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Presentation Title: Predictions with Restrictions: C&I Metered Energy Consumption

Abstract: As automated metering infrastructure (AMI) is becoming more available, utilities and policymakers are turning to normalized metered energy consumption (NMEC) to estimate energy savings achieved by individual customers without end use monitoring. In some jurisdictions, using NMEC is part of energy policy for certain programs and contexts. In theory, these data and methodological innovations will allow programs to install more measures with interactive effects and/or create the option for pay-for-performance, relying exclusively on data collected by the utility meters. This approach could help shift scarce energy efficiency program funds away from traditional evaluation tasks such as calculating deemed savings and building engineering models, and towards funding more projects, and provide more real-time savings results. Before these benefits may be realized through updated evaluation policies, however, evaluators must first validate these innovations on traditional billing analysis methods and confirm that analytical approaches reliably predict energy load shapes for individual customers, satisfying the requirements of NMEC analysis.

This paper presents the results of a case study that compares and contrasts the AMI Customer Segmentation (AMICS) and Temperature and Time of Week (TTOW) models to estimate daily electricity load shapes for a sample of 10 businesses that completed a HVAC retrofit project between 2015 and 2017. This sample covers a wide range of business types, operating schedules, and variability in load shapes.

Both the AMICS and TTOW model were designed for the purpose of using AMI interval data to predict whole building hourly or sub-hourly energy usage, while accounting for the impacts of outdoor temperatures and weekly operating schedules. A key benefit of the AMICS model is avoiding over-reliance on the average day. Most models like TTOW estimate the average load shape (by time-of-day or time-of-week) and then make a series of adjustments to that prediction depending on how the actual weather conditions differ from this average. The AMICS approach uses segmentation to produce a portfolio of load shapes. In order to assess the relative accuracy of these two modeling approaches, we conducted a cross validation using a series of randomized pre-period holdout tests for each site in our sample. This paper will build on existing research (AMI load shape analysis and prediction error diagnostics) and offer new insights for the next generation of programs.

This paper will be of interest to evaluators, policymakers, and program implementers who are choosing between multiple industry-accepted methods for estimating savings for individual buildings and developing new evaluation policies to realize the potential NMEC benefits. The NMEC approach offers the opportunity to gain more real-time realized savings data and potentially decrease evaluation costs. We will include innovative visuals using data visualization tools and side-by-side comparisons that go beyond the theory and mathematics, to demonstrate the relative power of each method, to ensure the results are applicable to an audience with a wide range of technical aptitude.