Keating Model 14 Incredible Frying Machine

In-Kitchen Appliance Performance Report

FSTC Report 5011.98.56

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Final Report, December 1998

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The information in this report is based on data generated at PG&E's Food Service Technology Center.

Acknowledgments

The establishment of the Food Service Technology Center reflects PG&E's commitment to the food service industry. The goal of the research project is to provide PG&E's customers with information to help them evaluate technically innovative cooking appliances and make informed equipment purchases regarding advanced technologies and energy sources. The project was the result of many people and departments working together within PG&E and the overwhelming support of the commercial equipment manufacturers who supplied the cooking appliances for testing.

PG&E's Food Service Technology Center is supported by the National Advisory Group that includes:

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McDonald's Corporation
National Restaurant Association
Safeway, Inc.
Underwriters Laboratories (UL)
University of California, Berkeley (UC Berkeley)
University of California, Riverside (CE-CERT)

Specific appreciation is extended to Keating for supplying the Food Service Technology Center with a model 14 IFM gas fryer for controlled testing in the appliance laboratory and subsequent installation and monitoring in the production-test kitchen.

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Contents

Contents

Executive Summary

This PG&E Food Service Technology Center (FSTC) research report presents the results of monitoring the Keating Model 14 Incredible Frying Machine gas fryer as it was used for routine menu production in PG&E's production-test kitchen and during tests under controlled laboratory conditions[1]. Keating's fryer was equipped with two infrared gas burners and three heat transfer tubes the burners are positioned in the two outer heat transfer tubes. The flue gases from the two burners were routed through the third heat transfer tubes which extracted additional remaining heat before the gases exited exiting the rear stack. Investigated performance indices included the measured peak energy input rate, preheat energy requirement and time, production energy consumption rate, idle energy consumption rate, and duty cycle. The fryer was monitored in the production-test kitchen over a 4-month test period. A summary of the test results is presented in Table ES-1.

To supplement monitoring information acquired during actual production conditions, controlled energy tests were also conducted.[1] The measured peak energy input rate was 81.8 kBtu/h, which was 3.5% higher than its 79.0 kBtu/h nameplate input. This fryer consumed 9,730 Btu of energy over the 7.0-minute preheat period (the time required to heat the frying medium from room temperature of 70°F ±5°F to 350°F). The rate of idle energy use averaged 4,700 Btu/h.

Energy use data for the four month test period was reduced to include only days that reflected typical fryer usage in the production-test kitchen (i.e., days when the fryer was used for two-meal periods). The fryer was used for an average of 6.0 hours, consuming 98,304 Btu per day. This includes the aggregate preheat, idle, and cooking energy for the entire day of appliance operation. The average rate of production energy use was 16,384 Btu/h, resulting in a production duty cycle of 20%.

Executive Summary

Table ES-1

Summary of Keating Model 14 IFM Gas Fryer Performance

Rated Energy Input (Btu/h)	79,000
Measured Energy Input Rate (Btu/h)	81,800
Preheat:	
Time to 350°F (min)	7.0
Energy Input (Btu/h)	9,730
Rate to 350°F(min)	40
Idle Energy Rate @ 350°F (Btu/h)	4,700
Idle Duty Cycle (%)	5.7
Production Energy Use (Btu/h)[a]	16,384
Appliance On-Time (h/d)	6.0
Average Production Energy Consumption Rate (Btu/day)	98,304
Production Duty Cycle (%)	20

[a] Includes preheat and idle energy over the hours of operation when fryer was in use.

Based on a 5-day per week, 52-week-per-year food service operation, the fryer would consume 25,559 kBtu per year. The total yearly cost to operate the fryer would be $164. This calculation is based on PG&E's G-NR1 schedule for commercial gas rates ($0.64/Therm) dated November 7, 1997.

The fryer was one of the most frequently used appliances in the production-test kitchen; it was used heavily to prepare a wide variety of items for lunch and dinner, including french fries, onion rings, fish fritters, fried chicken steak and breaded seafood. Over a typical day, the operators cooked about 50 pounds of food. Although the daily quantity of food was considered "light" compared to high volume fast food restaurants, it was considered representative of many corporate/commercial cafeteria operations offering a diverse menu mix to a broad customer base.

Executive Summary

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[1] Food Service Technology Center. In Press. Keating Model 14 IFM. *Application of ASTM Standard Test Method Designation F1361-95. Report 5011.95.32*, Products and Services Department, San Francisco, California: Pacific Gas and Electric Company.

1 Introduction

Background

The popularity of deep fried foods has increased in recent years leading to an increase in the purchase of deep-fat fryers by food service operations. These operations are becomingly increasingly sophisticated in their choice of equipment, with special emphasis on energy efficient equipment that meets their production capacity requirements. To meet the need for more fryer information, studies have been conducted on the performance characteristics of deep-fat fryers for the benefit of assisting customers with the selection of high performance, energy-efficient commercial cooking equipment.

