Measuring the Unmeasurable: A Case Study on APSs and Providing Embedded Evaluation for Low-Savings Measures

In an ever-changing regulatory environment, the importance of “embedded evaluation” or “real-time evaluation” has become increasingly important to utilities, implementers, and evaluators alike. Conversely, many state utility commissions have placed additional scrutiny on measures that are often considered low energy savings measures, requiring enhanced rigor evaluations that are otherwise cost-prohibitive and would have been assigned either partially deemed or fully deemed savings.

One such measure whose savings have historically been calculated in a deemed approach is the Advanced Power Strip (APS). These devices offer energy savings to customers by assigning a plug-load as a “control load” and turning the other outlets on the APS on or off depending on the on/off state of the control load. Thus, APSs save energy by reducing standby power drawn by any devices plugged into the non-control outlet. APSs have become prolific in the residential energy efficiency space, but individually, their energy savings are small. Digging deeper into that picture is possible but often necessitates employing time-consuming strategies like monitoring studies using data loggers. These methods are often cost-prohibitive and extremely sensitive to upstream delays, running counter to the goals of embedded evaluation.

In this study, we attempted to use three methods to triangulate savings for APSs. The first method utilized a pooled whole-house pre/post mixed effects regression model with a propensity score matched (PSM) comparison group. This regression method offers utilities a quick, cost-effective approach by which reliable savings can be produced as either an interim or standalone form of evaluation. However, certain drawbacks persist including needing to estimate program-level savings and extrapolating back to the individual measures of the program and needing a robust number of participants to generate savings estimates. Realized savings for this method were 30% of the expected savings, ranging between 1% and 60 % on the lower and upper 90% CI. Our second method employed was a Conditional Demand Analysis, which has similar benefits and constraints to the whole-house regression. Realized savings for this approach were 68% of the expected savings, ranging between 17% and 118% on the lower and upper 90% CI. Our third approach was a more traditional monitoring study that deployed plug load loggers and monitored how the customer was using the APS as compared to a regular power strip (RPS). The difference in usage was contextualized using a battery of surveys, timed strategically around the installation of the logger, the swap between APS and RPS, and the return of the logger. This approach is how we sought to understand the lower-than-expected savings from the whole-house regression and conditional demand analysis. Realized savings for the metering study were 31% of the expected savings, ranging between 17% and 44% on the lower and upper 90% CI.

The convergence of results between the methods indicates that the regression approaches can be used as a substitute for metering studies in the formulation of savings estimates and comparison. This provides cost-effective means for timely evaluation, even for low-saving devices. The metering study served to provide necessary context in understanding what went wrong, offering the means for a targeted solution. This method suggests that users are significantly misunderstanding how to use their APS. Some ignore the design of the device and only use the uncontrolled slots to power their devices, bypassing all energy-saving benefits. Other users would use questionable plug loads to serve as the control signal, such as a table lamp or a motorized recliner. For correct usage, lack of understanding has resulted in non-usage or misuse, indicating a need for improved instruction for savings to be fully realized.