Scheduling and Settlement Webinar

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PPL Electric Utilities

Estimation & Validation: Profiling

- Depiction of the amount of load an account uses over time
- Creation of a set of hourly load values attributable to all customers in a particular rate class
- Estimated customer load shapes in hourly kWh values
- Load shapes - day types, seasons, hours of the day
- PPL - four season, two day model (wkday /wkend)
  - Sunrise / sunset profile for lighting accounts
  - Approximately 30 profiles in use PPL Electric Utilities, typically one for each rate class.
- Profiles, usage factors and temperature variables are used to calculate the expected load when actual metered consumption is not available
- Unusual seasonal temperatures may skew aggregation results
- PPL's use of profile estimation in the Settlement A Backcast will be significantly reduced with the change to PJM InSchedule deadlines effective June 1, 2015

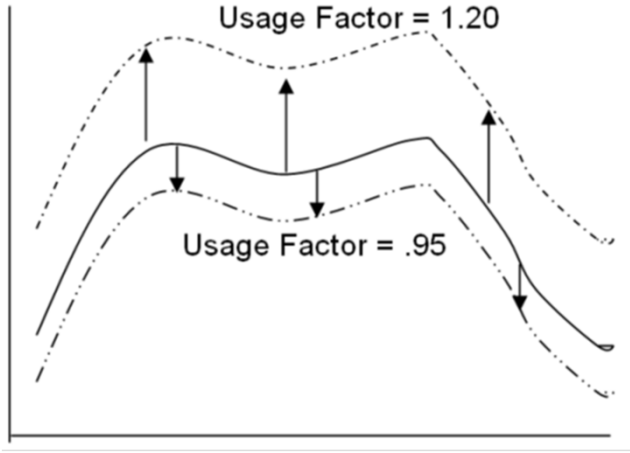
Estimation & Validation: Validation, Estimation and Editing (VEE)

- “Scrubbing” bad or missing data to make it more realistic
- Performed daily to obtain fully populated ‘approved’ 24-hour intervals

Examples: substation outages, storms, downed trees, maintenance, faulty meters, non-communicating meters, and meter software upgrades

Estimation & Validation: Usage Factors

- Profiles represent hourly loads that are typical for a segment
- A multiplier or usage factor adjusts the profile to more closely resemble each customer's individual hourly loads
- Usage factor is the ratio of a meter's recent historic consumption (kWh) to the consumption of the rate class profile for a period of the same duration
- Usage factors are used to adjust the magnitude of the load profile shape by scaling each of the profile's hourly loads up or down
- Usage factors are generally recalculated monthly for each customer meter



PPL Electric Utilities

Load Forecast

- Process of predicting load for a future time period
- Primary purpose - to have load values in place at PJM, in the event of issues preventing the submission of Settlement A InSchedules.
- Involves aggregating hourly loads using profiles, usage factors and weather adjustments
- Since forecast is for future dates, there is no actual metered data available, so profiles are used for all meters, including MV90
- No actual weather data is available, so forecasted weather is used
- It is PPL's Scheduling & Settlement team's practice to submit a ten day forecast twice per week
- PJM does not use submitted energy forecast data in any billing calculations
- No financial impact to suppliers based on the energy forecast

Zonal Tie-Out / PowerMeter Validation

- The process in which the flow of energy within the PPL Zone is accounted for and reconciled:
- Interconnection points have been established between PPL Electric Utilities and its counterparties at each of the locations where energy enters or leaves the zone
- The interconnection points include tie-lines with neighboring utilities and generation points
- Each interconnection point within the zone is metered and reconciled daily
- The zonal load calculation equals all load generated within the PPL Zone plus any load imported from outside the zone less any load exported out of the zone