PG&E's Food Service Technology Center monitored the Keating Model 14 IFM gas fryer under both laboratory and in-kitchen conditions. It was used for routine menu production in PG&E's production-test kitchen from September through December 1995. Five other fryers - two gas, three electric have similarly been monitored at the PG &E facility.[1,2,3] To supplement production energy monitoring data, controlled energy test data were also documented.

The glossary in Appendix A is provided so that the reader has a quick reference for the terms used in this report.

Objective

The objective of this appliance performance report was to document the energy consumption characteristics of the Keating gas fryer during the four months it was in operation at the production-test kitchen. The report documents fryer usage in relationship to its energy consumption and cost while in production. Therefore, the reader should bear in mind that this information is specific to PG&E's production-test kitchen, a corporate, cafeteria-style operation.

The Production Test Kitchen

The 1,500-square-foot kitchen is an integral component of the campus-style dining facility at PG&E's Learning Center in San Ramon, California. Nine cooking appliances are centrally located on two sides of a utility distribution system (UDS). The UDS functions as a central "spine" that contains all plumbing, wiring, and natural gas distribution lines. A 16-foot, double-sided canopy exhaust hood ventilates the equipment island at a design air flow of 9,600 cfm. Grilles along the front face of the hood direct makeup air into the kitchen.

The UDS was designed to accommodate quick connection and disconnection of the appliances as they are rolled in or out of the "line," with the flexibility to accommodate either a gas or an electric model in each appliance slot. Gas and electric meters interface with a remote data acquisition and processing system. Appliance monitoring and performance evaluations are conducted by the FSTC research team, independent of the food service operation.

Figure 1-1 is a floor plan of the production-test kitchen and appliance lineup.

Appliance Description and Operation

The Keating gas fryer incorporates the latest technology, including powered infrared burners, patent pending reclamation tubes, automatic basket lifts, electronic timers with Instant On™, and stainless steel construction.

The thermostatically controlled fryer is powered by two infrared burners, each rated at 39,500 Btu. Gas mixes with air as it enters the venturi, and the mixture is forced through a fine ceramic mesh screen. This mixture ignites on the outside surface of the ceramic, causing it to glow red. The glowing ceramic emits infrared radiation that is collected by the tube walls, which in turn transmit heat into the frying medium. A third heat transfer tube in the center of the frypot acts as a recycle baffle for the flue gases.

Introduction

Keating's patent pending Instant On™ improves fryer response time by anticipating loading. Designed to be used with automatic basket lifts, Instant On™ bypasses the thermostat and cycles the burners on when the cook timers are activated. The frying medium begins to heat just before the load hits, thereby reducing the total temperature drop. Table 1-1 presents the specifications for this Keating fryer and the manufacturer's product literature appears in Appendix B.

