ISO New England Manual for

Measurement and Verification of Demand Reduction Value from Demand Resources

Manual M-MVDR

Revision: 0
Effective Date: April 13, 2007

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ISO New England Manual for

Measurement and Verification of Demand Reduction Value from Demand Resources

Table of Contents

Revision History

Introduction

Section 1: Overview

Section 2: Project Information

Section 11: Monitoring Frequency and Duration

Section 12: Data Validation, Retention and Management

Section 13: Performance Reporting

Section 14: Independence and Auditing

Section 15: Measurement and Verification Supporting Documents

ISO New England Manual for

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List of Figures and Tables

Revision History

Approval

Approval Date: April 13, 2007 Effective Date: April 13, 2007

Revision History

Introduction

Welcome to the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this introduction, you will find the following information:

- What you can expect from the ISO New England Manuals (see "About ISO New England Manuals, ISO New England Operating Procedures, ISO New England Business Procedures and User Guides").
- What you can expect from this ISO New England Manual (see "About This Manual").
- How to use this manual (see "Using This Manual").

About ISO New England Manuals, ISO New England Operating Procedures, ISO New England Business Procedures and User Guides

The ISO New England Manuals, ISO New England Operating Procedures, ISO New England Business Procedures and User Guides are the instructions, rules, procedures, and guidelines established by the ISO for the operation, planning, and accounting requirements of the New England Control Area and the Market. Table 1.1 lists the ISO New England Manuals, ISO New England Operating Procedures, ISO New England Business Procedures and User Guides.

Table 1.1
Summary of ISO New England Manuals, ISO New England Operating Procedures, ISO New England Business Procedures and User Guides

Transmission	Market	Installed Capacity	Accounting and Billing	ISO Administrative
OP2: Meter and Communication Equipment Maintenance	**OP3:** Transmission Maintenance Scheduling	**M-20** Installed Capacity	**M27:** Tariff Accounting	**OP1**: Responsibilities and Authorities
OP6: System Restoration	**OP4:** Capacity Deficiency Procedures		**M-28:** Market Rule 1 Accounting	**OP10:** Analysis and Reporting of System Emergencies
OP7: Transmission Emergency Operations	**OP5:** Generation Maintenance Scheduling		**M29:** Billing	
OP11: Black Start Testing	**OP8:** Operating Reserve and AGC Requirements		**User Guide for submitting Internal Bilateral Transactions via SMS**	
OP12: Voltage and Reactive Control	**OP9:** External Transactions		**ISO New England Load Response Program Manual**	
OP13: Voltage Reduction and Load Shedding	**OP14:** Technical Requirements for Generators and Dispatchable Asset Related Demands		**ISO New England Measurement and Verification of Demand Reduction Value from Demand Resources**	
OP16: Transmission System Data	**OP18:** Metering and Telemetering Requirements			
OP17: Load Power Factor Correction	**M-06:** Financial Transmission Rights			
OP19: Transmission Operations	**M-11:** Market Operations			
Ancillary Service Schedule No. 2 Business Procedure	**M-35:** Definitions and Abbreviations			
	M-36: Forward Reserve			
	User Guide for External Transactions via EES			
	User Guide for Financial Transmission Rights via eFTR			
	User Guide for Submitting Bids and Offers via eMKT			

About This Manual

The ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources*** is one of a series of manuals within the Accounting and Billing set of manuals. Demand Resources may participate in the Forward Capacity Market. All Demand Resources that participate in the Forward Capacity Market are required to demonstrate performance during specific operating hours in a manner that provides electrical capacity to the New England Control Area. The methodology for determining the Demand Reduction Value and Capacity Value for the various types of Demand Resources that may participate in the Forward Capacity Market is defined in Market Rule 1.

To demonstrate a Demand Reduction Value, qualified Market Participants must comply with the Measurement and Verification standards defined in this Manual. The measured and verified electrical energy reductions during performance hours are the basis of FCA payments to Market Participants participating in the Forward Capacity Market.

Demand Resources classified as Real-Time Demand Response and Real-Time Emergency Generation are required to adhere to the requirements in Appendix A of this Manual.

The ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources*** specifies the elements of a Project Sponsor's Measurement and Verification Documents required under the Market Rules and includes but is not limited to the following:

Section 1: Overview
Section 2: Project Information
Section 3: Project General Assumptions
Section 4: Equipment, Measure, and Practice Detail
Section 5: Measurement and Verification Approach
Section 6: Establishing Baseline Conditions
Section 7: Statistical Significance
Section 8: Demand Reduction Value Calculations
Section 9: Monitoring Parameters and Variables
Section 10: Measurement Equipment Specifications
Section 11: Monitoring Frequency and Duration
Section 12: Data Validation, Retention and Management
Section 13: Performance Reporting
Section 14: Independence and Auditing
Section 15: Measurement and Verification Supporting Documents
Section 16: Responsible Parties
Section 17: Measurement and Verification Plan Format
Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation

Target Users

The target users for the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources*** are:

- *Market Participants* - Any Market Participant (including Demand Response Providers) requesting to purchase or sell Capacity to or from the Forward Capacity Market.

- *ISO Staff* - The ISO staff responsible for reviewing and approving Demand Resource Measurement and Verification Plans, as well as reviewing, approving and processing monthly performance reports of Demand Reduction Values.

References

The references to other documents that provide background or additional detail directly related to the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources*** are:

- ***ISO New England Load Response Program Manual, M-LRP***

Using This Manual

Because we believe that explaining concepts is just as important as presenting the procedures, we start each section with the "big picture". Then, we present details and procedures. This philosophy is reflected in the way we organize the material in this manual. The following paragraphs provide an orientation to the manual's structure.

What You Will Find In This Manual

- A table of contents
- An approval page that lists the required approvals and the revision history
- This introduction
- Seventeen sections and one appendix containing the specific guidelines, requirements, or procedures including ISO actions and Market Participant actions

Section 1: Overview

Welcome to the *Overview* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of the purpose and scope of the Manual (see "Purpose" and "Scope").
- A description of what is not provided in this Manual (see "What This Manual Does Not Provide").
- An overview of what occurs if this Manual is not complied with (see "Compliance with Standards").

1.1 Purpose

The ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources (M-MVDR)*** establishes the criteria required for qualified Market Participants to verify and report electrical energy reductions (MWh) for Demand Resources participating in the Forward Capacity Market during the performance hours defined for each of five different Demand Resource types defined in Market Rule 1. These performance hours (herein after "Performance Hours") include:

(1) Demand Resource On-Peak Hours,

(2) Demand Resource Seasonal Peak Hours,

(3) Demand Resource Critical Peak Hours,

(4) Real-Time Demand Response Event Hours, and

(5) Real-Time Emergency Generation Event Hours.

1.2 Scope

To be eligible to receive FCA Payments, Demand Resources must comply with all requirements set forth in this Manual in addition to any other relevant Market Rules, Operating Procedures and Manuals established by the ISO. Project Sponsors of Demand Resources shall conform to Market Rule 1 and provide an Annual Certification that the Demand Resource Projects (herein after "Project") for which the Project Sponsor is requesting compensation continue to perform in accordance with the submitted Measurement and Verification Documents reviewed by the ISO. The term "Project Sponsor" will be used throughout this Manual to refer to Market Participants, Demand Response Providers, Enrolling Participants and any other class of wholesale market customer that has a settlement account with the ISO and is eligible to register Demand Resources with the ISO pursuant to Market Rule 1.

A Market Participant may qualify a Project for the Forward Capacity Market as one of the following five resource types. The Demand Resource types defined in Market Rule 1 include:

(1) On-Peak Hour Demand Resources,

(2) Seasonal Peak Demand Resources,

(3) Critical Peak Demand Resources,

(4) Real-Time Demand Response Resources, and

(5) Real-Time Emergency Generation Resources.

Projects can be comprised of a variety of measures, systems, technologies, and strategies including, but not limited to, the following:

(1) Distributed Generation

(2) Load Management

(3) Energy Efficiency

All Project Sponsors wishing to (i) qualify a Demand Resource for a Forward Capacity Auction or Reconfiguration Auction and (ii) receive FCA Payments must prepare a Measurement and Verification Plan. Such Measurement and Verification Plans and other Measurement and Verification Documents must comply with the standards and criteria specified in this Manual.

This Manual specifies the acceptable methodologies for Measurement and Verification of Demand Reduction Values to be used for each of the five Demand Resource types defined in Market Rule 1 and listed above, and references other ISO Operating Procedures or Manuals that must be followed to qualify and participate in the Forward Capacity Market.

1.3 What This Manual Does Not Provide

This Manual is not intended to provide instruction to Project Sponsors in classifying a Project into one of the Demand Resource types listed above or in selecting the appropriate Performance Hours under which the Project must demonstrate electrical energy reduction to receive Capacity Value in the Forward Capacity Market. Project Sponsors unfamiliar with the Forward Capacity Market, Demand Resource types, or the Performance Hours for Demand Resources are encouraged to refer to Market Rule 1, other technical resources, and to secure qualified professional assistance prior to attempting to submit Projects for qualification in the Forward Capacity Market.

This Manual also does not provide instruction or assistance on Measurement and Verification methods and procedures. Project Sponsors who are unfamiliar with Measurement and Verification methods and procedures are encouraged to secure qualified professional assistance prior to attempting to submit Projects for qualification in the Forward Capacity Market.

1.4 Compliance with Standards

Failure to comply with the requirements of this Manual during the Forward Capacity Market qualification process will result in rejection of the Project Sponsor's Demand Resource Qualification Package. Failure to comply with the requirements of this Manual after a Project is qualified by the ISO to participate in the Forward Capacity Market may cause the Demand Resource to be unable to perform in the Markets, which may result in the forfeiture of Financial Assurance, reduced or no FCA Payments, or sanctions as provided for in Market Rule 1 Appendix B. This does not include compliance failures due to circumstances beyond the reasonable control of the Project Sponsor, such as transmission, distribution or communication outages that are external to the Demand Resource project. The ISO will determine the Resource's ability to perform in the markets when not in compliance with the requirements of this Manual.

Section 2: Project Information

Welcome to the *Project Information* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of the requirement to describe the proposed measures, systems processes and or strategies (see "Description").
- A description of the required project information which must be included in the Measurement and Verification plan (see "General Requirements").
- A description of additional required information for distributed generation (see "Additional Requirements for Distributed Generation").

2.1 Description

The Project Sponsor shall describe in its Measurement and Verification Plan each of the measures, systems, processes and/or strategies that make up its Project.

The Project Sponsor shall describe how each of the measures, systems, processes and/or strategies will be installed and operated to result in additional and verifiable reductions in end-use demand on the electricity network in the New England Control Area during Demand Resource On-Peak Hours, Demand Resource Seasonal Peak Hours, Demand Resource Critical Peak Hours, or Real-Time Demand Response Events.

