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Metrics & Methodologies to Evaluate Transportation Electrification Programs

CPUC Workshop

May 9th, 2019
Notes

• These principles and examples are based on my personal time at the Department of Energy and the National Renewable Energy Lab, as well as published materials.

• Great guides at: https://www.energy.gov/eere/analysis/program-evaluation

• These are my personal takes and NOT the official views of DOE or anyone else.
Why Evaluation?

• Show what was accomplished
• Foster research opportunities
• Improve future programs
• Inform big picture policy
Key Principles

- Program staff: look under the rock
- Managers: fight the ‘gotcha’ culture
- Start with the logic model
- Build evaluation into programs
- Understand your counterfactual
- Use deployment as an experiment where possible
- Start with a broad definition of impacts
- Consider direct and indirect (e.g. EV sales) impacts but keep them separate
- Make sure data can be aggregated
Logic Model

Figure 2-1. The Basic Elements of a Logic Model

Source: Gretchen Jordan, EERE Program Evaluation Training, 2014
Logic Model

Figure I.1 High Level Diagram of EERE Logic

Note: The outcomes in blue italics can be calculated using the standard method outlined in this Guide.

Impact Evaluation for Deployment Programs

1. Identify scope, objective, and priorities
2. Select the type(s) of evaluation to be completed
3. Select aspects of deployment changes to be evaluated
4. Identify researchable questions and metrics
5. Design the study and select the methods
6. Conduct the evaluation
7. Report and use results and data

Figure 1. Overview of the Impact Evaluation Framework

Impact Evaluation for Deployment Programs – Detail for Steps 2 & 3

Recovery Act Example

Recovery Act Example

Figure 7. Volt (left) and Leaf (right) drivers with access to home and workplace charging performed nearly all of their charging at those locations.

- **Residential Level 2 Average Installation**: $1,354
- **Workplace Level 2 Average Installation**: $2,223
- **Public Level 2 Average Installation**: $3,108
- **Blink DC Fast Charger Average Installation**: $22,626

Smart Grid Investment Grant Example

• “Under the U.S. Department of Energy’s (DOE) Smart Grid Investment Grant (SGIG) program, six utilities evaluated operations and customer charging behaviors for in-home and public electric vehicle charging stations:
  • Burbank Water and Power (BWP)
  • Duke Energy (Duke)
  • Indianapolis Power & Light Company (IPL)
  • Madison Gas and Electric (MGE)
  • Progress Energy (now part of Duke Energy as a result of a merger in 2012)
  • Sacramento Municipal Utility District (SMUD)”

• My note: findings mostly qualitative, not combinable between projects

SGIG Example Data

Figure 11. Charging Patterns with (TOU) and without (RES) Whole House Time-of-Use Rate during Summer Weekdays at Progress Energy (Peak period is in gray)

SGIG Example Data

Figure 12. Data on the Length of Charging Session from Burbank

## Lessons Learned

### Table 5. Summary of Lessons Learned

<table>
<thead>
<tr>
<th>Category</th>
<th>Lesson Learned</th>
</tr>
</thead>
</table>
| Planning and Management| • Initially install a small number of chargers as demonstrations, and evaluate their use to justify larger deployments.  
• Plan for sufficient resources to support customer issues throughout the project. A high level of customer support to address technical issues was typically required.  
• Conduct smaller, in-house process and field tests prior to full field implementation, perhaps using employees.  
• Develop detailed process maps to streamline operating procedures; guide vendors, installers, and service technicians; and provide higher quality customer services and issues resolution. |
| Market Development      | • Consider the needs of the different target markets, such as single families, multi-family housing units, fleets, employers, dealerships, and public access. Evaluate use cases for each that examines the charging patterns of the users in those segments. |
| Implementation          | • Site and installation scheduling requires hands-on attention which vendors can provide to help ensure customer satisfaction.  
• Locate chargers where it is convenient for the consumers, not necessarily for utilities. This will optimize utilization and shorten capital cost recovery. |

Clean Cities
### Clean Cities Example

#### Table 2. Emissions Reduced by Clean Cities Coalitions in 2016

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Tons of GHG Emissions Averted</th>
<th>Equivalent of Conventional Cars Removed</th>
<th>Percent of Coalition Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative Fuels and Vehicles</td>
<td>2,012,531</td>
<td>457,894</td>
<td>45%</td>
</tr>
<tr>
<td>HEVs</td>
<td>734,310</td>
<td>167,072</td>
<td>16%</td>
</tr>
<tr>
<td>Fuel Economy Improvements</td>
<td>530,818</td>
<td>120,773</td>
<td>12%</td>
</tr>
<tr>
<td>Idle Reduction</td>
<td>476,464</td>
<td>108,406</td>
<td>11%</td>
</tr>
<tr>
<td>VMT Reduction</td>
<td>351,077</td>
<td>79,878</td>
<td>8%</td>
</tr>
<tr>
<td>EVs and PHEVs</td>
<td>188,812</td>
<td>42,959</td>
<td>4%</td>
</tr>
<tr>
<td>Off-Road Vehicles</td>
<td>111,111</td>
<td>25,280</td>
<td>2%</td>
</tr>
<tr>
<td>Outreach Events Estimate</td>
<td>89,064</td>
<td>20,264</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Coalition Total</strong></td>
<td><strong>4,494,185</strong></td>
<td><strong>1,022,526</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

* Calculated as total passenger car GHG emissions (Table 2–13 in the U.S. Environmental Protection Agency’s (EPA’s) *Inventory of GHG Emissions and Sinks: 1990-2015*) divided by total short wheelbase light-duty vehicles (Table VM-1 in the Federal Highway Administration’s *Highway Statistics*, 2015).
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More (Federal) Resources