

Conveyor Toaster Analysis Report

Introduction

Due to the high constant radiant heat output, conveyor toasters are some of the most energy intensive plug load appliances found in restaurants. Given the popularity of toasted bread, muffins, and bagels, conveyor toasters are commonplace in any restaurant or cafe with a breakfast/lunch service. Conveyor toasters provide higher production capacity and ease of operation compared to standard pop-up toasters at a greater energy cost. The research team monitored conveyor toasters at ten different sites, ranging from campus cafeterias to cafes to full-service restaurants.

The baseline toasters were replaced at six of those sites, with toasters that had smart energy saving technology. Equipped with a sensor, these toasters would activate their energy save mode if there wasn't any product placed into the toaster for a given period of time. The default manufacturer setting for this technology was 30 minutes. Once energy save mode was activated, the toaster would pause the conveyor and significantly lower the electrical input to the heating elements. Once new product was finally placed into the toaster again, the sensor would deactivate the energy save mode and reengage the toaster at full input, slightly extending the cook time of the first batch after resuming cooking operation to maintain the same toasting quality. Thus, these toasters capitalized on reducing idle energy to save energy, which made the savings from replacement vary significantly depending on appliance idle times.

Caffe 817

As a European style bakery, Caffé 817 has a constant demand for bread toasting, making their Hatco TQ-10 Toast-Qwik conveyor toaster a perfect candidate for submetering. The conveyor toaster was monitored for three months, resulting in 15.5 kWh per day in electrical consumption, while operating for 8.8 hours per day on average. For most days, the toaster was turned on shortly before cafe opening and left on at a constant input all day, only being turned off at the close of business.

After baseline monitoring, the Hatco TQ-10 was replaced by a Hatco TQ3-400, which had approximately the same voltage and input ratings but also featured the automatic energy savings mode. This allowed the toaster to significantly reduce its energy rate during low usage periods, typically either immediately after initial preheat or during the afternoon. Caffé 817 was typically busy throughout all its hours of operation, so the replacement toaster still used 15.0 kWh per day, but only an average 9.8 hours of operation per day. Normalizing for hours on, this mean the toaster reduced energy consumption by 13%, equivalent to about \$123 for the average \$0.15 per kWh electrical rate. For this site, the energy efficient replacement had a payback period of 3.7 years.



Figure 1: Caffe 817 Baseline Hatco TQ-10 Conveyor Toaster

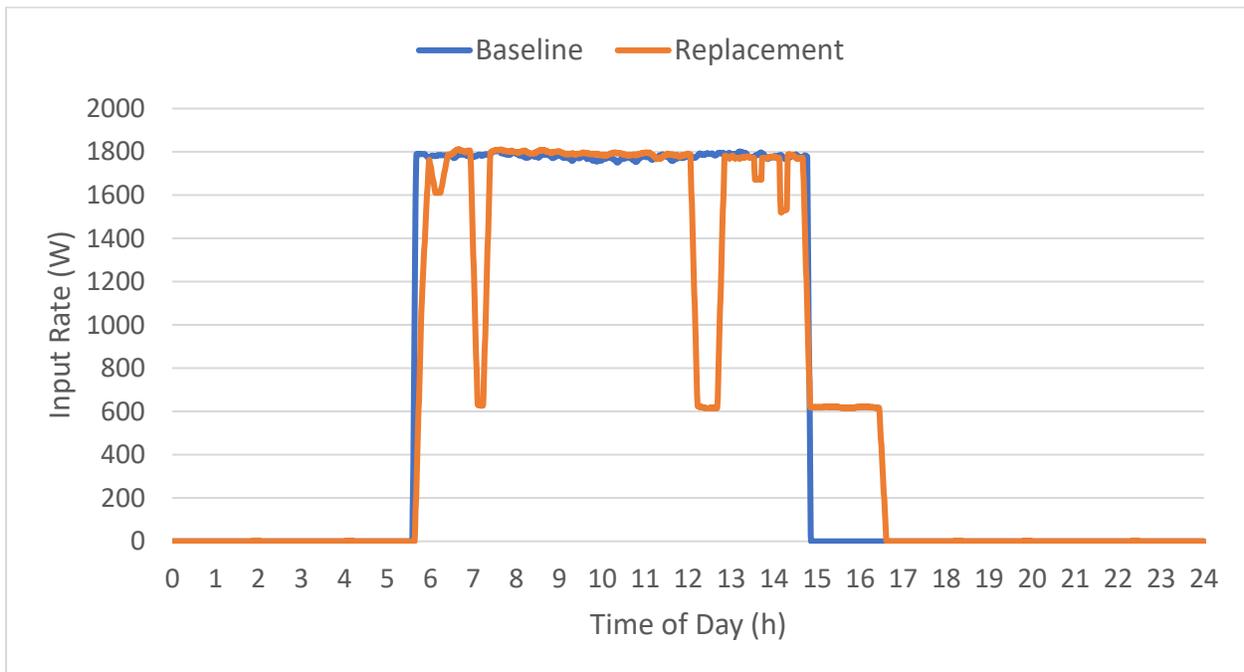


Figure 2: Caffe 817 Conveyor Toaster Daily Usage Profile

Mills College (Founders Commons)

The conveyor toaster monitored at the Mills College Founders Commons dining hall was a 120V Hatco TQ-10 Toast-Qwik. This conveyor toaster is located in the communal area for students to use during mealtimes. During meal service, the toaster is left on at a constant setting, used mainly to toast bread for sandwich making (the heat adjustment knob was missing). The staff turns the toaster off between meals as part of their cleanup process. The research team monitored the conveyor toaster for about three months, resulting in an average 10.7 kWh per day of electrical energy during an average 11.5 hours of operation.

