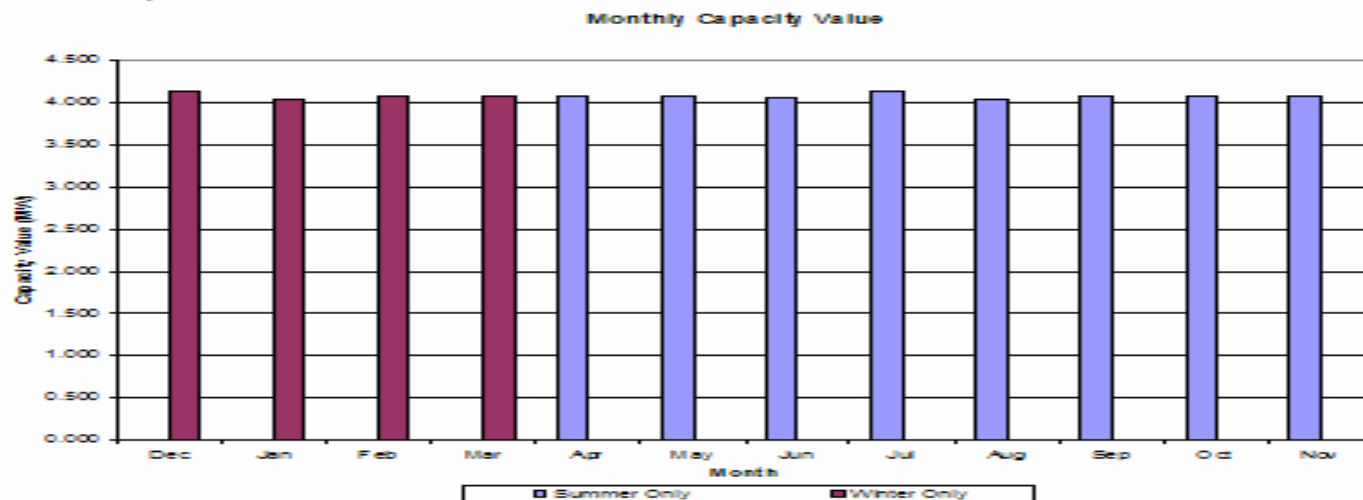
Demand Resources–Types and Characteristics

- Five Demand Resource Types:
 - “On-Peak” Demand Resources
 - “Seasonal Peak” Demand Resources
 - “Critical Peak” Demand Resources
 - “Real-Time Demand Response” Resources
 - “Real-Time Emergency Generation” Resources

(all DR Projects must provide a minimum DRV of 100 kW in a single Load Zone)
- **NOTE ALSO:**

FCA Requires 12-Month Capacity

- **Project Sponsors must be offer and deliver capacity in all 12 months of the year.**
- **Project Sponsors with Demand Resources with seasonal capability (i.e., higher in the summer than winter) can either:**
 - Offer a fixed 12-month Capacity Value based on their minimum capability, or
 - Make a Combined Offer consisting of multiple Demand and/or Supply resources. A Combined Offer can be made with another Project Sponsor, or
 - Participate in the monthly and seasonal Re-Configuration Auctions, but not the FCA or annual Re-Configuration Auctions, or
 - Participate in a Bi-Lateral Agreement with another Project Sponsor



