METHODS, METERS, AND MODELS: INNOVATIVE APPROACHES TO ESTIMATING SAVINGS

Moderator: Phil Bosco, Independent Electricity System Operator

PAPERS *(in order of appearance)*:

DR Impact Evaluation – Which Design and Analysis Method Is Right for What?
Craig Williamson, Applied Energy Group
Kelly Marrin, Applied Energy Group

Getting Everyone to "Yes": Putting Efficiency into Efficiency Programs by Standardizing Meter Data Analysis
Ethan Goldman, Vermont Energy Investment Corporation

Is More Always Better? A Comparison of Billing Regression Results Using Monthly, Daily and Hourly AMI Data
Stephen Grover, Evergreen Economics
John Cornwell, Evergreen Economics

SESSION SUMMARY:

The increasing granularity and availability of data is enabling evaluators to employ more innovative approaches to estimating savings. This session will take you on a journey, starting with upfront evaluation study design and choice of analysis method; transition to the utilization of advanced metering infrastructure (AMI) and sub-metering to override deemed savings values on smaller projects: and then finish with the enhancement of billing regression models using AMI data. The featured papers cover a wide range of programs including demand response, commercial retrofit, and residential whole home.

Williamson et al. will discuss the importance up-front study design and a related choice of analysis method on the back end. With different options for design and analysis methods, it can be challenging for a utility or regulator to decide what the best approach is. This paper will discuss different design and analysis options, and recommend which is most appropriate given various situations. Unlike Energy Efficiency (EE) impact evaluations, which usually focus first on energy savings, Demand Response (DR) impact evaluations focus on hourly load impacts, particularly but not exclusively during events and at the time of the system peak. Like EE evaluation, estimation of these impacts requires carefully designed studies, and a choice of analysis method. There are several analysis methods appropriate to estimate DR impacts, including difference of differences, regression, and price elasticity estimation. Each has advantages and disadvantages, and none is appropriate in all cases. Difference methods are simpler and more direct, require fewer assumptions, and are easier to understand, but not as flexible or adaptable. The paper will first discuss the critical importance of study design up front, and then talk about the strengths and weaknesses of the different methods and which methods work well in which situations. The paper will reference as examples different studies that have used the various methods, some of which we have been directly involved with and some done by others in the industry. Design and analysis methods really do matter. In order to get valid, accurate, and unbiased estimates of DR impacts, those managing and evaluating DR programs need to use the best method for their program, goals, and circumstance. This paper will help practitioners select the appropriate analysis and design methods for DR evaluation.

Goldman discusses how sub-metering CAN apply to energy efficiency and renewable energy programs' other critical uses Now that advanced metering infrastructure (AMI) is commonplace. A statewide energy efficiency utility has begun to standardize metering procedures and documentation to streamline analyses and reduce the incidence of data irregularities in its EM&V analyses. Faster feedback from reduced time for data scrubbing can enable corrections and the integration of inputs with project-level savings estimates. The efficiency utility has begun looking at (1) actual pre- and post-retrofit power levels of equipment, (2) equipment run hours from power metering and proxy measurements like AMI (whole-building) data analysis, and (3) normalization factors (weather and production levels). The efficiency utility hypothesized that measure types would be represented in its customer information tracking system of the program portfolio, well beyond "quantity x savings per customer = total." The model actually allows calculations from metered data to override assumed values in deemed savings estimates. The results will provide updated savings estimates, and actual uncertainty bounds that can indicate inputs that are worth updating with metered values. This model will help improve accuracy and credibility of savings estimates for large energy users with many projects and a broad range of performance characteristics. Now that affordable, communicating meters and sensors have lowered the "cost" of data for analysis, data availability is no longer limited to large projects. This paper examines how the efficiency utility has applied the model, and offers early results from its application to smaller customers, EM&V, and program design.

Grover et al. will review its study's targeted comparison of billing regression model results estimated using both monthly and hourly consumption data. It has been long known that daily and hourly variations in energy use were masked when consumption data are aggregated to the monthly level. With the availability of AMI data, billing regressions can now be estimated at the hourly rather than monthly level and with this advance comes the promise of potentially more accurate billing regression models. With the emergence and availability of detailed AMI billing data, we can observe changes in consumption on an hourly basis, or in some cases even 15-minute intervals. Previously, consumption data traditionally available for billing regressions are at the monthly level. The model will be a fixed effects regression, which is becoming the preferred model specification for many billing regression applications. The fixed effects model has the advantage of using indicator variables to control for both time and customer invariant factors, which helps minimize bias and reduces the need for collecting additional data. Explanatory variables used in the model include hourly weather data and indicator variables for energy use in major household end uses that were metered as part of the study. By using the same model specification for both data sources, we can assess the improvement in model fit and precision for key variables based solely on the shift from monthly to hourly data. The model will be estimated using existing data from a residential building stock assessment that was recently completed for the Pacific Northwest. These data contain whole house metered data as well as metered data for major end uses. This rich dataset presents the perfect opportunity to test how billing models might be improved with the use of more granular consumption data. In addition to the model results, the paper will also provide recommendations for optimal model specification and data preparation. The paper will be of interest to any evaluation practitioner that uses billing regressions to estimate energy savings and is interested in enhancing these models using AMI data.