Business Rules for Residential DR Participation in Synchronized Reserves

July 30, 2014
Demand Response Subcommittee
What is NOT changing

- 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.
Definitions

- Direct load control (DLC) – ability of CSP to directly curtail end use device at end use customer without intervention from end use customer
- Contract – agreement between end use customer and CSP for CSP to perform DLC and offer it as DR in the relevant PJM market
- Enrolled customer – A customer who has a contract with CSP, and for whom CSP has the physical ability to perform DLC
- Registered Customer – An enrolled customer who is registered with PJM
- Sample – customers selected from the registered population of non-interval metered customers who have interval meters installed for the purpose of settling all registered customers
- Population – registered customers
- e.g. A CSP may have 50,000 enrolled customers, but only 45,000 registered customers
Basic requirements

- 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
- Based on variance of meter data
- PJM may amend requirements for variance study after more experience is gained
• At least 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
\[ n = 75 = \text{Number of sampled meters} \]
\[ X_{it} = \text{Meter reading for customer } i \text{ at time } t \]

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

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

\[
\text{Var}(X_t) = s^2_{X_t} = \frac{1}{n} \sum_{i=1}^{n} (X_{it} - \bar{X}_t)^2
\]
• Calculate the sample size necessary to get 10% error at 90% confidence for each 1 minute interval:

\[ M_t = \left( \frac{Z_{\alpha/2}}{e} \right)^2 \frac{s_t^2}{X_t^2} \]

Where:

\[ Z_{\alpha/2} = 1.645 = \text{critical value at 90% confidence (} \alpha = 0.1 \) \\
\[ e = 0.1 = \% \text{ error} \]
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:

$$T = \text{total number of one minute time intervals}$$
Sample Requirements

• Separate samples
  – SR Subzone, Dispatch group or 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.
<table>
<thead>
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<th>sample</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>End Use device</td>
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<td>EDC/zone</td>
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<tr>
<td>AMP-ATSI</td>
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<tr>
<td>FE- ATSI</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>Switch type</td>
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<tr>
<td>100% - 1985</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>100% - 2010</td>
<td>X</td>
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• 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
    • Based on sum of device sizes at EDC account level
  – Geographic Stratification
    • PJM discretion, based on size, variability within region, etc.
    • e.g. AEP wide program would likely require geographic stratification, RECO probably not
  – CSP may propose alternate stratification to reduce variance
  – 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

• 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…” \(\rightarrow\) “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
Switch Operability – 2 way

• 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
Switch Operability – 1 way

• 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
  – Customer who terminates their own contract with CSP for participation in DLC/SR
  – 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
  – e.g. PJM requests the list on Tuesday, CSP must submit the list created on Monday of registered customers for Tuesday. CSP must do this by COB Thursday.

• CSP must maintain list of customers for each offer for 2 years from date of offer

• Total number of registered customers must be accurate on location in eLRS before an offer is submitted
• 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
  – PJM to publish template
• PJM will report results 1 year after participation for transparency