1. **RECOMMENDED ACTION: EFFECT OF EC VOTE TO ACCEPT RECOMMENDED ACTION:**

|  |  |  |  |
| --- | --- | --- | --- |
| x | Accept as requested | x | Change to Existing Practice |
|  | Accept as modified below |  | Status Quo |
|  | Decline |  |  |

**2. TYPE OF DEVELOPMENT/MAINTENANCE**

|  |  |
| --- | --- |
| **Per Request:** | **Per Recommendation:** |
| x | Initiation | x | Initiation |
|  | Modification |  | Modification |
|  | Interpretation |  | Interpretation |
|  | Withdrawal |  | Withdrawal |
|  |  |  |  |
| x | Principle | x | Principle |
| x | Definition | x | Definition |
| x | Business Practice Standard | x | Business Practice Standard |
|  | Document |  | Document |
|  | Data Element |  | Data Element |
|  | Code Value |  | Code Value |
|  | X12 Implementation Guide |  | X12 Implementation Guide |
|  | Business Process Documentation |  | Business Process Documentation |

Note: This does not include Technical data

**3. RECOMMENDATION**

**SUMMARY:**

The Retail Electric Quadrant (REQ) DSM-EE Subcommittee submits this Recommendation for 2011 Retail Annual Plan Item No. 3(b) “Develop business practice standards used to measure and verify reductions in energy and demand from energy efficiency in wholesale and retail markets. This includes developing business practices to measure and verify energy reductions for energy efficiency or a stand-alone Energy Efficiency Portfolio Standard.”

***DISCLAIMER:*** *This document contains Model Business Practices for the Measurement and Verification of electrical energy and demand impacts of Energy Efficiency Programs implemented within any regulated or unregulated retail arena. The information and practices contained within this document are subject to the Governing Documents and the requirements of the Applicable Regulatory Authority, and in the event of a conflict, the latter should have precedence over these Model Business Practices.*

**Measurement & Verification of Energy Efficiency Programs**

**Executive Summary**

This document contains the Model Business Practices for the Measurement & Verification (“M&V”) of Energy Efficiency programs. These Model Business Practices are applicable to the M&V of electrical Energy (kWh) and Demand (kW) impacts, also referred to as reductions or savings, of Energy Efficiency programs offered to Retail Customers.

These Model Business Practices may be applied within the context of regulatory or other market requirements and agreements. The information contained in these Model Business Practices does not replace the Governing Documents or the requirements of the Applicable Regulatory Authority. In the event of a conflict, the Governing Documents and the requirements of the Applicable Regulatory Authority should have precedence over these Model Business Practices.

Model Business Practices for M&V of Energy Efficiency programs have the potential to broaden implementation and acceptance of energy reduction measures and practices in both retail and wholesale markets. Retail Energy Efficiency in retail electricity markets should provide consistent and reliable evidence of reductions in electrical usage for qualification and performance. Methodologies for qualifying and demonstrating energy and demand reductions should be specified in the Governing Documents. These Model Business Practices are not intended to replace the existing rules and tariffs stipulated within each market or to establish or support any policy.

**Introduction**

The North American Energy Standards Board (NAESB) is a voluntary non-profit organization comprised of members from all aspects of the natural gas and electric industries. Within NAESB, the Retail Electric Quadrant (REQ) and the Retail Gas Quadrant (RGQ) focus on issues impacting the retail sale of energy to Retail Customers. REQ / RGQ Model Business Practices are intended to provide guidance to Distribution Companies, other Market Participants, and Applicable Regulatory Authorities involved in providing energy service to Retail Customers. The focus of these Model Business Practices is the Measurement & Verification of Energy Efficiency programs.

These Model Business Practices are voluntary and do not address policy issues that are the subject of state legislation or regulatory decisions. These Model Business Practices have been adopted with the realization that as the industry evolves, additional and amended Model Business Practices may be necessary. Any industry participant seeking additional or amended Model Business Practices (including principles, definitions, data elements, process descriptions, and technical implementation instructions) should submit a request to the NAESB office, detailing the change, so that the appropriate process may take place to amend the Model Business Practices.

**Business Processes and Practices**

**REQ.19.1 Principles**

**REQ.19.1.1** These Model Business Practices pertain to M&V of retail Energy Efficiency projects and programs. These Model Business Practices are intended to be applicable in any regulated or unregulated retail arena. The information contained within these Model Business Practices is not intended to replace the Governing Documents or the requirements of the Applicable Regulatory Authority. In the event of a conflict between these Model Business Practices and the Governing Documents or the requirements of the Applicable Regulatory Authority, the latter two should have precedence.