After baseline monitoring, the Hatco TQ-10 was replaced by a Hatco TQ3-400. The automatic energy savings mode activated relatively often compared to other sites with the replacement toaster, particularly during the mornings when many students skipped breakfast. The replacement toaster thus used 8.1 kWh per day, an energy reduction of 24%. The amounts to about \$138 in yearly energy savings, for the average \$0.15 per kWh electrical rate. For this site, the energy efficient replacement had a payback period of 3.3 years.



**Figure 3: Mills College Hatco TQ-10 Toast-Qwik
Baseline Conveyor Toaster**



**Figure 4: Mills College Hatco TQ3-400 Replacement
Conveyor Toaster**

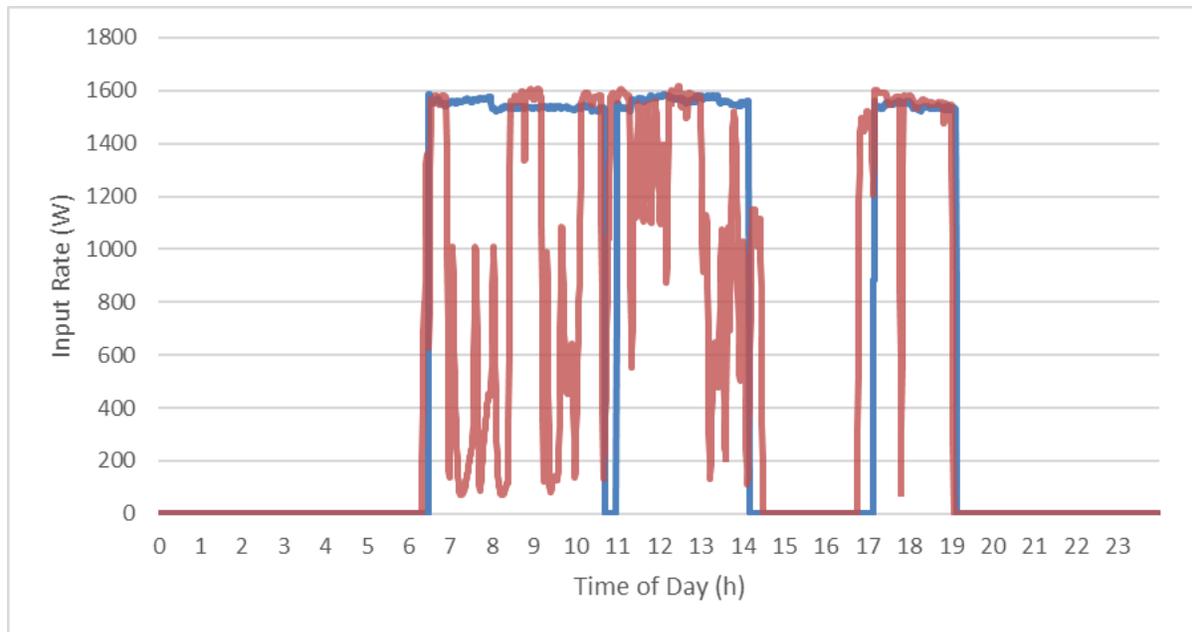


Figure 5: Mills College Daily Conveyor Toaster Operation

Tech Cafe A

Tech Cafe A has a corporate cafeteria that operates for breakfast and lunch hours on weekdays, with toast and sandwiches being one of the many options available. Though there is also a sandwich station where employees can order sandwiches, the conveyor toaster is located at the build-your-own sandwich bar, next to a small panini press and popup toaster. Given this bevy of options, the conveyor toaster isn't particularly a high use appliance. However, thanks to constant foot traffic, there is a consistent occasional demand for bread toasting. The baseline conveyor toaster was measured to consume 13.6 kWh per day on average during business days, while operating for 8.5 hours per day on average. For most days, the toaster was turned on shortly before cafeteria opening and left on at a constant input all day, only being turned off at the close of business.

After baseline monitoring, the Hatco TQ-10 was replaced by a Hatco TQ3-400. The automatic energy savings mode activated occasionally, but not often, due to the constant influx of employees. The replacement toaster used 11.0 kWh per day on average during business days, an energy reduction of 15%. The amounts to about \$83 in yearly energy savings, for the average \$0.15 per kWh electrical rate. For this site, the energy efficient replacement had a payback period of 5.4 years.