The Project description in the Measurement and Verification Plan and other Measurement and Verification Documents associated with the Project must be consistent with the Project description in the Project Sponsor's Qualification Package.

2.2 General Requirements

The Project Sponsor must provide in its Measurement and Verification Plan each of the following:

(1) Project Name;

(2) Project Sponsor's Market Participant Status;

(3) Demand Resource Type (On-Peak Demand Resource, Seasonal Peak Demand Resource, Critical Peak Demand Resource, Real-Time Demand Response Resource, or Real-Time Emergency Generation Resource);

(4) Load Zone within which the Project will be located;

(5) Project Location, including the name and address of the retail customer(s) where the Project will be implemented if known at the time the Measurement and Verification Plan is submitted to the ISO subject to the provisions in Section 12.2 of this Manual.

(6) Types of facilities in which the measures, systems, processes or strategies will be implemented;

(7) Customer classes and end-uses served;

(8) Types of measures that will be implemented (i.e., Energy Efficiency, Load Management, Distributed Generation);

(9) Estimated Demand Reduction Value (kW) per measure and/or per customer facility (measured at the customer meter), including supporting documentation (e.g., engineering estimates or documentation of verified savings from comparable projects) to substantiate the reasonableness of the estimated Demand Reduction Value that the Project Sponsor intends to offer into the Forward Capacity Auction;

(10) Estimated total Demand Reduction Value of the Project;

(11) The date by which the Project Sponsor expects to reach commercial operation (commercial operation for a Demand Resource shall mean the demonstration to the ISO by the Project Sponsor that the Demand Resource described in the Project Sponsor's New Demand Resource Qualification Package has achieved its full Demand Reduction Value);

(12) Status under ISO generation interconnection procedures (if applicable);

(13) For the first Forward Capacity Auction, whether the Project Sponsor elects to be treated as Existing Capacity in the Forward Capacity Auction;

(14) A description of the typical qualifications and experience of the Project Sponsor's Project team members and subcontractors that will be directly involved in Measurement and Verification activities.

For Projects where one or more of the requirements described in items (5) thru (9) listed above are not known at the time the Project Sponsor submits its Measurement and Verification Plan to the ISO for review and approval, the Project Sponsor shall specify which of the requirements are not available and may instead describe the types of customers to be treated, provide examples of the products, services, systems, processes and measures to be installed or effected, and the manner in which such efforts will be pursued. The manner in which the efforts will be pursued must be consistent with the approach described in the Project Sponsor's Customer Acquisition Plan, as defined in the Market Rule submitted to the ISO as part of the Project Qualification Process.

The Project Sponsor must provide to the ISO information that demonstrates the products, services, systems, processes and measures actually installed or affected are functionally equivalent to those described in its Measurement and Verification Plan. The Project Sponsor must provide the information prior to submitting its first Performance Report as described in Section 13 of this Manual.

2.3 Additional Requirements for Distributed Generation

For Projects involving the use of Distributed Generation, the Project Sponsor shall provide in its Measurement and Verification Plan:

(1) The aggregate nameplate capacity of the Distributed Generation resource;

(2) The most recent annual non-coincident peak demand (absent Distributed Generation output) of the end-use metered customer at the location where the Distributed Generation resource is directly connected;

(3) An estimate of the monthly average hourly load for each month of the Capacity Commitment Period (absent Distributed Generation output) of the end-use customer to which the Distributed Generation resource is directly connected; and

(4) An estimate of the Distributed Generation resource's monthly average hourly output for each month of the Capacity Commitment Period.

Section 3: Project General Assumptions

Welcome to the *Project General Assumptions* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***.

The Project Sponsor shall describe in its Measurement and Verification Plan any variables that affect the Project's electrical energy consumption or Distributed Generation output (such as outside temperature, time of day, process changes, occupancy, etc.) that will be measured or monitored and used in the determination of the Project's Demand Reduction Value during Performance Hours.

The Project Sponsor shall describe in its Measurement and Verification Plan all substantive assumptions for the Project's Demand Reduction Value, including but not limited to, baseline energy consumption, post measure installation energy consumption, process changes, and measure life.

If one or more of the variables that will be measured or monitored and/or assumptions that will be used in the determination of the Project's Demand Reduction Value during Performance Hours are not known at the time the Project Sponsor submits its Measurement and Verification Plan to ISO for review and approval, the Project Sponsor may provide alternative information and/or forecasts and indicate the portion of the Demand Reduction Value associated with such measurement and monitoring variables and/or assumptions and explain the basis for such forecasts.

Section 4: Equipment, Measure, and Practice Detail

Welcome to the *Equipment, Measure, and Practice Detail* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***.

The Project Sponsor shall provide in its Measurement and Verification Plan specifications of the equipment or types of equipment for projects being installed and/or modified. The information may include, but is not limited to, engineering analysis utilized to specify equipment, program design measures and or practices, or applications of equipment, measure or practice relative to end use or processes in the facility.

For Projects involving changes to business practices or strategies, the Project Sponsor shall provide a description of the practice or strategy that will effect the facility's energy consumption during the relevant Performance Hours relative to Baseline Conditions.

Section 5: Measurement and Verification Approach

Welcome to the *Measurement and Verification Approach* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***.

- A description of the requirement to describe the methodological approach(s) to be used in the Measurement and Verification Plan (see "Description").
- A description of the acceptable measurement and verification methodologies (see "Acceptable Measurement and Verification Methodologies").
- Requirements for use of alternative measurement and verification methodologies (see "Alternative Measurement and Verification Methodologies").
- A description of other acceptable methodological techniques (see "Other Acceptable Methodological Techniques").
- A description of general requirements on methodological approaches (see "Requirements").
- A description of general requirements for Real-Time Demand Response and Real-Time Emergency Generation on methodological approaches (see "Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation").

5.1 Description

The Project Sponsor must describe in its Measurement and Verification Plan which of the methodologies described in Section 5.2 it plans to use to determine its Project's Demand Reduction Value.

The Project Sponsor must describe in its Measurement and Verification Plan why the methodology or combination of methodologies selected is the most appropriate, relative for its Project. Project Sponsors may provide references to engineering best practices in the Measurement and Verification literature, reference reports, or state of the art to demonstrate that its proposed Measurement and Verification approach is appropriate for the Demand Resource type and will produce accurate and reliable Demand Reduction Values.

The Project Sponsor must describe the technical capabilities of its Project team and subcontractors to implement its proposed methodology.

5.2 Acceptable Measurement and Verification Methodologies

The following are the acceptable Measurement and Verification methodologies.

5.2.1 Option A: Partially Measured Retrofit Isolation/Stipulated Measurement

Option A may involve an equipment specific retrofit or replacement, new installation or a system level Measurement and Verification assessment. The approach is intended for measures where either performance factors (such as lighting wattage) or operational factors (such as operating hours) can be measured on a spot or short-term basis during baseline establishment and post-installation periods, or for measures for which a measured proxy variable can, in combination with well-established algorithms and/or stipulated factors, can provide an accurate estimate of the Demand Reduction Value

Option A methodology consists of the following:

(1) The factors, parameters and/or variables not measured can be stipulated based on assumptions, analysis of historical data, or manufacturer's data. If a stipulated factor is subject to change over the Performance Hours and/or measure life of the Demand Resource, the Project Sponsor shall describe how the changes will be factored into the calculation of the Demand Reduction Value.

(2) Option A involves measuring a variable other than electrical demand (MW) and using that variable in the calculation of the Demand Reduction Value. Measurements can include short-term or long-term end-use metering of a variable such as current (amperage) and voltage to calculate demand, equipment operating status (on/off), equipment operating times, equipment quantities (i.e., number of units installed, cubic feet of insulation installed) or facilities served where the Demand Reduction Value per facility is constant.

(3) Option A requires that a correlation be established between the metered/monitored proxy variable and electrical demand (MW). The Project Sponsor may establish the correlation by conducting short-term monitoring or a series of spot measurements of both stipulated parameters, and correlating the data sets (e.g., by performing a regression analysis) to determine the functional relationship between the two parameters.

(4) Engineering correlations may also be specified using documented engineering algorithms or as part of an engineering simulation.

(5) Equipment manufacturer's data, equipment data complied by a recognized industry group or equipment data compiled as part of a State-sponsored demand side management program (i.e., lighting fixture wattage tables) may be used in combination with the other measurements, variables or factors as described above to calculate Demand Reduction Value. Data from a manufacturer must be determined in a manner

consistent with standards established by a recognized United States government agency or national recognized industrial manufacturing association.

5.2.2 Option B: Retrofit Isolation/Metered Equipment

Option B involves a retrofit or system-level Measurement and Verification assessment. The approach is intended for retrofits with performance factors and operational factors that can be measured at the component or system level using interval electrical demand meters, as defined in Section 10 and Appendix A of this Manual, installed on the affected end-use.

Option B methodology consists of the following:

(1) Spot or short-term electrical demand measurements can only be used when variations in operations are not expected to change over the measure life.

(2) When temporal variations are expected, electrical demand measurements must be made over a period of time sufficient to represent performance during the Performance Hours and across the measure life of the resource.

(3) This method may be more appropriate when the electrical loads to be impacted by the Project are small relative to the building load, a facility does not currently have whole-premise interval metering, or if end-use electrical demand data can be readily obtained from a building energy management or control system.

(4) The Project Sponsor must take into consideration any interactive effects that may alter electrical loads on other end-use equipment being monitored.

5.2.3 Option C: Whole Facility/Regression

Option C estimates Demand Reduction Values by analyzing the overall energy use in a facility and identifying the impact of the implemented measure on total building or facility energy use patterns. The evaluation of whole-building or facility level metered data is completed using techniques ranging from simple billing comparison to multivariate regression analysis.

Option C methodology consists of the following:

(1) Demand Reduction Value is measured using whole-premise interval meters.

(2) Option C is appropriate for measures that cannot be measured directly, such as insulation or other building envelope measures.

(3) Option C should not be used if the Demand Reduction Value is expected to be small relative to the total facility load, due to the small "signal-to-noise ratio,"

5.2.4 Option D: Calibrated Simulation

Option D involves calibrated computer simulation models of component or whole building energy consumption to determine measure energy savings. Engineering simulation models (such as DOE-2) can model both residential buildings (homes, apartments and condominiums) as well as more complex commercial buildings. Operational simulations can be used for industrial processes that take into account the specifics of the process addressed by the energy efficiency actions. Both engineering and operational simulations are made more powerful by calibrating these methods to actual kW and kWh data from the site or process being examined, even if these data are available for a monitoring period shorter than or different from the required Performance Hours. Short-term metering and monitoring are methods that produce data that can be used to adjust engineering simulations. This approach is generally termed "calibrated engineering simulations." Linking simulation inputs to baseline and post-installation conditions completes the calibration. Characterizing baseline and post-installation conditions may involve metering performance and operating factors both before and after the retrofit. Long-term whole-building energy use data may be used to calibrate the simulation(s).