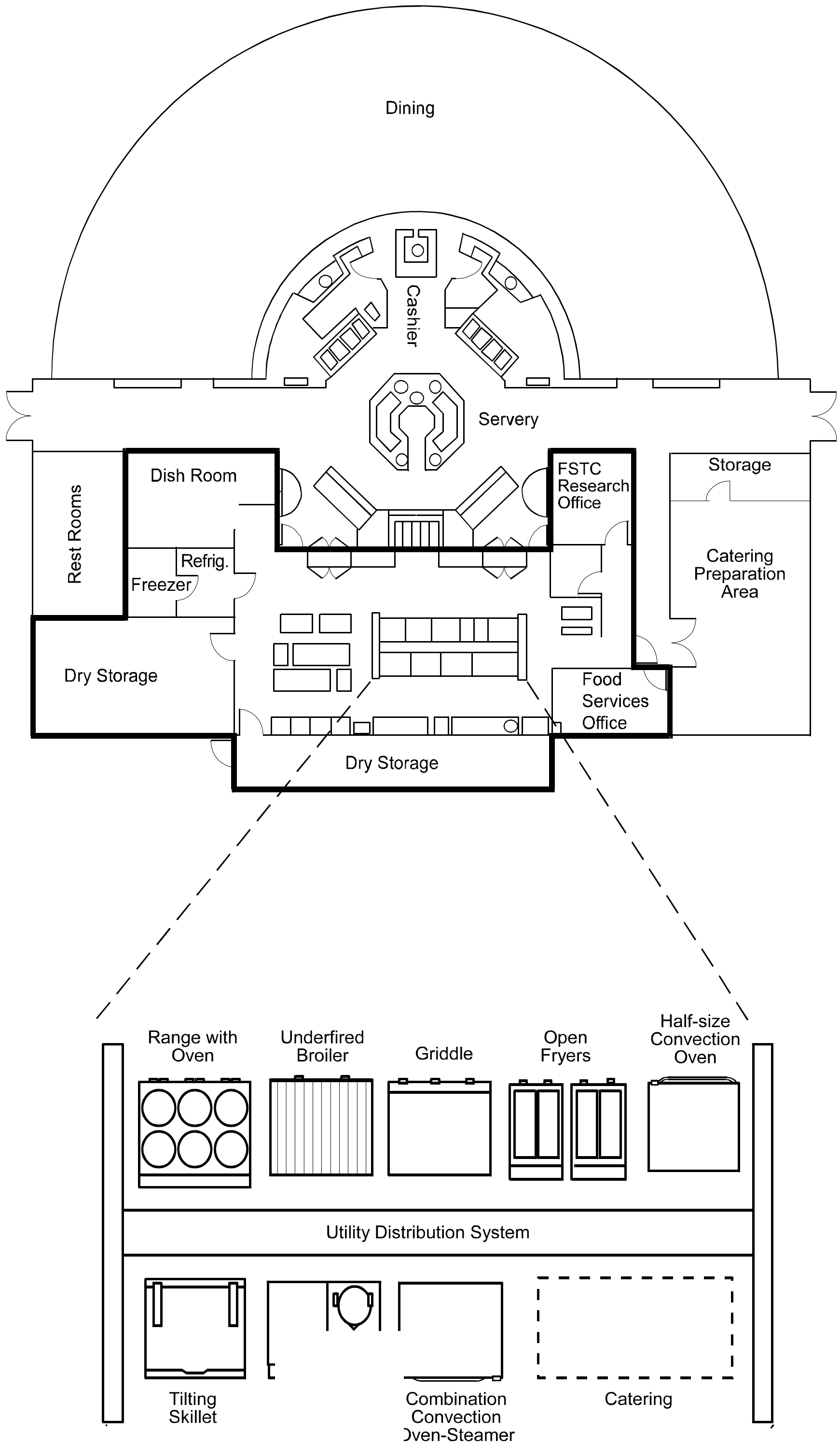


Figure 1-1.

Production-test kitchen,

PG&E Learning Center.

Table 1-1. *Appliance Specifications for the Keating Gas Fryer.*

Generic Appliance Type:	Open, deep- fat fryer
Manufacturer:	Keating of Chicago, Inc.
Model:	14 IFM Gas
Rated Energy Input:	79,000 Btu/h
Heat Transfer:	Three tubes made of mirror polished stainless steel. The middle tube has a patent applied for recycle baffle inside to increase efficiency. Two incone mesh tubular type burners en-cased in ceramic cloth.
Fryer Medium Capacity:	44 lbs.
Frying Area:	13-3/4” x 15-3/4”
Construction:	16 gauge stainless steel with three 18 gauge stainless steel heat transfer tubes polished to a mirror #7 stainless steel finish.
Controls:	Hydraulic type, close range thermostat accu-rate to ± 2° F from 250° F to 375°F with stainless steel bulb tip. Two electronic timers settable from 0 to 90 minutes with memory repeat and Instant-On™ start mode. 100% Safety Shut Off spark ignition control module that has a sensor to shut system down if ignition does not occur in 2-½ seconds.
Accessories:	Pair of chrome plated mesh fry baskets, chrome plated grid screen, sample of Keating Klenzer and Sea Powder.

2 Controlled Energy Tests

Purpose

The purpose of conducting energy tests under controlled, or lab-style conditions is to:

1. Verify that the appliance operates at the manufacturer's rated energy input.
2. Characterize preheat and idle energy use under select operating conditions.

Methods and Results

FSTC researchers operated the Keating 14 IFM gas fryer under controlled laboratory conditions and in accordance with the *ASTM Standard Test Method for the Performance of Open, Deep Fat Fryers* (Designation F1361-95)[4]. For a detailed discussion of the development of the procedures and test results, refer to PG&E's *Development and Application of a Uniform Testing Procedure for Open, Deep Fat Fryers* (Report 008.1-90.22)[2]. A complete application of the standard test method was applied to the Keating's gas fryer is discussed in the FSTC report on the Keating fryer performance test[1].

The controlled energy tests were conducted with the thermostat set to a calibrated 350°F set point. The energy input rate was determined as part of the preheat test. The fryer was loaded with oil to the indicated fryer fill line and then turned on. Energy consumption and time were monitored until the temperature in the center of the cooking zone was 350°F. For the idle test, the fryer was allowed to stabilize at 350°F for one hour. After the fryer had stabilized, the energy was monitored over a 2-hour idle period. All tests were conducted using partially hydrogenated vegetable based frying medium.

Results of the controlled testing are summarized in Table 2-1.Figure 2-1 plots the oil temperature and fryer energy consumption during the preheat test.