**REQ.19.1.2** This document is intended to provide general M&V guidance[[1]](#footnote-1), and is intended to create consistency across retail and wholesale markets, where appropriate and applicable. These Model Business Practices do not establish practices or provide guidance related to the compensation, design, operation, or use of Energy Efficiency. These Model Business Practices do not establish practices or provide guidance related to how the results are used. They do not establish practices or provide guidance related to the evaluation of program design, cost effectiveness (cost-benefit analysis), implementation (process evaluation) or market assessments (market evaluations).

**REQ 19.1.3** These Model Business Practices include recognition that Energy Efficiency is an evolving practice within the energy service industry with increased penetration across wholesale and retail markets. As such, terminology used in the energy service industry to define approaches to quantifying electrical energy and demand savings from energy efficiency investments vary. For the purposes of these Model Business Practices, the term M&V refers to a range of activities that are used to estimate savings from energy efficiency projects or programs.  Such activities not only include M&V of site-specific project savings, but also include statistical sampling and analysis to estimate program level savings, measure life and persistence, and use of deemed savings and large scale billing analysis. In these Model Business Practices, the term M&V covers this range of activities which are sometimes referred to as “impact evaluation” activities in the retail industry and relevant guidance documents.

Without limiting the reference to M&V for these Model Business Practices, the term M&V is sometimes used more narrowly in the industry to define the application of certain methods for determining site-specific savings. For example, the National Action Plan for Energy Efficiency (NAPEE) Model Impact Evaluation guide reserves the term M&V for the four IPMVP options, and characterizes deemed savings and large scale billing analyses as alternative impact evaluation methods.

**REQ.19.2 Definition of Terms**

**REQ.19.2.A Definitions**

*To be added later*

 **REQ.19.2.1 M&V:** The process of determining reductions in usage and/or demand resulting from Demand Response or Energy Efficiency.

**REQ.0.2.xx Energy Efficiency Provider (EEP):** The Entity administering an Energy Efficiency program.

**REQ.19.2.C Abbreviations and Acronyms**

*To be added later*

**EEP Energy Efficiency Provider**

**IPMVP International Performance Measurement and Verification Protocols**

**REQ.19.3 Model Business Practices**

**REQ.19.3.1 Measurement and Verification Methodologies**

**REQ.19.3.1.1 IPMVP M&V Methodologies:** M&V methodologies should be appropriate to the measure type and sensitivity of the measurement techniques. These methods are commonly applied to analyzing measure or project level savings. A representative sample of projects in the program can be selected and the savings from those selected projects are determined and may be applied to the entire population of projects.

Acceptable methods can include, but are not limited to, the following IPMVP options.

**REQ.19.3.1.1.1 IPMVP Option A: Partially Measured Retrofit Isolation/Stipulated Measurement:** IPMVP Option A may involve an equipment specific retrofit or replacement, new installation or a system level M&V 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, or for measures for which a measured proxy variable and/or stipulated factors, can provide an accurate estimate of energy and demand savings.

**REQ.19.3.1.1.2 IPMVP Option B: Retrofit Isolation/Metered Equipment:**IPMVP Option B involves a retrofit or system-level M&V 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 installed on the affected end-use.

**REQ.19.3.1.1.3 IPMVP Option C: Whole Facility/Regression Analysis:**IPMVP Option C estimates Energy and Demand by analyzing the overall Energy use in a facility and identifying the impact of the implemented measures on the total building or facility Energy use patterns. The analysis of whole-building or facility level metered data may be completed using techniques ranging, for example, from billing comparisons to multivariate regression analysis.

**REQ.19.3.1.1.4 IPMVP Option D: Calibrated Simulation:** IPMVP Option D involves calibrated computer simulation models of component or whole-building demand and energy usage to measure demand and energy savings.

**REQ.19.3.1.2 Alternative M&V Methodologies:**  Alternative or supplemental methodologies should be appropriate to the measure type and sensitivity of the estimation techniques. These alternative methodologies are commonly applied to program level savings, and may include, but are not limited to:

**REQ.19.3.1.2.1 Deemed savings:** Deemed savings are stipulated values based on historical savings values of like measures directly or indirectly measured, determined through engineering calculations or based on previous studies. As with the IPMVP M&V approaches described above, the savings determined for a sample of projects may be applied to all the measures or projects in the program. This approach is best suited for projects with predictable operating conditions and documented stipulated values such as energy-efficient appliances.