5.3 Alternative Measurement and Verification Methodologies

The Project Sponsors may propose alternative methodologies not listed in Section 5.2. Project Sponsors proposing alternative methodologies shall demonstrate that the alternative methodologies will be equivalent to one of the accepted methodologies described in Section 5.2 above, and demonstrate justifiable need for deviation from the acceptable methodologies described in Section 5.2 based on unique Project requirements.

5.4 Other Acceptable Methodological Techniques

In addition to the acceptable methodological approaches described above, several methodological techniques may be applied to one or more of the methods described in Section 5.2. The following describe other acceptable methodological techniques.

5.4.1 Engineering Calculations and Audit Results

The Project Sponsor may use engineering algorithms to calculate the Project's Demand Reduction Value during the Performance Hours. Engineering algorithms must be supplemented with data collected on the energy-consuming equipment effected by the measures.

5.4.2 Load Shape Analyses

The Project Sponsor may use verifiable measure hourly load shapes to calculate a Project's Demand Reduction Value during the Performance Hours. Measure load shapes must be based on actual metering data, load research, and/or simulation modeling.

Values for monthly or annual energy savings (whether from engineering calculations, analysis of billing data, simulation modeling or other means described in this Manual) can be combined with information on verifiable measure load shapes to produce values for electrical energy reduction (MWh) during the Performance Hours. Measure load shapes shall be based on actual metering data, load research (current or historic) and/or simulation modeling.

5.5 Requirements

The Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the requirements listed below.

(1) Project Sponsors using Option D for existing buildings, systems, processes or equipment must calibrate the simulation model to actual kW or kWh data from the buildings, systems, processes or equipment being modeled.

(2) Projects that include the use of Distributed Generation or Emergency Generation must follow Option B and directly measure the electrical demand (MW) output of the Distributed Generation or Emergency Generation. Projects involving multiple Distributed Generation or Emergency Generation installations may use Option B in conjunction with statistical sampling as described in Section 5 of this Manual.

(3) If statistical sampling is used to determine any variables, factors, parameters, engineering factors, or load shapes used in the calculation of Demand Reduction Values, the statistical sampling must satisfy the requirements described in Section 5.

5.6 Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation

The requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation are described in Appendix A of this Manual.

Section 6: Establishing Baseline Conditions

Welcome to the *Establishing Baseline Conditions* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of the requirement to establish baseline conditions (see "Descriptions").
- A description of general requirements for all Demand Resources on establishing, measuring and reporting baseline (see "Requirements for All Demand Resources").
- A description of requirements for Demand Resources involving new construction or major renovations on establishing, measuring and reporting baseline (see "Requirements for Demand Resources involving New Construction or Major Renovations").
- A description of requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation on establishing, measuring and reporting baseline (see "Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation").

6.1 Descriptions

The Project Sponsor shall describe in its Measurement and Verification Plan the methodology used to determine Baseline Conditions for the measures comprising its Project, where Baseline Conditions are defined as the kW load of a measure in use during performance hours, or the kW load that would have existed, in the absence of a demand reduction measure that affected such measure's load.

The Project Sponsor shall identify in its Measurement and Verification Plan any and all equipment, systems, practices or strategies or type of the aforementioned, whose alteration from its Baseline Condition operation will lead to reduced demand during the Performance Hours.

6.2 Requirements for All Demand Resources

The Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the applicable requirements listed below.

(1) For Projects where the Demand Reduction results from measures involved variable load equipment or equipment whose operation is time-dependent or weather-dependent, the Baseline Conditions must be calculated for each hour across the Performance Hours.

(2) For Projects where Demand Reduction is actively controlled by the Project Sponsor, facility personnel , or an energy management system, results from measures involved variable load equipment or equipment whose operation is time-dependent or weather-dependent and Baseline Conditions are calculated based on historical hourly load or output data, the Project Sponsor must demonstrate that the variance in the historical hourly load or output data used in the calculations of Baseline Conditions comply with the statistical reliability criteria set forth in Section 7.2 of this Manual.

(3) For Projects where the Demand Reduction is actively controlled by the Supplier, facility personnel, or an energy management system and Baseline Conditions are calculated using a rolling average of historical hourly load or output data over some period prior to the Performance Hours, the Project Sponsor must exclude historical hourly loads or output coincident with the Performance Hours from the Baseline Conditions calculations.

(4) For Projects in which existing and operating equipment is removed from service during the defined Performance Hours or has its electrical consumption usage reduced during the defined Performance Hours, the Baseline Conditions shall be the kW load of that operating equipment across the Performance Hours prior to such equipment removal or reduced use.

(5) For Projects in which failed equipment is replaced by a more efficient equivalent or by an alternative strategy for delivering comparable output, the Baseline Condition shall be the nameplate rating of the equipment meeting the level of efficiency required by applicable state code, federal product efficiency standard, or standard practice, whichever is most stringent. If there is no applicable state code or federal standard, then standard practice shall be used as the basis for establishing Baseline Conditions and shall be documented in the Measurement and Verification Plan.

(6) For Projects in which operating equipment is replaced with a more efficient equivalent unit, the Baseline Condition is the kW load of that operating equipment across the Performance Hours. In the absence of a measured baseline, the baseline values shall be level of efficiency required by applicable state code or Federal product efficiency standard or standard practice if there is no applicable state code or federal standard. If applicable, the Project Sponsor shall describe the method by which the Baseline Condition may be adjusted over the Measure Life. If standard practice is used as the basis for the Baseline Condition, it shall be documented in the Measurement & Verification Plan.

(7) For Emergency Generation Projects metered at the generator output, (resources whose operation is limited to loss of external power to the facility or the implementation by the ISO of voltage reduction of 5% requiring more than 10 minutes to implement), the Baseline Condition electricity output shall be zero.

(8) For Emergency Generation Projects metered at the customer billing meter or a sub-meter within the facility, the Project Sponsor is required to calculate Baseline Conditions as described above.

6.3 Requirements for Demand Resources Involving New Construction or Major Renovations

For new construction or major renovation Projects, the Baseline Conditions shall be equal to the kW load during the applicable Performance Hours of equipment meeting the level of efficiency required by:

(1) Applicable state code or Federal product efficiency standard, or

(2) Standard practices, provided the Project Sponsor can document the standard practices in the Measurement and Verification Plan, if there are no applicable state codes or Federal product efficiency standards, or

(3) Standard practices that are less stringent than applicable state code or Federal product efficiency standards, provided the Project Sponsor can demonstrate the less stringent standard practices by providing a study, report or analysis conducted in a manner consistent with the requirements in Section 7 and other applicable sections of this Manual, or

(4) Standard practices that are more stringent than applicable state code or Federal product efficiency standards, provided the Project Sponsor can document the more stringent standard practices in the Measurement and Verification Plan.

6.4 Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation

The requirements for determining Baseline Conditions for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation are described in Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation of this Manual.

Section 7: Statistical Significance

Welcome to the *Statistical Significance* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of the requirements to meet statistical significance (see "Description").
- A description of the requirements for statistical sampling (see "Statistical Sampling").
- A description of the requirements for sample size recalibration (see "Sample Size Recalibration Based on Monitoring Data").
- A description of the requirements for sampling over load zones (see "Sampling Over Load Zones").

7.1 Description

The Project Sponsor must describe in its Measurement and Verification Plan how it will meet or exceed the statistical precision and accuracy standards specified in this Manual. The Measurement and Verification Plan must demonstrate that the techniques utilized to calculate sample accuracy and precision comply with the methods described in this Manual. The accuracy requirement needs to include a description of how the Measurement and Verification effort will use methods to mitigate and adjust for the potential types of bias applicable to the methods being used in the Measurement and Verification effort. Where monitoring is specified over the measure life, the Measurement and Verification plan must also describe how accuracy and precision will be monitored on the sample during the measure life.

7.1.1 Requirements

(1) All Project Sponsors shall include in its Measurement and Verification Plan a description of how Measurement and Verification efforts address accuracy and precision issues as described in this Manual appropriate for the measurement and verification approach being proposed and strategy to calculate the Demand Reduction Value.

(2) Project Sponsors that propose the use of Measurement and Verification Reference Documents to support estimates including but not limited to, engineering estimates, load profiles, measure life, and coincidence factors, shall provide justification for use appropriate to the Measurement and Verification methodology to calculate the Demand Reduction Value.

(3) If the Demand Reduction Value calculations include an engineering-based direct measurement, measurement of proxy variables or simulations, then the Project Sponsor shall describe methods to control relevant types of potential bias including, but not

limited to: (a) accuracy and calibration of the measurement tools (as described elsewhere in this Manual); (b) measurement error; (c) engineering model bias; (d) modeler bias; (e) deemed parameter bias; (f) meter bias; (g) sensor placement bias; and (h) sample selection bias or non-random selection of equipment and/or circuits to monitor.

(4) If the Demand Reduction Value calculations include regression or statistical analyses, then the Project Sponsor shall describe methods to control relevant types of potential bias including, but not limited to: (a) model misspecification; (b) statistical validity; (c) error in measuring variables; (d) autocorrelation; (e) heteroscedasticity; (f) collinearity; (g) outlier data points; and (h) missing data.

(5) If the Demand Reduction Value calculations include any form of survey or interview data, the Project Sponsor shall describe methods to control relevant types of potential bias including, but not limited to: (a) construct validity; (b) sampling frame versus population; (c) selection bias (for a sample and for a census attempt where not all sites within the census received usable data); (d) non-response bias; (e) error in measuring variables; (f) sample homogeneity relative to project (external validity); (g) outlier data points; and (h) missing data.

7.2 Statistical Sampling

The Demand Reduction Value during Performance Hours or other key parameters for a Project including multiple installations of similar Demand Resource measures and/or facilities may be developed by sampling the total population of all measure installations. Sampling shall meet a statistical accuracy and precision of no less than 80% confidence level and 10% relative precision as described below.

7.2.1 General Requirements

If sampling will be conducted, the Project Sponsor must describe in its Measurement and Verification Plan each of the following general sampling conditions:

(1) The population to be sampled,

(2) The required sample size in accordance with this Manual,

(3) The planned sample size, plus contingencies for attrition due to metering equipment failure and the like,

(4) All assumptions and calculations for determining the sample size, and

(5) The method for selecting sample points.

7.2.2 Sample Size Requirements

If sampling will be conducted, the Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the requirements listed below for determining the sample size and sample point.

