

# CEC Plug-load Project

## EPC-15-027 Electric Plug Load Savings Potential of Commercial Foodservice Equipment

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June 1<sup>st</sup>, 2018



CALIFORNIA  
ENERGY COMMISSION

### Project Goals



- 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

## 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
- Promote adoption of energy saving practices and technologies in the food service industry



## 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, with most averaging 10+ plug loads.



### Plugloads: an underexplored category

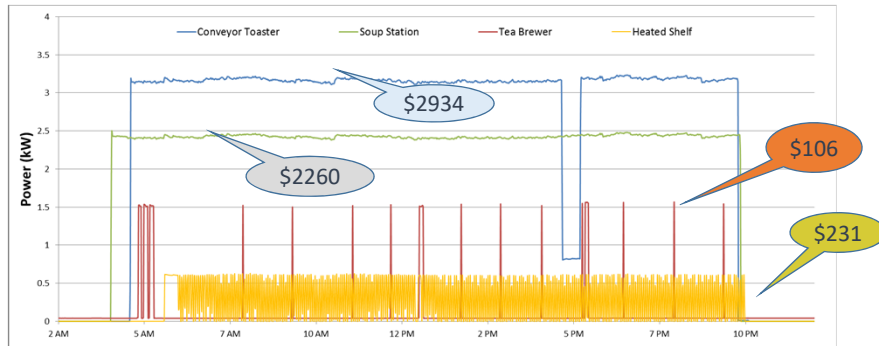


### Energy Data Collection



## Daily profile of Plug-Load Appliances

Does energy usage follow energy demand?



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

## Baseline Appliance Summary

- 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

## Applying Energy Saving Strategies



- Utilizing new, energy efficient technologies
  - Demand driven energy usage
  - Automatic standby modes

### New Technology: Induction

- From 375 kWh/yr per soup well to 143 kWh/yr
- Estimated savings = \$420/yr



@ \$0.15/kwh

### 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

	Baseline	Induction
Average Daily Energy Use	18.2 kWh	7.4 kWh
Annual Energy Cost	\$1000	\$400



@ \$0.15/kwh

## Advanced Controls

- Automatic Energy Saving Mode
- Smart Conveyor Speed Adjustment



## Problems with Manual Standby Modes

...they're not always used!



## Limited Standby Mode Functionality



- Coffee brewer with built-in logic for energy saving mode. After 4 hour from last done brewing, the thermostat heater for water reduce temperature set-point.

## Growth of Energy Saving Technologies

- Heat lamps: optical or weight sensors to verify presence of food product
- Plugloads constantly left on, sometime even 24 hours





## Replacements Results

Appliance Type	Number of Units Replaced /Modified	Baseline		Replacement		Savings from Direct Replacement
		Total Average Daily Energy Usage (kWh/day)	Normalized Energy Usage Rate (kW)	Total Average Daily Energy Usage (kWh/day)	Normalized Energy Usage Rate (kW)	
Coffee Brewer	2	2.0	0.25	1.0	0.18	50%
Conveyor Toaster	2	31.6	2.43	18.3	1.80	42%
Hotplate	1	18.2	2.17	7.4	1.54	59%
Soup Well	2	1.2	0.15	0.5	0.08	58%

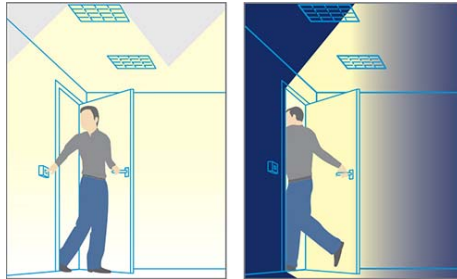
## Creating a Market

- Helping consumers find energy efficient options
- Encouraging manufacturers to invest in creating energy efficient equipment
- Help the food service industry push towards higher energy efficiency standards



## Behavioral Changes

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



## Next Steps:

- Continue working with equipment manufacturers to acquire replacement appliances
- Looking for more baseline sites and new technologies to test!

