Pitco Model RPB14 Technofry 1™
Floor Model Gas Fryer

In-Kitchen Appliance Performance

Report 5011.94.10

Food Service Technology Center Manager: Don Fisher

Production-Test Kitchen

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POLICY ON THE USE OF FOOD SERVICE TECHNOLOGY CENTER TEST RESULTS AND OTHER RELATED INFORMATION

- The Food Service Technology Center (FSTC) is *strongly* committed to testing food service equipment using the best available scientific techniques and instrumentation.

- The FSTC is neutral as to fuel and energy source. It does not, in any way, encourage or promote the use of any fuel or energy source nor does it endorse any of the equipment tested at the FSTC.

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PREFACE

The decisions involving the purchase of modern food service equipment are influenced by many factors. Cost is certainly a priority. Are extra features worth the extra cost? Performance considerations are crucial. Will advanced technology, fuel-efficient appliances show a good return on the investment? Should appliances be gas or electric? How much will they cost to operate? Can an appliance meet peak production demands? The food service industry has historically relied on manufacturer specifications and limited test data when selecting new equipment.

PG&E is providing a source of reliable information through its Food Service Technology Center (FSTC) in San Ramon, California. The appliance testing program at the FSTC was originally undertaken to respond to the many requests for information about the performance of cooking appliances PG&E receives from the 25,000 food service customers in its service territory. Since its beginning in 1986, the project has grown into a full-scale research program, combining the sophisticated instrumentation and controlled environment of a laboratory with the real-life conditions of a production kitchen. The FSTC comprises two distinct, but complementary, research components.

The first, integrated with PG&E's corporate Learning Center, is the production-test kitchen. This facility is a unique combination of a food service operation and a test environment. As a production kitchen, it provides cafeteria-style breakfast and lunch and sit-down dinner for 500 customers a day. As a test kitchen, it is equipped to monitor the energy consumed by both gas and electric cooking appliances as they are used for routine menu production by the kitchen staff. Appliance usage and associated energy consumption patterns in the production-test kitchen are used to support the development of laboratory test methods.

The second component is an appliance laboratory equipped with energy monitoring and data acquisition equipment, 60 feet of canopy exhaust hoods integrated with utility distribution systems, appliance setup and storage areas, and a state-of-the-art demonstration and training facility. Within the Center, the research team develops uniform testing procedures to evaluate the overall performance of both gas and electric cooking equipment. These test methods focus on measuring the energy consumption and production capacity of an appliance as it is used to cook standardized loads of typical food product.

ACKNOWLEDGMENTS

The establishment of a state-of-the art Food Service Technology Center reflects PG&E's commitment to the hospitality industry. The goal of the research project is to provide PG&E's food service 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 equip-met manufacturers who loan the cooking appliances for testing. Specific appreciation is extended to Pitco Frialator, Inc., for supplying the Food Service Technology Center with a Model RPB14 Technofry1™ gas fryer for controlled testing in the appliance laboratory and subsequent installation and monitoring in the production-test kitchen.

PG&E's Food Service Technology Center acknowledges the support of the project's National Advisory Group. Participating organizations from the research community include the Electric Power Research Institute (EPRI), the Gas Research Institute (GRI), the American Gas Association Laboratories (AGAL), and Underwriters Laboratories (UL). Representing end users are the National Restaurant Association, the California Restaurant Association, McDonald's Corporation, Darden Restaurants, Inc., Marriott International and the International Facility Management Association (IFMA).

EXECUTIVE SUMMARY

This research report presents the results of monitoring the Pitco Model RPB14 Technofry1™ floor model gas fryer as it was used for routine menu production in PG&E's production-test kitchen and during tests under controlled conditions. The primary objective was to measure fryer energy usage over a typical day of operation. The Pitco gas fryer was monitored over a six-month test period. To supplement in-kitchen energy information acquired during actual production conditions, controlled energy tests were also conducted. A summary of the test results is presented in Table ES-1.