(1) If the Demand Reduction Value is estimated from one or more samples, the required sample size(s) must be based upon targeting 10% relative precision at an 80% confidence level. If a Demand Resource Project consists of multiple sites and/or measures, and the Project Sponsor uses multiple samples to estimate the aggregated Demand Reduction Value during the Performance Hours in each Load Zone as the sum of all individual measured Demand Reduction Values, the sampling requirements may be met (1) for each sample or combination of samples used, (2) for the combination of all samples, or (3) by using strata as described in Section 7.2.2(2).

(2) If the Demand Reduction Value is estimated from a sample drawn from 2 or more strata the overall test sample size must be based upon targeting 10% relative precision with an 80% confidence interval. Strata shall be defined as any subset of the Project's population that is based on known information. The concept of strata may include, but is not limited to: programs in a state sponsored demand side management portfolio or subsets of an entire population of affected equipment at a project site that have similar operating characteristics.

(3) All Sampling calculations shall incorporate a plan to compensate for potential data loss through,

(a) Over sampling

(b) Sample site replacement in the course of the study,

(c) Demonstration that precision and confidence targets will still be met with a smaller sample size.

(4) The Project Sponsor shall demonstrate the method for controlling bias in sample selection including, but not limited to random sampling, census or rolling census for each sample and strata used.

(5) The Coefficient of Variation (c.v.) used to derive the required sample size shall be the measured c.v. for the primary measurement including all its error components.

(6) The Project Sponsor shall demonstrate the method for controlling bias attributed to the c.v. as it relates to sample size determination.

(7) If a c.v. from prior Measurement and Verification or Measurement and Verification Reference Documents is not available for the primary measurement applicable to the segments of sites, installed measures, and/or strategy, then the Project Sponsor shall use a default value for the initial c.v., not less than 0.5 for homogeneous samples (samples from populations that are uniform with respect to some criteria of classification) and 1.0 for heterogeneous samples (samples from populations that are variable with respect to some criteria of classification), until such time that a c.v. can be estimated from the Project sample population.

(8) If a method such as stratified ratio estimation is used to take advantage of supporting information for the population, the c.v. may be adjusted to take account of the added efficiency of the stratification and estimation methodology.

7.2.3 Sample Size Calculation Requirements

The formulas below are illustrative of the calculation of required sample size and precision. Alternative sample size determination shall meet the minimum requirements set forth in section 7.2.2 and be documented in the Measurement and Verification plan.

(1) The Project Sponsor shall calculate the sample number to achieve a precision of 10% using the following equation, utilizing a *t* value of 1.282, which corresponds to a two tailed 80% confidence interval of an infinite population, where

n' = number of samples in an infinite population

c.v. = coefficient of variation as set by a default value or where it is known, and

r.p = precision

$$n' = \left\{ \frac{1.282 \times c.v.}{r.p.} \right\}^2$$

The sample size (n) for the finite population (N) less than 200 shall be calculated using the following equation, where

n' = number of samples in an infinite population

$$n = \frac{n'}{1 + \frac{n'}{N}}$$

7.3 Sample Size Recalibration Based on Monitoring Data

In the absence of a reliable c.v. the Project Sponsor may use a default c.v. as described in Section 7.2.2. However, once performance data has been collected, the Project Sponsor shall demonstrate that the level of Precision and Accuracy is met in the sampling methodology by calculating the relative precision with a new estimate of c.v.

7.3.1 Sample Recalibration Requirements

(1) The Project Sponsor shall calculate the relative precision of sampling studies based on the new estimated sample coefficient of variation calculated using the following equations, where:

$\bar{x}$ = sample mean,

s = standard deviation, and

n' = number of samples in an infinite population.

$$c.v. = \frac{s}{\bar{x}}$$

$$r.p. = \frac{1.282 \times c.v}{\sqrt{n'}}$$

(2) In the case where the finite population (N) is less than 200, the relative precision of the sampling study shall be calculated using the following equation, where:

n = number of samples in a finite population, and

N = total number of units in the population

$$r.p. = \sqrt{1 - \frac{n}{N}} \frac{1.282 \times c.v}{\sqrt{n}}$$

If a method such as stratified ratio estimation is used to take advantage of supporting information for the population, the estimated c.v. and achieved relative precision may be adjusted to take account of the added efficiency of the stratification and estimation methodology.

7.4 Sampling Over Load Zones

If the Project Sponsor conducts sampling for a population of similar Demand Resources spanning multiple Load Zones, then the Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the requirements listed below:

7.4.1 Requirements

The Project Sponsor shall demonstrate that the accuracy and precision requirements discussed above apply to the overall population of Demand Resources being studied, rather than to the Project or Projects within each individual Load Zone.

The Project Sponsor shall demonstrate the method for controlling any bias attributed to sampling across Load Zones.

Section 8: Demand Reduction Value Calculations

Welcome to the *Demand Reduction Value Calculations* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of the requirement to determine the Demand Reduction Value (see "Description").
- A description of the requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation on calculation of the Demand Reduction Value (see "Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation").
- A listing of holidays as defined in OP-14 applicable to Demand Resources. (see "Holidays).

8.1 Description

The Project Sponsor shall describe in its Measurement and Verification Plan how it will calculate the Demand Reduction Value during the applicable Performance Hours for the Project. The description must include, where applicable, the following factors used in the Demand Reduction Value calculations:

(1) Equations and Formulas

(2) Assumptions

(3) Manufacturers Equipment Specifications

(4) Direct Measurement Data

(5) Indirect Measurement Data

(6) Engineering Factors, Parameters and Other Variables

If the one or more of the factors listed above are not known or not available at the time the Project Sponsor submits its Measurement and Verification Plan to the ISO, the Project Sponsor shall describe at what point in its Project's life cycle the unknown or unavailable factors will be known and available and how the factors will be used in the Demand Reduction Value calculations.

8.2 Requirements

The Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the requirements listed below:

(1) The reported monthly Demand Reduction Value shall achieve at least a 10% relative precision at an 80% confidence level.

(2) If Baseline Conditions are used in the calculation of Demand Reduction Value, the Project Sponsor must make adjustments to the Baseline Conditions to reflect operating conditions at the time of the Performance Hours.

(3) Formulas used by the Project Sponsor to determine Demand Reduction Values shall include any modifying factors, including, but not limited to, coincidence appropriate for the specified Demand Resource type (e.g., On-Peak Demand Resource, Seasonal Peak Demand Resource, or Critical Peak Demand Resource) and the relevant Performance Hours, realization rate, measure life, and equipment failure rate.

(4) If a Demand Resource Project consists of multiple sites and/or measures, the Project Sponsor may calculate the aggregated Demand Reduction Value during the Performance Hours in each Load Zone as the sum of all measured Demand Reduction Values, provided that each measured Demand Reduction Value achieves at least a 10% relative precision at an 80% confidence level, or the aggregated Demand Reduction Value achieves at least a 10% relative precision at an 80% confidence level.

(5) If sampling will be conducted, the Project's aggregated Demand Reduction Value in each Load Zone must be calculated from the measured data of the sample, and the Measurement and Verification Plan shall describe how this calculation will be performed.

8.3 Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation

The requirements for calculating the Demand Reduction Value for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation are described in Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation of this Manual.

8.4 Holidays

The days listed below are holidays as defined in ISO New England Operating Procedure No. 14 (Technical Requirements for Generators, Demand Resources and Asset Related Demands) applicable to Demand Resources. Demand Resources are not required to be available for interruption on the following holidays:

(1) New Year's Day

(2) Memorial Day (Federal)

(3) Independence Day

(4) Labor Day

(5) Veterans Day (Federal)

(6) Thanksgiving Day

(7) Christmas Day

If a holiday with a pre-determined day (e.g., New Year's Day, Independence Day, Christmas Day) falls on a Saturday, the holiday will be observed on the preceding Friday; if such a holiday falls on a Sunday, the holiday will be observed on the following Monday. Demand Resources are not required to be available for interruption on observed holiday dates.

Section 9: Monitoring Parameters and Variables

Welcome to the *Monitoring Parameters and Variables* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of the requirement to describe monitoring parameters and variables in the Measurement and Verification Plan (see "Description").
- A description of the requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation on calculation of the Demand Reduction Value (see "Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation").

9.1 Description

The Project Sponsor shall describe in its Measurement and Verification Plan the variables that will be measured, monitored, counted, recorded, collected, and maintained to determine the Project's Demand Reduction Value during Performance Hours.

The Project Sponsor shall describe in its Measurement and Verification Plan how each of the variables will be measured, monitored, recorded, collected and maintained.

9.2 Requirements

The Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the requirements listed below. When equipment manufacturer, model, serial number and age are not readily available, the Project Sponsor may propose alternative means of acquiring or estimating the information.

(1) For Projects affecting **HVAC Systems,** the Project Sponsor must, at a minimum, collect and maintain, the following information:

(a) On HVAC equipment: equipment capacity, quantity, manufacturer, model and serial numbers, and age.

(b) On HVAC system controls: location of zones, temperature set-points, control set-points and schedules, and any special control features.

(2) For Projects affecting **Building Envelope,** the Project Sponsor must, at a minimum, collect, maintain and report on all key variables effecting savings associated with the measures.

(3) For Projects affecting **Interior or Exterior Lighting Systems,** the Project Sponsor must, at a minimum, collect and maintain the following information: number and types of lamps and ballasts, with nameplate data.

(4) For Projects affecting **Major Electric Consuming Equipment,** the Project Sponsor must, at a minimum, collect and maintain the following information: equipment capacity, quantity, manufacturer, model and serial numbers and age.

(5) For Projects affecting **Weather Sensitive Electrical Loads including HVAC**, where temperature, humidity or degree-days will be used in the calculation of Demand Reduction, the Project Sponsor shall collect and maintain representative site weather data, either measured on-site or obtained for a nearby site, from the National Climatic Data Center ("NCDC"). On-site measurement equipment must satisfy the requirements described in Section 10.

(6) For Projects that include **Distributed Generation or Emergency Generation,** the Project Sponsor must measure and record the electrical output of the generator during Performance Hours using an interval meter that satisfies the requirements described in Section 10. Additionally, the Project Sponsor must:

(a) Report to the ISO the most recent annual non-coincident peak demand (absent Distributed Generation output) of the end-use metered customer at the location where the Distributed Generation resource is directly connected for each year that the Distributed Generation resource participates in the Forward Capacity Market; and

(b) Report the monthly average hourly load of the end-use customer to which the Distributed Generation resource is directly connected separately from the Distributed Generation resource's monthly average hourly output for each month of the Capacity Commitment Period.

9.3 Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation

The requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation are described in Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation of this Manual.

Section 10: Measurement Equipment Specifications

Welcome to the *Measurement Equipment Specifications* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of requirements for measurement equipment.
- A description of the requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation for measurement equipment specifications (see "Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation").

