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Presentation Title: Going for the Gold: Experimental Design in DR Program Evaluation

Abstract: Over the past three years, a Northeast utility has leveraged the expanding ownership of smart thermostats and the growing market for peak demand savings by offering a bring your own thermostat (BYOT) demand response (DR) program to its customers. Historically, DR program savings would be evaluated using a within-subject baseline relying on non-event days to form the counterfactual. However, this approach suffers from threats of internal and external validity. Are non-event days similar enough to event days? Does selection bias limit the ability for extrapolating findings to the broader population? More recently, the evaluation community has begun working with utilities to incorporate experimental design into DR programs, addressing these concerns. Typically, the approach uses an “A/B” design in which customers are sorted into two groups (“A” and “B”) and dispatched in an alternating pattern. This method allows the group that opted in to the program but randomly was not dispatched for an event to serve as the counterfactual. Still, this approach has limitations -- total DR impacts for a single event are cut in half, and the ability to examine savings impact of consecutive events or participation fatigue is limited.

In the third year of its residential BYOT DR demonstration project, the utility implemented a unique approach aimed at addressing one of these limitations. Rather than an “A/B” design, the utility used an “A/B/C” experimental design in which groups “A” and “B” were alternately dispatched, while group “C” was dispatched for all events. With this design, a control group existed for each event, but a subset of customers experienced the full DR season. Over 6,000 thermostats were enrolled by the beginning of the 2018 DR season, and the utility used a stratified randomization to assign them equally across the three groups. The evaluation relies on thermostat telemetry data to estimate impacts, and results will be shared with the utility in December 2018.

This paper adds to the research on residential smart thermostat DR program savings and establishes an evaluation approach that simultaneously minimizes concerns of internal and external validity, while providing the most useful information to utilities regarding customer acceptance of the DR solution and program design.