CEC Plug-Load Project Results

TAC Technical Advisory Committee
Update meeting
April 5, 2018

Presentation by:
David Zabrowski
Mark Finck & Edward Ruan

https://fishnick.com/cecplug/
Thank You to the Plug Load Project Sponsor

TAC Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melisa Marks, CFSP</td>
<td>Southern California Gas Company</td>
</tr>
<tr>
<td>Raveena Wisham</td>
<td>San Diego Gas &amp; Electric</td>
</tr>
<tr>
<td>Andre Saldivar, CEM, CFSP, CMVP</td>
<td>Southern California Edison</td>
</tr>
<tr>
<td>Charlie Souhrada, CFSP</td>
<td>North American Association of Food Equipment Manufacturers (NAFEM)</td>
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<tr>
<td>Brian Ward</td>
<td>Target Market &amp; Media Services</td>
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<tr>
<td>Jeffrey Clark</td>
<td>National Restaurant Association (NRA)</td>
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<tr>
<td>Juliann Rogers</td>
<td>CKE Restaurants, Inc.</td>
</tr>
<tr>
<td>Rob Carr</td>
<td>McDonald’s Corporation</td>
</tr>
<tr>
<td>Don Fisher</td>
<td>Fisher-Consultants, LLC</td>
</tr>
<tr>
<td>Judy Nickel</td>
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</tr>
<tr>
<td>Brad Meister</td>
<td>California Energy Commission</td>
</tr>
<tr>
<td>Beth Lorenzini</td>
<td>FER Magazine</td>
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</table>
CEC Plug Load Project
Web Page

http://www.fishnick.com/cecplug/

Goals for Today:

1. Explain the Project
2. Base-line Appliance Results
3. Market profile / Survey
4. Appliance replacement insight
5. Get you Interested – support next goals
Plug-Load Project Team:

- Frontier Energy
  - David Zabrowski - Project Manager
  - Mark Finck - Principal Investigator
  - Edward Ruan – Site and Field – Appliance / Data Analysis
  - Denis Livchak – Data Analysis and Reporting
- Fisher Consultants
  - Don Fisher – Technical Support
- Opinion Dynamics – Customer Survey
- ADM Associates, Inc. - Measurement and Verification

What are “Plug Loads” and Why do we care?

- All Day “ON”
- Energy Costs
- Heat Gain
- Building Models
- Carbon Footprint
- IoT
Objective: Energy Reduction Potential of unventilated commercial plug load foodservice equipment

- Research and determine Plug Load appliances and determine site categories
- Identify top energy using appliances with greatest potential to implement a reduced energy mode during periods of minimal activity
- Field monitoring at 5 target sites (currently 14 and growing)
- Demonstrate potential to reduce appliance's energy consumption without hindering overall kitchen production
- Can use pre-commercial appliance designs and control technologies
- Operational behavior changes
- Create a database of appliance energy info
Equipment Overview

Heating

Equipment Overview

Holding
Equipment Overview

Beverage

Research and identify appliances

<table>
<thead>
<tr>
<th></th>
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<td>2.000</td>
<td>500</td>
<td>4</td>
<td>6</td>
<td>34</td>
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<td>600</td>
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<td>4</td>
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<td>11</td>
<td>5</td>
<td>16</td>
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<td>700</td>
<td>6</td>
<td>6</td>
<td>12</td>
<td>2</td>
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<td>Rice Cooker</td>
<td>1.550</td>
<td>81</td>
<td>5</td>
<td>7</td>
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<td>900</td>
<td>400</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>3</td>
<td>0.8</td>
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<td>280</td>
<td>125</td>
<td>6</td>
<td>18</td>
<td>19</td>
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<td>Hot Water Dispensers</td>
<td>2,000</td>
<td>300</td>
<td>12</td>
<td>12</td>
<td>53</td>
<td>24</td>
<td>6.3</td>
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</table>