**REQ.19.3.1.2.2 Large-scale billing analysis:** Statistical analyses are conducted on the energy usage data collected from revenue meters or equivalent for all or most of the participants in an Energy Efficiency program and either non-participants (a control group) or a baseline condition. This approach is primarily used for residential programs with homogeneous participants, load characteristics and measures. Billing analysis may be appropriate when project-specific analyses are not practical. Billing analysis may only be useful for quantification of energy use rather than demand use, unless interval meter data is available.

**REQ.19.3.1.3 Verification:** For projects or programs involving installation of measures, methodologies should include a verification component for each project or a sample of projects that verifies baseline conditions, measures were actually installed, and/or measures were installed and are operating correctly.

**REQ.19.3.1.4 Measure Life and Persistence:** Methodologies should include mechanisms for estimating measure life and persistence of measures.

**REQ.19.3.2 Energy Efficiency Baselines**

**REQ.19.3.2.1 Underlying Assumptions:** Baseline definitions should include a description of underlying assumptions used for establishing the Baseline conditions that would have occurred in the absence of the program (i.e., the counterfactual).

**REQ.19.3.2.2 Energy Efficiency Baseline Conditions:** The baseline should reflect the conditions under which new Energy Efficient equipment or processes are installed to provide a service function. The four primary conditions are as follows:

(a) Replacement or retrofit of functional equipment still within its current useful life or process improvements.

(b) Replacement of functional equipment beyond its current useful life.

(c) Unplanned replacement for (of) failed equipment.

(d) New construction.

**REQ.19.3.2.3 Standard Energy Efficiency Baseline:** The standard Energy Efficiency Baseline should be the nameplate rating of the equipment meeting the more stringent level of efficiency required by applicable state code, the federal or state (as applicable) product efficiency standard, or standard practice. The standard Energy Efficiency Baseline should be determined at the time of installation or as set forth in the Governing Documents or as established by the Applicable Regulatory Authority.

**REQ.19.3.2.4 Current Load Energy Efficiency Baseline.** The current load Energy Efficiency Baseline should be the current load of the existing operating equipment or facility. The current load Energy Efficiency Baseline should be determined at the time of installation or as set forth in the Governing Documents or as established by the Applicable Regulatory Authority.

REQ.19.3.2.5 The application of the Energy Efficiency Baseline conditions described in REQ 19.3.2.2 applicable to the two baselines REQ 19.3.2.3 and REQ 19.3.2.4 is summarized below in Table REQ.19.3.2.6.

Table REQ.19.3.2.6.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Primary Condition** | **Standard EE** **Baseline** | **Current Load EE** **Baseline** |
| **A** | Replacement or retrofit of functional equipment still within its current useful life or process improvements |  | **X** |
| **B** | Replacement of functional equipment beyond its current useful life | Depends on Governing Documents orApplicable Regulatory Authority | Depends on Governing Documents orApplicable Regulatory Authority |
| **C** | Unplanned replacement for (of) failed equipment | **X** |  |
| D | New construction | **X** |  |

**REQ.19.3.4 Statistical Significance**

**REQ.19.3.4.1 General:** M&V of Energy Efficiency programs may include measurement methodologies utilizing statistical estimation techniques for estimating Energy and Demand savings. In the event that statistical methods are used, the following expectations for statistical significance should be met:

**REQ.19.3.4.1.1 Specification for Statistical Error and Precision when Sampling is Used:** Sample error and precision used should be suited to the provisions of the program (e.g. at least 80/10 using a two-tailed test or 90/10 using a one-tailed test), subject to the Governing Documents and the requirements of the Applicable Regulatory Authority.

**REQ.19.3.4.1.2 Sample Size Calculation:** The sample size should reflect a population coefficient of variation (c.v.) which may not be known at the time of sample design. The desired error and precision level are also inputs into sample size calculation. The sample size may be established using an estimate of the c.v. For example, the estimated c.v. should be not less than 0.5 for homogeneous populations and not less than 1.0 for heterogeneous populations.

**REQ.19.3.4.1.3 Sample Size Recalibration:** Population sampling error and precision should be recalibrated using a measured c.v. The sample c.v. used should be calculated from the measured sample population and applied to the reported estimate of sampling error and precision.

**REQ.19.3.4.1.4 Sampling Over Geographically Areas:** Sampling used over heterogeneous geographical areas and/or application of sampling studies from one area to another should help control for potential bias and help meet the overall error and precision requirements.

**REQ.19.3.4.1.5 Sample Bias Control:** Sampling bias control should mitigate sources of 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.

