Draft Small Customer Aggregation Program Rules

1. Aggregations must be at least 2.0 MW for DADRP, 1.0 MW for RTDRP, 100 kW for SCR and 100 kW for EDRP. In each case the requirement is zone-specific. The NYISO will establish an up-front means of certifying that the aggregation has an expectation of meeting this requirement. This will be established as part of the approval of the verification methodology; the sampling plan or other measurement methodology will assign an initial (a priori deemed) estimate of the response per site in order to drive the sample size. The aggregation can be comprised of two or more different sampling methods, provided that such a super aggregation was allowed by the NYISO. The MW limit can also be met by combining participants enrolled by different brokers (DRP or LSE) provided that the brokers agree to submit all participants under a single program entity.

2. Proposals for measuring aggregation performance can involve one of several methods:
a. The deployment of approved whole-premise kW metering devices on a sample of participants
b. The deployment of approved end-use device or process kW metering devices on a sample of participants that elect to limit PRL program participation to specified end-use devices or processes.
c. Provision for supplying verifiable behavioral actions, equipment operating logs, or other data that is deemed to be sufficiently indicate the load level the customer otherwise would have consumed, but for the PRL program event participation
d. Other measurement systems that indicate the load level the customer otherwise would have consumed, but for the PRL program event participation.

Proposals for measuring aggregation performance must comply with the Measurement and Verification (M&V) Guidelines (Appendix A).

3. Each proposal for small customer aggregation will be reviewed by the NYISO staff and the Price Responsive Load Working Group, and must be approved by a majority of the Chairs and Vice-Chairs of the Management Committee and Business Issues Committee and the Chairman of the Price Responsive Load Working Group.

4. One method per end-use premise. End-use electricity customers may subscribe load at a given premise to PRL programs only under a singe performance methodology, either the standard method or an approved alternative methodology.

5. Aggregations may be declared as ICAP or UCAP, subject to the rules established in the applicable NYISO Procedures for ICAP/UCAP suppliers.

6. The Aggregation broker is responsible for all costs associated with developing and administering the alternative performance methodology. Applications for approval of alternative methodologies must include a explicit description of the methodology and how it would be tracked and administered, accompanied by the specific administration processes required. The NYISO in approving an application will specify the costs associated with administration that the applicant must bear. The aggregation applicant must agree to be responsible for all such costs, including costs incurred by the ISO for developing and administrating the alternative methodology. The ISO may, at its discretion, require that some or all of such cost be reimbursed by the applicant upon approval of the methodology, or deduct all costs from payments for curtailments by participants, or a combination of the two methods of cost recovery.

7. Aggregators must accept full responsibility for payments to and penalties levied against the members of the aggregation. The NYISO will require that each member of the aggregation execute an agreement to participate indicating that it accepts the provisions of the ISO program and authorizes the LSE/DRP to act as its broker for the purposes of participation

8. Failure to comply with aggregation procedures. The NYISO may, at any time, terminate its agreement with an aggregation broker if it determines that the broker is not fulfilling it obligation under the aggregation agreement. Customers belonging to such aggregation may henceforth participate by signing up under any approved means of participation.

Appendix A: Measurement and Verification Guidelines the Small Customer Aggregation Program[1]

The Small Customer Aggregation (SCA) Program provides an opportunity for customers without facility-wide interval metering to participate in all NYISO Demand Response Programs. Enrolling Participants must have the ability to interrupt their customers' loads upon receipt of an activation notice from NYISO.

Examples of potential load reduction strategies could include:

- Traditional direct load control, such as air-conditioner and electric hot water heater cycling and pool pump curtailments
- Permission-based control of thermostat set-points
- Control of lighting circuits and dimmable ballasts
- Compressor controls on vending machines and refrigeration
- Distributed generation dispatch

For each load curtailment event, Enrolled Participants will submit to NYISO their aggregate load reduction (MWh) for each zone and hour of the event pursuant to the rules applicable to each DR program. Generally, each end-use customer's load reductions are verified based on a comparison of facility-level interval metering data from previous non-event days and the event day. Because this data will generally not be available for each customer in the SCA Program, an alternative measurement and verification (M&V) methodology must be employed. The methodology may involve the use of alternate monitoring instrumentation and/or sampling of a statistically valid number of customers or end-use devices. The Enrolling Participant must develop an M&V Plan that describes in detail their proposed methodology for determining aggregated load reductions, and submit it to NYISO for approval. This appendix describes the general issues that Participants should consider in creating an M&V Plan.