**Figure 6: Tech Cafe A Hatco TQ-10
Baseline Conveyor Toaster**

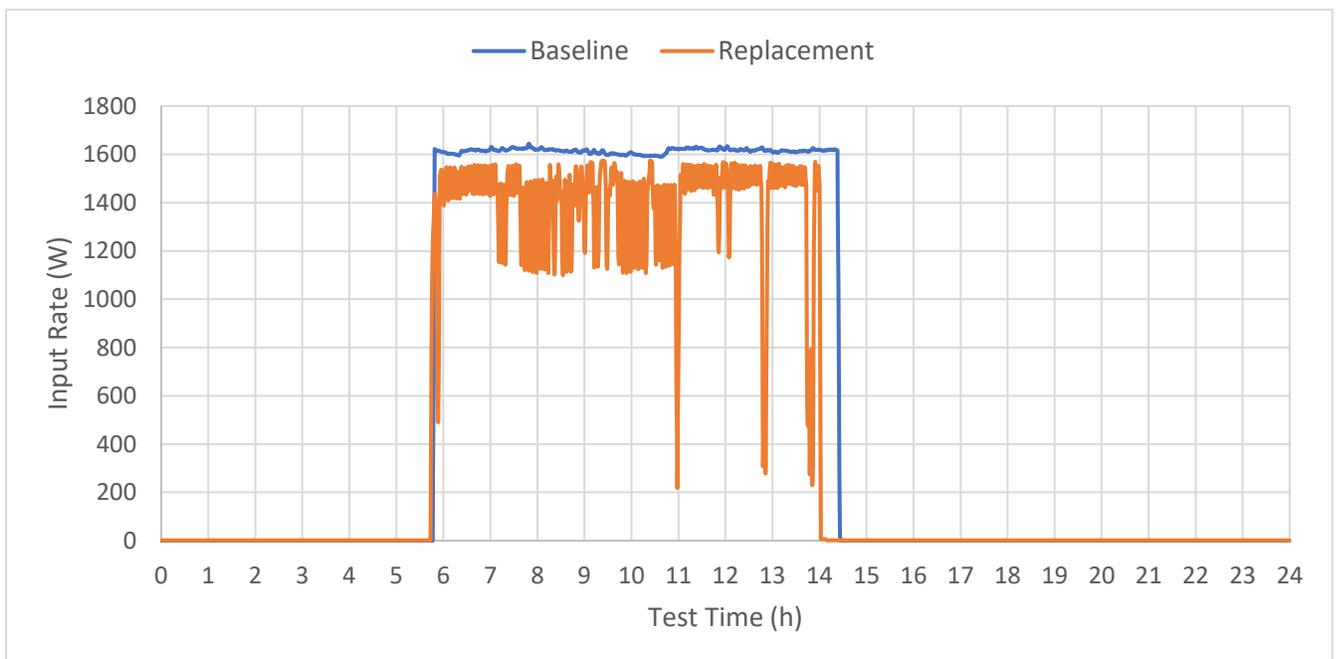


Figure 7: Tech Cafe A's Daily Conveyor Toaster Energy Profile Comparison

Cafe/Bakery

The Belleco JT2-B conveyor toaster in Cafe/Bakery's San Ramon location was monitored for a month and a half inside the electrical panel. This 208V/20A appliance was usually turned on early in the morning around 3 AM and left constantly running until the store's closing time

around 10 PM. The conveyor toaster also featured an energy saving mode, but this was rarely engaged during the monitoring period - the data showed that the energy saving mode was only engaged three times in over a month of monitoring. This is due both to high customer demand and staff preference for convenience over energy savings. The conveyor toaster at Cafe/Bakery used significantly more energy than most every monitored location due to much longer operating hours. The toaster averaged 52.4 kWh per day with 18.0 hours of operation.

After baseline monitoring, the Belleco toaster was replaced by a Hatco TQ3-900H, which operated at a lower average input and featured the automatic energy savings mode. The automatic energy savings mode activated often throughout the day. The replacement toaster used 28.5 kWh per day on average during business days, an energy reduction of 46%. This amounts to about \$1290 in yearly energy savings, for the average \$0.15 per kWh electrical rate. The energy efficient replacement had a payback period of only 3 months for this site, since the long and energy intensive hours of operation created a large energy savings opportunity.