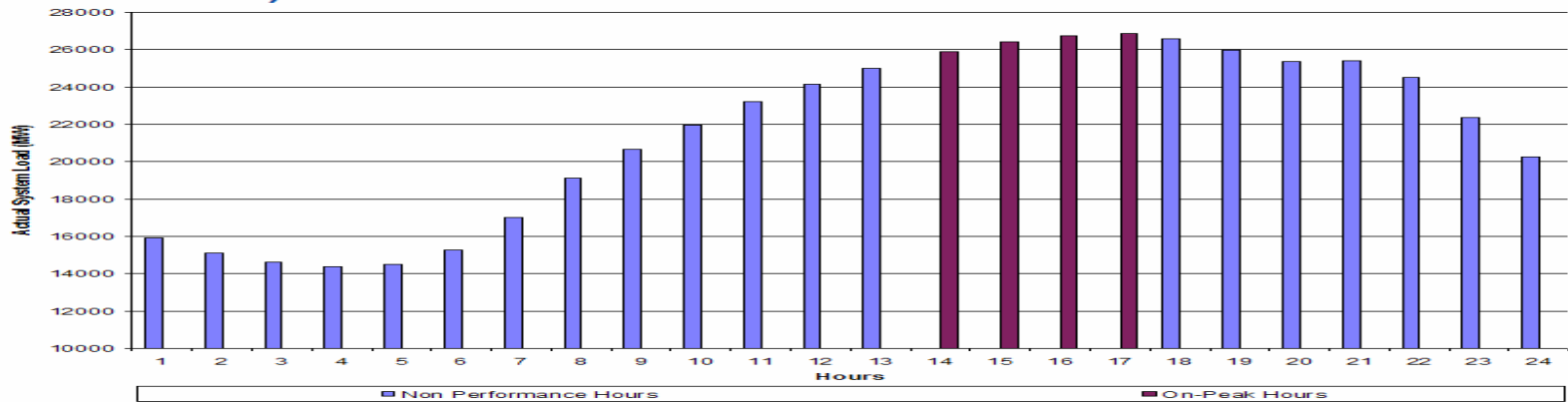
Distributed Generation - Applicable as Demand Resources

- Generation resources directly connected to end-use customer load and located behind the end-use customer's billing meter.
- Less than 5 MW nameplate rating or nameplate rating lower than non-coincident peak at the host facility.
- Examples of DG applicable as demand resources:
 - 4.5 MW CHP unit,
host facility non-coincident peak load is 4.5 MW.
 - 16 MW CHP unit,
host facility non-coincident peak load is 22 MW
- For individual Distributed Generation projects from a single facility with a Demand Reduction Value greater than or equal to 5 MW the critical path schedule requirements and the monitoring and milestones are the same as those required for New Generating Capacity Resources as set forth in Section III.13.1.1.2.2.2.
 - **Major Permits**
 - **Project Financing Closing**
 - **Interconnection Request**
 - **Major Equipment Orders**
 - **Substantial Site Construction**
 - **Major Equipment Delivery**
 - **Major Equipment Testing**
 - **Commissioning**
 - **Commercial Operation**

On-Peak Demand Resources

- On-Peak Demand Resources measure their load reduction during the following hours:
 - **Summer On-Peak Hours:** 1 p.m. to 5 p.m. Non-Holiday Week Days in June, July and August
 - **Winter On-Peak Hours:** 5 p.m. to 7 p.m. Non-Holiday Week Days in December and January
- Designed for non-dispatchable measures that are *not weather sensitive* and reduce load across pre-defined hours (e.g., lighting, motors, etc.).

On-Peak Example (Summer Weekday during Peak Load Conditions)



“On-Peak Demand Resources” example “Projects”:

- Commercial/Industrial lighting retrofit program
- Commercial/Industrial motor replacement program
- Industrial process -- processor controlled load management
- Aggregated domestic storage water heating retrofit
- Aggregated domestic water heating load management

M&V to determine DRV is likely derived from counting, engineering estimates, non-kW/kWh metered quantities (e.g., amps, on/off state, operating hours), proxy installations, spot measurement and calibration

(5 to 7 pm winter hours may preclude/limit some applications' value)

