



Electric Plug Load Savings Potential of Commercial Foodservice Equipment – Final Fact Sheet

Frontier Energy, Inc. (formerly Fisher-Nickel, Inc.) is a dedicated team of engineers, technicians, culinary experts, educators, and energy specialists who use their expertise to encourage the commercial foodservice industry to become more sustainable in their purchasing decisions and operations.

Commercial Plug Load Equipment Evaluation & Replacement Project

Frontier Energy collaborated with the California utilities to research baseline plug load cooking and warming equipment and replace them with high-efficiency plug load equipment. Plug load equipment was divided into 22 categories and submetered at 29 sites. A total of 91 baseline and 37 efficient appliances were submetered, including 18 replacements.

Energy-Efficient Equipment Selection

Frontier Energy teamed up with leading innovative commercial plug load cooking and warming equipment manufacturers to replace existing baseline equipment with energy-efficient alternatives. Researchers tested all equipment for the project at the Food Service Technology Center and selected replacement candidates based on potential energy savings demonstrated during testing. Innovative technologies included effective heating methods, improved insulation, and intelligent controls. Some replacement equipment was donated by manufacturers and some equipment was funded by Silicon Valley Power for the project.

Plug Load Equipment Analysis

Frontier Energy submetered existing plug load cooking and warming equipment to determine the most energy intensive appliance categories. Conveyor toasters, hotplates, and espresso machines represented the greatest energy use across all monitored sites. Conveyor toasters, present at ten sites, consumed the most energy due to their high cooking temperatures and basic controls. Baseline hotplates, which use resistance elements to heat pots or pans, had significant energy use but were found at only one site. Espresso machines are often left on 24/7, adding up to significant standby energy consumption. Holding cabinets are underutilized and poorly insulated, wasting energy. Soup warmers showed lower energy consumption per unit, but many sites used multiple units, increasing the total energy consumption.

The Replacement – Appliance Swap

After establishing the appliances with the most energy savings potential, baseline equipment was replaced and metered for energy consumption. Most of the 120V plug load equipment was easy to replace, while higher amperage 208V equipment required in-panel metering. Appliances like rapid cook ovens replaced cooking processes that required submetering several appliances like panini makers and microwaves. **Restaurant owners were happy with the equipment replacements and often noted better product quality than the previous equipment. Some programmable equipment like automatic setback toasters and**

espresso machines with programmable timers required training sessions to maximize functionality and energy savings. Once programmed however, most restaurant owners found the new equipment just as or easier to use than their old equipment.

Capturing the Energy Savings

Researchers submetered replacement energy-efficient equipment for electric consumption over several months to capture energy savings over baseline equipment. Replacement equipment included conveyor toasters, induction cooktops, holding cabinets, soup wells, rapid cook ovens, and an espresso machine. Appliance energy usage ranged from 20 kWh per day for a conveyor toaster or an espresso machine to <1kWh for a 7-quart soup warmer. Energy intensive plug load appliances can use over 7,000 kWh per year. Appliances had varying hours of operation, e.g. espresso machines being on 24 hours a day and conveyor toasters at QSRs being on for 18 hours per day. Soup wells and panini presses had the shortest operating hours at 5 hours per day.

Energy Savings Results

Energy savings varied between 21% and 65% for each appliance replaced. **The average energy savings was 2,300 kWh per year per plug load appliance (a 39% reduction) by strategically replacing existing equipment with energy-efficient alternatives.**

Project Benefits

Plug load appliances are often overlooked as smaller, ancillary energy sources; however, this project highlighted the energy usage of this previously under researched appliance category. The project identified five categories with the highest potential savings: soup wells, hotplates, espresso machines, conveyor toasters, and holding cabinets. These appliance categories showed the highest savings at monitored sites via replacement with induction soup warmers/hotplates, automatic setback conveyor toasters, programmable shutoff insulated espresso machines, and double-door insulated holding cabinets. The project also identified several high-energy consuming categories with no

market available energy-efficient models (as of 2019): heat lamps, warm wells, and rice cookers. Energy-efficient models in these categories can be developed by manufacturers utilizing technologies like demand control sensors and induction heating.

Education

Project findings were shared with a technical advisory committee consisting of California utilities, influential foodservice operators, and industry professionals. Participating manufacturers will be able to use project findings to promote sales of energy-efficient equipment and other manufacturers will understand the value of developing more energy-efficient products. Project results including successes and lessons learned will be disseminated through seminars, webinars, and industry articles. Data collected from the demonstration sites will be used to support existing utilities' energy-efficiency programs and widen emerging technology programs. **These programs ultimately drive energy savings and emission reduction in California.**

Benefits for California

With an estimated 93,300 commercial foodservice (CFS) facilities operating in California, the total electric load of these establishments approaches 7.36 GWh annually (Cal TF 2016). Across all of California's foodservice establishments, there are an estimated one million different plug load appliances, accounting for more than 2 TWh per year. **With an average adoption rate of 10% for the existing energy-efficient technologies, this study demonstrated the potential to reduce California plug load energy consumption through strategic replacement by 51.3 GWh per year.**

Full Report:

For more detailed project information, case studies, and the full report, please visit: <https://fishnick.com/cecplug>

This fact sheet summarizes the *Electric Plug Load Savings Potential of Commercial Foodservice Equipment* conducted by Frontier Energy on behalf of the California Energy Commission's (CEC) Electric Program Investment Charge Program. Contract Number EPC 15-027