Moving the Needle to Improve Electric Bus Fuel Economy

Mersiha McClaren, Ph.D.
Problem: Driver Efficiency & Operating Costs Highly Variable

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<table>
<thead>
<tr>
<th>Time</th>
<th>Avg kWh/Mile</th>
<th>Cost per Route</th>
<th>Cost per Day</th>
<th>Routes per Depleted Battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route at 1pm</td>
<td>3.15</td>
<td>$2.98</td>
<td>$95.24</td>
<td>177</td>
</tr>
<tr>
<td>Route at 2pm</td>
<td>3.84</td>
<td>$3.63</td>
<td>$116.02</td>
<td>216</td>
</tr>
<tr>
<td>Route at 3pm</td>
<td>2.39</td>
<td>$2.26</td>
<td>$72.18</td>
<td>134</td>
</tr>
<tr>
<td>Route at 4pm</td>
<td>2.01</td>
<td>$1.90</td>
<td>$60.85</td>
<td>113</td>
</tr>
</tbody>
</table>

Note: Graphs provided by Energy Solutions.

1 - Average commercial electricity cost in Lancaster is $0.12/kWh
2 - Assumes each route takes 30 minutes and bus is operating 16 hours/day
3 - Average bus battery capacity of 450 kWh
What is Program Doing?

INTERVENTIONS

TRAINING & FEEDBACK → REWARDS → CONTEXTUALIZE PERFORMANCE → RAISE THE BAR
Many Factors to Consider to Capture Program Impacts

**Identify Available Data & Data Needs**
1. Interviews with drivers & supervisors
2. Observed driving behavior
3. Assessed bus onboard telemetry system

**Develop Evaluation Design**
Tracking same drivers pre- and post- program roll out

**Establish Baseline Condition**
Determined effect size – how many drivers (sample size) and data points per driver in the pre- & post-program condition

**Install Eq. to Collect Data & Using Multiple Data Sources**

- **Using bus telemetry system & driver tracking system to track:** Bus/Driver ID, Start/End Time of the Trip, Trip Length, Route, Battery Stats, & Fuel Efficiency
- **Installed phones on each bus to track:** Acceleration, Breaking, etc.
- **Tracking internal records** to capture program costs
- **Exploring external data sources:** Weather data

Key Goal: To predict the success of behavior type interventions
Thank You

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