On-Peak Demand Resources

Monthly Demand Reduction Value

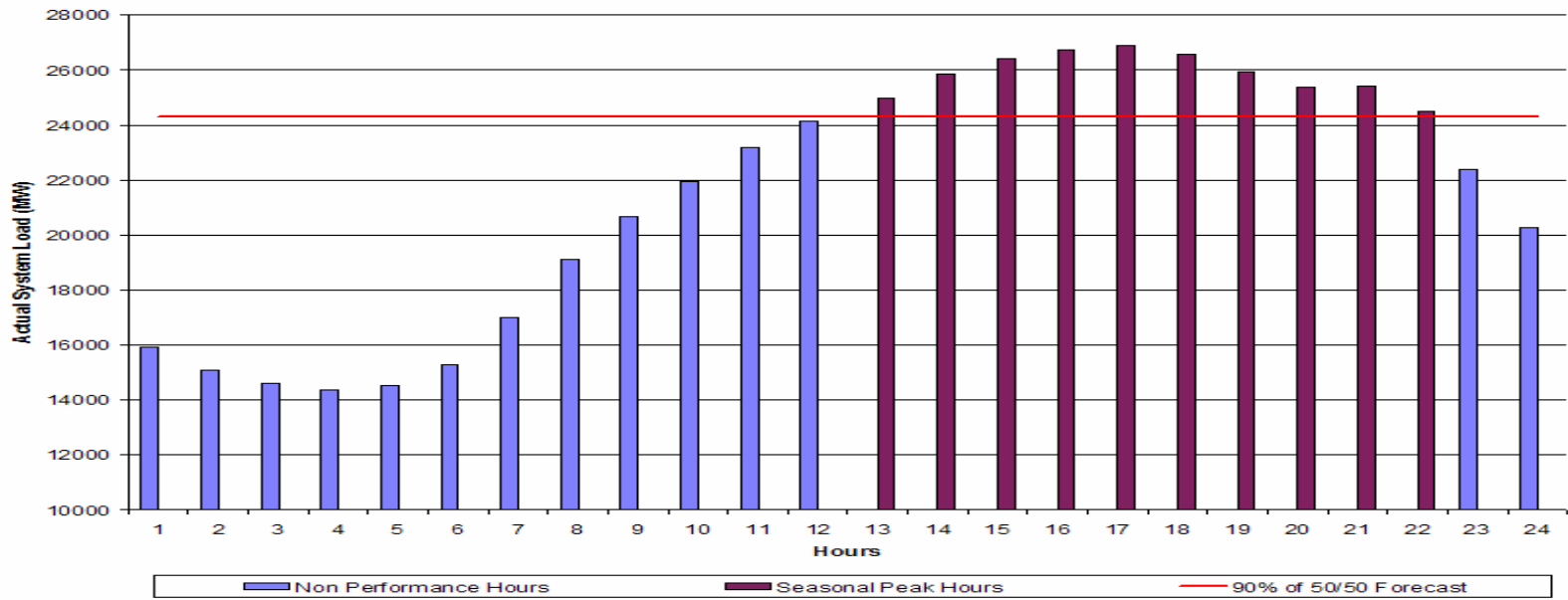
- June, July, August, December and January
 - Average Hourly Load Reduction or Output over the On-Peak Hours in the month
- September, October, November, April and May
 - Simple average of the Average Hourly Load Reduction or Output in the months of June, July and August
- February and March
 - Simple Average of the Average Hourly Load Reduction or Output in the months of December and January

	June	July	August	September	October	November
Electrical Energy Reduction (kWh)	50,000	52,000	58,000			
On-Peak Hours	84	84	92			
Average Hourly Reduction (MW)	0.595	0.619	0.630			
Demand Reduction Value (MW)	0.595	0.619	0.630	0.615	0.615	0.615

Seasonal Peak Demand Resources

- Seasonal Peak Demand Resources must reduce load during Non-Holiday Week Days when the ***Real-Time System Hourly Load*** is equal to or greater than **90%** of the most recent “50/50” System Peak Load Forecast for the applicable Summer or Winter Season.
- Designed for non-dispatchable, weather-sensitive measures such as energy efficient HVAC measures.

Seasonal Peak (Weekday during Peak Load Conditions)



“Seasonal Peak Demand Resources” example “Projects”

- Process modification – e.g., shut down (or don’t start) a manufacturing line
- Behind-the-meter DG (< 5 MW or < host facility non-coincident peak)
Combined Heat & Power (CHP)
- Aggregated, Combined Offer (Demand/Demand or Demand/Supply)
HVAC retrofit Projects
 - “Cold climate” heat pumps
 - Storage heat / ice storage

Seasonal Peak Demand Resources

Monthly Demand Reduction Value

- **June, July, August, December and January**
 - Average Hourly Load Reduction or Output over the Seasonal Hours in the month
 - If there are no Seasonal Peak Hours in a month, values from a previous month, audit or engineering estimates can be used
- **September, October, November, April and May**
 - Simple average of the Average Hourly Load Reduction or Output in the months of June, July and August
- **February and March**
 - Simple Average of the Average Hourly Load Reduction or Output in the months of December and January