<table>
<thead>
<tr>
<th>Appliance Category</th>
<th>Est. Inventory in CA (W)</th>
<th>Total Energy Use (W-hr)</th>
<th>Total Power Reduction during Standby (W)</th>
<th>Total Energy Reduction (W-hr)</th>
<th>Penetration Rate (%)</th>
<th>Adjusted Power Reduction (W)</th>
<th>Adjusted Energy Reduction (W-hr)</th>
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<tbody>
<tr>
<td>Coffee Vertical</td>
<td>49,000</td>
<td>597.0</td>
<td>81.0</td>
<td>177.4</td>
<td>10%</td>
<td>8.1</td>
<td>36.7</td>
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<td>Coffee Conveyor</td>
<td>38,000</td>
<td>199.7</td>
<td>38.0</td>
<td>35.5</td>
<td>12%</td>
<td>5.7</td>
<td>7.7</td>
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<td>Food Warmers</td>
<td>40,000</td>
<td>208.5</td>
<td>41.4</td>
<td>11.0</td>
<td>10%</td>
<td>0.2</td>
<td>11.2</td>
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<td>Tea Plate/Tea</td>
<td>25,000</td>
<td>109.5</td>
<td>7.5</td>
<td>16.4</td>
<td>10%</td>
<td>0.8</td>
<td>1.6</td>
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<td>Rice Cooker</td>
<td>13,000</td>
<td>49.8</td>
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<td>19%</td>
<td>2.4</td>
<td>6.2</td>
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<td>Soup Warmer</td>
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<td>125.6</td>
<td>17.2</td>
<td>50.2</td>
<td>10%</td>
<td>2.6</td>
<td>7.5</td>
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<td>Coffee Brewers</td>
<td>200,000</td>
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<td>130.0</td>
<td>587.0</td>
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<td>40.0</td>
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<td>Hot Water Dispensers</td>
<td>30,000</td>
<td>903.0</td>
<td>100.0</td>
<td>430.0</td>
<td>10%</td>
<td>10.0</td>
<td>43.0</td>
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</tbody>
</table>

TOTALS: 76.2 362.6
Site / Locations

- Restaurants:
  - Fine Dining:
    - Bridges Restaurant, Danville
  - Casual:
    - SideBoard – Danville
    - SideBoard – Lafayette
    - Dabba, San Francisco
    - Lin Jia Asian Kitchen, Oakland
- Café / Bakery:
  - Rebecca’s Café, San Ramon
  - Caffe 817, Oakland
  - Chain account Café/Bakery, San Ramon
- Quick Service
  - McDonald’s
  - Togo’s Sandwich
  - Chipotle

- Cafeteria Kitchen:
  - San Ramon Valley Conference Center, San Ramon
- University / College:
  - Mills College Founders Commons, Oakland
  - UC Berkeley Crossroads Dining Hall, Berkeley
- Hotel:
  - DoubleTree – Pleasanton
- Lab:
  - Food Service Technology Center

Market Assessment

- Extrapolate findings to estimate total energy savings potential
- Create business case outlining the projected benefits of implementing specific energy-saving measures
Potential For Big Savings From Small Loads?

Appliance Plug Loads can be substantial - there are approximately 100,000 commercial food service (CFS) facilities operating in California and over 1 million facilities nationwide.

Project Status: Baselines Measured

• Assessed baseline plug load energy usage at 14 commercial foodservice facilities.
• Facilities included a large bakery/cafe chain, university dining, hotel, fine-dining, fast casual, take-out and cafes
• Sub metered from 2 to 8 appliances at each site
• Energy use for each appliance type was averaged and normalized to generate energy usage estimates
In-Line Data Collection Techniques

Custom In-Line Data Collection Boxes
In-Panel Data Collection Techniques

Metering Validation

ADM Associates, Inc. - Measurement and Verification
Project Status: Baselines Measured

- Conveyor toasters, coffee brewers, espresso machines, rice cookers, and soup wells were the most commonly metered appliances.
- The most energy intensive appliances observed were conveyor toasters.
- Appliance energy usage varied significantly by site and operation type, with hours of operation and appliance settings playing a key role.
- Rice cookers, soup wells, and tea brewers used the least energy due to lower hours of operation and lower average input rates.

Client Survey
Let’s Look at Some Data!