Developing an Acceptable M&V Plan

The basic objective of the M&V Plan is to describe both the data acquisition procedure and the analysis methodology that will be used by the Enrolling Participant to determine their aggregate load reductions in each hour and NYISO pricing zone, for each load curtailment event. While unique issues may require attention on a case-by-case basis, all M&V Plans should address the following general issues.[2]

Description of the load curtailment measures. The M&V Plan should describe the nature of the load curtailment measures, including the type of end-use equipment involved and the manner in which load will be controlled by the Participant. It should

[1] NYISO wishes to acknowledge that these guidelines were initially developed by ISO – New England, along with a group of industry experts, in response to a directive from the Federal Energy Regulatory Commission in Docket ER02-2330. NYISO staff participated in that effort.

[2] Participants may wish to consult resources available on standard M&V practice for energy efficiency projects, such as the International Performance Measurement and Verification Protocol (IPMVP).

also characterize the nature of the loads under control, with respect to factors such as whether the loads are constant, staged, or continuously variable; are weather or time-dependent; or have interactive effects on other loads. To verify the nature of load characteristics, some short-term monitoring may be necessary and the data included with the submittal of the M&V Plan.

A constant load device is one that operates at the same demand (kW) whenever it is on, such as a bank of fluorescent lights controlled by a single switch or a single-speed compressor in a packaged air conditioner unit. Since demand is rarely perfectly constant, a load can be treated as constant if it varies by no more than 5-10% from its average value during operation. A staged load is one that can operate at several fixed demand levels, such as a two-speed compressor in a packaged air conditioning unit. A continuously variable load can operate at any demand within some range – for example, a fan or pump motor with flow controls or a variable speed drive.

The M&V Plan should identify the specifications for each piece of end-use equipment affected by the load curtailment strategy at each customer site. Relevant information may include the equipment capacity (kW, tons, horsepower, full-load amps, etc.), operating schedule, and customer controls (manual operation, energy management system, etc.).

Measurement and monitoring strategy. The measurement and monitoring activities proposed for calculating load reductions are a central component of the M&V Plan, and the following set of issues should be addressed.

- *Monitored Parameter(s)*. At least three general options could be considered:

  (1) Facility-wide metering of demand (kW). This is the approach typically used in traditional direct load control programs, in which load reductions are estimated based on a sample of whole-premise interval meters. This approach may not be appropriate if the curtailed loads are small relative to the total facility load due to the small "signal-to-noise ratio".

  (2) End-use interval metering of demand (kW). This approach may be more appropriate than Option 1 if curtailed loads are small relative to the building load. However, consideration must be given to the possibility of interactive effects that may significantly alter loads on other end-use equipment. For example, control of dimmable ballasts may lead to higher use of desk lamps.

  (3) End-use interval metering of a proxy variable for demand, such as current (amperage) or status (on/off). This approach is characterized by similar attributes as Option 2, but also requires that a correlation be established between the monitored proxy variable and demand (kW). These correlations may be established by conducting short-term monitoring or a series of spot measurements of both parameters, and correlating the data sets (e.g., by performing a regression analysis) to estimate the functional relationship between the two parameters. Alternatively, engineering estimates of this relationship or use of equipment manufacturer's data may be appropriate in some circumstances.

Other M&V methods are possible, such as calibrated building simulation, but are unlikely to be practicable or appropriate for load curtailment measures.

- *Monitoring Interval and Period*. The M&V Plan should specify the period over which monitoring will be conducted and the interval over which monitored values will be averaged and recorded. In most cases, parameters will be measured continuously and averaged over 15-minute or hourly intervals.

- *Instrumentation*. The M&V Plan should identify the type of monitoring and data logging equipment to be used, and its accuracy, as indicated by calibration or manufacturer's data. In general, the preferred method for measuring demand (kW) is to use a true RMS measurement device with an accuracy of at least ±2%.[3] NYISO will generally not accept M&V strategies that consist of calculating demand based only on the measured current (amps) and the nominal voltage, since such methods ignore the effects of power factor and harmonics. Furthermore, demand measurements for three-phase devices should be conducted on all phases in order to account for any phase imbalance. If a facility's energy management system (EMS) will be used to record pulse output from a power transducer, the processing accuracy of the EMS must be verified. If the M&V strategy involves measuring proxy variables, the demand (kW) values calculated from this monitoring data should achieve an accuracy of ±2%.

- *Sampling*. If sampling will be conducted, the M&V Plan should define each population to be sampled, the sample size, and the target level of precision and confidence. The M&V Plan should include all calculations conducted for determining the sample size and describe how the sample points will be selected. For additional information on sampling, refer to the section below titled "Sampling."

Load reduction calculation methodology. The M&V Plan must describe how the Enrolling Participant will calculate their aggregate load reductions on an hourly and zonal basis, from the monitored data of individual end-use devices or customers. In general, this will require determining for each monitored point:

(1) The actual load or value of a monitored proxy variable (e.g., duty cycle) during each hour of the load curtailment event, and

(2) The baseline load or value of a monitored proxy variable during each hour of the event.

