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Presentation Title: End Use Insights: How Utilities Can Leverage Granular End-Use Energy Consumption Data to Better Navigate an Evolving Energy Market

Abstract: This paper explores how utilities can optimize the delivery of current and future Demand Side Management (DSM) programs by measuring and incorporating residential behind-the-meter loads to better address the challenges inherent in integrating Distributed Energy Resources (DERs) into DSM portfolio design, program marketing, resource planning and gird operations. The availability of more robust and granular data at the end use level is now enabling utilities to apply data science principles and actionable intelligence to adapt and improve their understanding of multiple, distinct end use cases for a host of different residential measures based on household characteristics and other customer segmentation considerations.

We are successfully implementing this strategy through an ongoing energy metering study in the southwestern USA where the impacts of intermittency (i.e., the Duck Curve) caused by solar PV growth are particularly pronounced. In more than 100 residential homes we have installed energy meters that are capable of storing and remotely transmitting consumption-related data from primary end-use equipment at 1-minute intervals. Although the initial cost of collecting and managing this ongoing and dynamic data stream may be higher than conventional metering studies, the study is demonstrating an enhanced value to the utility for DSM planning and evaluation, as well as across broader forecasting and management functions.

In this paper, we provide detailed insights and examples showing how more granular energy consumption data streams are being used to facilitate program planning, implementation, and evaluation decisions within an evolving and dynamic energy market. We discuss how more granular end-use energy usage data from a statistically significant sample of households is extrapolated to create representative load shapes for a utility's broader service territory, and how these load shapes can inform locational forecasting and planning impacts at the substation, feeder, and end-use levels. To illustrate this, we employ advanced data science principles for certain end-uses, such as water heating, and segment these analyses into various archetypes, including:

1) Archetypes that can be used by program planners to facilitate load management programs that incentivize use of DERs at certain times of the day by predicting hourly impacts and their response to price signals.
2) Targeted marketing that can be used by program implementers to identify customers whose energy usage profiles resemble high impact archetypes.
3) Predicted dollar savings that can be used by program implementers to engage customers who are on Time-of-Use (TOU) or demand rates.
4) Predicted availability of services and end uses for use by program managers to determine the potential for various load control strategies (e.g. switching off a water heater for two hours in the morning)

We conclude this paper by describing how other utility groups such as resource planners, electricity market and rate analysts, transmission and distribution engineers, and others can benefit from the enhanced value of more granular end-use energy consumption data in their respective analyses and decisions.