Residential Central Air Conditioning Regional Assessment

January 13, 2010
Overview of Effort

- Evaluated High Efficiency Residential CAC units for
  - Connecticut Light & Power
  - United Illuminating
  - National Grid (MA & RI)
  - NSTAR Gas & Electric

- Sample of 96 sites, covering CT, RI, NEMA, SEMA, and WCMA
  ISO Load Zones,

- Monitored 101 units
  - CAC runtime
  - Indoor temperature
Overview of Effort

• Regression models were developed for each household, based on outside weather and time of day variables
  - With each household’s response coefficients to weather determined, they could then be “transplanted” to different load zones by inputting the appropriate weather
  - By containing a cross-section of load zones, the model is more robust and flexible in application to various local weather patterns

• Results from regression models include
  - Annual kWh savings
  - On-peak kW reductions & coincidence factors
  - Seasonal peak kW reductions & coincidence factors
### Per-Site Average Annual kWh Savings

<table>
<thead>
<tr>
<th>CAC Size</th>
<th>Sample Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>2.5</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>38</td>
</tr>
<tr>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Annual kWh Savings

![Bar Chart showing kWh Savings by CAC Size]

- **Average**
- **1.5**
- **2**
- **2.5**
- **3**
- **3.5**
- **4**
- **5**
Per-Site Average On-Peak Reductions

On-Peak kW Reduction

- Average
- 1.5
- 2
- 2.5
- 3
- 3.5
- 4
- 5

On-Peak Coincident Factor

- Average
- 1.5
- 2
- 2.5
- 3
- 3.5
- 4
- 5
Per-Site Seasonal Peak Reductions

**Seasonal Peak kW Reduction**

- **Seasonal Peak Coincident Factor**

![Graph showing seasonal peak kW reduction and coincident factor across different CAC sizes.](image)
### Zone-Level Annual kWh Savings

<table>
<thead>
<tr>
<th>CAC Size</th>
<th># Units in Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>220</td>
</tr>
<tr>
<td>1.5</td>
<td>246</td>
</tr>
<tr>
<td>2</td>
<td>785</td>
</tr>
<tr>
<td>2.5</td>
<td>474</td>
</tr>
<tr>
<td>3</td>
<td>898</td>
</tr>
<tr>
<td>3.5</td>
<td>138</td>
</tr>
<tr>
<td>4</td>
<td>409</td>
</tr>
<tr>
<td>4.5</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>85</td>
</tr>
</tbody>
</table>

![Zone-Level Annual kWh Savings](image-url)
Zone-Level On-Peak Reductions

**Zone-Level On-Peak kW Reduction**

- CAC Size (Tons): 1.5, 2, 3, 3.5, 4.5
- Reduction: 30%, 35%, 40%, 45%

**Zone-Level On-Peak Coincident Factor**

- CAC Size (Tons): 0%, 5%, 10%, 15%, 20%, 25%, 30%
- Factor: 0%, 5%, 10%, 15%, 20%, 25%, 30%, 45%
Net-to-Gross Analysis

- Surveyed 70 customers for each utility
- Assess Free-Ridership from multiple approaches
  - Could the respondent have afforded High Efficiency CAC without the rebate?
  - Did the respondent change their plans after learning of the available rebate?
  - How important was the rebate in their decision making?
## Key Survey Results

<table>
<thead>
<tr>
<th></th>
<th>CL&amp;P</th>
<th>United Illuminating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Could Afford w/o Rebate?</td>
<td>89.7%</td>
<td>73.9%</td>
</tr>
<tr>
<td>Would Purchase High Efficiency Equipment Within One Year?</td>
<td>73.3%</td>
<td>75.41%</td>
</tr>
<tr>
<td>Changed Equipment Purchase to Qualify for Rebate?</td>
<td>19.3%</td>
<td>11.5%</td>
</tr>
<tr>
<td>Rebate Very Important?</td>
<td>27.9%</td>
<td>34.8%</td>
</tr>
<tr>
<td>Learned of Rebate After Purchasing High Efficiency Equipment?</td>
<td>30.9%</td>
<td>18.8%</td>
</tr>
<tr>
<td>Free-Ridership Percentage:</td>
<td>50.1%</td>
<td>31.8%</td>
</tr>
</tbody>
</table>
Differences in Program Participants

- Whether or not a participant is financially able to purchase high efficiency equipment absent the rebate is a direct indicator of free-ridership.
- % of participants that could afford high-efficiency equipment without a rebate was 15.8% greater among CL&P participants.
- This accounts for 82.3% of variation in free-ridership between the two utilities.