The baseline represents the value that would have been expected of the device or customer absent any load curtailment event. For constant load equipment that operates

[3] This recommendation for meter accuracy follows the performance requirements for solid-state electrical metering devices set by the American National Standard Institute, ANSI C12.16-1991. Additionally, for power measurements on circuits with significant harmonics, IEEE Standard 519 recommends a digital sampling rate of at least 3 kHz.

with a constant schedule and/or duty cycle, the baseline is a fixed quantity. However, for load curtailment measures involving variable load equipment or equipment whose operation is time-dependent or weather-dependent, the baseline must be calculated for each hour of each load curtailment event. The M&V Plan should explain how the actual and baseline loads will be calculated, identifying the period that will be used to calculate the baseline load (e.g., the prior ten similar days), and how any adjustments (e.g., for temperature or time of day) will be made. Participants may wish to refer to the general NYISO methodology for calculating customer baseline loads, as described in the Emergency Demand Response Program (EDRP) and Day-Ahead Demand Reduction Program (DADRP) manuals.

Calculating load reductions from a sample. If the load reductions will be measured for the entire population of controlled loads or customers, then the Participant's aggregated load reduction in each hour and zone will be calculated as the sum of all individual measured load curtailments. However, if sampling will be conducted, the Participant's aggregated load reduction in each hour and zone must be calculated from the monitoring data of the sample, and the M&V Plan should describe how this calculation will be performed.

The calculation methodology will take one of two general forms:

(1) Load reductions will be determined for each member of the sample and extrapolated to the population in terms of some average normalized value, such as the average kW reduction per unit, per ton of cooling capacity, per kW of connected load, or some other analogous unit.

(2) A proxy variable for load reduction (e.g., change in duty cycle) is determined for each member of the sample, and the load reduction for the entire population is calculated based on the average measured value of the proxy variable and additional stipulated or measured input parameters for each member of the population (e.g., connected load).

A variety of other critical issues that relate to calculating load reductions from a sample may also arise and should be addressed in the M&V Plan, including equipment failure and customer over-rides. For control technologies that allow the Participant to determine over-ride rates and signal failures, better accuracy is possible using these known rates and applying them to the savings for those with successful signal and no over-ride. For example, some thermostat control technologies allow the Participant to know the signal failure and override for all members of the population. In this case, by separating out all members of the sample with signal failures or overrides, the variation in measured load reduction for the remaining sample points will be generally smaller than it would if the load reduction were calculated for the entire sample. The average load reduction for this subset of the sample can then be extrapolated to the portion of the population that had no signal failure or customer override.

Sampling

Enrolling Participants are likely to employ load curtailment strategies that involve curtailing similar types of small loads dispersed across a large number of customer sites (e.g., cycling of residential air conditioners) or within a single customer facility (e.g., lighting circuits or vending machines). In some cases, it may not be feasible for the Participant to individually monitor each piece of equipment, and it may be appropriate to monitor a representative sample. To do so, the Participant must first identify the relevant populations and then determine the appropriate sample size for each population. After monitoring has been conducted, the Participant must evaluate the distribution of their sample in order to recalculate their sample size for the following year.

Identifying the Relevant Populations. To monitor a sample of end points, the Participant must first identify populations whose members (e.g., end-use devices, customers, lighting circuits) would be expected to have similar values for the monitored parameter. If the populations are defined too broadly, the sample will be unlikely to provide statistically significant results. Populations should consist of members that are similar with respect to:

- Type and size of equipment affected by the load curtailment strategy;
- Usage patterns (e.g., residential vs. commercial; coastal vs. inland weather zones); and
- Load control strategy (e.g., duty cycle control vs. thermostat set point control).

Determining the Appropriate Sample Size. The appropriate sample size depends on the target level of precision at some specified confidence interval. The default statistical target is 90/10 (10% precision at a one-tailed 90% confidence level).[4]

A generally accepted methodology for calculating the appropriate sample size is to conduct simple random sampling for *each* population. To follow this approach, first calculate the sample size corresponding to an infinite population (*n'*), according to Equation (1):

$$n' = \left(\frac{z \times c.v.}{p} \right)^2 \qquad (1)$$

where *z* is the z-factor for a given confidence interval (z = 1.282 for a one-tailed 90% confidence interval); *p* is the precision (p = 0.1 for 10% precision); and *c.v.* is the coefficient of variation, which is equal to the ratio of the standard deviation of the sampled variable to its average value. In general, the greater the expected variation in the variable from one device to the next – e.g., due to operational patterns or equipment size – the greater the value of *c.v.* that should be used to calculate the sample size. If monitoring has already been conducted, the *c.v.* should be based on the monitored data. Otherwise, a default initial value of *c.v.* = 0.5 should be used. For loads curtailments that

[4] In other words, the sample size should be sufficiently large such that there is a 90% probability that the average value of the sample will not exceed the average value of the population by more than 10%.

are likely to have significant variations from one device to the next, a larger *c.v.* may be necessary.

