

Estimating Demand Response Load Impacts, A New Study by LBNL

Lawrence Berkeley National Laboratory (LBNL) issued a new study in January entitled, “Estimating Demand Response Load Impacts: Evaluation of Baseline Load Models for Non-Residential Buildings in California.” This study analyzes the performance of different baseline load profile models for commercial buildings participating in a demand response (DR) program in order to provide a statistically valid evaluation of how well each model performs, and to relate the performance to more general building characteristics.

The report states that the genesis of the study lies in the interest of both Federal and California state policymakers in developing more standardized and consistent approaches to estimate and verify the load impacts of DR programs and dynamic pricing tariffs. In order to determine the actual peak load reduction, a baseline load profile (BLP), which is an estimate of what the load would have been without any DR actions, is needed. Accurate BLP estimates help ensure that individual participants in DR programs are fairly compensated as part of settlement procedures for their actual load reductions, and that the contribution of demand response resources in aggregate is properly accounted for in resource planning and benefit cost screening analysis. The authors state that in both cases it is important to avoid systematic bias in estimating the load reductions.

LBNL evaluated seven BLP models, for a sample of 32 largely commercial and industrial sites in California incorporating 33 separately metered facilities. The models were evaluated on both their accuracy and bias. This study also looked at the impact of weather effects on the performance of the models.

According to the authors, the models evaluated can be loosely categorized into two groups: (1) *averaging methods*, which use some linear combination of hourly load values from previous days to predict the load on the event day and (2) *explicit weather models*, which use a formula based on local hourly temperature to predict the load. For each BLP model, both a model with and without a morning adjustment were tested. Morning adjustment models incorporate site usage data from the morning of the DR event prior to load curtailment.

The authors conclude that DR program administrators should have flexibility and multiple options for suggesting the most appropriate BLP method for specific types of customers. Key load characteristics to be considered in BLP methods are weather-sensitivity, an issue for mainly commercial and institutional buildings, and variability of loads.

Other conclusions presented by the authors include the following:

1. The model currently used by California utilities to estimate load reductions in several of their DR programs could be improved substantially if a morning adjustment factor were applied.
2. Applying a morning adjustment factor significantly reduces the bias and improves the accuracy of *all* BLP models.
3. Characterization of building loads by variability and weather sensitivity is a useful screening indicator that can be used to predict which types of BLP models will perform well.
4. BLP models that incorporate temperature (e.g. explicit weather models) improve accuracy of the estimated baseline loads.
5. Explicit weather models are the only model type that consistently avoids bias.
6. For customer accounts with highly variable loads, the study found that no BLP model produced satisfactory results, although averaging methods perform best in accuracy (but not bias).
7. For buildings with low load variability all BLP models perform reasonably well in terms of accuracy.
8. Customers that are highly weather sensitive, should be given the option of using BLP models that explicitly incorporate temperature.

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