Data - the numbers

What do the numbers mean?

Make the data usable for the project
## CEC Plug Load Results

### Baseline Table

<table>
<thead>
<tr>
<th>Appliance Type</th>
<th>Number of Appliances Monitored</th>
<th>Total Average Daily Energy Usage (kWh/day)</th>
<th>Total Average Daily Hours of Operation (h/day)</th>
<th>Normalized Energy Usage Rate (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee Brewer</td>
<td>6</td>
<td>8.6</td>
<td>20.0</td>
<td>0.43</td>
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<tr>
<td>Conveyor Toaster</td>
<td>4</td>
<td>22.4</td>
<td>10.2</td>
<td>2.34</td>
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<tr>
<td>Espresso Machine</td>
<td>3</td>
<td>8.1</td>
<td>13.9</td>
<td>0.59</td>
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<tr>
<td>Heat Strip</td>
<td>2</td>
<td>13.5</td>
<td>18.0</td>
<td>0.84</td>
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<tr>
<td>Heated Shelf</td>
<td>1</td>
<td>4.2</td>
<td>13.7</td>
<td>0.31</td>
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<td>Holding Cabinet</td>
<td>4</td>
<td>10.3</td>
<td>9.0</td>
<td>1.19</td>
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<td>Hotplate</td>
<td>1</td>
<td>18.2</td>
<td>8.4</td>
<td>2.17</td>
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<td>Panini Press</td>
<td>2</td>
<td>9.8</td>
<td>8.0</td>
<td>1.23</td>
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<tr>
<td>Rice Cooker</td>
<td>5</td>
<td>1.6</td>
<td>5.4</td>
<td>0.85</td>
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<td>Soup Well</td>
<td>4</td>
<td>1.0</td>
<td>8.9</td>
<td>0.13</td>
</tr>
<tr>
<td>Tea Brewer</td>
<td>3</td>
<td>1.9</td>
<td>18.0</td>
<td>0.11</td>
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<td>Tortilla Warmer</td>
<td>5</td>
<td>6.3</td>
<td>9.3</td>
<td>0.67</td>
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<td>Wet Well</td>
<td>3</td>
<td>4.2</td>
<td>7.0</td>
<td>0.69</td>
</tr>
</tbody>
</table>

### Bakery/Café: Daily profile of Plug-Load Appliances

![Graph showing daily profile of plug-load appliances with energy costs at $0.15/kwh](image)

- Conveyor Toaster: $2900
- Soup Station: $2250
- Tea Brewer: $100
- Heated Shelf: $250

@ $0.15/kwh
Let’s Start with Conveyor Toasters

Mills College (Dining Hall)

Breakfast, Lunch and Dinner service

$585/yr

@ $0.15/kwh
Rebecca’s Cafe

Used only in the morning/afternoon

$600/yr

@ $0.15/kwh

Caffe 817

Breakfast, Lunch and Afternoon Café Service

$850/yr

@ $0.15/kwh
Bakery/Café: Baseline

Breakfast, Lunch and Dinner – Busy All Day

$2900/yr

@ $0.15/kwh

Conveyor Toaster with a power reduction selectable mode

Problem is this manual mode selection requires crew to be motivated to use
Phase Two: Monitor Intelligent Conveyor Toasters

Built-in sensor automatically activates the set toast cycle when a product is placed on the conveyor

Color sensing system monitors and adjusts conveyor speed and temperature to toast food consistently