Controlled Energy Tests

Table 2-1. *Summary of Controlled Energy Tests of the Keating 14 IFM Gas Fryer*

Rated Energy Input Rate (Btu)	79,000
Measured Energy Input Rate (Btu)	81,800
Preheat:	
Time to 350°F (min)	7.0
Energy to 350°F (Btu/h)	9,730
Rate to 350°F(°F/min)	40
Idle Energy Rate (Btu/h)	4,700
Idle Duty Cycle (%)	5.7

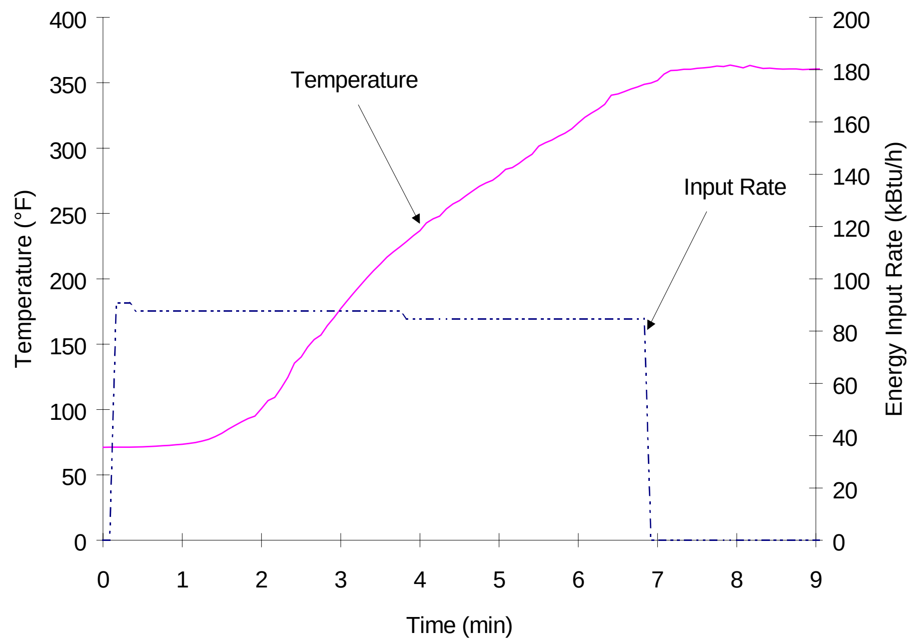


Figure 2-1.
Preheat test at 350°F

3 Production Monitoring

Energy Performance

The dataset from which the "typical day" characteristics were quantified covers a 4-month period, from September through December 1995. All Fridays, Saturdays, Sundays, and holidays were eliminated from the dataset because they were not considered typical of fryer usage in this operation. The production duty cycle was derived by dividing the average production energy consumption by the appliance's peak energy input rate. The average daily energy performance for the Keating 14 IFM fryer is summarized in Table 3-1. The energy monitoring system used to collect the data is described in Appendix C.

Table 3-1.
Average Daily Energy Performance

Average Daily Energy Performance

Measured Peak Energy Input Rate (kBtu)	81.8
Daily Production Energy Use (kBtu/d) [a]	95.3
Appliance On-Time (h/d)	6.0
Production Energy Consumption Rate (kBtu)[b]	16.4
Production Duty Cycle (%)	20

[a] Includes preheat and idle energy over the hours of operation when the fryer was in use.
[b] Note that the average production energy consumption rate was based on aggregate preheat, idle and cooking energy for the hours of operation over the two meal periods.

The energy consumption profile plotted in Figure 3-1 characterizes the typical day energy use for the fryer in the production test kitchen. The energy consumption data are presented on a 1-minute basis (dotted line plot) and a 15 minute "sliding window" average (solid line plot). The energy consumption plot illustrates that the fryer was used for two distinct meal periods (lunch and dinner) for a total appliance on time of 6 hours. The higher energy consumption peaks at the beginning of each operation reflect the energy required to preheat the fryer to a set operating temperature. Following each preheat period, the intermittent spikes above the idle or base rate of energy use reflect the incremental energy required to cook the food product loaded into the fryer.

Energy consumption varied from 21.6 kBtu to 137.5 kBtu per day, and appliance on-time varied from 2 hours to 10 hours per day. The frequency distributions for daily production energy use and hours of operation for the fryer are presented in Appendix D.