Table ES-1

Summary of Pitco Model RPB14 Technofry1 Gas Fryer In-Kitchen Energy Performance

Rated Energy Input (kBtu/h) [a]	80.0 (80,000 Btu/h)
Measured Peak Energy Input Rate (kBtu/h)	81.5 (81,500 Btu/h)
Preheat:	
Time to 350°F (min)	10.5
Energy (kBtu)	13.8
Rate to 350°F (°F/min)	25.6
Idle Energy with Thermostat Set to 350°F (kBtu/h)	5.6
Idle Duty Cycle (%)	6.9
Production Energy Use (kBtu/d) [b, c]	97.4
Appliance On-Time (h/d)	8.6
Average Production Energy Consumption Rate (kBtu/h)	11.3
Duty Cycle (%)	13.9

[a] 1 kBtu/h = 1,000 Btu/h
[b] Includes preheat, idle, and cooking energy when the fryer was in use.
[c] Energy consumption is based on a heating value of 1,025 Btu/ft^3.

Energy use data for the test period were 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—lunch and dinner). The hours of operation over the day averaged 8.6, during which time the fryer consumed 97.4 kBtu. The average rate of production energy use (based on the aggregate preheat, idle, and cooking energy for the entire day of appliance operation) was 11.3 kBtu/h, resulting in a duty cycle of 13.9%. Earlier monitoring of gas fryers in the production-test kitchen showed production energy consumption rates of 13.9 kBtu/h for an 80 kBtu/h-nameplate rated infrared gas fryer and 17.8 kBtu/h for a 85 kBtu/h-nameplate atmospheric fryer, resulting in duty cycles of 17%, and 21%, respectively. At 14%, the Technofry has the lowest duty cycle of the gas fryers monitored in the production-test kitchen.

Based on a 5-day-per-week, 52-week-per-year food service operation, the fryer would consume an estimated 25,324 kBtu per year, or 253 therms. This corresponds to an annual energy cost of $131 based on PG&E's applicable rate schedule for natural gas ($0.52/therm) and represents an average monthly energy cost of approximately $11.

Fryer usage by the production staff was typical of many food service operations—the cooks deep-fried standard food items such as French fries, onion rings, tempura vegetables, eggrolls, breaded seafood, and chicken. Over a typical day, they cooked about 50 pounds of food in the fryer. Although the daily quantity of food cooked 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.

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Section 1

INTRODUCTION

The Pitco Model RPB14 Technofry1 gas floor model fryer, along with an electric Pitco floor model fryer,[1] was monitored for energy consumption in PG&E's production-test kitchen over a 6-month test period. To supplement production energy monitoring data, controlled energy test data were documented.[2,3] The RPB14 gas fryer was also tested in the appliance laboratory according to the American Society for Testing and Materials (ASTM) Standard Test Method for the Performance of Open Deep Fat Fryers (ASTM Designation F 1361-91).[4] A glossary of the terms used in this report is provided in Appendix A.

OBJECTIVES

The objective of this appliance performance report is to present the energy consumption characteristics of the Pitco Model RPB14 Technofry1 gas fryer during the six months it was in operation at PG&E's production-test kitchen. The report documents how the fryer was used and the relationship of its energy consumption to its operating characteristics 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.

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 (Figure 1-1). Nine cooking appliances are centrally located on two sides of a utility distribution system, which 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 production center 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 an interdisciplinary research team, independent of the food service operation.

APPLIANCE DESCRIPTION AND INSTALLATION

The Pitco RPB14 Technofry1 gas fryer was set up in accordance with the manufacturer's installation manual. Appliance specifications are summarized in Table 1-1. The manufacturer's specification sheet is in Appendix B.