**Figure 8: Cafe/Bakery Belleco JT2-B
Baseline Conveyor Toaster**



**Figure 9: Cafe/Bakery Hatco TQ3-900H Replacement
Conveyor Toaster**

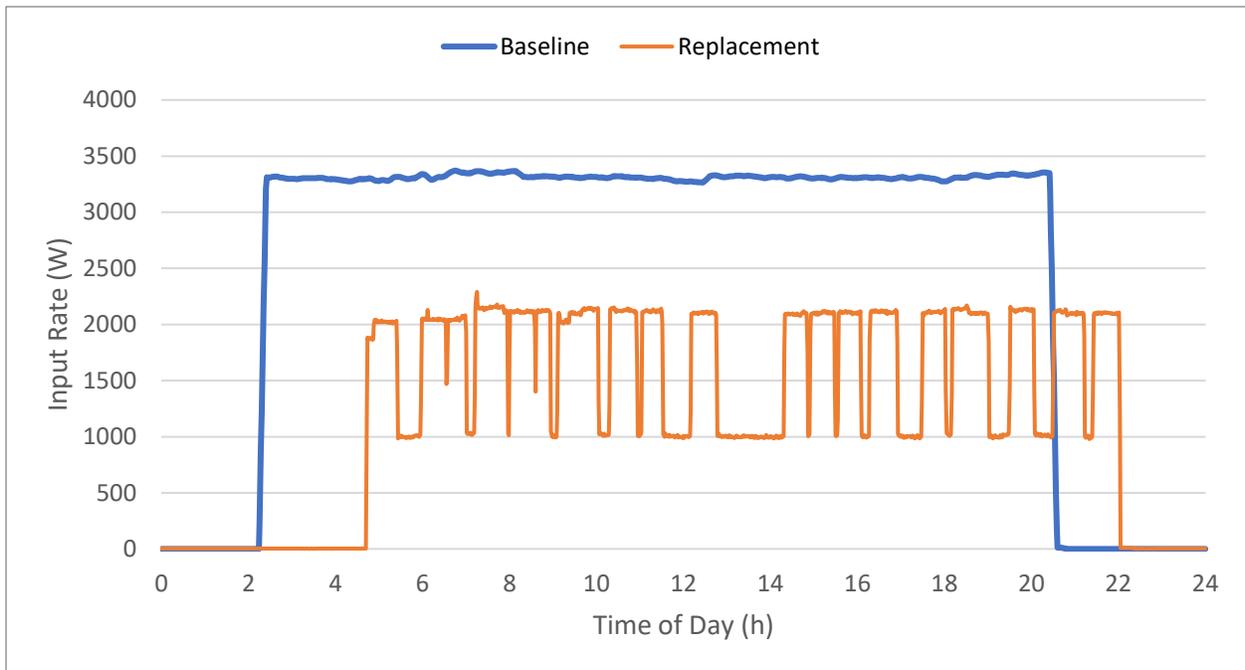


Figure 10: Cafe/Bakery Daily Conveyor Toaster Energy Profile Comparison

Spreadz

Spreadz is a sandwich store located in the middle of a business park area, catering mainly to corporate workers looking for a quick lunch. They do catering and delivery and have had such success that they recently opened a second store. Frontier monitored the conveyor toaster at the main store, which operates from 10:30am to 2:30pm every weekday. The conveyor toaster was often turned on significantly earlier though, to prepare large sandwich orders for delivery. The baseline conveyor toaster averaged 11.4 kWh per day on average during business days, while operating for 7.3 hours per day on average.

After baseline monitoring, the Holman QCS-2-500 was replaced by a Hatco TQ3-400. Initially, the toaster supplied with the manufacturer default settings of 30 minutes of inactivity before activating the automatic energy savings mode. Under these settings, the mode only activated occasionally, since they had consistent business. The replacement toaster used 10.4 kWh per day on average during business days, an energy reduction of 11%. For the average \$0.15 per kWh electrical rate, this equates to about \$80 per year in annual energy savings.



Figure 11: Spreadz Baseline Conveyor Toaster



Figure 12: Spreadz Replacement Hatco Conveyor Toaster

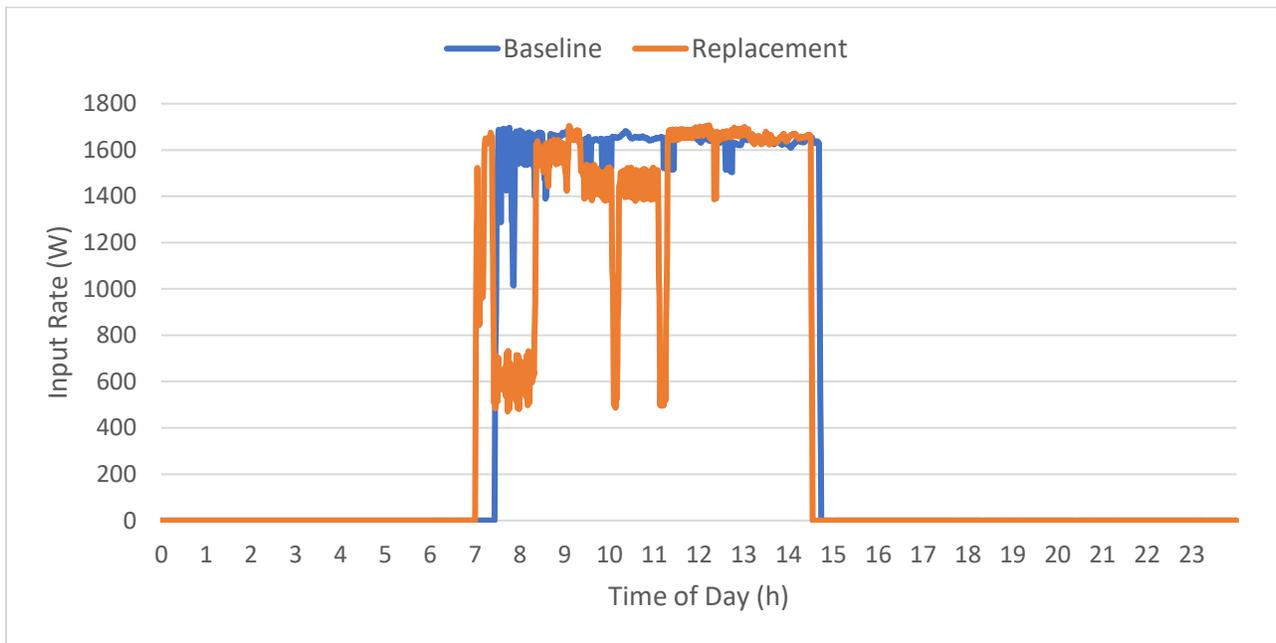


Figure 13: Spreadz Conveyor Toaster Energy Profile Comparison (30 Minute Setting)

Researchers later changed the settings to activate the energy savings mode after 10 minutes of inactivity. This allowed the toaster to utilize the mode more frequently, without affecting the speed of service in any substantial way. Staff did not notice any changes from the previous setting and this shorter activation window setting. This new setting reduced the average daily business day electrical consumption to 9.3 kWh, bring total energy reduction from their

baseline toaster to 19%. The amounts to about \$80 in yearly energy savings, for the average \$0.15 per kWh electrical rate. The energy efficient replacement toaster had a \$180 lower purchase price than the baseline unit, so the energy savings for this store was all profit. Overall, Spreadz was pleased with the replacement toaster’s speed of service, output product quality, reduced heat and safety hazard, and the eye-catching aesthetic which matches their logo.

