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**Presentation Title:** The Whole is Greater than the Sum of Its Parts: Finding Synergy between Surveys and Consumption Analysis

**Abstract:** Have you ever been left questioning consumption analysis results? Have you wondered if survey results were anomalies due to a low response rate or a misunderstanding of the questions?

In this paper, the authors will present results from an evaluation using consumption analysis integrated with a survey. This evaluation focused on residential ductless heat pumps (DHP) replacing electric forced air furnaces (eFAF) in the northwestern US. A previous consumption analysis provided evidence that savings were lower than expected, but gave no direction to improve the measure and no explanation for stakeholders to understand why DHP savings weren't being realized. While consumption analysis (i.e., billing analysis) is becoming increasingly common for evaluation (e.g., for behavioral and pay-for-performance programs, and as a part of automated evaluation), this shortcoming is often encountered: consumption analysis can provide decision makers with accurate estimates of "what" the savings are, but it doesn't often provide enough information for "why" the estimated savings were found (Goodman 2018, ACEEE, 5-7).

For a second phase of evaluation, we fielded a survey in addition to the consumption analysis and received results for 36% (172) of participants in the consumption analysis. Surveys are commonly used in evaluation, but like consumption analysis, come with their own list of limitations largely related to the reliability of results (Baumgartner 2017, UMP Chapter 12, 3-12). Similar to our approach, many energy efficiency program evaluations include both consumption analysis and surveys, but often the analysis and presentation of results for each are separate. Surveys are most commonly used exclusively for process evaluations, and at best, evaluators may use survey results to provide context for savings estimates from an impact analysis. While this approach enables some inference from survey results to better understand consumption analysis findings, it is still hard to trust that the survey respondents reflect the population, or to understand which themes from the survey are most relevant to the impact analysis findings.

To combat the limitations of both consumption analysis and surveys, our team used a unique approach to incorporate the survey responses within the consumption analysis, which was possible due to the high survey response rate. Survey questions focused on understanding which trends affected savings the most, such as customers using DHPs to reduce wood-heat instead of eFAF use, or people using DHPs to improve comfort in an otherwise uncomfortable room. Our evaluation team created a mapping from the survey responses to categorize customers into groupings based on the expected level of savings. The groups were incorporated into the consumption analysis dataset, and savings estimates were found through regression analysis for each group.

This approach enabled our team to corroborate the survey findings and estimated impacts, and to understand exactly which factors were (or weren't!) driving the low savings. In addition, with context around the unexpected savings, stakeholders trusted that the results were correct. Ultimately, this confidence allowed them to have productive conversations focused around making improvements to the DHP measure to increase savings.