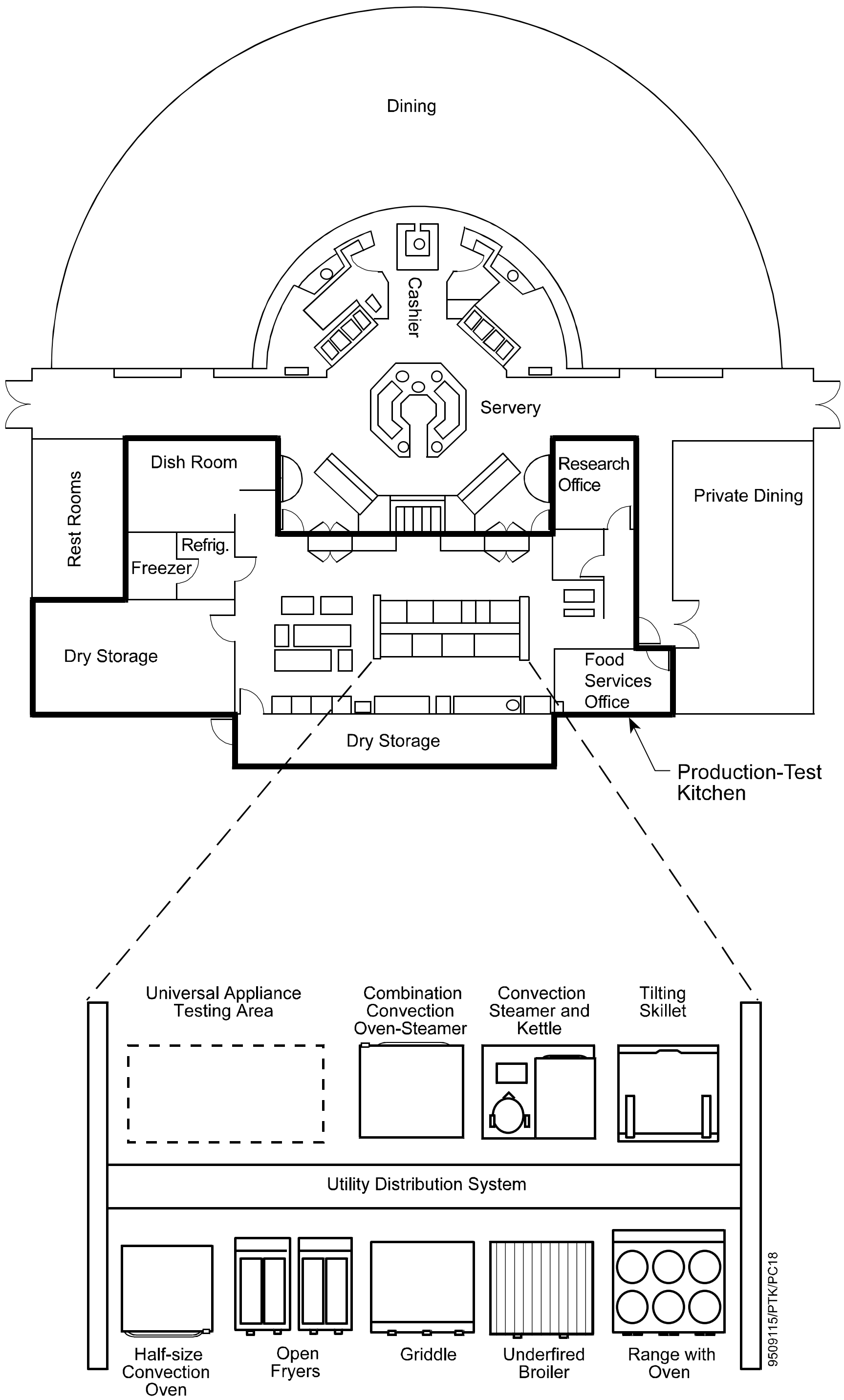

Figure 1-1. Dining facility, PG&E Learning Center.