10.1 Description

The Project Sponsor shall describe in its Measurement and Verification Plan each measurement, monitoring and/or data recording device type that will be used to measure, monitor and record data for each parameter and variable described in the Project Sponsor's Measurement and Verification Plan pursuant to Section 9 of this Manual.

The Project Sponsor shall describe, to the most practical extent, in its Measurement and Verification Plan how each measurement, monitoring and/or data recording device will be installed (including its specific location) and operated to measure, monitor and/or record data from each of the parameters and variables described in the Project Sponsor's Measurement and Verification Plan pursuant to Section 9 of this Manual.

10.2 Requirements

The Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the requirements listed below:

(1) All solid-state measurement, monitoring and data recording equipment must meet or exceed the relevant standards set by the American National Standard Institute ("ANSI") or equivalent standard.

(2) Measurement, monitoring and data recording equipment that is directly measuring watt-hour, volt-hour, volt-ampere-hours, reactive volt-ampere-hour, and the associated demand components should conform to ANSI or equivalent standards.

(3) Instruments or transducers for the analog or digital measurement of volt, volts-squared, amperes, amperes-squared, phase angle, volt-amperes, watts, and reactive volt-amperes should conform to ANSI or equivalent standards.

(4) Data recorders that are recording pulses from measurement and monitoring devices must utilize a pulse rate within the resolution capabilities of the recorder.

(5) All measurement, monitoring and data recording equipment installed on electric circuits with significant harmonics must meet the relevant standards provided by the Institute of Electrical and Electronics Engineers ("IEEE").

(6) Any measurement or monitoring equipment that directly measures electrical demand (kW) must be a true RMS measurement device with an accuracy of no less than ±2%.

(7) Any measurement or monitoring equipment that directly measures electrical demand from three-phase devices must be installed such that measurements are taken on all three-phases to account for any phase imbalance or an equivalent method that can measure electrical demand using two phases.

(8) Any measurement or monitoring equipment that directly measures electrical demand on circuits with significant harmonics must have a digital sampling rate of at least 2.6 kHz as defined in the relevant IEEE Standards.

(9) Any measurement or monitoring equipment of proxy variables that do not directly measure electrical demand, including but not limited to voltage, current, temperature, flow rates and operating hours, must have an accuracy rating such that the overall accuracy of the calculated demand (kW) using the proxy variables is not less than ± 2%.

(10) Any measurement or monitoring equipment of current (amps) and nominal voltage used to calculate electrical demand must include the power factor of the end-uses in the demand (kW) calculations.

(11) Data recorders must be synchronized in time, within an accuracy of +/- 2 minutes per month, with the National Institute of Standards and Technology ("NIST").

(12) All measurement, monitoring and data recording equipment must be calibrated by the Project Sponsor or its independent calibration contractor in such a way to meet or exceed the Federal Energy Management Program ("FEMP") Measurement and Verification Guidelines, applicable American Society of Heating, Refrigeration and Air Conditioning Engineers ("ASHRAE") standards, NIST, or equivalent standard.

(13) The Project Sponsor must ensure that all measurement, monitoring and data logging equipment shall be maintained in such a way as to meet or exceed industry and manufacturer standards.

(14) The Project Sponsor must maintain documentation on all measurement, monitoring and data recording equipment maintenance and calibration activities. Documentation and records must be maintained as specified in Section 12 of this Manual.

(15) The Project Sponsor shall provide to ISO, upon request, measurement equipment maintenance, calibration and testing records to demonstrate that the Project Sponsor's measurement equipment is calibrated and maintained in accordance the requirements described in this Manual.

(16) The Project Sponsor may propose alternative methods to demonstrate the measurement, monitoring and data recording equipment used in the determination of Demand Reduction Value satisfies the accuracy, calibration and maintenance standards described in the Manual.

(17) Interval metering devices shall collect electricity usage data at a frequency of 15 minutes or less.

10.3 Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation

The requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation are described in Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation of this Manual.

Section 11: Monitoring Frequency and Duration

Welcome to the *Monitoring Frequency and Duration* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of requirements for monitoring frequency and duration.
- A description of the requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation monitoring frequency and duration (see "Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation").

11.1 Description

The Project Sponsor shall describe in its Measurement and Verification Plan the monitoring frequency and duration for each monitoring parameter and variable described in Section 9.

11.2 Requirements

The Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the requirements listed below:

(1) The duration and frequency of metering and monitoring must be sufficient to ensure an accurate representation of the amount of electrical demand consumed or generated both without and after Project installation and during Performance Hours.

(2) For Projects using Option B methodology described in Section 5.2 the direct measurement of electrical demand or generation must be made using an interval meter that satisfies the requirements described in Section 10.

(3) All measurements must be taken at typical system conditions within the time periods and frequency that shall demonstrate coincidence with the Performance Hours as defined in the Market Rules.

(4) If independent parameters, such as but not limited to: temperature, humidity, or heating degree days are used in the calculation of Demand Reduction Values, the Measurement and Verification Plan shall describe methods to ensure measurement is performed over a duration and frequency sufficient to accurately represent of the amount of electrical demand consumed or generated both without and after Project installation and during Performance Hours.

11.3 Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation

The requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation are described in Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation of this Manual.

Section 12: Data Validation, Retention and Management

Welcome to the *Data Validation, Retention and Management* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of requirements for data validation, retention and management.
- A description of the requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation data validation, retention and management (see "Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation").

12.1 Description

The Project Sponsor shall describe in its Measurement and Verification Plan the systems, processes and methods it will employ to validate any and all data used in determining Demand Reduction Value during Performance Hours.

The Project Sponsor shall describe in its Measurement and Verification Plan the systems, processes and methods it will employ to estimate any missing measurement data that will be used in determining Demand Reduction Value during Performance Hours.

The Project Sponsor shall describe in its Measurement and Verification Plan the systems and processes it will use to maintain any and all data used in determining Demand Reduction Value during Performance Hours.

12.2 Requirements

The Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the requirements listed below:

(1) For Demand Resource Projects targeting customer facilities with greater than or equal to 10 kW of Demand Reduction Value per facility, the Project Sponsor must maintain the following:

(a) Retail customer's address,

(b) The retail customer's utility distribution company,

(c) Utility distribution company account identifier such as account number or meter number,

(d) Measures installed, and

(e) The corresponding monthly Demand Reduction Values until the end of the Measure Life, or until the Demand Resource is permanently De-Listed or retired from the Forward Capacity Market.

(2) For Demand Resource Projects targeting customer facilities with less than 10 kW of Demand Reduction Value per facility, the Project Sponsor shall have the option of maintaining records as described above for customer facilities with greater than or equal to 10 kW of Demand Reduction Value per facility, or maintaining records of aggregated Demand Reduction Value and measures installed by Load Zone and Meter Domain.

(3) The Project Sponsor must validate all measured data used in the Demand Reduction Value calculations. Data that has failed validation may not be used in any Demand Reduction Value calculation.

(4) For Projects involving an individual facility, generator or energy consuming equipment, the Project Sponsor must conduct the following validation checks on any interval data from an individual facility:

(a) Time Check: The Project Sponsor must validate that the measurement devices time clock is within plus or minus two minutes of the true time as defined by the National Institute of Standards and Technology ("NIST").

(b) Sum Check: The Project Sponsor must validate that the difference between the sum of the values recorded over the intervals and the value recorded by the meter over the same time period is within plus or minus two percent. This check may be done on either consumption or pulse data, provided the data scaling is consistent throughout the period.

(c) High/Low Check: The Project Sponsor must establish minimum and maximum expected values for each Demand Resource Project. The minimum and maximum values must be based on equipment ratings or historical equipment and/or facility consumption data. The Project Sponsor shall identify any and all interval data that is greater than the maximum expected value or less than the minimum expected value. Any such interval data shall be deemed to fail validation.

(d) Zero Value Check: The Suppler shall identify any and all interval data with a value equal to zero. The Suppler shall verify whether or not the zero value is the correct value for that interval. If the Project Sponsor determines that the zero value is incorrect, the Project Sponsor shall substitute a corrected or estimated non zero value for the zero value. Under no circumstances shall the Project Sponsor substitute a zero value for missing interval data.

(e) The Project Sponsor must identify any and all estimated data used in the Demand Reduction Value calculations, as well as the methodology used to develop the estimate.

(f) The Project Sponsor shall classify all data that has passed validation and is used in the Demand Reduction Value calculations as either: (i) actual data, (ii) estimated data or (iii) missing data. The data classification shall be stored along with the data values in the Project Sponsor's data retention and management system described in Section 12.1

12.3 Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation

The requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation are described in Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation of this Manual.

Section 13: Performance Reporting

Welcome to the *Performance Reporting* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of requirements for performance reporting.
- A description of the requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation performance reporting (see "Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation").
- A description of ISO New England audit rights (see "Verification, Errors and Fraud").

13.1 Description

The Project Sponsor shall describe in its Measurement and Verification Plan how it will prepare the reports required to comply with ISO monthly data reporting requirements.

13.2 Requirements

The Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the reporting requirements listed below:

(1) On a monthly basis, the Project Sponsor shall report for each of its Demand Resource Assets registered with ISO the total Demand Reduction Value (MWh) during the Performance Hours applicable to the Demand Resource in the Obligation Month.

(2) The Project Sponsor shall report the Demand Reduction Values (MWh) for each Demand Resource Project according to the ISO's published Settlement schedule.

(3) The Project Sponsor may report revised Demand Reduction Values (MWh) for each Demand Resource Project according to the schedule defined by ISO.

(4) The Project Sponsor shall report the Demand Reduction Values (MWh) for each of its Asset in a format defined by the ISO.

(5) The Project Sponsor shall report the Demand Reduction Values (MWh) for each of its Assets using a software application and electronic interface as defined by the ISO.

(6) The Project Sponsor shall provide to the ISO on a monthly basis work sheets, engineering calculations, reference materials, meter readings and any other data necessary to support the Demand Reduction Values for each of its Demand Resource Projects.

(7) For Demand Resource Projects using Statistical Sampling, the Project Sponsor shall provide to the ISO on a monthly basis certification that the samples used in the calculation of the Demand Reduction Value comply with the minimum statistical significance requirements described in Section 7.2.2 of this Manual. The Project Sponsor shall describe any deviations from minimum statistical significance requirements and any and all actions taken to correct deviations.

(8) For Demand Resource Projects where Demand Reduction Values (MWh) are derived using Baseline Conditions, the Project Sponsor shall provide to the ISO on a monthly basis a description of any and all adjustments made to Baseline Conditions used in the Demand Reduction Value calculations.

13.3 Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation

The requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation are described in Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation of this Manual.

