Building Occupant Feedback Systems and Plug Loads:

Opportunities and Results

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What are plug loads?

Behavioral:

- Printer
- Lamp
- Coffee maker
- Globe

Institutional:

- Water cooler
- Copy machine
- Computer servers
- Elevator

- Space heater
Plug load research: overview

- 8 offices buildings, 2 K-12 schools
- 3 are LEED-certified
- 5,000 sf - 500,000 sf
- Locations: SF Bay Area, San Diego, Atlanta, Honolulu, New Jersey, Colorado, Virginia
Plug loads as percent of total electricity use

- CEUS 2006
- CBEC 2003
- 50k sf floors
- 23k sf low-rise
- 24k sf low-rise
- 500k sf tower
- 15k sf floors

0.0% 20.0% 40.0% 60.0% 80.0% 100.0%
SF Office Electricity Demand
Monday, Oct 4 - Sunday, Oct 10, 2010

Kilowatts

Lighting
HVAC
Plug Loads
### Behavior Change: Energy Competitions

<table>
<thead>
<tr>
<th>School</th>
<th>Duration</th>
<th>kWh Saved</th>
<th>$ Saved</th>
<th>Buildings</th>
<th>Winner</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Missouri</td>
<td>Apr 4 - May 2, 2010</td>
<td>18,700 kWh</td>
<td>$1,600</td>
<td>3</td>
<td>11.3% reduction</td>
</tr>
<tr>
<td>Elon University</td>
<td>Feb 16 - Apr 6, 2010</td>
<td>231,000 kWh</td>
<td>$13,900</td>
<td>41</td>
<td>36.9% reduction</td>
</tr>
<tr>
<td>St John's University</td>
<td>Feb 3-17, 2010</td>
<td>22,300 kWh</td>
<td>$4,200</td>
<td>6</td>
<td>15.8% reduction</td>
</tr>
<tr>
<td>Hamilton College</td>
<td>Apr 15-30, 2009</td>
<td>44,300 kWh</td>
<td>$5,500</td>
<td>11</td>
<td>40.9% reduction</td>
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<tr>
<td>Oberlin College</td>
<td>Apr 9-23, 2009</td>
<td>10,700 kWh</td>
<td>$1,400</td>
<td>17</td>
<td>42.5% reduction</td>
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<tr>
<td>Boston College</td>
<td>Feb 1-28, 2009</td>
<td>15,200 kWh</td>
<td>$2,200</td>
<td>8</td>
<td>9.1% reduction</td>
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</tbody>
</table>
Feedback & Competitions in OC Dorms

Competitions + feedback = reductions in electricity use

- Significant reductions occur during competitions (≈10%)
- Reductions are sustained during post-competition period
- Web traffic from buildings positively correlated with electricity reductions
Characters & Empathy
Building Dashboard

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