Power saver mode automatically kicks on after a set amount of time

It Knows when to Doze
Bakery/Café: Replacement

Decrease from 3kW to 2kW

$1000/yr

Café / Bakery energy comparison

Installation
Mills College: Replacement

Input Rate Modulation

$140/yr

Lab Data
Estimated Savings from Setback

<table>
<thead>
<tr>
<th>Appliance</th>
<th>Normal Operation</th>
<th>Using the Setback Feature</th>
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</thead>
<tbody>
<tr>
<td>Preheat Energy (kWh/day)</td>
<td>0.87</td>
<td>0.87</td>
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<tr>
<td>Setback Idle Energy (kWh/day)</td>
<td>0</td>
<td>9.16</td>
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<tr>
<td>Setback-to-Full Power</td>
<td>0</td>
<td>3.24</td>
</tr>
<tr>
<td>&quot;Recovery Energy&quot; (kWh/day)</td>
<td>62.67</td>
<td>23.82</td>
</tr>
<tr>
<td>Full Power Energy (kWh/day)</td>
<td>23.127</td>
<td>13,501</td>
</tr>
<tr>
<td>Annual Energy (kWh/year)</td>
<td>$3,469</td>
<td>$2,025</td>
</tr>
<tr>
<td>Annual Cost ($/year)*</td>
<td></td>
<td></td>
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</table>

*based on $0.15/kWh
## Learning More About Vertical Toasters

<table>
<thead>
<tr>
<th></th>
<th>Standard Heat Shield without Damper</th>
<th>Standard Heat Shield with a Detachable Damper Underneath</th>
<th>Air Channel Heat Shield with an Integrated Damper</th>
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<tbody>
<tr>
<td>Preheat Energy (kWh/day)</td>
<td>0.90</td>
<td>0.84</td>
<td>0.74</td>
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<td>Idle Energy (kWh/day)</td>
<td>24.27</td>
<td>20.65</td>
<td>13.57</td>
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<td>Cooking Energy (kWh/day)</td>
<td>5.56</td>
<td>5.54</td>
<td>4.39</td>
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<td>Annual Energy (kWh/year)</td>
<td>11,186</td>
<td>9,839</td>
<td>6,807</td>
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<td>Annual Cost ($/year)*</td>
<td><strong>$1,119</strong></td>
<td><strong>$984</strong></td>
<td><strong>$681</strong></td>
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</table>

*based on $0.15/kWh

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## Baseline Toaster Energy Savings

**Breakfast mode from 4AM to 10 AM, then in lunch mode the rest of the day**

- **74 kWh/day**
- **Toaster Input Rate (W)**
- **Test Time (h)**
- **Toaster Input Rate (W)**
- **Test Time (min)**

---
## Horizontal Toaster Energy Savings

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Baseline</th>
<th>Replacement</th>
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<tr>
<td><strong>Operating Mode</strong></td>
<td>Breakfast</td>
<td>Lunch</td>
</tr>
<tr>
<td><strong>Operating Time (h)</strong></td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td><strong>Heat Transfer Type</strong></td>
<td>radiant</td>
<td>contact</td>
</tr>
<tr>
<td><strong>Energy Per Day (kWh)</strong></td>
<td>85.58</td>
<td>35.59</td>
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<tr>
<td><strong>Energy Cost Per Year</strong></td>
<td>$4,685</td>
<td>$1,948</td>
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<td><strong>kWh Energy Cost per store</strong></td>
<td>$7,234</td>
<td>$3,453</td>
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<td><strong>Energy Savings (mWh)</strong></td>
<td>-</td>
<td>25.20</td>
</tr>
<tr>
<td><strong>Annual Energy Savings</strong></td>
<td>-</td>
<td>$3,781</td>
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</tbody>
</table>

*Cost and savings calculated for the breakfast and lunch periods.*
Lunch

30:00 min

How About Soup Warmers?

Less energy use than a conveyor toaster but there are a lot of soup warmers out there!
Caffe 817 (7-Quart)

Input Rate (W) vs. Time of Day (h)

Mills College (11-Quart)

Input Rate (W) vs. Time of Day (h)
Standard Countertop Soup Warmer vs Induction Lab Testing Data

**69% Energy Reduction!**

Wet Well holding rate: 339 W  
Induction holding rate: 105 W

Direct Replacement Savings

- Café test site: replacement of baseline soup warmer with induction = 52% energy savings
- Client pleased with performance and noted ease of use

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Induction</th>
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<tbody>
<tr>
<td>Average Daily Energy Use</td>
<td>0.90 kWh</td>
<td>0.44 kWh</td>
</tr>
<tr>
<td>Annual Energy Cost</td>
<td>$49.00</td>
<td>$23.96</td>
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</tbody>
</table>

@ $0.15/kwh
Direct Replacement Savings

- College campus test site: replacement of baseline soup warmer with induction = 63% energy savings

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Induction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily Energy Use</td>
<td>1.45 kWh</td>
<td>0.54 kWh</td>
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<tr>
<td>Annual Energy Cost</td>
<td>$78.95</td>
<td>$29.40</td>
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</table>

![Graph showing energy use comparison between baseline and induction soup warmers.]