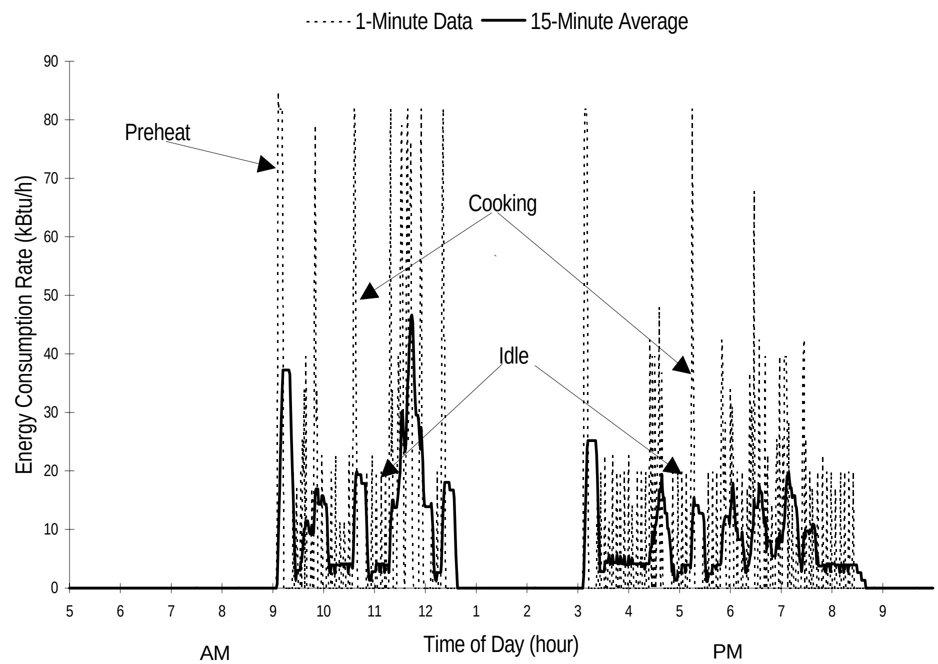


Figure 3-1.
Typical day energy consumption profile.

Note: The energy consumption profile for the typical day is plotted on a 15-minute average. The 1-minute plot reflects the instantaneous input of energy into the appliance during preheat and subsequent element cycling during idle, while the 15-minute plot better characterizes the average rate of energy use (see Appendix C).

Estimated Annual Energy Cost

Based on the average daily energy consumption and assuming a 5-day per week, 52-week-per-year food service operation, the fryer would consume an estimated 25,559 kBtu per year . At a cost of $0.64 per therm, the total cost to operate the fryer would be $164 per year.

These costs of operation, as shown in Table 3-2, were calculated using a seasonally weighted average of PG&E's gas rates (Schedule G-NR1) for small commercial customers, which would be applicable if the production test kitchen were billed separately (Appendix E).

Table 3-2.

Estimated Annual Energy Cost

Annual Production Energy Consumption (98.3 kBtu/d x 5 days x 52 weeks per year) (kBtu)[a]	25,559
Annual Energy Cost[b] Total Annual Energy Cost for Fryer	$163.57

[a]Note: Estimates are based on PG&E's G-NR1 rate schedule in effect on November 7, 1997 (see Appendix E).
[b] Does not include customer charges.

Food Production

The Keating gas fryer was frequently used for preparation of many lunch and dinner items in the production-test kitchen. An FSTC researcher observed the gas fryer during several periods of normal operation and interviewed the cooks. The cooks' daily worksheets were also reviewed to obtain a list of the food items prepared and to determine how the fryer was being used. Figure 3-2 depicts the Keating fryer in operation.

Items Cooked

The fryer was used daily to prepare similar items for both the lunch and dinner meal periods: french fries, onion rings, fish, corn fritters, chicken fried steak, calamari, zucchini sticks and clam strips.

Figure 3.2
Keating Infrared Gas Fryer in the production test kitchen

In-Kitchen Observations

In-kitchen observations provided information about actual kitchen staff usage of the fryer over a typical day of operation. It was operated for around 6 hours over two distinct periods (lunch and dinner), providing more than 500 meals per day and used about 98.3 kBtu of energy per day. The thermostat was set at 350°F. The fryer was usually turned on at 9:00 A.M. and left on until approximately 1:00 P.M., at which time it was shut off. It was turned on again at around 4:00 P.M. and operated until 9:00 P.M. During these periods, it was used to cook approximately 50 pounds of food. The period of heaviest cooking occurred between 11:30 A.M. and 12:45 P.M.

Interviews with the cooks also furnished non-energy performance information about the fryer. The Keating fryer received high praise for ease of use and convenience of its controls. Equipped with a timer, the Keating fryer was a food saver, resulting in very little burnt product.

4 Conclusions and Recommendations

Production

The energy performance of the Keating 14 IFM gas fryer was successfully monitored and documented as it was operated in the production-test kitchen. In-kitchen observations were beneficial to understand how the appliance was used by the food service staff. Fryer usage was typical of many food service operations in that the operators deep-fried standard food items such as french fries, onion rings and breaded food (chicken, fish , shrimp, clam strips, calamari and zucchini sticks). Although the quantity of food cooked (an average of 50 pounds per day) would be considered "light" compared to high volume fast food restaurants, it was considered representative of many corporate/commercial cafeteria operations offering a diverse menu mix to a broad customer base. The fryer was operated on an average of 6 hours per day during lunch and dinner. The fryer was routinely turned off between these two meal periods. The fryer thermostat was set at 350°F, a standard temperature setting in commercial food service operations.