Table 1-1

Appliance Specifications

Generic Appliance Type:	Thermostatically controlled fryer
Manufacturer:	Pitco Frialator, Inc.
Model:	RPB14 Technofry1™ Floor Model Gas Fryer
Rated Energy Input:	80,000 Btu/h (80.0 kBtu/h)
Heat Transfer:	Two metal fiber, radiant power burners
Controls:	Electronic ignition featuring Pitco's Hot Surface Ignition (HSI). Proportional solid-state temperature control, external power switch, a white power on indicating light, a green temperature light to show the burners are on, and a red HI temperature light to indicate limited control operation. Both melt and non-melt cycles are built in. Supplied with a 6' power cord.
Configuration:	Single vat with integral cold zone. The fry vat is constructed of welded 16 US Std. gauge Type 304 stainless steel sides, front, and bottom. Heat exchanger tubes are also No. 11 US Std. gauge 304 stainless steel.
Frying Medium Capacity:	Minimum 40 lb; Maximum 50 lb
Dimensions:	Width: 13-5/8" x 14" inches
Accessories:	Two nickel plated 3x3 wire mesh twin (oblong) fry baskets or one nickel plated 3x3 wire mesh square fry basket
Options:	Casters, basket lifts, built-in filter, UFM filter, covers

The Pitco Frialator Model RPB14 features the manufacturer's new Technofry1 radiant burner design: A fan circulates the unburned fuel-air mixture through a metal fiber honeycomb. The mixture burns on the outside of this honeycomb, causing it to glow red and emit infrared radiation to the surrounding tube walls. Each baffled tube provides a large surface area to transfer heat to the frying medium. Burned gases are then circulated around the fry vat prior to being exhausted to the atmosphere through the flue.

Section 2

CONTROLLED ENERGY TESTS

PURPOSE

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

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

METHOD

The controlled energy tests were conducted with the thermostat at the 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, with the temperature controls set to 350°F. Energy consumption was monitored for the preheat period, after the fryer was first turned on. Preheat was considered complete when the temperature measured by the thermocouple above the thermostat reached 350°F. For the idle test, the fryer was allowed to stabilize at 350°F for 1 hour. After the fryer had stabilized, the energy was monitored over a 2-hour idle period. All tests were conducted using a partially hydrogenated soybean-based frying medium.

RESULTS

The results of the controlled energy tests are summarized in Table 2-1. The measured peak energy input rate for this fryer was 81.5 kBtu/h, confirming its 80.0 kBtu/h nameplate input. The time and energy required to preheat the fryer to 350°F from an ambient temperature state are illustrated in Figure 2-1.

Table 2-1

Summary of Fryer Controlled Energy Test

Rated Energy Input (kBtu/h)	80.0
Measured Peak Energy Input Rate (kBtu/h)	81.5
Preheat	
Time to 350°F (min)	10.5
Energy (kBtu)	13.8
Rate to 350°F (°F/min)	25.6
Idle Energy with Thermostat Set to 350°F (kBtu/h)	5.6
Idle Duty Cycle (%)	6.9