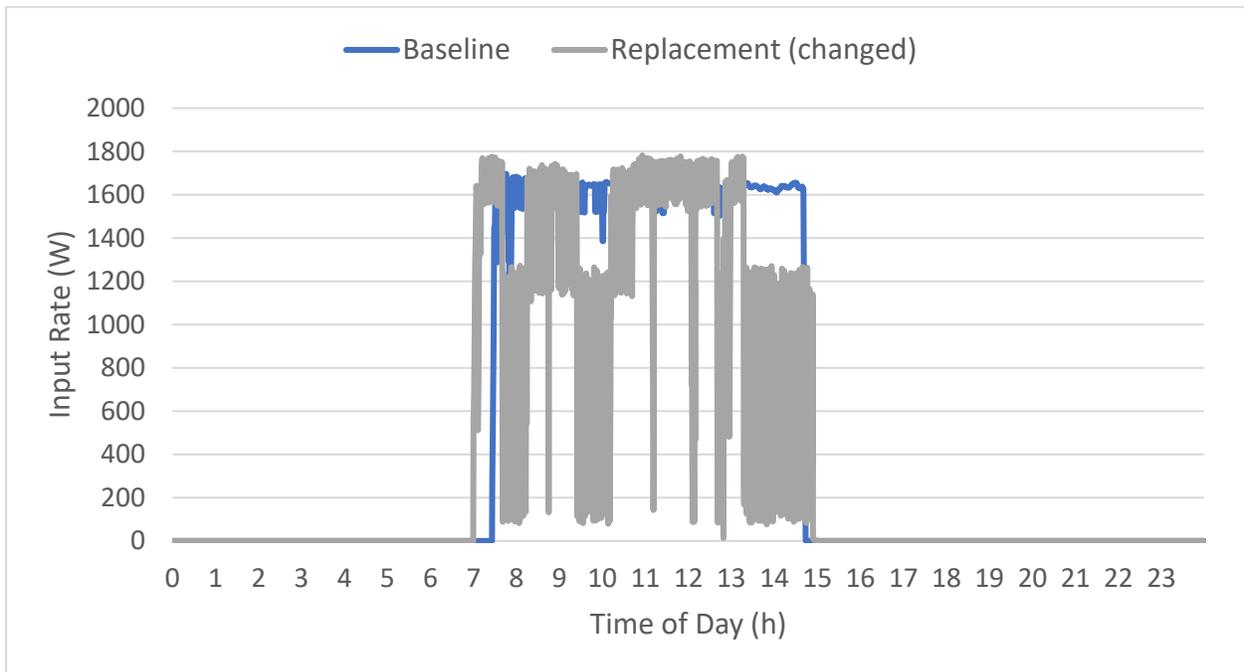


Figure 14: Spreadz Conveyor Toaster Energy Profile Comparison (10 Minute Setting)

Voyager Craft Coffee

Voyager Craft Coffee is a popular cafe specializing in espresso and drip coffee beverages, which they pair with various toast and pastry options for snacking. They are open from 7 AM to 7 PM daily and are well known for their creative and aesthetic signature drinks, themed after various cities around the world. Business is a constant flow of take-out orders and customers who sit inside the café to chat or work while enjoying their coffee. The conveyor toaster is running nearly the entire time, fulfilling toast orders for customers to snack on with their coffee. Researchers measured the baseline conveyor toaster averaged 18.4 kWh per day on average, while operating for 11.2 hours per day on average.

Frontier Energy replaced the baseline Waring toaster with a Hatco TQ3-400. Initially, there were no savings from the replacement, since the coffee shop was so busy that the toaster rarely ever went into its setback mode. After switching the setback mode to trigger at 10 minutes instead of 30 minutes of inactivity (factory setting), however, the replacement toaster reduced the energy use to an average 17.0 kWh/day, a normalized savings of 10% compared to the baseline. The decreased activation period did not affect service in any way, and the owners were still very

happy with the speed and quality of the output product. The replacement toaster was also less hot to the touch, making it safer to work with. However, the setback mode activation was still infrequent due to the shop's constant toaster orders, so the energy savings were less than the 20% conveyor toaster savings observed at the other sites. The replacement toaster saved about \$98 per year in energy costs, for the average \$0.15 per kWh electrical rate. The energy efficient replacement had a payback period of 6.1 years though, since their original unit was very cheap.