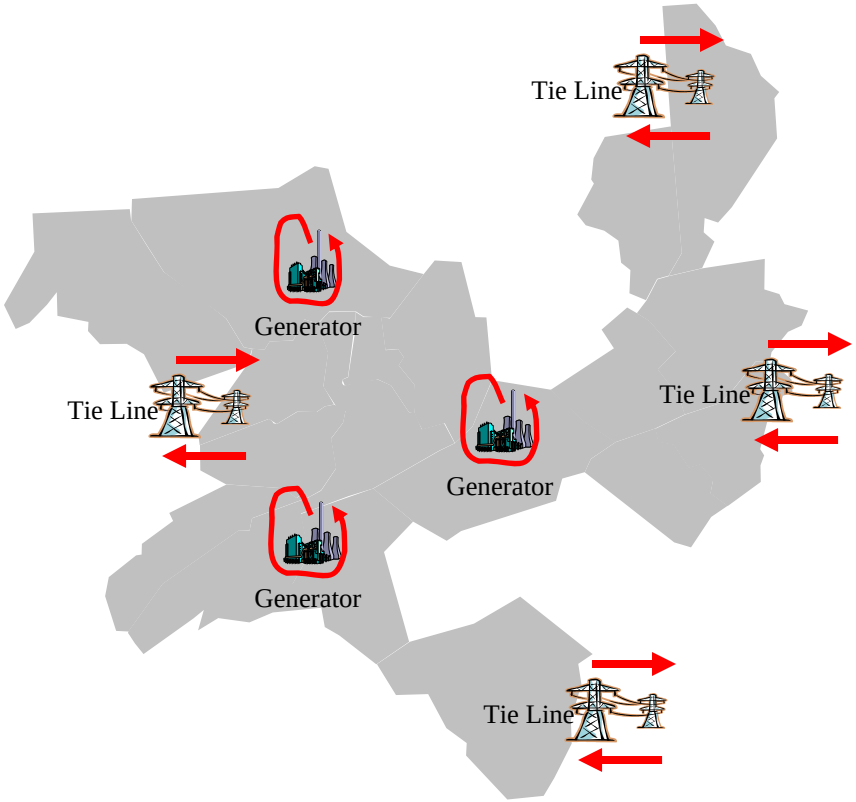
Zonal Tie-Out / PowerMeter Validation

- The responsibility for submitting metered data for interconnection points within the zone is shared between PPL Electric Utilities and its counterparties (neighboring utilities and generator within the zone)
- PPL uses their own meters to validate the numbers submitted by counterparties
- All Settlement A & B hourly submissions must equal the corresponding hourly zonal load value
- All aggregation results include the application of UFE to reconcile to the zonal load values.

Zonal Load Calculation

LOAD (INCLUDING LOSSES) = ∑GEN + ∑TIE(IN) - ∑TIE(OUT)

- Hourly load values calculated for previous day
- Calculation derived from PJM power meter submissions by PPL & counterparties
- Correction period available at end of each month



Settlement A Backcast Process

- Each supplier's estimated hourly load responsibility for the previous day(s) is aggregated and submitted to PJM
- EDCs are required by PJM to submit hourly load values for each entity serving load within their zone
- The entities serving load can include EGSs, Municipalities, and POLR Suppliers
- Aggregated hourly load is the sum of all the supplier's customers' energy consumed for each hour, plus the associated distribution and transmission losses and allocated UFE
- PJM uses the data to determine the charges or credits for each supplier for that day's transactions related to energy and ancillary services
- Each hour's aggregated load is scaled up or down to match the corresponding hour's zonal load

Settlement A Backcast Process

- The difference is called Unaccounted For Energy (UFE) and is allocated to all supplier loads and POLR groups on a load ratio basis
- The only actual metered data currently used in a Settlement A aggregation comes from the largest 1,200 customers who have MV-90 type meters
- The remaining customers, typically have a TNS type meter, and hourly loads are estimated using weather sensitive profiles and usage factors at the meter level
- Beginning June 1, 2015, the PJM submission deadline will be extended to two business days after the day being settled
- This change allows PPL to include actual TNS meter data in the daily aggregations

Settlement A Backcast Process

- Customers who do not chose a retail supplier remain with the EDC as the Provider of Last Resort (POLR)
- All POLR load is procured through a wholesale action, where suppliers bid on tranches in four retail categories: Residential, Small Commercial & Industrial, Large Commercial & Industrial Fixed Price and Large Commercial & Industrial Hourly Price
- Suppliers are able to view their data in either the InSchedule application or via the PJM MSRS reporting tool
  - values include estimated losses by rate class and UFE
- PJM adjusts these values using hourly deration factors which can be downloaded in the reports section of the InSchedule application
- The derated hourly values can be viewed or downloaded in the MSRS reports.

Settlement B Backcast

- Settlement B submission data covers a full calendar month, delta values are submitted to PJM
- The Delta equals Settlement A submission MW values minus Settlement B aggregated MW values
- The final aggregation includes nearly all actual meter read data
- EDCs are required to submit deltas per contract, per hour to PJM for the calendar month that ended two months prior
- PJM uses the data to determine the adjustment to charges or credits for each supplier for that month's transactions related to energy and ancillary services
- Each hour's aggregated load is adjusted for rate class losses and scaled up or down to match the corresponding hour's zonal load, the POLR load is divided up among the POLR suppliers based on their contract's total tranche percentage, and UFE is allocated to all supplier loads and POLR groups on a load ratio basis

Settlement B Backcast

- Settlement B Backcast files are uploaded to the PJM InSchedule application
- Delta values are required to be uploaded to PJM by midnight on the last day of the calendar month
- Suppliers are able to view their deltas in either the InSchedule application or via the PJM MSRS reporting tool
- The deltas include estimated losses by rate class and the applied UFE
- PJM adjusts these deltas using hourly deration factors which can be downloaded in the reports section of the InSchedule application.