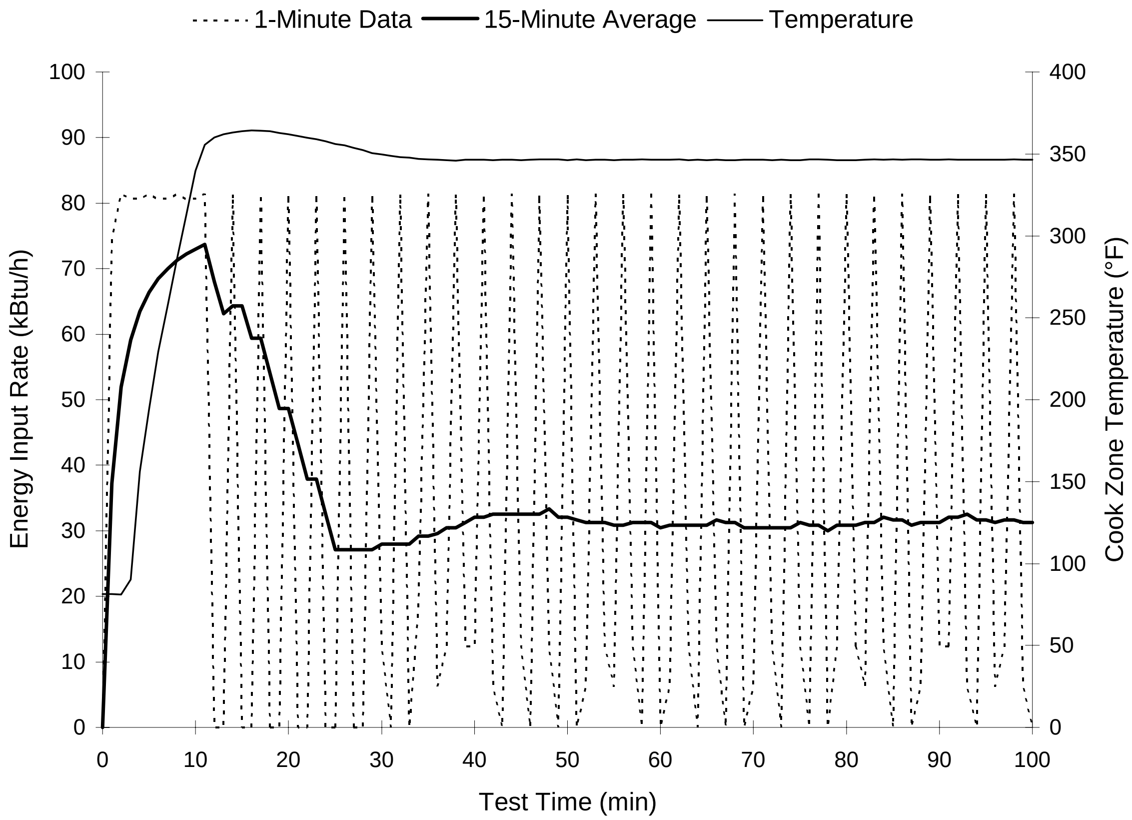

Figure 2-1. Preheat and idle energy test at 350°F.

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

Section 3

PRODUCTION MONITORING

ENERGY

In establishing the typical day production energy use, the day-to-day energy data for the 6-month test period were reduced to include only days when the fryer was used for two-meal periods—lunch and dinner. Fridays, Saturdays, Sundays, and holidays were eliminated because they were not considered typical of fryer usage in this operation. Average daily production energy use for the Pitco RPB14 Technofry1 gas fryer is summarized in Table 3-1. Note that the average production energy consumption rate was based on the aggregate preheat, idle, and cooking energy for the hours of operation over the two-meal periods. The average production energy use rate was derived by dividing the daily production energy use by the corresponding hours of fryer operation. The duty cycle was calculated by dividing the average production energy consumption rate by the appliance's peak energy input rate. The energy monitoring system used to collect these data is described in Appendix C.

Table 3-1

Average Daily In-Kitchen Energy Consumption

Measured Peak Energy Input Rate (kBtu/h) [a]	81.5
Production Energy Use (kBtu/d) [b, c]	97.4
Appliance On-Time (h/d)	8.6
Average Production Energy Consumption Rate (kBtu/h)	11.3
Duty Cycle (%)	13.9

[a] 1 kBtu/h = 1,000 Btu/h
[b] Includes preheat, idle and cooking energy over the hours of operation when the fryer was in use.
[c] Energy consumption is based on a heating value of 1,025 Btu/ft^3

The energy consumption profile plotted in Figure 3-1 characterizes the typical day energy use for the fryer in this production 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 for a total appliance on time of 8.6 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.