Energy Consumption and Conservation Potential

Laboratory testing at the FSTC found the Keating gas fryer to have the highest cooking energy efficiencies of any other gas fryers tested. In the production-test kitchen, the production energy consumption rate was slightly lower for this fryer, demonstrating the increased energy efficiency.

It was estimated that the fryer would consume 25,559 kBtu per year for this 5-day per week food service operation. This corresponds to an annual energy cost of $164 based on PG&E's applicable gas rates (G-NR1) to small, commercial core customers.

The chefs generally turned the fryer on at 9 A.M. until 9 P.M. A 10% reduction in energy use is possible if the fryer could be turned off for 3 hours each day. Even under such heavy-use patterns, as seen in the production-test kitchen, a 3-hour non-production period is feasible between the lunch period and the beginning of dinner preparation (see Figure 3-1).The Keating gas fryer is a “workhorse” appliance and, as supported by interviews with the kitchen staff, performed favorably. Both the laboratory and in-kitchen performance indices reflect that this fryer is an energy efficient appliance.

5 References

1. Food Service Technology Center. 1995. *Keating Model 14 IFM Gas Fryer Performance Test.* Report 5011.95.32. Products and Services Department. San Francisco, California: Pacific Gas and Electric Company.

2. Food Service Technology Center. 1991. *Development and Application of Uniform Testing Procedure for Open, Deep Fat Fryers*. Report 088.1-90.22. Department of Research and Development. San Ramon, California: Pacific Gas and Electric Company.

3. Food Service Technology Center. 1990. *PG&E Production-Test Kitchen: Cooking Appliance Performance Report*. Report 008.1-90.8. Department of Research and Development. San Ramon, California: Pacific Gas and Electric Company.

4. American Society of Testing and Materials. *Standard Test Methods for the Performance of Fryers*. Designation F275-95. In Annual Book of ASTM Standards. Philadelphia: American Society for Testing and Materials.

A Glossary

Appliance On-Time (minute, hour)
Hours of Operation
Operating Period
Operating Time
The total period of time that an appliance is operated (from the perspective of food service staff) from the time it is turned "on" to the time it is turned "off." Appliance on-time excludes any "off" periods between the first and last appliance operation.

Average Daily Production Energy Consumption Rate (kW or kBtu/h)
The average rate of production energy consumption based on the daily production energy consumption and the appliance operating or "on" time.

Average Daily Production Energy Rate =

$$\frac{\text{Daily Production Energy Consumption}}{\text{Appliance On - Time}}$$

Note: By basing the total daily production energy consumption on a 24-hour period, the total quantity of pilot energy (if applicable) is considered within the average production energy consumption rate and is based on the actual period of appliance usage.

Average Production Energy Consumption Rate (kW or kBtu/h)
Average Production Energy Rate
Average Production Energy Use Rate
The average rate of production energy consumption based on the production energy consumption and the appliance operating or "on" time for a specified period of appliance operation.

Average Production Energy Consumption Rate =

$$\frac{\text{Production Energy Consumption}}{\text{Operating Time}}$$

Baseload Energy Consumption (Btu or kBtu)
Baseload Energy
The total amount of energy that would be consumed over the operating period of an appliance if it had never been used to cook food.

Baseload Energy Consumption Rate (kW or kBtu/h)
Base Rate
Baseload Energy Rate
Baseload Rate
The lowest rate of energy consumption reflected by the energy consumption profile (based on a 15-minute sliding window average) recorded during appliance operation. Generally, this definition is not extended to include the rate of pilot energy consumption. It is typically equal to the lowest value of idle energy consumption rate.

Cold Zone
The volume in the fryer below the heating element(s) or heat exchanger surface designed to remain cooler than the fry zone and hot zone.

Cook Zone
Cooking Zone
The volume of oil in the fryer where the fries are cooked. Typically, the entire volume from the heating element(s) of a heat exchanger surface to the surface of the frying medium.

Cooking Energy Consumption (kWh or kBtu)
The total energy consumed by an appliance during the cooking period.

Cooking Energy Consumption Rate (kW or kBtu/h)
The average rate of energy consumption during the cooking period.

Cooking Energy Efficiency
The quantity of energy input to the food products; expressed as a percentage of the quantity of energy input to the appliance during the heavy-, medium-, and light-load test.

Cooking Period (minute, hour)
The period of time (derived from in-kitchen monitoring or by interpreting the energy consumption profile) that an appliance is actually used for cooking.

Glossary

Daily Energy Consumption (kWh or kBtu)

Daily Energy Use
Daily Production Energy Consumption
Daily Production Energy Use

The total amount of energy consumed by an appliance as it is used within the Production-Test Kitchen over a 24-hour period.

Note: By basing the total daily production energy consumption on a 24-hour period, the total quantity of pilot energy (if applicable) is considered within the average production energy consumption rate.

