Business Rules for Residential DR Participation in Synchronized Reserves

June 24, 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.
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
Sample requirements

- 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
Variance Study Requirements

- 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

\[
Mean(X_t) = \overline{X_t} = \frac{1}{n} \sum_{i=1}^{n} X_{it}
\]

\[
Var(X_t) = s_{X_t}^2 = \frac{1}{n} \sum_{i=1}^{n} (X_{it} - \overline{X_t})^2
\]
• 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:
- \( Z_{\alpha/2} = 1.645 \) = 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:
\[ T = \text{total number of one minute time intervals} \]
Sample Requirements

- 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.
<table>
<thead>
<tr>
<th>sample</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td><strong>End Use device</strong></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>AC</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td><strong>EDC/zone</strong></td>
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<tr>
<td>AMP-ATSI</td>
<td>X</td>
<td>X</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><strong>Switch type</strong></td>
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<td></td>
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<tr>
<td>100% - 1985</td>
<td>X</td>
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<td>X</td>
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</tr>
<tr>
<td>100% - 2010</td>
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<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
  – 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
• 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