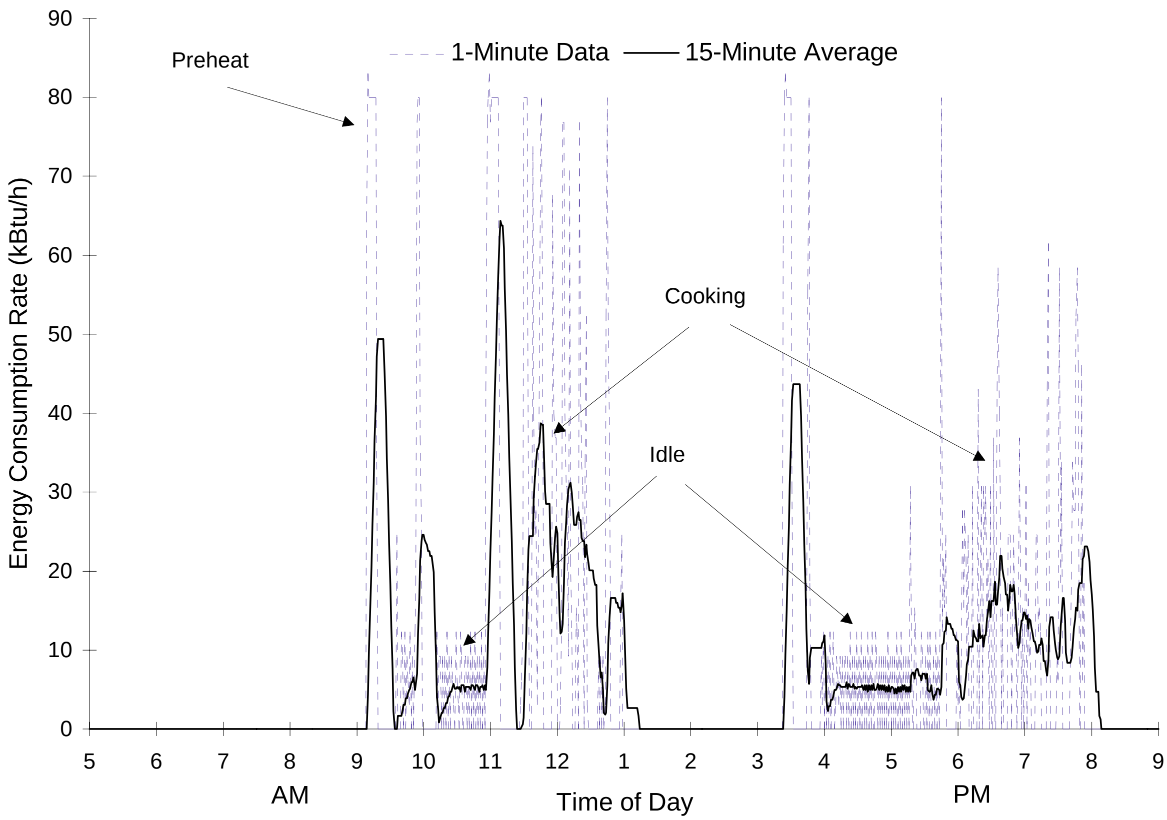

Figure 3-1. Typical day energy consumption profile.

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

The frequency distributions for production energy use and daily hours of operation for the dataset are presented in Appendix D. These figures show how many times different values of production energy use and hours of operation occurred during the monitoring period. The production energy consumption varied from 13 to 20 kBtu per day. The operating hours varied from 6 to 9 hours per day.

ESTIMATED ANNUAL ENERGY CONSUMPTION AND COST

Based on a 5-day-per-week, 52-week-per-year food service operation, the fryer would use 25,324 kBtu, or 253 therms, of gas energy per year. This translates to an annual energy cost of $131 (see Table 3-2). The costs were calculated using PG&E's average gas rate for small, nonresidential customers (Schedule G-NR1), which would be applicable if the production-test kitchen were billed separately (Appendix E).

