The Whole Is Greater Than the Sum of its Parts:

Finding Synergy Between Surveys and Consumption Analysis

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IEPEC Conference
Denver, Colorado
August 21, 2019
The Context

Advantages

Billing Analysis
• Accurate estimates of what the savings are

Customer Surveys
• Explanation and context for the estimated savings

Limitations

Billing Analysis
• Not enough information to determine why the estimated savings were found

Customer Surveys
• Reliability of self-reported results
• Uncertainty around which behaviors drive savings
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A comprehensive approach incorporating the survey responses with the billing analysis can combat these limitations.
Background

• Bonneville Power Administration covers a large territory in the Northwest

• Provides electricity primarily to public utility districts, municipalities, and electric cooperatives

• Maintains energy efficiency goals and incentivizes energy efficiency measures to help meet targets

Source: Bonneville Power Administration
Study Objective

Evaluate energy savings from ductless heat pumps (DHPs) displacing the use of electric forced air furnaces (eFAFs) in residential homes.
Billing Analysis Methodology

Data collection and cleaning: Collected monthly billing data and removed anomalous bills and sites that could not be included in the evaluation

Comparison group matching: Matched on pre-period energy use, heat zone, and home type

Regression analysis: Used a regression model to control for non-treatment differences in energy use between treatment and comparison group customers
Billing Analysis Results

The WHAT
Billing analysis results revealed savings estimates for DHPs were about 50% of the deemed savings.

The WHY
The analysis and results gave no indication as to why the savings were lower than expected.
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The WHY
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Next step: provide context around the savings estimates found with the billing analysis.
Survey Implementation

**Goal:** Design a survey to learn about customer behaviors and use of their heating equipment

**Method:** Field to phone and web-based survey to 487 customers who were included in our billing analysis

**Response rate:** 172 completes (35%)
Many customers responded to the survey indicating they use DHPs such that savings should be lower than expected

- Customers increased air conditioning (AC) use.
- Customers continued using their eFAC after the DHP was installed.
- Customers used their DHP to displace non-electric heating (such as woodstoves).
Investigate AC Use

Ran a monthly model to determine if energy consumption increases during summer months due to increased AC use.
AC Use Findings

Impacts during summer months are small but generally positive

Increased AC use due to new DHP installations is not a primary cause for lower than expected savings.
Ran a model to determine if savings vary by a customer’s assigned savings category

<table>
<thead>
<tr>
<th>Category</th>
<th>Expected Level of Savings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little-to-no eFAF displacement</td>
<td>Zero to negative</td>
<td>• Primarily used non-electric heat before DHP was installed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Did not use DHP for heating</td>
</tr>
<tr>
<td>Partial eFAF displacement</td>
<td>Positive but low</td>
<td>• Continued to use their eFAF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Displaced some non-electric heat</td>
</tr>
<tr>
<td>Full eFAF displacement</td>
<td>High</td>
<td>• Previously used their eFAF as the primary heating source AND completely stopped using the eFAF after the DHP was installed</td>
</tr>
</tbody>
</table>
Customer Behavior Findings

**Higher savings:** Customers who completely displaced the use of their eFAF

**Lower savings:** Customers who continued to use their eFAF or displaced non-electric heat

Customer behavior is a primary driver for lower than expected savings.
**Results Summary**

- Savings are lower than expected
- No clear driver for DHP savings
Results Summary

Billing Analysis Results

☑ Savings are lower than expected

? No clear driver for DHP savings

Customer Survey Results

? Specific behaviors may lead to lower than expected savings:
  - Continued eFAF use
  - Using the DHP to displace non-electric heat
  - Increased AC use
Results Summary

Billing Analysis Results

- Savings are lower than expected
- No clear driver for DHP savings

Combined Results

- Continued eFAF use and previous use of non-electric heat lowers savings
- Deemed savings are realized when the DHP is installed and used as intended
- Increased AC use is not leading to lower savings

Customer Survey Results

- Specific behaviors may lead to lower than expected savings:
  - Continued eFAF use
  - Using the DHP to displace non-electric heat
  - Increased AC use
Key Takeaways

The What and The Why

This method can provide you with accurate savings estimates and with information for *why* the estimated savings were found.

Context Inspired Confidence

With context around the savings estimates, stakeholders can trust the results, which allows them to have productive conversations focused on improving measures.

Value Added

Understanding why the savings estimates were found allows evaluators to provide real world, actionable insights to program administrators and regulators to make informed decisions.
Thank You

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