13.4 Verification, Errors and Fraud

The ISO may periodically audit Project Sponsor performance reports and other data to insure that it is consistent with the requirements described in this Manual.

All information submitted by the Project Sponsor is subject to audit by the ISO. Disputes concerning erroneous performance reporting shall be resolved through the ISO's existing dispute resolution procedures (except for disputes between the Project Sponsors and retail customer which are not the responsibility of the ISO).

If, in review of the Project Sponsors performance reports or other data, the ISO determines that the Project Sponsor has committed fraud to extract excess Capacity Payments, the ISO will have the right to ban the Project Sponsor or its customers from participation in the wholesale electricity markets, as well as pursue other legal options at the sole discretion of the ISO.

Section 14: Independence and Auditing

Welcome to the *Independence and Auditing* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of requirements for independence and auditing
- A description of the requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation independence and auditing (see "Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation").

14.1 Description

The Project Sponsor shall describe in its Measurement and Verification Plan the aspects of the Measurement and Verification process that will be conducted by independent third-parties. For purposes of this manual, an independent third-party is a party that does not have a direct financial interest in the FCA Payments resulting from the Project Sponsor's reported Demand Reduction Values.

14.2 Requirements

The Project Sponsor must describe in its Measurement and Verification Plan how it will satisfy each of the requirements listed below:

(1) The Project Sponsor shall provide to the ISO an Annual Certification of Accuracy of Measurement and Verification Documents, verified by an independent third-party auditor, with a statement certifying that the Projects for which the Project Sponsor is requesting compensation continue to perform in accordance with the submitted Measurement and Verification Documents reviewed by the ISO in accordance with the Market Rules.

(2) The Project Sponsor shall cooperate in any and all unannounced audits or tests of a Demand Resource conducted by the ISO to verify its compliance with the requirements as set forth in Market Rule 1 and in this Manual. These audits may be conducted on a periodic basis, or at the ISO's discretion should the ISO have a reason to suspect a deficiency in the Project Sponsor's compliance with any of the requirements in this Manual or the Market Rules. On site audits will be coordinated with the Project Sponsor and scheduled during normal business hours.

(3) The Project Sponsor shall allow the ISO to audit testing and calibration records, and order and witness the testing of metering and measurement equipment installed pursuant to the Demand Resource's approved Measurement and Verification Plan

(4) The Project Sponsor will be responsible for all expenses associated with installing, maintaining, calibrating and testing the metering, data recording and measurement equipment installed pursuant to the Demand Resource's approved Measurement and Verification Plan.

14.3 Requirements for Demand Resources Defined as Real-Time Demand Response or Real-Time Emergency Generation

The requirements for Demand Resources defined as Real-Time Demand Response or Real-Time Emergency Generation are described in Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation of this Manual.

Section 15: Measurement and Verification Supporting Documents

Welcome to the *Measurement and Verification Supporting Documents* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of the requirement to describe Measurement and Verification Plan supporting documents (see "Description").
- A description of requirements for Measurement and Verification Plan supporting documents (see "Requirement").

15.1 Description

The Project Sponsor shall describe in its Measurement and Verification Plan any and all reports, studies, specifications and other documents referenced in its Measurement and Verification Plan.

15.2 Requirements

All reports, studies, specifications and other documents referenced in the Project Sponsor's Measurement and Verification Plan must have been prepared and published within five years of the Measurement and Verification Plan's submission date to the ISO, unless the Project Sponsor can demonstrate that the results of a study prepared and published more than 5 years from the time of the Measurement and Verification Plan's submission are still relevant to the Demand Resource.

Upon request, the Project Sponsor shall provide to the ISO copies of any and all reports, studies, specifications and other documents referenced in its Measurement and Verification Plan.

Section 16: Responsible Parties

Welcome to the *Responsible Parties* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***.

The Project Sponsor shall identify in its Measurement and Verification Plan the parties involved in various aspects of the Project, including but not limited to the following:

(1) Project Management

(2) Measure Implementation

(3) Measure Operation and Maintenance

(4) Measurement Equipment Calibration and Testing

(5) Monthly Demand Reduction Value Calculations

(6) Data Validation, Retention and Management

(7) Monthly Performance Reporting

(8) Independent Project Auditing

(9) Quality Assurance

Section 17: Measurement and Verification Plan Format

Welcome to the *Measurement and Verification Plan Format* section of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this section you will find the following information:

- A description of the required format of the Measurement and Verification Plan (see "Requirements").

17.1 Requirements

(1) The Project Sponsor's Measurement and Verification Plan must follow the outline below. In each section, Project Sponsor shall describe the specific elements of its proposed plan and how the plan will comply with all the applicable requirements specified in this Manual:

(a) Project Description

(b) Project General Assumptions

(c) Detailed Equipment, Measure, and Practice Description

(d) Measurement and Verification Approach

(e) Methodology for Establishing Baseline Conditions

(f) Statistical Sampling Plan

(g) Demand Reduction Value Calculations

(h) Monitoring Parameters and Variables

(i) Measurement Equipment Specifications

(j) Monitoring Frequency and Duration

(k) Data Validation, Retention and Management

(l) Performance Reporting

(m) Independence and Auditing

(n) Measurement and Verification Supporting Documents

(o) Responsible Parties

Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation

Welcome to *Appendix A: Requirements for Real-Time Demand Response and Real-Time Emergency Generation* of the ***ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources***. In this appendix you will find the following information:

- A description of Real-Time Demand Response and Real-time Emergency Generation Resources (see "Real-Time Demand Response and Real-time Emergency Generation Resources - Summary").
- A description of eligibility criteria for Real-Time Demand Response and Real-time Emergency Generation Resources (see "Eligibility Criteria").
- A description of operating mechanisms and implementation for Real-Time Demand Response and Real-time Emergency Generation Resources (see "Operating Mechanism/Implementation").
- A description of requirements for telemetering, baseline and verification operating mechanisms and implementation for Real-Time Demand Response and Real-time Emergency Generation Resources (see "Telemetering, Baseline and Verification").

A1 Real-Time Demand Response and Emergency Generation Resources - Summary

This Appendix A to Manual M-MVDR deals specifically with the Real-Time Demand Response Resources and the Real-Time Emergency Generation Resources.

A1.1 Real-Time Demand Response Resources

Real-Time Demand Response Resources require customers to commit to mandatory energy reductions on 30-minutes notice from the ISO. Real-Time Demand Response Resources are eligible to qualify as Demand Resources in accordance with Market Rule 1. The performance criteria are defined later in this Appendix A.

Real-Time Demand Response Resources will be notified of mandatory interruptions during Critical Peak Hours, as defined in the Market Rules.

The ISO may activate Real-Time Demand Response Resources on either a zonal or system wide basis.

A1.2 Real-Time Emergency Generation Resources

Real-Time Emergency Generation Resources require Project Sponsors to commit to mandatory energy reductions on 30-minutes notice from the ISO during periods as defined in Market Rule 1. The performance criteria are defined later in this Appendix A.

Real-Time Emergency Generation Resources will be notified of mandatory interruptions as defined in Market Rule 1. An excerpt from the relevant section of Market Rule 1 is below:

The New England Control Area or an individual or a group of Load Zones is deficient in 30-minute Operating Reserve, and the ISO implements voltage reductions of five percent of normal operating voltage that require more than 10 minutes to implement.

The ISO may activate Real-Time Emergency Generation Resources on either a zonal or system wide basis.

A1.3 Internet-Based Communication System (ICBS)

The roles, responsibilities, and duties of the IBCS Open Solution and IBCS Providers are further defined in the document "Requirements for IBCS OS and IBCS Providers" posted on the ISO web site. That document also provides information on becoming a certified IBCS Provider.

During a Real-Time Demand Response Resource or Real-Time Emergency Generation Resource activation ("an Event"), Real-Time Demand Response and Emergency Generation Resource customers will be notified through its IBCS Provider.

A2 Eligibility Criteria

A2.1 Who Can Participate?

Any Project Sponsor can subscribe either itself and/or an end-user to provide Demand Reductions of not less than 100 kW. Aggregation of load by the Project Sponsor is allowed and can be used to reach or exceed the minimum requirement. Reductions greater than five MW may be allowed at the discretion and approval of the ISO. A Project Sponsor can sign up any eligible load located within the New England Control Area consistent with Market Rule 1.

A2.2 Real-Time Demand Response Resources

Project Sponsors that participate as Real-Time Demand Response Resources agree to provide a certain level of Demand Reduction Value when activated at the discretion of the ISO. These Project Sponsors:

(1) Must be willing and able to interrupt load within 30-minutes after receiving the instruction from the ISO through its IBCS Provider.

(2) Must be willing and able to interrupt load during Critical Peak Hours and Shortage Hours as defined in Market Rule 1.

Real-Time Demand Response Resources are eligible to qualify as ICAP Resources in accordance with Market Rule 1.

A2.3 Real-Time Emergency Generation Resources

Participation in the Forward Capacity Market as a Real-Time Emergency Generation resource is limited to Distributed Generation whose federal, state and/or local air quality permit(s) limit the operation of these generators in response to requests from the ISO to the times when the ISO implements voltage reductions of five percent of normal operating voltage that require more than 10 minutes to implement. Project Sponsors that participate as Real-Time Emergency Generation Resources agree to provide a certain level of reduction when activated at the discretion of the ISO. These Project Sponsors:

(1) Must be willing and able to interrupt load within 30-minutes after receiving the instruction from the ISO through its IBCS Provider.

(2) During OP4, when the ISO is deficient in 30-minute Operating Reserve, and the ISO implements voltage reductions of five percent of normal operating voltage that require more than 10 minutes to implement.

Real-Time Emergency Generation Resources are eligible to qualify as Demand Resources in accordance with Market Rule 1.

A2.4 Minimum Qualifications for Real-Time Demand Response and Emergency Generation Resources

In order to participate a resource owner must:

(1) Be a Market Participant with a settlement account or sign an agreement with such a Market Participant who will act as the Project Sponsor, (an intermediary between the ISO and the resource owner).

(2) Interval meters as defined in Section A4 of this Appendix A for all resources or ISO approved Measurement and Verification Plans that comply with the requirements defined in this Manual.

(3) For each interval meter or approved Measurement and Verification Plan, be able to provide a minimum 100 kW curtailment or aggregate interval meters to obtain a minimum 100 kW curtailment commitment per Load Zone during Events.

(4) Meet the metering requirements set forth in Section A4 of this Appendix A or the Measurement and Verification Plan requirements in accordance with Manual M-MVDR.

(5) Resources must be able to provide data in the format and frequency required to interface with the IBCS Open Solution. Project Sponsors must utilize the services of an ISO certified IBCS Provider to provide such data services.

(6) Resources must be able to curtail its load within 30 minutes of notification from the ISO notification.