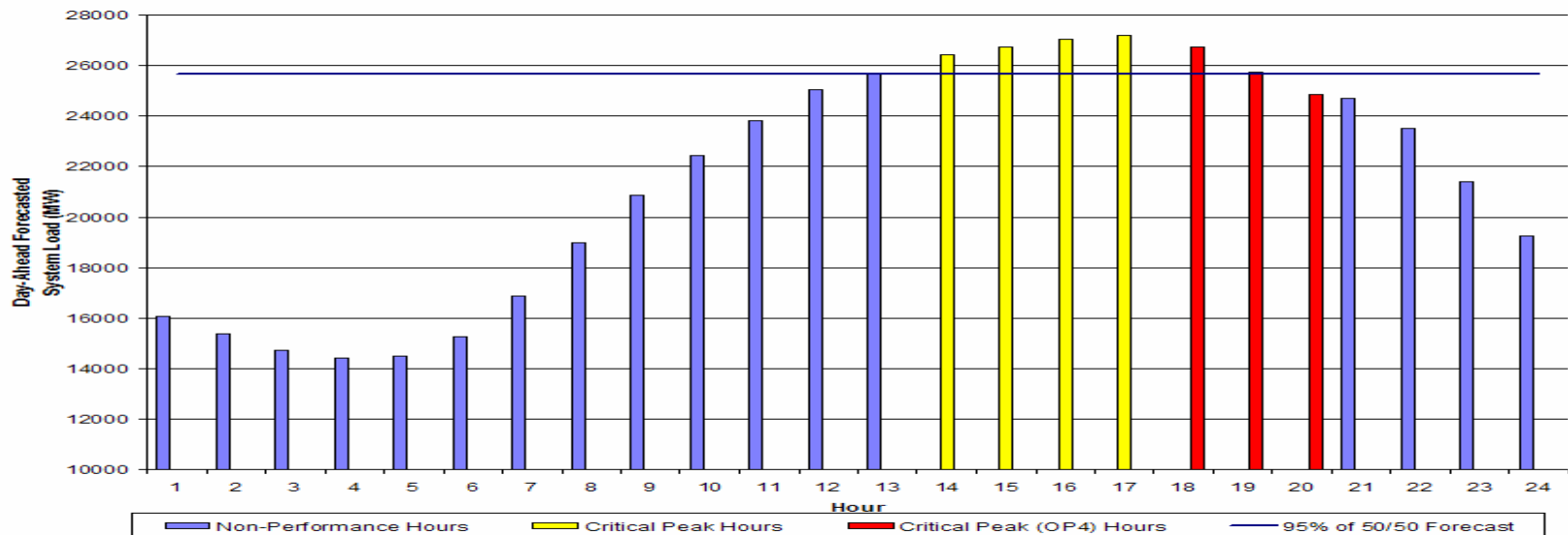
	June	July	August	September	October	November
Electrical Energy Reduction (kWh)		7,800				
Seasonal Peak Hours	0	8	0			
Average Hourly Reduction (MW)		0.975				
Demand Reduction Value (MW)	1.006	0.975	0.975	0.985	0.985	0.985

June based on Engineering Estimate from Supplier's approved M&V Plan
 August set equal to the Demand Reduction Value from the Previous Month (July)

Critical Peak Demand Resources

- Critical Peak Demand Resources must reduce load across Forecasted Peak Hours and Shortage Hours.
 - **Forecast Peak Hours** are hours when the ISO's **Hourly Day-Ahead Forecasted Load** (for non-holiday weekdays days) is equal to or greater than **95%** of the most recent 50/50 System Peak Load Forecast for the applicable summer or winter season.
 - **Shortage Hours** are hours when the ISO implements OP-4 Action 6 or higher (See Definitions). *OP4 Actions are called in real-time.*
- Designed for measures that can be dispatched by the project owner based on system conditions.