Induction Potential

- Energy metering of four baseline soup warmers and seven induction soup warmers showed that induction units used 62% less energy than their wet well counterparts

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Induction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily Energy Use</td>
<td>1.2 kWh/d</td>
<td>0.44 kWh/d</td>
</tr>
<tr>
<td>Average Input Rate</td>
<td>0.13 kW</td>
<td>0.07 kW</td>
</tr>
</tbody>
</table>

![Graph showing daily energy usage comparison between baseline and induction soup warmers.]

@ $0.15/kwh
Induction Soup Warmer Savings Potential in a Fast Casual Restaurant

• From 375 kWh/yr per soup well to 143 kWh/yr
• Times 12 soup wells
• Estimated savings = $420/yr

@ $0.15/kwh

Other Energy Saving Alternatives?
How About Hot Plates?

Induction in Other Applications

Café site: baseline electric hotplate to induction hotplate

– Energy use was reduced by 59%
– Estimated annual energy savings of about $600

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Induction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily Energy Use</td>
<td>18.2 kWh</td>
<td>7.4 kWh</td>
</tr>
<tr>
<td>Annual Energy Cost</td>
<td>$1000</td>
<td>$400</td>
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</tbody>
</table>

@ $0.15/kwh
Hotplate Energy Usage Comparison

Sample Weekly Energy Usage Profile

- Baseline
- Induction

Other Replacement Options
How About Wet Wells?

Big Range of Energy Use

Wet Well at Rebecca’s Café

- Warmer rarely used (only 3 days out of the month monitored)
- Average energy usage of only 0.3 kWh/day across entire month

@ $0.15/kwh

$15/yr
Wet Well at Togo’s Sandwich

- One of two 12” x 20” Warmers used every day

$405/yr

Wet Well – Soup Station at Bakery/Café

$2,250/yr
## Dry Well: Potential Savings

<table>
<thead>
<tr>
<th></th>
<th>Dry Well</th>
<th>Steam Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Wells</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total Product Volume (gal)</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Preheat Energy (Wh/day)</td>
<td>570</td>
<td>4,156</td>
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<tr>
<td>Holding Energy (Wh/day)</td>
<td>13,125</td>
<td>25,350</td>
</tr>
<tr>
<td>Annual Energy Consumption (kWh/yr)</td>
<td>4,999</td>
<td>10,767</td>
</tr>
<tr>
<td>Annual Operating Energy Cost ($/yr)</td>
<td>$740</td>
<td>$1,615</td>
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</tbody>
</table>

@ $0.15/kwh

## Solutions Better Than Dry Wells?

Induction Wells On The Way?
Heat Strips

Heat Strip – Over Product warming heaters
Mills College (Café)

![Graph showing power usage and cost over a day for Mills College Café.]

$350/yr

Doubletree Hotel

4ft Heat Strip

![Graph showing power usage and cost over a day for Doubletree Hotel.]

ON 24 hrs / 7 days/week
NO indication of power ON (lamp)
No power switch at unit.

$1,100/yr

@ $0.15/kwh
Replacement Options

- Behavioral changes can make a dramatic difference
  – (example: Doubletree)
- Heat strips with optical sensors

![Testing a Prototype]

<table>
<thead>
<tr>
<th>Location</th>
<th>Baseline (kWh/d)</th>
<th>Replacement (kWh/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bakery/Café</td>
<td>4.2</td>
<td>N/A</td>
</tr>
</tbody>
</table>

@ $0.15/kwh

$230/yr
Replacement Options

Need to find options with an energy saving mode, likely using either optical or weight sensor. Suggestions?

