# CEC Plug-load Project

## EPIC- Electric Plug Load Savings Potential of Commercial Foodservice Equipment

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FRONTIER energy

California Energy Commission
Edmund G. Brown Jr., Governor

## Plug-Load Project Team:

- Frontier Energy
  - David Zabrowski - Project Manager
  - Mark Finck - Principal Investigator.
  - Edward Ruan – Engineer – II, Site and Field – Appliance / Data Analysis
  - Denis Livchak – Engineer – III, Data Analysis and Reporting
- Opinion Dynamics
  - Isabelle Gecils – Project Manager site survey
- Fisher Consultants
  - Don Fisher – Technical Support
- ADM Associates, Inc. Measurement and Evaluation
  - Third Party Measurement and Verification (M&V).
    - Dan Mort - Director
    - Doug Thomas – Field Technician

## Energy Reduction Potential

- The objectives of this project are to *identify* the *top energy* using appliances with the *greatest potential* to implement a *reduced* energy mode during *periods of minimal activity* and to demonstrate the potential to *reduce* the appliance's *overall energy consumption without hindering* overall *kitchen production*.
- This study will assess the energy load and energy reduction potential of unventilated commercial plug load foodservice equipment, characterize equipment usage through field monitoring at five different commercial kitchens in Northern California (PG&E service territory), and demonstrate reduced energy consumption through the use of pre-commercial appliance designs and control technologies, and behavior operation changes.

## Energy Analysis

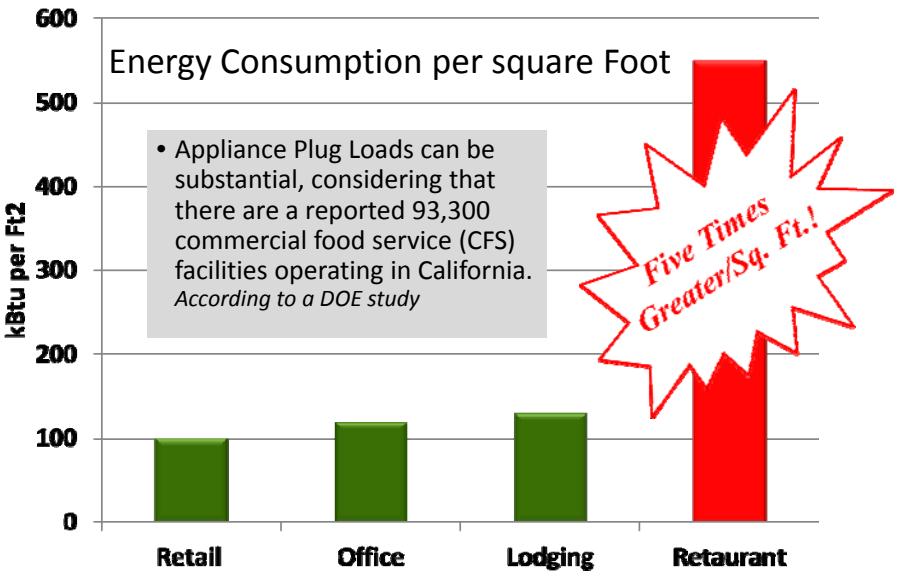
- Characterize energy usage of different types of plug load equipment found in commercial kitchens and create a database
- Identify the unhooded electrical appliances with the greatest energy savings potential and experiment to see what sort of savings we can achieve
  - Savings can be from equipment replacement or behavioral change
  - Energy savings method cannot hinder overall performance
- Create business case that advances the adoption of energy saving practices and technologies in the food service industry

## Market Assessment

- Extrapolate project findings to estimate total energy savings potential in the food service industry
- Create business case outlining the projected benefits of implementing specific energy-saving measures

# Market Assessment

- The specific goals are to characterize the type and quantity of unventilated commercial electric cooking and warming equipment, to assess the energy savings potential that new technologies and advanced appliance controls can achieve within commercial kitchens, and to demonstrate the potential impact of behavior modification on the adoption and implementation of these technologies.
- The result will be used to build a business case that supports the specification and usage of practical energy-saving measures during non-peak production periods.




