

Business Rules for Residential DR Participation in Synchronized Reserves

June 24, 2014

Demand Response Subcommittee

- Compliance calculations
- Non-performance penalties
- Flexible/inflexible rules
- Meter accuracy requirements – 2%
- Data submission – within 2 business days of event
- DR limitation in SR – 33%
- Meter level – entire EDC account number, no submetering

- Only a sample of customers will have 1 minute metering. Sampled data will be extrapolated to population.

- Load reduction must be directly controlled by CSP – no behavioral programs
- Residential customers only
- If population has 1-minute metering, actual population data must be used

- Stratified simple random sample
- Must achieve less than 10% error at 90% confidence

- **Sample size determination**
 - Less than 10% error at 90% confidence level
 - Approximate sample size of 300 (using sample data PJM currently has access to)
 - Based on variance study for each sample
 - PJM may amend requirements for variance study after more experience is gained

- 75 randomly selected participants
- 2 weeks of contiguous one minute meter data
- Data collection during season that end use device is in use/will be curtailed
 - e.g. June – September for ACs

$n = 75 =$ Number of sampled meters

$X_{it} =$ Meter reading for customer i at time t

- Calculate the mean and variance across all customers for each minute

$$Mean(X_t) = \bar{X}_t = \frac{1}{n} \sum_{i=1}^n X_{it}$$

$$Var(X_t) = s_{X_t}^2 = \frac{1}{n} \sum_{i=1}^n (X_{it} - \bar{X}_t)^2$$

- Calculate the sample size necessary to get 10% error at 90% confidence for each 1 minute interval:

$$M_t = \left(\frac{Z_{\alpha/2}}{e} \right)^2 \frac{s_t^2}{\bar{X}_t^2}$$

Where:

$Z_{\alpha/2} = 1.645 =$ critical value at 90% confidence ($\alpha = 0.1$)

$e = 0.1 =$ % error

- Sample size required:
 - Average across all one minute intervals to obtain sample size that will have 10% precision at 90% confidence

$$M = \frac{1}{T} \sum_{t=1}^T M_t$$

Where:

T = total number of one minute time intervals

- **Separate samples**
 - Zone, SR subzone, EDC, registration
 - End use device/device grouping
 - e.g. AC, water heater, both
 - Curtailment algorithms
 - e.g. 50% cycling, 100% cycling, thermostat set point
 - Different switches with same curtailment algorithm
 - Necessary if switch capability is substantially different
 - e.g. 1985 switches with operability of 60% and 2010 switches with operability of 90% require separate samples. Similar switches with same algorithm from 2010 and 2014 do not need additional sample.

sample		1	2	3	4
End Use device	AC	X	X	X	X
EDC/zone	AMP-ATSI	X	X		
	FE- ATSI			X	X
Switch type	100% - 1985	X		X	
	100% - 2010		X		X

- **Sample stratification**
 - Control device size in 2 groups roughly at median
 - e.g. median AC size is 3.1 kW, stratification by AC size < 3.1 kW and > 3.1 kW
 - **Geographic Stratification**
 - At PJM discretion, depending on size of region, variability within region, etc.
 - e.g. AEP wide program would likely require geographic stratification, RECO probably not
 - PJM will adjust stratification requirements as experience is gained to reduce sample size

- Annual sample calibration

- Based on annual sample variance update
- Proportion of each stratum in the sample must be within +/- 1 sample of population proportion
 - e.g. Sample size = 150 customers
 - Population proportion stratum A= 20%
 - Stratum A should be 30 customers
 - does not need to be recalibrated if 29 – 31 customers
- Replacements if necessary must be randomly selected, maintain strata integrity, etc.
- If population is expanded in non-random manner, sample must be expanded appropriately

- NAESB Validating, Editing & Estimating (VEE) Protocol
 - EEI Uniform Business Practices for Unbundled Electricity Metering Volume II, 12/5/2000
- Must follow NAESB VEE protocol.
 - NAESB VEE protocol is intended for hourly data
 - Replace “hour” with “interval” in NAESB protocol
 - e.g. “If less than 2 hours...” → “If less than 2 intervals”
- If 5 intervals or more are missing for 1 meter
 - If still enough meters to satisfy sample size: do not submit data from meter
 - If less than sample requirement - data from that meter must be submitted as all 0’s for that event

- 2 way communication
 - Performance factor for each event based on actual population operability
 - Inoperable switch in sample
 - Sample size $> M$: do not report load data from in-operable switch
 - Sample size $< M$: must report load data from switch
 - Can repair faulty switch in sample or population at any time

- 1 way communication
 - Must report data from all switches, even if inoperable
 - Cannot repair failed switches until:
 - Repair faulty switches in population
 - OR Reselect entire sample
 - Includes any system/device that would cause end-use device not to reduce load properly in the population
 - Metering and metering communication
 - Can be fixed in sample
 - Includes only systems/devices that would not affect load reduction in population
 - Component that is related to both metering and switching cannot be repaired
 - Switch failures in sample must be reported to PJM within 2 business days

- CSP must submit initial list of customers
 - EDC account number and address
- Replacement
 - Customer who moves from their premises
 - Or customer who terminates their own contract
 - Replacement customer must be randomly selected to maintain integrity of strata
- CSP must maintain a list of all replacements and furnish to PJM within 2 business days of request
- If number of available customers falls below registered customers due to churn, must report to PJM in advance of offering

- Number of customers offered cannot exceed number of registered customers
- Partial resource offer:
 - Offered customers must be randomly assigned from pool of all registered customers

- CSP must maintain list of:
 - registered customers (daily) – determined day before operating day
 - offered customers (for all eMKT offers) – determined before offer is submitted
 - cycled customers – for all events – determined immediately after cycling is initiated based on actual customers who are cycled
- Data to be furnished to PJM within 2 business days of request
- If data cannot be furnished in timely manner, or number of customers falls below registered/committed value without reporting:
 - CSP may referred to MMU for review
 - Deficiency penalties may be assessed
 - Registered value may be reduced and offered value capped

- M&V Plan
 - Annual
 - Details of variance study
 - Meter qualification
 - Meter quality assurance
 - Data validation, error correction protocol
 - Sample selection and stratification detail