**REQ.19.3.5 Energy Efficiency Value Savings Calculations: Energy Savings and Demand Reductions Calculations**

**REQ.19.3.5.1 Energy Efficiency Savings Value Calculation Variables:** Calculation of Energy and Demand Reduction Values for equipment, measures and practices should be performed using Energy (kWh) or Demand (kW) values calculated according to M&V methodologies provided herein. Calculation of Demand Reduction Values for equipment, measures and practices, including weather sensitive loads, may include estimated modifiers or proxy variables. Estimated modifiers and proxy variables used in the calculation of the Demand Reduction Value should include, but are not limited to the following: coincidence factor, realization rate, equipment failure rate, weather normalization for weather sensitive loads, temperature, humidity, flow, concentration, volts, amps, lumens, and quantity.

**REQ.19.3.6 Measurement and Monitoring**

**REQ.19.3.6.1 Measurement and Monitoring Parameters and Variables Requirements:** Measurement and monitoring involve the collection of data of various types from equipment, measures and practices. Monitoring parameters and variables should be used in the calculation of the Energy savings and Demand reductions..

**REQ.19.3.6.1.1** All measured monitoring parameters and variables used in calculation of the Energy savings and Demand reductions should be documented.

**REQ.19.3.6.1.2** All measured monitoring parameters and variables used in the calculation of the Energy savings and Demand reductions should be applicable to the category of equipment, measure or practice, including but not limited to: heating ventilating and air conditioning (HVAC) equipment, HVAC controls, building envelope, interior/exterior lighting, major electric consuming equipment and weather sensitive loads.

**REQ.19.3.6.2 Monitoring Frequency and Duration:** Monitoring frequency and duration of sampling should be managed so as to reduce measurement error and biases. It should help ensure accurate representation of the Energy savings and Demand reductions during the performance hours or minimum reporting interval, whichever is less, consistent with statistical significance as called for in REQ.19.3.4

**REQ.19.3.7      Measurement Equipment Specification**

**REQ.19.3.7.1** Meter accuracy should meet or exceed industry standards or as specified by the Applicable Regulatory Authority.

**REQ.19.3.7.2** Meters and other equipment should meet or exceed industry standards equivalent to ANSI C12 or as specified by the Applicable Regulatory Authority.

**REQ.19.3.7.5** The meter clock / time accuracy should meet or exceed industry standards equivalent to ANSI C12 or as specified by the Applicable Regulatory Authority.

**REQ.19.3.7.6** The method of Validating, Editing and Estimation (VEE) should conform to an accepted methodology (such as the guidelines published in the current edition of the Edison Electric Institute’s Uniform Business Practices for Unbundled Electricity Metering), and should be specified in the Governing Documents.

**REQ.19.3.8 Data Validation**

 All measured data used in the Energy savings and Demand reduction calculations should be validated using standard VEE procedures (see REQ.19.3.7.6). The following checks on any interval data from an individual facility or energy consuming equipment should be made by the EEP:

**REQ.19.3.8.1 Time Check:** Validate that the measurement devices time clock is within ± two minutes of the true time as defined by NIST.

**REQ.19.3.8.2 Sum Check:** 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 ± 2%. This check may be performed on either usage or pulse data, provided the data scaling is consistent throughout the period.

**REQ.19.3.8.3 High/Low Check:** Establish minimum and maximum expected values for each parameter, project, facility, or measure. The minimum and maximum values should be based on equipment ratings or historical equipment and/or facility usage data. All interval data that is greater than the maximum expected value or less than the minimum expected value should be identified. Any such interval data should be deemed to fail validation.

**REQ.19.3.8.4 Zero Value Check:** Identify any interval data with a value equal to zero. Verification of whether the zero value is the correct value for that interval should be made. If it is determined that the zero value is incorrect, substitution of a corrected or estimated non-zero value for the zero value may be allowed. A zero value should not be substituted for missing interval data.

**REQ.19.3.8.5 Identification of Estimated Data:** All estimated data used in the Energy savings and Demand reductions calculations, as well as the methodology used to develop the estimate, should be identified.

**REQ.19.3.8.6 Identification of Data Classifications:** All data that have passed VEE and used in the Energy savings and Demand reductions calculations should be classified as (i) actual data, (ii) estimated data or (iii) missing data. The data classification should be stored along with the data values in a data retention and management system consistent with the Governing Documents.

1. For additional information , refer to: hyperlink to IPMVP, National Action Plan for Energy Efficiency Model Impact Evaluation Guide (US DOE/US EPA), and other US DOE guidance documents. [↑](#footnote-ref-1)