## Typical Commercial kitchen Prep-line

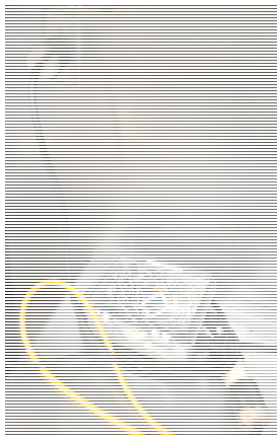
*Table 2. Estimated CCFS Plug Load Energy Consumption and Savings Potential for Select Appliance Categories*

| Appliance Category | Avg. Power During Typical Use (W) | Avg. Power During Standby (W) | Est. Production Hours | Est. Standby Hours | Est. Energy Use/day (kWh) | Est. Energy Reduction/ day (kWh) | Est. Energy Reduction/ year (MWh) |
|---|---|---|---|---|---|---|---|
| Toaster Vertical | 2,600 | 800 | 8 | 6 | 36 | 11 | 2.9 |
| Toaster Conveyor Radiant | 1,800 | 800 | 4 | 4 | 14 | 4 | 1.1 |
| Food Warmers Top Heat | 1,000 | 100 | 11 | 5 | 16 | 5 | 1.2 |
| Hot Plate/btm Heat Holding | 1,000 | 700 | 6 | 6 | 12 | 2 | 0.5 |
| Rice Cooker | 1,550 | 81 | 5 | 7 | 12 | 10 | 2.7 |
| Soup Warmer | 800 | 400 | 8 | 8 | 8 | 3 | 0.8 |
| Coffee Brewers / Hot Water Dispensers | 800 | 125 | 6 | 18 | 19 | 12 | 3.2 |
| Espresso Machines | 2,200 | 200 | 12 | 12 | 53 | 24 | 6.3 |

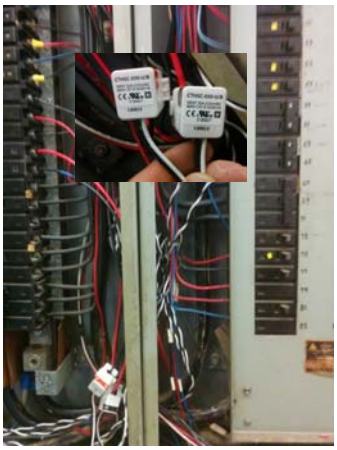
*Table 3. Estimated CCFS Plug Load Energy Consumption and Savings Potential for Select Appliance Categories*

| Appliance Category | Est. Inventory in CA | Total Energy Use (GWh) | Total Power Reduction during Standby (MW) | Total Energy Reduction (GWh) | Penetration Rate (%) | Adjusted Power Reduction (MW) | Adjusted Energy Reduction (GWh) |
|---|---|---|---|---|---|---|---|
| Toaster Vertical | 45,000 | 597.9 | 81.0 | 177.4 | 10% | 8.1 | 17.7 |
| Toaster Conveyor Radiant | 38,000 | 199.7 | 38.0 | 55.5 | 15% | 5.7 | 8.3 |
| Food Warmers Top Heat | 46,000 | 268.6 | 41.4 | 75.6 | 15% | 6.2 | 11.3 |
| Hot Plate/btm Heat Holding | 25,000 | 109.5 | 7.5 | 16.4 | 10% | 0.8 | 1.6 |
| Rice Cooker | 11,000 | 49.8 | 16.2 | 41.3 | 15% | 2.4 | 6.2 |
| Soup Warmer | 43,000 | 125.6 | 17.2 | 50.2 | 15% | 2.6 | 7.5 |
| Coffee Brewers / Hot Water Dispensers | 200,000 | 1,401.6 | 135.0 | 887.0 | 30% | 40.5 | 266.1 |
| Espresso Machines | 50,000 | 963.6 | 100.0 | 438.0 | 10% | 10.0 | 43.8 |
| | | | | | **TOTALS** | **76.3** | **362.6** |