(7) Must be able to submit required meter reading data to the IBCS Open Solution by 1300 on the third business day after the Operating Day. Revised metering data may be submitted up to 90 days following the dispatch day for inclusion in the Monthly Services Invoice.

A2.5 Load Aggregation

Load aggregation is permitted for Project Sponsors to meet or exceed the minimum 100 kW load reduction level, but the aggregated resources must be in the same Load Zone. For resources that are not able to reduce to the minimum at each site but are interested in participating, a Project Sponsor can aggregate these sites using systems, software, or hardware. The aggregated amount must exceed or example 100 kW per Load Zone. Aggregated resources must be located in the same Load Zone. The sites must be aggregated by Load Zone and either Real-Time Demand Response or Real-Time Emergency Generation. For simplicity and ease of identification, the ISO suggests that aggregated groups are categorized as follows:

(1) "Participant – 1 or Company Being aggregated" Zone 1

(2) "Participant – 1 or Company Being aggregated" Zone 2

The ISO will expect to see each aggregated group as a single entity. The Project Sponsors that desire to aggregate these sites using an IBCS will need to confirm with its IBCS Provider that it can and will aggregate the resources into a single control point.

A2.6 Restrictions

A resource cannot be subscribed to more than one Demand Resource Type. A resource that has been modeled in the Energy Management System ("EMS") may not participate as a Real-Time Demand Response or Emergency Generation Resource. Selection of a specific Demand Resource Type is permanent for the life of the resource.

A2.7 Requirements for Project Sponsors with Distributed Generation

Owners of Distributed Generation including but not limited to hospitals, data centers, office buildings, warehouses, and industrial locations are eligible to participate as a the Real-Time Demand Response or Emergency Generation Resource (as appropriate). Distributed Generation can serve all or part of what otherwise would be the electricity grid load, thereby reducing the total system load during an Event. The requirements for participation are as follows:

(1) The Project Sponsor must satisfactorily complete the information required in Section I.3.9 of the ISO Tariff.

(2) The Project Sponsor must be capable of receiving notification through the IBCS.

(3) The generator must be capable of responding within 30 minutes notice of an instruction to reduce load for a Real-Time Demand Response or Emergency Generation Resource.

(4) The Project Sponsor must have an Interval Meter as described in Section A4 of this Appendix A or an approved Measurement and Verification Plan.

(5) The Project Sponsor must provide assurance that the same Metered Load is not subscribed with more than one Project Sponsor or included in more than one category.

(6) The Project Sponsor must report to the ISO the most recent annual non-coincident peak demand (absent Distributed Generation output) of the end-use metered customer at the location where the Distributed Generation resource is directly connected for each year that the Distributed Generation resource participates in the Forward Capacity Market.

(7) For each month of the Capacity Commitment Period, the Project Sponsor must report the monthly average hourly load of the end-use customer to which the Distributed Generation resource is directly connected separately from the Distributed Generation resource's monthly average hourly output.

(8) If applicable, comply with (at a cost to the generator owner) all state and federal air emissions regulations.

A2.8 Responsibilities of Project Sponsors

Each Project Sponsor is expected to act as a liaison between the ISO and Project Sponsor's retail customers. Project Sponsors have the following responsibilities:

(1) Sign up, set up, and train retail customers at cost to Project Sponsor.

(2) Allocate necessary resources to ensure appropriate hardware and software installation, maintenance, calibration and testing.

(3) Arrange for retail customer notification of Real-Time Demand Response or Emergency Generation Resources that require the retail customer's response.

(4) Consult with the retail customers to improve performance during events.

(5) Assist the retail customers in the development of demand reduction strategies, and determine amount of curtailment possible at different price levels (as applicable).

(6) Field questions about notices, baselines, FCA Payments, and reports.

(7) Project Sponsor must provide self-certification of the retail customer's Demand Reduction capability and verification that the reported Demand Reduction Value is an accurate representation of the retail customer's actual response.

(8) Notify the retail customers of the availability and opportunity to participate. The Project Sponsor will:

   (a) Obtain the necessary information from the retail customer required to complete the submission of the resource registration.

   (b) Assure the resource registration information is complete and accurate.

   (c) If necessary coordinate/schedule site installation between the IBCS Provider and the retail customer.

   (d) If the resource will utilize a customized Measurement and Verification Plan, the Project Sponsor must obtain approval from the ISO of its Measurement and Verification Plan in accordance with this Manual.

   (e) Settle with the retail customers, based on contract terms, for FCA Payments received.

   (f) Submit Meter data to the IBCS Open Solution by 1300 hours on the third business day after the Operating Day.

(g) Meter data must be submitted for all non-Demand Response Holiday weekdays.

A3 Operating Mechanism/Implementation

A3.1 Event Initiation and Termination

A3.1.1 Real-Time Demand Response Resources

(1) Real-Time Demand Response Resources will only be notified when the projected hourly load as shown in the ISO's most recent next day forecast system load, as published daily on the ISO's website by 1100, for Monday through Friday on non-holidays, during the months of June, July, August, December and January is equal to or greater than 95% of the most recent 50/50 system peak load forecast, as determined by the ISO, for the applicable summer or winter season, or

(2) ISO begins to allow the depletion of 30-minute reserve in the Load Zone where the Demand Resource is located.

(3) Real-Time Demand Response Resources will receive a separate notification when it can restore its loads.

A3.1.2 Real-Time Emergency Generation Resources

(1) Real-Time Emergency Generation Resources will be notified when the New England Control Area or an individual or a group of Load Zones is deficient in 30-minute Operating Reserve, and the ISO implements voltage reductions of five percent of normal operating voltage that require more than ten minutes to implement.

(2) Real-Time Emergency Generation Resource s will receive a separate notification when it can restore its loads.

A3.2 Response Times

After Real-Time Demand Response or Emergency Generation Resources are notified by the ISO, the ISO expects curtailment of contracted load within 30 minutes.

A4 Telemetering, Baseline and Verification

A4.1 Telemetering Requirements

The term Interval Meter as used throughout this Appendix A refers to a meter that records energy consumption (or generation) on at least a five minute basis and may store energy consumption (or generation) to a finer granularity. For the purposes of the Real-Time Demand Response and Emergency Generation Resources, an Interval Meter will include meters that meet either requirement provided below.

In the case where the Interval Meter is the same meter used by the distribution company for billing purposes and will be revenue quality meter the accuracy on the meter shall be ± 0.5%.

In the case where Interval Metering is installed specifically for the Real-Time Demand Response or Emergency Generation Resources and will not be used for other billing purposes, the meter installation can either be a revenue quality meter as described above or a non-revenue quality meter described as follows. A Demand Response or Emergency Generation Resource may use non-revenue Interval Metering devices with an overall accuracy of ± 2.0% as the source of the performance data. For each non-revenue interval meter device used, the Project Sponsor will submit certification from the meter manufacturer that the model in question meets the ± 2.0% accuracy threshold, recognizing errors in:

(1) Current measurement

(2) Voltage measurement

(3) A/D conversion

(4) Calibration

Such meters shall be periodically tested and calibrated in accordance with the standards for revenue quality metering.

Data shall be transmitted to the IBCS Open Solution through an ISO-approved IBCS Provider.

A Project Sponsor can submit a Measurement and Verification Plan to the ISO for approval in place of using an Interval Metering. The Measurement and Verification Plan must meet the requirements defined in this Manual.

A4.2 Calculation of Baseline Conditions (Customer Baseline)

A4.2.1 Baseline Condition Calculation Method

The Baseline Conditions or Customer Baseline is the average hourly load, rounded to the nearest kWh, for each of the 24 hours in a day. The Customer Baseline calculation process does not begin until the registration process and meter data reporting requirements are complete. There will be no retroactive Customer Baseline calculations performed. The Customer Baseline used for computing performance for the Real-Time Demand Response and Emergency Generation Resources shall consist of eligible weekdays (weekdays that are non-Demand Response Holidays and non-interruption days). A Customer Baseline is required whenever load is participating as part of the Demand Resource unless an approved Measurement and Verification Plan is used. For Distributed Generation or for an approved Measurement and Verification Plan, where the actual generator output is metered, the metered output or the calculation in accordance with the Measurement and Verification Plan will be used for the performance measurement.

The Customer Baseline for the Real-Time Demand Response and Emergency Generation Resources shall be calculated as the simple average for each hour as defined below:

(1) For a New Asset (an asset with no previously computed baseline): The Customer Baseline is the simple average and will be calculated for each hour in day based on meter data from the initial five business days after the asset is approved and hourly meter data begins to be recorded. Missing data during these initial 5 days will be assigned the value of zero and used in the computation of the Customer Baseline. Since the asset is not available to interrupt for a Real-Time Demand Response or Emergency Generation Event during this 5-day period, all business days are included in the calculation of the Customer Baseline for a new asset. Once the Customer Baseline can be computed, the asset is ready to interrupt. Therefore, the Customer Baseline for any hour of the first day that an asset is ready to interrupt (day 6) is:

Customer Baseline 6 = (Sum Meter Reading for the hour) / 5

[day 6 Customer Baseline calculation]

From this point forward, the Customer Baseline is calculated the same as any other asset that is ready to respond.

(2) For Existing Assets (an asset that is ready to respond):

(a) For each day (weekdays and non-Demand Response Holidays), the Customer Baseline is calculated starting from the previous day's Customer Baseline. If the present day is a Real-Time Demand Response or Emergency Generation Event day, the Customer Baseline for the present day is equal to the Customer Baseline for the previous program day. If the present day is not a Real-Time Demand Response or Emergency Generation Event day, then the Customer Baseline for the present day is calculated solely for the purpose of determining the Customer Baseline for the next day. The Customer Baseline for a non-Event day is calculated starting from the previous day's Customer Baseline and then applying the hourly data from the present day.

(b) If the present day is a Real-Time Demand Response or Emergency Generation Event day, Demand Response Holiday or weekend, the Customer Baseline is not computed. The Customer Baseline is only calculated for non-Event days. The Customer Baseline for a Real-Time Demand Response or Emergency Generation Event day, a Demand Response Holiday or weekend, is equal to the Customer Baseline for the previous day. If the present day is a non- Event day, the present day's Customer Baseline is computed using the weighted average of the previous day's Customer Baseline and the meter data for the present program day. The weighting for this calculation are 0.9 applied to the previous day's Customer Baseline and 0.1 applied to the meter data. The computed Customer Baseline becomes the Customer Baseline for the next day. Since Real-Time Demand Response or Emergency Generation Event days are excluded from the computation of the Customer Baseline, if there are multiple, consecutive Load Response Event days, the Customer Baseline calculated from the last non-Event day will be the Customer Baseline for the consecutive event days as well. The computation is performed separately for all 24 hours of the day.