Figure 15: Voyager Craft Coffee Waring Baseline Conveyor Toaster



Figure 16: Voyager Craft Coffee Hatco Replacement Conveyor Toaster

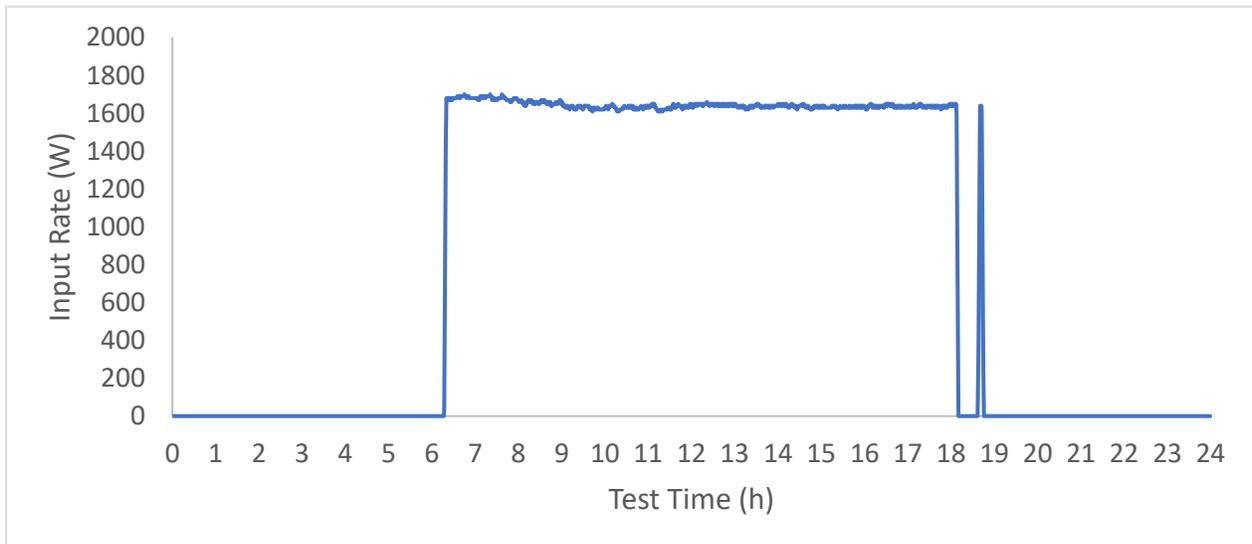


Figure 17: Voyager Craft Coffee Baseline Conveyor Toaster Operation

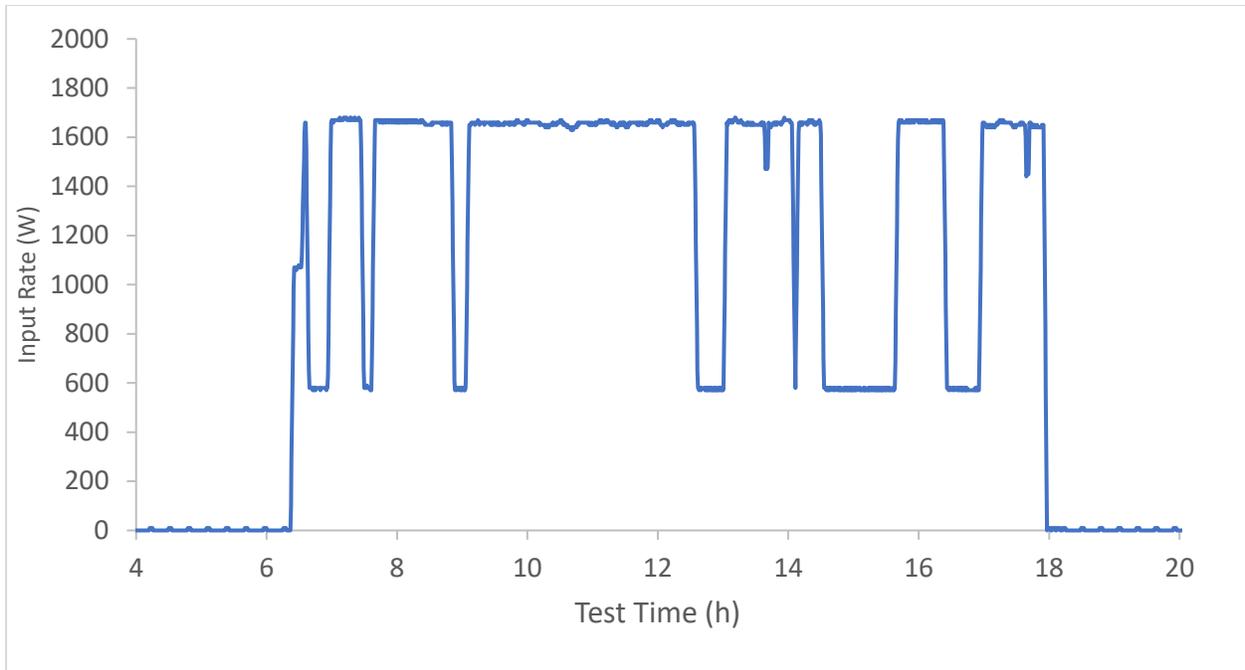


Figure 18: Voyager Craft Coffee Replacement Conveyor Toaster Operation, 10-Minute Setback

Results

Conveyor toasters are one of the strongest candidates for plug load energy reduction due to their high input rates and long hours of operation. Conveyor toasters were often the most energy intensive plug load appliance monitored in the participating sites. Replacements yielded an estimated average savings of about \$223/year in utility savings when using the average national electrical rate of \$0.15 per kWh.