Critical Peak (Weekday during Peak Load Conditions)



Critical Peak Demand Resources example Projects:

- Process modification – e.g., shut down (don't start) a manufacturing line
- Behind the meter DG
- Load management – e.g., radio/pager/internet/AMR initiated interruption of water heating, unessential lighting, indoor pool pumps & dehumidifiers

Defined Term

- **Weighted Average Hourly Load Reduction or Weighted Average Hourly Output**
 - Sum of the Demand Resource's electrical energy reduction or output (MWh) during **Forecast Peak Hours** plus
 - Sum of the Demand Resource's electrical energy reduction or output (MWh) during **Shortage Hours** multiplied by two (2)
 - Divided by the number of Forecast Hours in the month plus the number of Shortage Hours in the month multiplied by two (2)

	Weighting Factor	Reduction (MWh)	Hours
Forecast Peak Hours	1	1.500	8
Shortage Hours	2	0.500	4
Weighted Total		2.500	16
Weighted Average Hourly Reduction (MW)			0.156

Critical Peak Demand Resources

Monthly Demand Reduction Value

	June	July	August	September	October	November
Electrical Energy Reduction during Forecast Peak Hours (kWh)		8,300	7,200			
Forecast Peak Hours	0	8	8			
Electrical Energy Reduction during Shortage Hours (kWh)		-	3,400			1,100
Shortage Hours	0	0	4			2
Weighted Average Hourly Reduction (MW)		1.038	0.875			0.550
Demand Reduction Value (MW)	1.006	1.038	0.875	0.973	0.973	0.761

June based on Engineering Estimate from Supplier's approved M&V Plan

November based on the Average of Summer Average and November Weighted Average Hourly Reduction

Real-Time Demand Response Resources

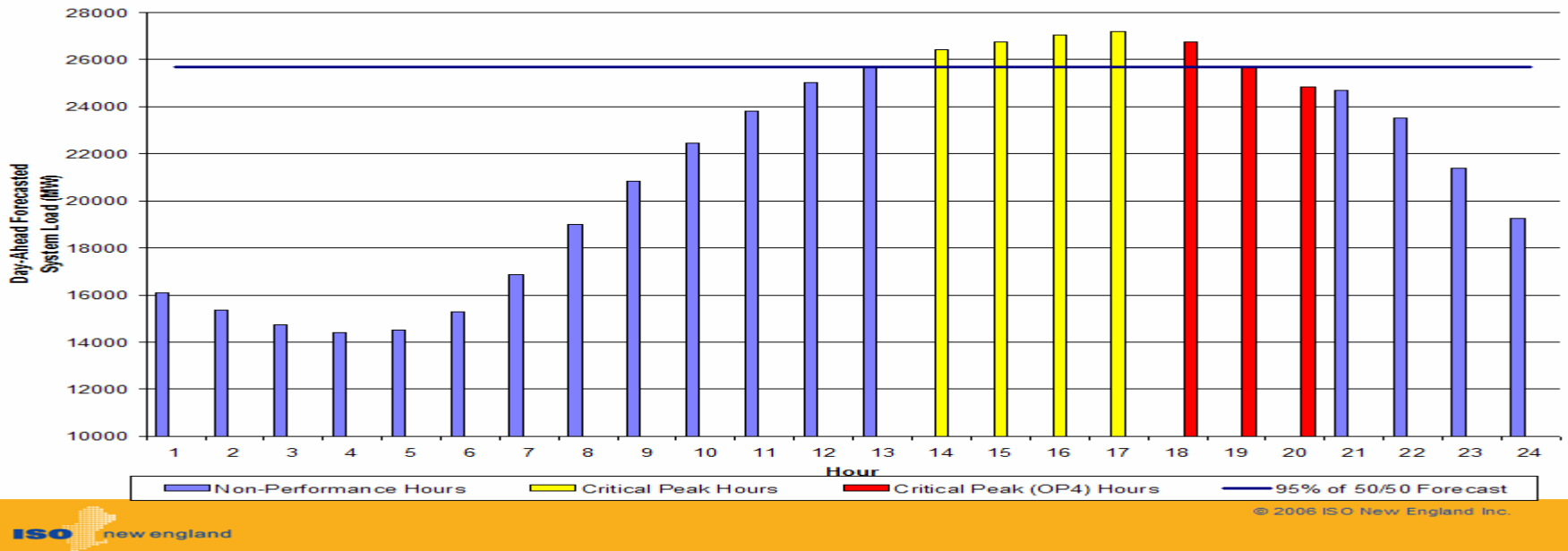
- The ISO will send Dispatch Instructions to Real-Time Demand Response Resources:
 - They must curtail electrical usage within 30 minutes of receiving a Dispatch Instruction; and
 - Continue curtailing usage until receiving a Dispatch Instruction to restore electrical usage.
- Designed for dispatchable measures with no binding air quality permitting restrictions on their use *during Critical Peak Hours*.