## Energy Data Collection



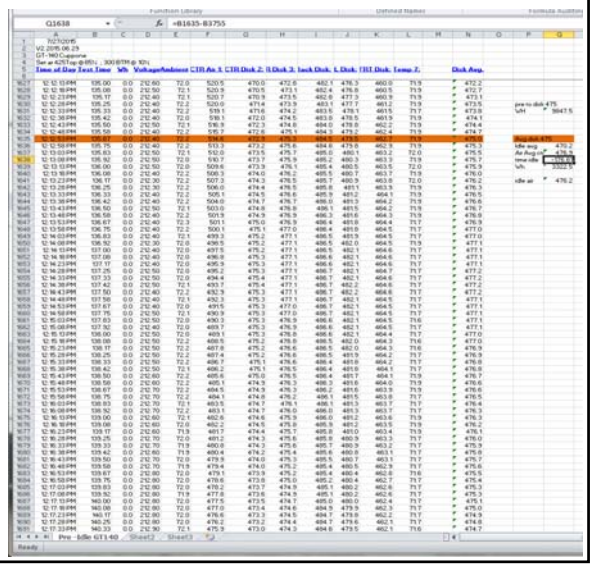
## Energy Data collection



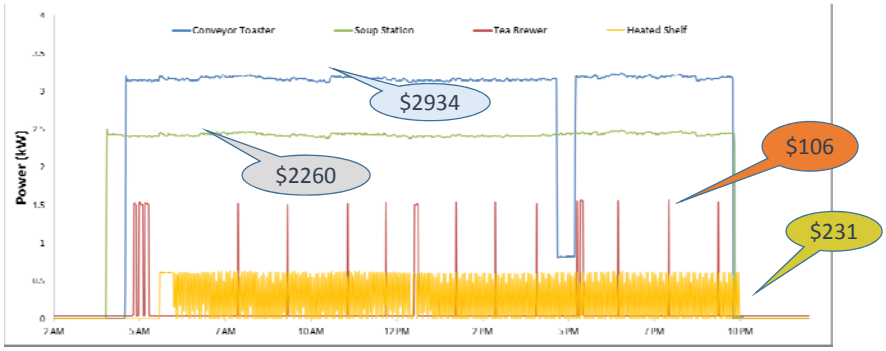
# Data - the numbers

What do the numbers mean?

Make the data usable for the project

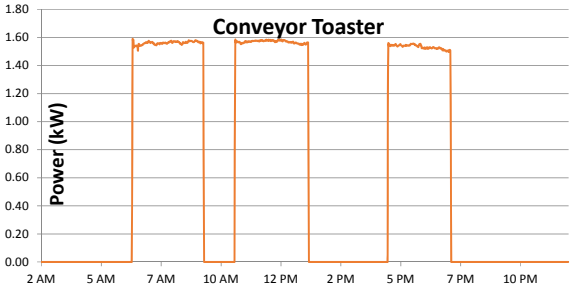


Daily profile of Plug-Load Appliances



## Mills College (Dining Hall)

- Hatco TQ-10 Toast-qwik Conveyor Toaster (120V, 15A, 1.8kW)
- Dining Hall with breakfast, lunch and dinner service

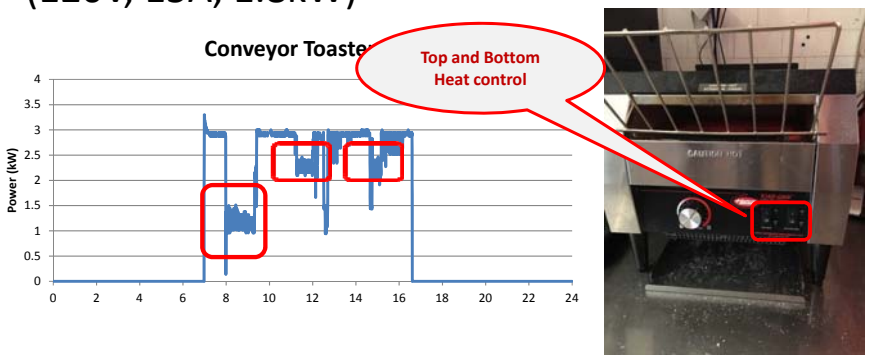



Toaster Operating set point!