Due to the relatively small price point difference between conveyor toasters with setback mode capabilities and conventional models, the simple payback time on the incremental cost difference is reasonable. Payback periods ranged anywhere from instant to six years at the very worst. The average payback period was about three years for a 120V toaster and three months for a 208V toaster. The payback period for 208V toasters is significantly shorter because energy consumption is much higher. From the data collected, the averaged measured energy consumption was nearly four times as large for 208V toasters than 120V toaster, 49 kWh/day to 12 kWh/day. However, the cost difference between 208V and 120V toasters isn't nearly as large, with the 208V units only costing 1.5 to 2 times more than 120V units.

Conveyor toasters have an average working life of about five years, so midlife equipment replacements can make sense for both 120V and 208V toasters. An early retirement program could yield significant energy savings in the commercial foodservice market because of the prevalence of conventional uncontrolled conveyor toasters. Additional research should be conducted to confirm the payback period for 208V conveyor toasters, which represents a strong energy savings opportunity at only a few months.

Overall, Frontier found that efficient conveyor toasters with automatic energy save modes reduced energy use by 21%, while still creating a quality product and without impacting speed of service. Operators found the efficient toasters to output less heat to the space and to be safer since they weren't as hot to the touch. Overall, sizeable energy savings and other benefits to the operator make conveyor toasters a strong replacement appliance option.

Table 1: Conveyor Toaster Results

| Site | Total Average Energy (kWh/d) | Total Average Hours (h) | Average Input Rate (kW) |
|----------------------|------------------------------|-------------------------|-------------------------|
| Baseline | | | |
| Caffe 817 | 15.5 | 8.8 | 1.766 |
| Mills | 10.7 | 11.5 | 0.930 |
| Rebecca's | 11.9 | 6.0 | 1.831 |
| Cafe/Bakery | 52.4 | 18.0 | 2.911 |
| Voyager Craft Coffee | 18.4 | 11.2 | 1.640 |
| Spreadz | 8.2 | 5.2 | 1.561 |
| Mission City Grill | 46.0 | 14.5 | 3.166 |
| Tech Cafe A | 8.0 | 5.0 | 1.589 |
| Plaza Suites | 14.4 | 11.3 | 1.280 |
| Café Gabriela | 11.3 | 6.5 | 1.727 |
| Average | 19.6 | 9.8 | 2.014 |
| Replacement | | | |
| Cafe/Bakery | 28.5 | 18.0 | 1.583 |
| Caffe 817 | 15.0 | 9.8 | 1.534 |
| Voyager Craft Coffee | 17.0 | 11.5 | 1.481 |
| Spreadz | 6.4 | 5.1 | 1.268 |
| Tech Cafe A | 9.0 | 6.6 | 1.356 |
| Mills | 8.1 | 11.5 | 0.708 |
| Average | 14.0 | 10.4 | 1.343 |

Table 2: Conveyor Toaster Replacement Data Comparison

| Site | Baseline or Replacement? | Total Average Daily Energy Usage (kWh/day) | Total Average Daily Hours of Operation (h/day) | Normalized Energy Usage Rate (kW) | Normalized Savings (%) | Payback Period (yrs) |
|-------------|--------------------------|--|--|-----------------------------------|------------------------|----------------------|
| Cafe/Bakery | Baseline | 52.4 | 18.0 | 2.911 | 45.6 | 0.2 |

| | | | | | | |
|-------------------------|-------------|------|------|-------|------|-------------|
| | Replacement | 28.5 | 18.0 | 1.583 | | |
| Caffe 817 | Baseline | 15.5 | 8.8 | 1.766 | 13.2 | 3.7 |
| | Replacement | 15.0 | 9.8 | 1.583 | | |
| Voyager Craft Coffee | Baseline | 18.4 | 11.2 | 1.640 | 9.7 | 6.1 |
| | Replacement | 17.0 | 11.5 | 1.481 | | |
| Spreadz | Baseline | 8.2 | 5.2 | 1.561 | 18.8 | 0 (Instant) |
| | Replacement | 6.4 | 5.1 | 1.268 | | |
| Tech Cafe A | Baseline | 8.0 | 5.0 | 1.589 | 14.7 | 5.4 |
| | Replacement | 9.0 | 6.6 | 1.356 | | |
| Mills | Baseline | 10.7 | 11.5 | 0.930 | 23.9 | 3.3 |
| | Replacement | 8.1 | 11.5 | 0.708 | | |
| Average | | | | | 21.0 | 3.1 |