The sample size (n) for the finite population (N) can then be calculated according to Equation (2):

$$n = \frac{n'}{1 + {n'}/{N}} \tag{2}$$

where n is rounded up to the nearest integer.

If a Participant has multiple populations, as an alternative they may calculate sample sizes based on a stratified sampling approach, applied across all of the populations. This technique involves more complex sample size calculations, but will generally yield a smaller total number of sample points.

If the Participant believes that the sample sizes corresponding to a 90/10 statistical target would result in onerous M&V costs relative to project benefits, they may propose a reduction in sample sizes. However, NYISO will then de-rate the Participant's load curtailments. To determine the level of de-rating, first calculate the precision at 90% confidence associated with the reduced sample size, according to Equation (3):

$$p = z \times c.v. \times \sqrt{\frac{{N}/{n} - 1}{N}} \tag{3}$$

The de-rating of load curtailments is based on the difference between this precision and the target level of 10%. For example, if the precision associated with a reduced sample size is 15%, load curtailments will be de-rated by 15%-10% = 5%.

For any sample calculation methodology, it is advisable that the Participants over-sample (e.g., by 10%) to compensate for potential data loss due to failures in monitoring equipment or other factors. Also, as mentioned previously, NYISO may call a curtailment event in a subset of pricing zones, rather than system-wide. If only a sub-set of customers are called to curtail during such situations, the statistical accuracy of the sample will likely be reduced. To guard against such events, the Participant may wish to over-sample in some number of zones. Once the total sample size has been calculated for each population, the specific sample points should be selected at random from the members of each population.

Evaluating the Sample Distribution Based on Monitoring Data. During the first year of participation in the Small Customer Aggregation Program, a default value for the coefficient of variation (*c.v.*) of 0.5 will typically be assumed. However, after curtailment events have been called, the Participant can more accurately estimate the *c.v.* of the population, based on the monitoring data for these events. For simple random sampling, the procedure for evaluating the *c.v.* of each population is as follows:

(1) For each hour of each load curtailment event, calculate the mean value and standard deviation of the sampling variable (e.g., kW reduction per unit).

(2) Based on the hourly standard deviation and mean values, calculate hourly values for the *c.v.*, equal to the ratio of the standard deviation to the mean.

(3) Calculate the average of the hourly *c.v.* values for all curtailment events during the calendar year.

Based on these calculated *c.v.* values, the Participant can re-calculate the appropriate sample size for the following program year, using Equations (1) and (2). If the calculated *c.v.* values are significantly larger than 0.5, this could indicate either that the population has a wide distribution with respect to the sampling variable, or that the population is composed of two or more distinct groups that should be disaggregated into separate populations. In the latter case, the Participant should re-calculate the *c.v.* values for each separate population, based on the existing sample data from each of these groups.

M&V Plan Checklist

Enrolling Participants may wish to consult the following checklist to ensure that their M&V Plan addresses the necessary issues and contains adequate detail.

(1) The M&V Plan describes the load curtailment strategy and related end-use devices, identifying:

- ☐ The type, quantity, and location of end-use devices that will be controlled
- ☐ The manner in which end-use devices will be controlled
- ☐ The general characteristics of the end-use devices, with respect to factors such as load variability, time- or weather-dependence, and interactive effects on other end-use equipment
- ☐ Detailed specifications, to the extent possible, for each end-use device to be controlled, including nameplate capacity, operating schedule, and customer controls

(2) The M&V Plan describes the measurements that will be conducted to calculate load reductions for each hour and zone during NYISO load curtailment events, identifying:

- ☐ The parameters that will be measured
- ☐ The duration over which monitoring will be conducted
- ☐ The interval over which monitoring data will be averaged and recorded
- ☐ The type of monitoring and data logging equipment to be used and their accuracy (include calibration data and/or manufacturer's spec sheets to verify instrumentation accuracy)
- ☐ If applicable, the populations to be sampled, the target level of precision and confidence, and the sample sizes (include all calculations used to determine sample size)

(3) The M&V Plan describes the methodology by which aggregate load reductions for each hour and zone will be calculated from the monitoring data, identifying:

- ☐ How the actual load will be calculated, for M&V strategies that involve the measurement of proxy variables
- ☐ How the baseline load will be calculated, including the period used to calculate baseline loads and adjustments that will be made to account for weather or time of day
- ☐ If sampling will be conducted, the calculation method by which monitored results from the sample will be applied to the entire population, including (if applicable) the effect of customer over-rides and signal or equipment failure
- ☐ Any alternative calculation methods that will be employed specifically in cases that NYISO calls for load reductions in only a sub-set of pricing zones