## Common 1500 to 2500 watts


# Caffe 817

- Hatco TQ-10 Toast-qwik Conveyor Toaster (120V, 15A, 1.8kW)






# Intelligent Toast-Qwik conveyor

The built-in Spot-On technology senses when a product is placed on the conveyor and automatically activates the set toast cycle, and the ColorGuard sensing system monitors and adjusts conveyor speed and temperature to toast food consistently. For energy efficiency, a power saver mode automatically kicks on after a set amount of time

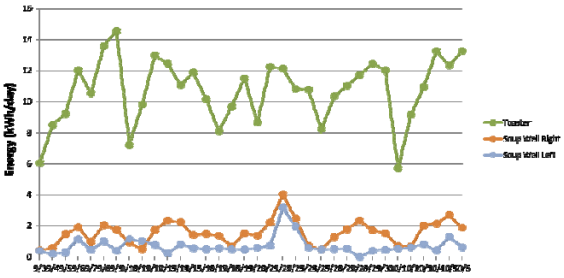
# Smart Conveyor Toaster

The new electronic control measures temperature of the exposed toasting compartment and adjusts the conveyor speed to give the same expose of the set temperature.

Thus if the toaster is in a set-back temperature such as energy saving mode the conveyor will slow as the temperature is lower and speed-up as the temperature is increased



# Soup Warmer

# Induction vs Wet Well

Wet well holding rate: 339 W

Induction holding rate: 105 W

**69% Energy Reduction!**

CEC Plug Load project data

# Induction Well Savings Potential

- Each well is currently averaging about 0.28 kWh per day
- Use of induction wells estimated to be saving the restaurant $831 annually!


CEC Plug Load project data

## Coffee Machines

- Machines have built-in logic for set back. After (4 Hrs.) from last done brewing, the thermostat heater for water reduce temperature set-point.

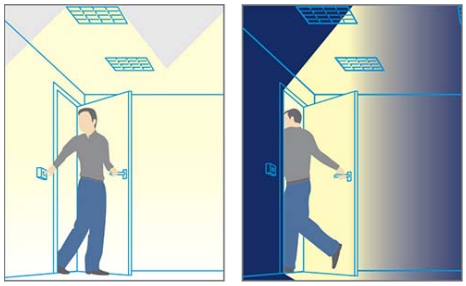
## Curtis Coffee Brewer

| | | | |
|---|---|---|---|
| Energy Save Mode (Activates after 4 Hours of Inactivity) | No Change | No Change | Tank temperature is maintained at the temp setpoint default |
| | Turn Tank Heater Off | | Tank is turned off. |
| | Reduce tank temp to: 140°F | | Tank temperature maintained at 140F. |

Commercial Foodservice Kitchen Equipment Operating at Peak Energy Demand for the Full Day-Part CEC Plug-Load Project:

## Behavioral Changes

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



## Project Challenges

- Energy saving modes being accepted by operators – that might effect service times
- Individual site saving per appliance is low dollar amount that operators reluctant to change operational behavioral.
- Donation of appliances from equipment suppliers as energy saving replacements
- Difficult to monitor appliances that are mobile

## Current Project Statics

- Just completed Field M&V validation at five sites.
- Replacement appliances have been installed, Hot top, one Toaster, three soup warming wells.
- Working with equipment manufactures to acquire replacement – coffee machine, conveyor toasters and warming units.
- Expending base-line locations for steamers and hold shelf units.