(c) Continuing with the formula from day six above, if day seven is an Event day (for the specific type) then the Customer Baseline for day seven is the Customer Baseline from day six (the previous day). If day seven is not an Event day, then the Customer Baseline for day seven is calculated solely for determining of the Customer Baseline for day eight. The Customer Baseline for each hour of day seven is calculated using the following formula:

If day seven is an Event day then:

Customer Baseline 7 = Customer Baseline 6 [day 7 Customer Baseline if event day]

If day seven is not an Event day then:

Customer Baseline 7 = 0.9 * Customer Baseline 6 + 0.1 * Meter Reading 7 [day 7 Customer Baseline calculation]

(3) The Customer Baseline distributed by the IBCS OS to the IBCS Providers each day will be based upon the assumption that today will be a Load Response Event day.

(4) When computing the Customer Baseline as described above, no data will be excluded from the computation. Missing data will be assigned the value of zero.

(a) In determining the actual interruption provided, the Customer Baseline is subject to adjustment as follows:

(i) If an Event results from one or more Demand Resource Shortage Hours and no Demand Resource Forecast Peak Hours were forecasted for the Event day, then the Customer Baseline will be increased or decreased to reflect the actual usage for the two hours preceding the start of the Event.

(ii) If one or more Demand Resource Forecast Peak Hours were forecasted for the Event day, then the Customer Baseline will be adjusted to reflect the actual usage for the two hours preceding the start of the Event, provided, however, that no adjustment will be applied that would reduce the Customer Baseline.

(iii) If the Event coincides with a scheduled shutdown of the facility or scheduled maintenance of energy consuming equipment associated with the Demand Resource, then no adjustment will be applied to the Customer Baseline and the Customer Baseline as originally computed is used to determine the amount of interruption. If the actual usage for the two hours preceding the start of the Event is equal to or less than 10% of the Customer Baseline, the ISO will deem the Demand Resource to be on scheduled facility shutdown or scheduled equipment maintenance on the Event day. If the actual usage for the two hours preceding the start of the Event is greater than 10% of the Customer Baseline, the Customer Baseline as originally computed may be used to determine the amount of interruption provided that the Project Sponsor submits evidence that demonstrates, to the ISO's satisfaction, that the facility or equipment was on scheduled shutdown or maintenance on the Event day.

(iv) If there are multiple, consecutive Event days for a specific resource type, the Customer Baseline for those resources will be the Customer Baseline from the last non-Event day. The adjustment to the Customer Baseline to reflect the actual usage for the two hours preceding the interruption will be calculated separately for each Event day, and the adjustment for consecutive days will be the higher of the previous Event day's adjustment or the present day's adjustment. However, the Customer Baseline adjustment to reflect actual usage for the two hours preceding the interruption is subject to the limitation described above.

(b) Example 1: The Customer Baseline is 330 kWh for hour-beginning 10 AM, the time at which an interruption is due to start, and the customer's actual usage from hour-beginning 0800 to 1000 is 20 kWh below the Customer Baseline. The calculated adjustment would be down 20 kWh in each hour to reflect the actual load prior to the start of the event. However, the Event resulted from one or more Demand Resource Forecast Peak Hours in the Event day and this adjustment would reduce the Customer Baseline, therefore the adjustment is not applied and the Customer Baseline as originally computed for that Event day is used to determine the amount of interruption.

(c) Example 2: The Customer Baseline is 330 kWh for hour-beginning 10 AM, the time at which an interruption is due to start, and the customer's actual usage from hour-beginning 0800 to 1000 is 20 kWh below the Customer Baseline. The

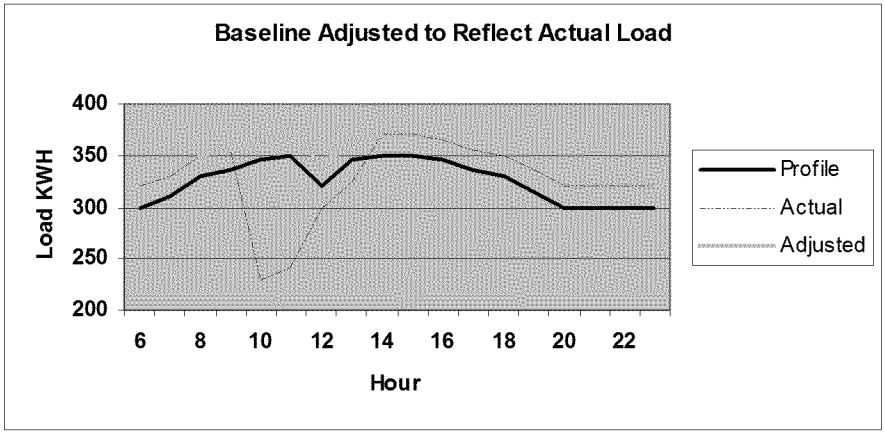
calculated adjustment would be a decrease of 20 kWh in each hour to reflect the actual load prior to the start of the event. The Event resulted from one or more Demand Resource Shortage Hours and no Demand Resource Forecast Peak Hours in the Event day; therefore the downward adjustment will be applied to the Customer Baseline for the Event day to determine the amount of interruption.

(d) Example 3: The Customer Baseline is 330 kWh for hour-beginning 10 AM, the time at which an interruption is due to start, and the customer's actual usage from hour-beginning 0800 to 1000 is 20 kWh above the Customer Baseline. The calculated adjustment would be an increase of 20 kWh in each hour to reflect the actual load prior to the start of the Load Response Event. Since this adjustment would increase the Customer Baseline, the adjustment is applied and the adjusted Customer Baseline is used to determine the amount of interruption.

(5) The IBCS OS will calculate the Customer Baseline on a daily basis for Real-Time Demand Response and Emergency Generation Resources.

The following graphic shows the Customer Baseline load profile, adjusted profile, and actual load based on metered data described in example 2.

Exhibit A4.2 – Baseline Adjustment



A4.2.2 Exclusion Provisions

Two exclusions are required when computing the Customer Baseline: Demand Response Holidays and Event days with events in a given Load Zone, as defined below:

(1) Demand Response Holidays are listed in this Appendix A.

(2) Event days (for a given Load Zone) are excluded from the Customer Baseline calculation for the appropriate Real-Time Demand Response or Emergency Generation Resources and therefore do not result in a recalculation of the Customer Baseline. The

Customer Baseline for an Event day is equal to the Customer Baseline calculated for the last non-event day. For assets that are building its 5-day historical data, Event days are not excluded from the Customer Baseline calculation, because the asset is not Ready to Respond to an Event until a Customer Baseline can be calculated.

A4.3 Performance Measurements and Compliance

A4.3.1 Performance

The Demand Reduction Value for metering configurations that include load reduction is measured as the difference between the Customer Baseline (adjusted) and the actual metered usage by hour during the event. The Customer Baseline shall be shifted (adjusted) to align the Customer Baseline with the actual metered usage for two hours preceding the interruption for the Event. However, if there are consecutive Event days, the Customer Baseline adjustment used on the first day will be compared to the Customer Baseline adjustment for each consecutive Event day, and the greater adjustment will be applied to the Customer Baseline for the second and subsequent consecutive days. For Distributed Generation, either the generator output as metered or a combined measurement of the site load and Distributed Generation as metered (at the option of the Project Sponsor) will be used for performance as defined below.

A4.3.1.1 Load Only Configuration

For premises subscribing only the load, performance for each hour shall be calculated as:

$$P_h = CB_h - AL$$

Where: P_h = performance for the hour

CB_h = Customer Baseline for the hour as calculated using the simple average method described above in Appendix A section A4.2.

AL = actual load for the hour

A4.3.1.2 Distributed Generation Only Configuration

For premises subscribing for only Distributed Generation and metered at the generator, performance for each hour shall be calculated as:

$$P_h = OG_h$$

Where: P_h = performance for the hour

OG_h = Metered Distributed Generator output for the hour

For premises subscribing for only Distributed Generation and metered such that only the net Demand Reduction value is available, performance for each hour shall be calculated as:

$$P_h = CB_h - AL$$

Where: P_h = performance for the hour

CB_h = Customer Baseline for the hour as calculated using the simple average method described above in Appendix A section A4.2.

AL = actual load for the hour

A4.3.1.3 Load and Distributed Generation Configuration

For premises subscribing both the Distributed Generation and the load as a Real-Time Demand Response or Emergency Generation Asset, performance for each hour shall be the net of Distributed Generation and load as defined below.

Where Distributed Generation and load are metered separately:

$$P_h = OG_h + [CB_h - AL]$$

Where Distributed Generation and load are metered such that only the net Demand Reduction value is available, performance for each hour shall be calculated as:

$$P_h = CB_h - AL$$

Where: P_h = performance for the hour

OG_h = Metered Distributed Generator output for the hour

CB_h = Customer Baseline for the hour as calculated using the simple average method described above in Appendix A section A4.2.

AL = actual load for the hour

A4.3.2 Compliance Period

The Compliance Period includes every hour in the Event beginning with the initial hour and ending with the end of the Event.

A4.4 Data Submission

Resource Type	*Responsible Party*	*Data to Submit*	*Deadline*
Real-Time Demand Response Resource	IBCS OS from IBCS Provider	All days, all hours	*2.5 business days after the Operating Day*
Real-Time Emergency Generation Resource (metered at Generator output)	IBCS OS from IBCS Provider	Event hours only	*2.5 business days after the Operating Day*
Real-Time Emergency Generation Resource (metered at load meter)	*IBCS OS from IBCS Provider*	*All days, all hours*	*2.5 business days after the Operating Day*

Table A4.4 – Meter Data Submission Deadlines

The IBCS OS will provide the ISO with hourly Interval Meter data, or interval data for an approved Measurement and Verification Plan, needed to calculate FCA Payments in response to an Event by 1300 on the third business day after the Operating Day. Revised metering data may be submitted up to 90 days following the dispatch day for inclusion in the following month's bill. If the Demand Response Asset is ready to respond, but the IBCS Provider fails to submit the required data, the Project Sponsor is responsible for submitting the required metering data to the ISO. The ready to respond date for resources that require a Customer Baseline (Meter Type = CONS or CONS+GEN) is the date the initial Customer Baseline is established in the IBCS-OS. Depending on when the Project Sponsor's IBCS Provider started sending data to the IBCS-OS and the quality of that data, the Ready-to-Respond date may be different than the Ready-to-Respond date provided by the Customer Asset Management System (CAMS) when the Project Sponsor registers the resource with the ISO.

For resources that do not require a Customer Baseline (Meter Type = GEN), the Ready-to-Respond date is the date the IBCS Provider is able to begin submitting interval data to the IBCS-OS after the ISO has approved the Project Sponsor's registration of the resource with the ISO.