Real-Time Demand Response Resources

Monthly Demand Reduction Value

- **June, July, August, December and January**
 - *Weighted Average Hourly Load Reduction or Output over the Critical Peak Hours in the month*
 - *If there are no Critical Peak Hours in a month, values from a previous month, audit or engineering estimates can be used.*
- **September, October, November, April and May**
 - *If there are no Critical Peak Hours in the month, simple average of the Weighted Average Hourly Load Reduction or Output in the months of June, July and August.*
 - *If there are Critical Peak Hours in the month, simple average of (i) Weighted Average Hourly Load Reduction or Output over the Critical Peak Hours in the month and (ii) simple average of the Weighted Average Hourly Load Reduction or Output in the months of June, July and August.*
- **February and March**
 - *If there are no Critical Peak Hours in the month, simple average of the Weighted Average Hourly Load Reduction or Output in the months of December and January.*
 - *If there are Critical Peak Hours in the month, simple average of (i) Weighted Average Hourly Load Reduction or Output over the Critical Peak Hours in the month and (ii) simple average of the Weighted Average Hourly Load Reduction or Output in the months of December and January.*

Real-Time Demand Response



- Real-time Demand Response requires Internet-Based Communications System

Real-time Demand Response Resources example Projects:

- Short-notice process / load interruption
- Behind the meter DG

Real-Time Demand Response Resources

Monthly Demand Reduction Value

	June	July	August	September	October	November
Electrical Energy Reduction during Forecast Peak Hours (kWh)		8,300	7,200			
Forecast Peak Hours	0	8	8			
Electrical Energy Reduction during Shortage Hours (kWh)		-	3,400			1,100
Shortage Hours	0	0	4			2
Weighted Average Hourly Reduction (MW)		1.038	0.875			0.550
Demand Reduction Value (MW)	1.006	1.038	0.875	0.973	0.973	0.761

June based on Engineering Estimate from Supplier's approved M&V Plan

November based on the Average of Summer Average and November Weighted Average Hourly Reduction

Real-Time Emergency Generation Resources

- The ISO will send Dispatch Instructions to Real-Time Emergency Generation Resources:
 - They must curtail electrical usage within 30 minutes of receiving a Dispatch Instruction; and
 - Continue curtailing usage until receiving a Dispatch Instruction to restore electrical usage.
- ***Designed for dispatchable Emergency Generators only.***
 - Distributed Generation whose Federal, State and/or Local air quality permit(s) limit the operation of these generators to OP-4, Action 12 – the action in which voltage reductions of five percent (5%) of normal operating voltage that require more than 10 minutes to implement.
- The amount of Emergency Generators used to meet the Installed Capacity Requirement (ICR) is limited to **600 MW.**

Real-Time Emergency Generation Resource

Monthly Demand Reduction Value

	June	July	August	September	October	November
Electrical Energy Output (kWh)		7,800	4,200			3,000
RTEG Event Hours	0	4	2			2
Average Hourly Output (MW)		1.950	2.100			1.500
Demand Reduction Value (MW)	2.013	1.950	2.100	2.021	2.021	1.500

June based on Engineering Estimate from Supplier's approved M&V Plan
 August set equal to the Demand Reduction Value from the Previous Month (July)
 November based on the November Average Hourly Output

- As with RTDR, Real-Time Emergency Generation requires IBCS

Demand Resources Projects Decision Issues

- DR Project Capacity Obligations Are Similar to and As Serious As for Generating Projects
- Stringent Qualification and Performance Requirements (for both Implementing and Operating)
- Project Sponsors Responsible for ISO Review, Monitoring Costs
- Financial Assurance Required to Back Commitments and Penalty Payments
- A sampling follows:

Qualification Package

- Project Description
 - Minimum Project Size = 100 kW
 - Must be located in a single Load Zone
- Source of Funding
- Customer Acquisition Plan and Critical Path Schedule
- Measurement & Verification Plan
- Capacity Commitment Period Election
 - Maximum 5 Years for New Capacity