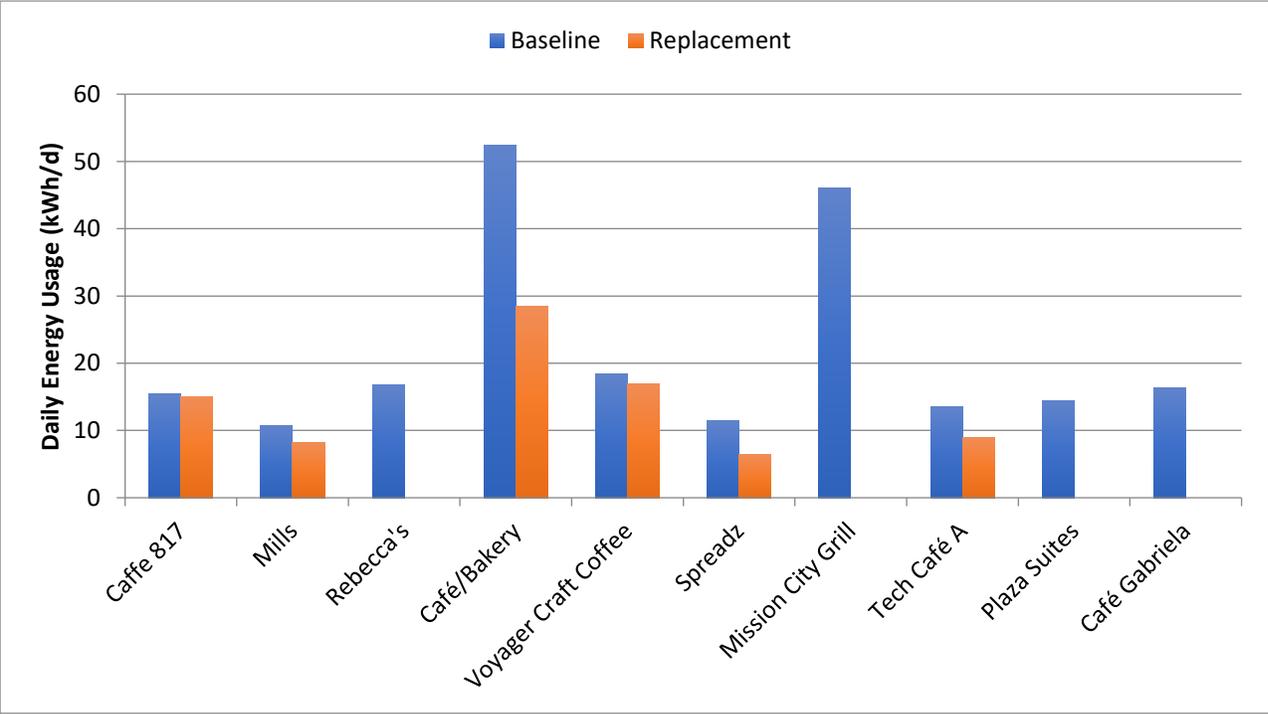


Figure 19: Conveyor Toaster Daily Energy Usage Comparison

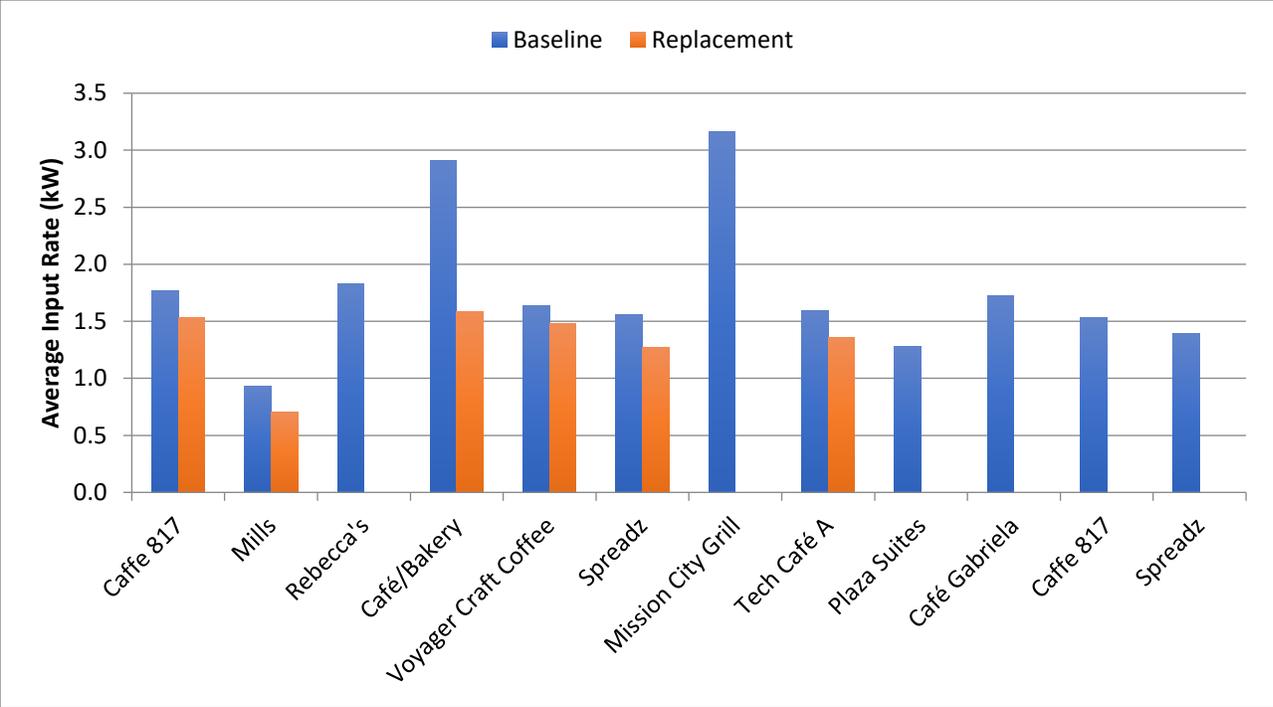


Figure 20: Conveyor Toaster Average Power Comparison