Energy Consumption Profile

Energy Use Profile

A plot of appliance energy consumption showing energy consumption rate on the Y-axis and time on the X-axis.

Note: The area under the curve (plot) represents the total energy consumption for the period of integration. For uniformity in production reports, use the following terms and units for the coordinate labels:

y-axis: Energy Rate (kW or kBtu/h)

x-axis: Time (AM & PM)**:** (Hour) (Min)

Energy Consumption Rate (kW or kBtu/h)

Energy Input Rate
Energy Rate

The rate of appliance energy consumption over a specified period of operation (see Energy Consumption Profile).

Energy Use Data Set

A set of daily energy consumption data compiled in accordance with typical day criteria.

Hot Zone

The area surrounding the heating element(s) or heat exchanger surface.

Idle Energy Consumption (kWh or kBtu)

Idle Energy Use

The amount of energy consumed by an appliance operating under an idle condition over the duration of an idle period.

Idle Energy Consumption Rate (kW or kBtu/h)

Idle Energy Input Rate
Idle Energy Rate
Idle Rate

The rate of appliance energy consumption while it is “idling” or “holding” at a stabilized operating condition or temperature.

Idle Duty Cycle (%)

Idle Energy Factor
Idle Load Factor

The idle energy consumption rate expressed as a percentage of the measured energy input rate.

Idle Energy Factor =

$$\frac{\text{Idle Energy Consumption Rate}}{\text{Measured Energy Input Rate}} \times 100$$

Idle Temperature (°F, Setting)

The temperature of the cooking cavity/surface (selected by the appliance operator or specified for a controlled test) that is maintained by the appliance under an idle condition.

Idle Time (minutes, hour)

Idle Period

A period of time that an appliance is consuming energy at its idle energy consumption rate while maintaining a specified stable operating condition or temperature.

Note: Idle time may include both necessary or unnecessary appliance “idling.” This is simply differentiated by applying the appropriate adjective to the idle energy period term (e.g., needless idle time, necessary idle period.)

Measured Energy Input Rate (kW, W or kBtu/h, Btu/h)
Measured Input
Measured Peak Energy Input Rate
Peak Rate of Energy Input
The maximum or peak rate at which an appliance consumes energy, measured during appliance preheat or while conducting a water-boil test (i.e., the period of operation when all burners or elements are "on")

Pilot Energy Consumption (kBtu)
Pilot Energy Use
Standing or Constant Pilot Energy Consumption
Standing or Constant Pilot Energy Use
The amount of energy consumed by the standing pilot of an appliance over a specified period of time.

Pilot Energy Rate (kBtu/h)
Average Pilot Energy Rate
Average Pilot Energy Use Rate
Pilot Energy Consumption Rate
The rate of energy consumption by the standing or constant pilot while the appliance is not being operated (i.e., when the thermostats or control knobs have been turned off by the food service operator).

Preheat Energy Consumption (kWh or kBtu)
Preheat Energy
The total amount of energy consumed by an appliance during the preheat period.
Note: The reporting of preheat energy must be supported by the specified temperature/operating condition.

Preheat Energy Rate
The rate of appliance energy consumption while it is "preheating" to a predetermined temperature.

Preheat Time (minute, hour)
Preheat Period
The time required for an appliance to "preheat" from the ambient room temperature (75 ± 5°F) to a specified (and calibrated) operating temperature or thermostat set point.

Production Day
Production Period
The time period when an appliance is used by the kitchen staff, typically between the hours of 5 A.M. and 8 P.M.

Production Duty Cycle (%)
Load Factor
Production Energy Factor
Production Factor
The average production energy consumption rate (based on a specified operating period for the appliance) expressed as a percentage of the measured energy input rate.

Production Duty Cycle =

$$\frac{\text{Average Production Energy Consumption Rate}}{\text{Measured Energy Input Rate}} \times 100$$

Production Energy Consumption (kWh or kBtu)
Production Energy Use
The total amount of energy consumed by an appliance as it is used within the Production-Test Kitchen over a specified time period (e.g., 10 A.M. to 1 P.M., dinner period). Production energy consumption is numerically equal to daily energy consumption if the production period is not specified.
Note: This integrated energy use includes preheat energy, idle energy, and pilot energy associated with the specified time period.

Rated Energy Input Rate (kW, W or kBtu/h, Btu/h)
Input Rating (ANSI definition)
Nameplate Energy Input Rate
Rated Input
The maximum or peak rate at which an appliance consumes energy as rated by the manufacturer and specified on the nameplate.

Typical Day

A selected day of energy usage based on predetermined criteria that will generate a production energy consumption profile reflecting typical production usage for a specific appliance. The typical day criteria may comprise:

- Typical day energy consumption should approximate average daily energy consumption for energy use data set.
- A specified number of appliance operations and/or cooking periods (e.g., lunch and dinner only).
- A specified range in operating hours.
- A specified mode of operation (or combination of modes) may be associated with a typical day's operation.