Net Metering Process for Settlement

- Customers with MV90 meters:
  - Hourly aggregated negative load values are aggregated with supplier's positive load
- Customers with TNS meters:
  - Customer's load is estimated for settlement A & true up is done for settlement B
  - Both positive & negative deltas can be submitted for B
- Unable to submit negative InSchedules to PJM

Settlement C

- Re-submission of Settlement B with more accurate data after the two month window
  - Recalculation of delta values
- Only done in extreme cases
  - Example: Large Metering Error
- PJM requires sign off from all affected parties before they'll accept correction
- PJM generally makes corrections involving long time periods over an extended period of time

Financial Settlement Adjustment

- Process exists for opportunity to settle dollar amounts only
- Can be used for long term zonal load adjustment or long term customer meter adjustment
- Sign off from each impacted party required
  - Form is provided to PJM
  - PJM has waived sign off for credit only adjustments in the past
  - Financial adjustment shows up on monthly PJM Bill

Commonly Used Scheduling Terms

Aggregation – The process of summing energy loads according to a predefined logic.

Load – a customer's energy use measured in kilowatts (kW) or megawatts (MW). When referring to more than a single hour, the units of load are kilowatt-hours (kWh) or megawatt-hours (MWh). Load can vary based on: weather, time of day, season and economic conditions.

MUNI – Municipal wholesale customers. All Muni's within our territory are metered with MV90 meters. UFE is not applied to Muni aggregation results.

MV-90 – A revenue quality meter designed for larger Commercial and Industrial customers. There are approximately 1200 customers in our service territory currently using this type of meter. Many of the interchange locations used for zonal load calculations also have MV-90 meters. Meter readings are retrieved daily and provide 15 minute interval usage.

NYPA – An acronym meaning New York Power Authority. Output from certain NYPA hydroelectric plants is allotted to EDCs in neighboring states, including Pennsylvania. PPL Electric Utilities receives energy and capacity allotments of approximately 4 MW per hour.

Commonly Used Scheduling Terms

Provider of Last Resort or POLR – In Pennsylvania, EDC's are required to supply electricity to a customer in the event that the customer does not select a retail supplier. PPL Electric Utilities currently auctions off all POLR load in the wholesale market.

TNS – This is a revenue meter that provides usage data primarily for residential and small commercial & industrial customers. Because there are 1.4 million meters currently in the system, the TNS data processing time for loading into MDM system is more than 24 hours.

Tranche – A portion of the POLR load that is divided up equally among the winning wholesale bidders of PPL Electric Utilities' default supply procurement process.

Unaccounted for Energy (UFE) – This is the delta or difference on an hourly basis (positive or negative) between the PPL Zonal Load, as measured by PJM, and the sum of the individually metered customer hourly loads plus losses, as calculated in the Settlement A and B aggregations. UFE is distributed among all suppliers in the zone on an hourly basis, in proportion to their load.

Zonal Load – This is the load by hour for the PPL Zone as determined by PJM based on PowerMeter submissions.

Questions?

Q&A

Q. For the daily Backcast, what is the difference between TNS vs MV90 meters?

A. For MV90 meters actual interval data, is available when the backcast is generated for the prior day. For TNS meters, the actual interval data is not available, until after the backcast for the prior day is generated. Therefore, estimates are created based upon profiles, usage factors and weather.

- Effective 6/1/15, the backcast will be generated two days after the day being scheduled. This change, allows PPL the ability to send actual interval data for the majority of the accounts. Since this data will include a greater degree of actual data, increasing the accuracy of Settlement A submissions.

Q. How does unusual weather impact the Settlement A backcast and forecast submissions.

A. When the weather is abnormally high or low for the season, the estimation process has a difficult time creating an accurate forecast. PPL uses a 4 season profile model. Typically, the shoulder months (May, Sept, Mar), present challenges if the weather is abnormal for that season. So for example, an unusually hot day occurred in Sept 2013, and PPL was in its Fall season from a profiling point of view. The PPL backcast was much lower than the total usage for the PPL zone. So the UFE was allocated across all customers equally. For Commercial accounts with MV90 meters the actual intervals were correct, but since they all received an allocation of the UFE, their Settlement A submissions were artificially inflated. Settlement B took care of this issue, 60 days after the Settlement A submission to PJM.