Business Rules for Residential DR Participation in Synchronized Reserves

July 30, 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.

- 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

- 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 = $ 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

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

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

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

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

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
  - 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.

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
    - 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
  - 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
  - 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