B Manufacturer's Product Specifications

C Energy Monitoring System

Energy data are collected once each minute, which means that the highest resolution measurement of energy rate is a 1-minute average. This 1-minute average, shown as the dotted line on the graph of the typical day profile, differs from actual instantaneous power explained in the following paragraphs.

Short periods of full input are not reflected as full input. Heating elements and burners are usually either full on or off. A plot of 1-minute data may show some less-than-full-on 1-minute values because the elements or burners operate on full for only part of the minute.

Long periods of constant input rate are usually reflected as a sawtooth pattern. Gas pulses are generated by the meter, which measures the flow of gas to the appliance. Each pulse corresponds to a specific quantity of gas energy consumed. The system stores the number of pulses for each minute, but it only stores an integer value for the number of pulses even though the actual energy consumed during the period corresponds to a non-integer value. For example, if the actual consumption during a 1-minute period corresponds to 6.6 pulses, only the integer "6" will be stored for that minute. The "0.6" will be carried forward and added to pulses generated during the next minute. If the energy consumed during the next minute is also 6.6 pulses, then the pulse value stored will be the integer portion of 7.2 (6.6 + 0.6) and the 0.2 will be carried to the next time interval.

D Frequency and Distribution of Dataset

Figure D-1.
*Frequency of gas fryer daily pro-
duction
energy consumption.*

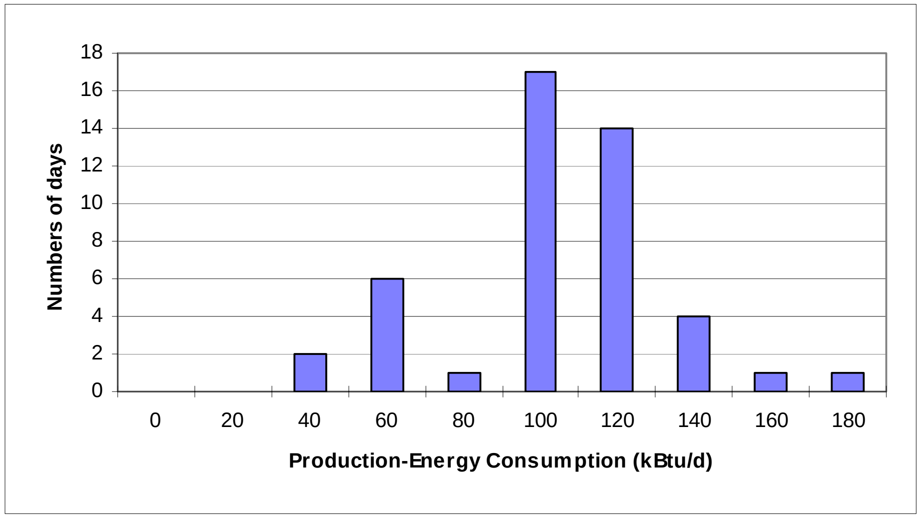
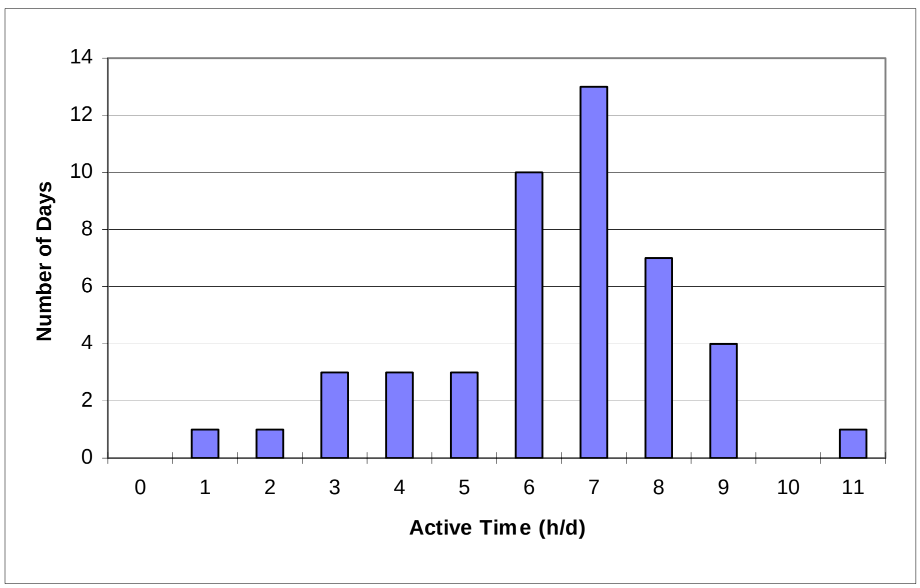


Figure D-2.
Frequency of gas fryer daily on-time.



E PG&E Energy Rates