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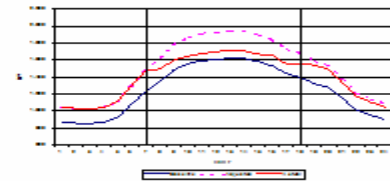
Customer Acquisition Plan

- Somewhat analogous to the requirement that Generators document site control
- Required contents:
 - Description of proposed Customer Market
 - Estimated size of Target Market
 - Marketing Plan
 - Explain how savings goals will be achieved and customers will be recruited (i.e., marketing and outreach strategy, incentive offerings) and any progress-to-date (e.g., leads, customer commitment letters)
 - Viability of Marketing Plan
 - Supporting documentation showing that the targeted level of market penetration is *achievable* (based on market potential studies and/or prior program experience)
 - Critical Path Schedule

M&V Standards Manual

- The Project Sponsor must describe in their Measurement and Verification Plan how the Demand Reduction Value during performance hours will be calculated, including any calculations for the Baseline and post installation electricity consumption.

Baseline Conditions



Option A: Spot or Short-Term Measurement with Stipulated Values



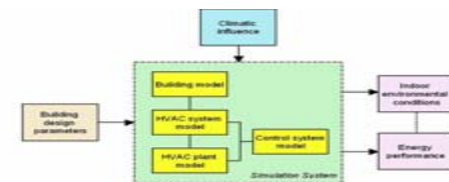
Option B: End-Use or System Interval Metering



Option C: Whole Facility Metering and Analysis



Option D: Calibrated Simulation



Measurement and Verification Requirements

- Distributed Generation must provide real time metering for determination of Monthly Demand Reduction Value
- Must measure and record electrical output of the generator during Performance Hours at a frequency of no less than one hour increments.
- Must report the most recent annual non-coincident peak demand (absent Generation output) and the monthly average hourly load of the end-use metered customer at the location where the DG resource is directly connected.
- Measurement, monitoring and data recording equipment directly measuring watt-hrs, volt-hrs, volt-ampere-hrs, reactive volt-ampere-hrs and associated demand components must conform to standards set by American National Standards Institute or equivalent standards.

Financial Assurance

- For the 1st Forward Capacity Auction the Financial Assurance Requirement will be \$22.50 per kW.
- **For a 500 kW project, a total of \$11,250 will be required payable in three installments.**
- Provisions to return some of the Financial Assurance for projects that deliver all or a portion of their Capacity Offer prior to the Commitment Period.
- Acceptable forms of Financial Assurance include Cash, Letter of Credit or Corporate Guarantee.

Demand Resource Considerations

- Many Demand Resource projects will involve measure installations that “ramp-up” during the Planning Period
- On a set date in advance of the next FCA, the progress of all Project Sponsors in meeting their milestone schedule is reviewed
 - If the percent completion equals or exceeds the milestone schedule, then FA is released for capacity that has come on-line
 - If the milestone is missed, FA is retained
 - If capacity/customers who were previously participating are lost and not replaced, FA for the lost capacity must be re-posted within 5 business days
- 15 days before the next FCA, additional FA equal to the amount outstanding is posted
- The above process is repeated for one more FCA

Measurement of Savings

- Direct Measurement
- Indirect Measurement
- Statistical Sampling
- Independent Verification
- Auditing
- Testing

Project Reporting

- **Description:**
 - The Project Sponsor shall describe in their Measurement and Verification Plan how they will prepare the reports required to comply with ISO New England's monthly data reporting requirements.
- **Requirements:**
 - Monthly reporting shall consist of documents describing
 - Overall project status.
 - Certification of measurement verification and compliance with statistical significance.
 - Deviations from the M&V Plan and actions taken to correct deviations.
 - Adjustments to Demand Reduction Value calculations (baseline, decommissioning, delisting).
 - All data as described in the M&V Plan including raw and processed data.

Independence

- **Description:**

- The Measurement and Verification implementation shall not be biased by any financial interest in the results or efforts resulting from the implementation of evaluation recommendations.

- **Requirements:**

- The Project Sponsor shall demonstrate independence of the entity implementing the pre- and post-installation inspections of Demand Resource measures, such that the evaluation is independent of the Project Sponsors design, management and implementation.