

Summary of the studies found in: Measurement and Verification for Demand Response *Prepared for the National Forum on the National Action Plan on Demand Response: Measurement and Verification Working Group* by Miriam L. Goldberg & G.Kennedy Agnew – DNV KEMA Energy and Sustainability

1. Ontario Power Authority (OPA)

Report: Assessment of Settlement Baseline Methods for Ontario Power Authority's Commercial & Industrial Event Based Demand Response Programs. Freeman, Sullivan & Co. (September 2010)

Purpose: to analyze accuracy of current and alternative baselines used for settlement of DR3.

Methods tested: 48 baseline methods were tested using data from 95 existing customers including:

- Top 3, 7, and 9 out of the last 10 non-event days;
- Bottom 3 and 7 out of the last 10 non-event days;
- All 10 of the last 10 non-event days; and
- Top and Bottom 15 out of the last 20 non-event days
- Also tested two types of In-day Adjustments (4 hour and 6 hour with a two hour buffer between the event period and the adjustment window)

All baselines were compared to the current High 15 of 20 methodology (with and without same-day adjustments) to highlight realizable improvements.

Key Findings:

- 10 of 10 baseline with a 6-hour adjustment was recommended due to the following:
 - o Averages a very low overall load-impact error (-0.5%) during most common event period;
 - o Accurate for customers both above/below one MW of contracted load reduction;
 - o Produces narrowest distribution of errors and generates few extreme error values at either the customer level or at the settlement account level;
 - o Most accurate baseline across all event windows
- The study also recommended that if a same-day adjustment is adopted, the method should be reassessed the next year

2. California Public Utilities Commission (CPUC)

Report: 2011 Statewide Evaluation of California Aggregator Demand Response Programs Volume II: Baseline Calculation Rules and Accuracy. Freeman, Sullivan & Co. (June 2012)

Purpose: Analyze the accuracy of baseline estimates for the California Investor Owned Utility Aggregator DR programs.

Test data: statewide Capacity Bidding Program (CBP), Aggregator Managed Portfolio (AMP), and Demand Response Resource Contracts (DRRC)

Methods tested: a number of variations on the standard 10 of 10 day average with same day adjustment based on the first three hours of the previous four hours and capped at 20 percent, specifically:

- Individual vs. aggregate application of adjustments
- Level of adjustment cap; and
- Aggregator choice of adjustment vs universal adjustment

Key findings:

- Universal application of same-day adjustments almost always increases accuracy compared to aggregator choice
- Calculating adjustments at the settlement portfolio level has a limited effect on bias but reduces the magnitude of same-day adjustments
- The effect of increasing the adjustment cap varies by program and option. When it does change results, accuracy generally improves slightly

3. PJM

Report: PJM Analysis of DR Baseline Methods (2011)

Purpose: to analyze baseline options for PJM DR programs and to rank performance based on relative error and variability as well as expected administrative costs.

Test data: 39% of the total number of DR customers across PJM territory and 54% of Peak Load Contribution customers at the time of PJM's system peak. (Data tested from 2008 through 2010).

Methods tested: range of baselines used by ISOs today including:

- PJM
- Other ISOs and RTOs
- Suggested by the Market Monitor
- Suggested by evaluator
- Range of data selection criteria: average load of a subset (High X of Y), rolling ISO-NE baseline, match-day baselines, flat baselines, regression baselines
- Adjustments: additive, multiplicative, additive regression-based PJM weather sensitive

Key findings:

- Baselines that use an average load over a subset of a rolling time period (10 of 10, high 5 of 10, high 4 of 5, middle 4 of 6, and ISO-NE) with a same day additive or multiplicative adjustment performed better than any unadjusted baselines or those with the PJM weather-sensitive adjustment
- These baselines had similar results and performed well across all segments, time periods and weather conditions except in the case of variable load customers (they should be segmented with a different performance evaluation method and/or market rule)
- PJM's high 4 of 5 baseline with additive adjustment consistently one of the most accurate baselines and required no additional administrative cost to implement – 10 of 10 and ISO-NE

slightly more accurate – PJM found that benefits were incremental and could not justify the incremental costs.

4. California Energy Commission (CEC)

Report: “Protocol Development for Demand Response Calculation – Findings and Recommendations” (Feb 2003)

Purpose: explore components of a baseline and compare accuracy across the full range of possible baselines using actual data

Test Data: 646 accounts across all regions of the United States through the years 1998 – 2001

Methods Tested: Data selection criteria, Estimation methods, Adjustments

Key Findings:

- No single approach offered a comprehensive solution across all kinds of account load characteristics and conditions
- Baseline calculations should provide for alternatives based on customer load characteristics
- Program operator should ultimately authorize the final baseline decision

Recommendations:

- Rolling 10 day window with an additive adjustment based on the 2 hours prior to the event start (provides the best, most practical baseline)
- For weather-sensitive loads, limiting the data selection criteria (the rolling window) to the five highest average load days is not as effective as using a baseline adjustment
- Simple averages with adjustments are nearly as good as weather regressions
- High variability amongst loads is a challenge regardless of the baseline methodology employed

5. ISO-NE

Report: ISO New England Inc., “Analysis and Assessment of Baseline Accuracy: Final Report” (August 2011)

Purpose: Analyze bidding patterns in the Day Ahead Load Response Program and the effect on baseline accuracy

Key Findings:

- Participants could offer load reduction at a low enough price to clear every day (resulted in the baseline remaining frozen at the same level as the first cleared day of the series)
- Seasonal drift made the frozen baseline inaccurate as the number of cleared days increased
- Asymmetric adjustments cause biased estimates of load reduction
- Baseline accuracy and bias are directly impacted by frequency with which resources clear in the market – a symmetric adjustment does not reduce inaccuracies
- Develop policies which limit the number of days a customer can clear during a set timeframe or require meter data in baseline computation even if the resource clears