Now, let's talk Coffee Makers
Mills College (Café)

$480/yr

@ $0.15/kwh

Bakery/Café

$1,000/yr

@ $0.15/kwh
FSTC: Baseline

FSTC Coffee Brewer

$150/yr

@ $0.15/kwh

FSTC: Replacement

Same model, controlled with Off/On timer

FSTC Coffee Brewer
Baseline vs Replacement

- Timer controlled On/Off resulted in idle energy savings, about 12% of the total energy usage
- Using mfg. energy savings mode there was crew dissatisfaction delay of 30 mins for first pot of ready to drink coffee.
- Controls work best with behavior-change based training

Bakery/Café

![Graph showing power usage and cost savings]

- $250/yr
- @ $0.15/kwh
Mills College (Café)

$450/yr

Espresso Machine Challenge – Always ON

production

idle

idle
Espresso Machine Controlled with Internal Timer
Cut Energy Cost by 33%

$225/yr savings

Tea Brewers on the other hand...
Mills College (Café)

$90/yr

Togo’s Sandwich

$120/yr
Options Besides Timer or Energy Save Mode?

Relative Appliance Energy Usage

- At Bakery/Café
Panini Grills

UC Berkeley

$240/yr

@ $0.15/kwh
Togo’s Sandwich

$780/yr

What Does a Efficient Panini Grill Look Like?
Tortilla Warmers

Chipotle

$480/yr

@ $0.15/kwh
Efficient Tortilla Warmers?

Rice Cookers
Lin Jia Asian Kitchen

@ $0.15/kwh

$85/yr

Lin Jia Asian Kitchen

@ $0.15/kwh

$120/yr
## Innovative Technologies?

And a Few Replacements Made!

<table>
<thead>
<tr>
<th>Appliance Type</th>
<th>Number of Units Replaced /Modified</th>
<th>Baseline</th>
<th>Replacement</th>
<th>Savings from Direct Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total Average Daily Energy Usage (kWh/day)</td>
<td>Normalized Energy Usage Rate (kW)</td>
<td>Total Average Daily Energy Usage (kWh/day)</td>
</tr>
<tr>
<td>Coffee Brewer</td>
<td>2</td>
<td>2.0</td>
<td>0.25</td>
<td>1.0</td>
</tr>
<tr>
<td>Conveyor Toaster</td>
<td>2</td>
<td>31.6</td>
<td>2.43</td>
<td>18.3</td>
</tr>
<tr>
<td>Hotplate</td>
<td>1</td>
<td>18.2</td>
<td>2.17</td>
<td>7.4</td>
</tr>
<tr>
<td>Soup Well</td>
<td>2</td>
<td>1.2</td>
<td>0.15</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Project Challenges

- Difficult to change operator usage
- Savings per appliance relatively small - owner/operator looking for BIG dollar savings.
- Finding equipment technology to reduce idle (non-production) energy and without affecting speed of service – limited options!
- Kitchen management systems difficult to implement for small stores

Current Project Status

- Completed Field M&V validation at five sites
- Installed replacement toasters, soup wells, and hot plates
- Continue working with equipment manufacturers to acquire replacement appliances
- Expanding baseline locations
- Project continues until 2020
Behavioral Changes

Behavior can have a significant impact on plug load energy use – next study?

Making sure equipment is turned off at night
Turn on energy saving modes when business is slow

notes

• Could add panini grills and tortilla warmers
• Have holding cabs for baselines but no replacements yet –
• See the findings/conclusions section
• See sidebar with list of different appliances – all the ones they have already looked at.
notes

- Look at plug load ops – different for different places. Cost can be big relative to cost of equipment.
- Add some costs to the energy profile slides.
- Add espresso idle cost savings slide.
- Turn on and off with controls could be big as many are left on 24/7 – IoT?
- Discussion?
- Ask for equipment and locations – study wraps in 2020 - looking for dry wells, holding cabinet, heated shelves, heat strips, new tech.
- Change from kwh/day/year to kwh/day or kwh/y.

Energy Use Comparison of Holding Equipment
Energy Usage Comparison of CFS Heating Equipment

Energy Usage Comparison of CFS Beverage Equipment