Table 3-2

Estimated Annual Energy Consumption and Cost

Annual Production Energy Consumption [a]	
97.4 kBtu per day x 5 days x 52 weeks per year =	25,324 kBtu, or 253 therms [a]
Annual Energy Cost [b, c]	
253 therms x $0.5167 per therm =	$131 per year

[a]100 kBtu (or 100,000 Btu) = 1 therm
[b]Estimates are based on PG&E's G-NR1 rate schedule in effect on January 1, 1996 (see Appendix E).
[c]Does not include customer charges.

FOOD PRODUCTION

Items Cooked

The fryer was used to cook lunch and dinner menu items. At lunch, the operators used it primarily to batch cook French fries and onion rings and to fry other breaded foods such as chicken, fish, shrimp, clam strips, calamari, and zucchini sticks. At dinner, the operators used it for French fries and onion rings and for cooked-to-order sesame chicken, fish and chips, beer-battered shrimp, breaded mozzarella and zucchini sticks, Mexican chimichangas, and Chinese eggrolls.

In-Kitchen Observations

In-kitchen observations provided information about how the chef and fry cooks actually used the gas fryer during a typical day of operation in the kitchen. It was operated for around 8.6 hours over two distinct periods (lunch and dinner) and used about 97 kBtu of energy during the day. Typically 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 again turned on around 3:30 P.M. and operated until 8:00 P.M.

During these periods, it was used to cook approximately 50 pounds of food; the heaviest cooking occurred between 11:30 A.M. and 12:45 P.M.

Section 4

CONCLUSIONS AND RECOMMENDATIONS

The energy performance of the Pitco Model RPB14 Technofry1 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, tempura vegetables, and breaded foods (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 an average of 8.6 hours per day—approximately 4 hours at lunch and 4.5 hours at dinner. It was routinely turned off between these two meal periods. The fryer thermostat was consistently set at 350°F, a standard temperature setting in commercial food service operations.

CONTROLLED ENERGY TESTING

Conducting controlled preheat and idle tests helped to characterize the fryer’s input rate, preheat time, and idle rate under real-life, production conditions. For example, based on the controlled energy test data, FSTC researchers were able to quantify the energy that would have been consumed by the fryer if food had not been cooked (i.e., the baseload or idle component of the daily energy). The Pitco Model RPB14 Technofry1 gas fryer compared well to other infrared gas-fired fryers tested at the FSTC.[5,6,7]

PRODUCTION ENERGY MONITORING

Production energy consumption for the Pitco Model RPB14 gas fryer was relatively stable over the 6-month test period, averaging 97.4 kBtu per day. Based on the average operating time of 8.6 hours over the two-meal periods, this represented an average production energy consumption rate of 11.3 kBtu/h. Earlier monitoring of gas fryers in the production-test kitchen showed production energy consumption rates of 13.9 kBtu/h for an 80 kBtu/h nameplate rated infrared gas fryer and 17.8 kBtu/h for an 85 kBtu/h nameplate atmospheric fryer, representing duty cycles of 17% and 21%, respectively.[5,6,8] At 14%, the Technofry had the lowest duty cycle of the gas fryers monitored in the production-test kitchen.[5,6,8]

ANNUAL ENERGY CONSUMPTION, DEMAND, AND COST

It was estimated that the fryer would consume 25,342 kBtu, or 253 therms, of energy per year for this 5-day-per-week food service operation. This corresponds to an annual energy cost of $131 using PG&E’s

applicable gas rate for small commercial customers (GNR-1) effective January 1, 1996. Based on this rate, the resulting unit cost ($/kBtu) of the gas energy consumed by the fryer was $0.135.

Section 5

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Appendix A

GLOSSARY

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.

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

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.

$$\text{Average Production Energy Consumption Rate} = \frac{\text{Production Energy Consumption}}{\text{Operating Time}}$$

Baseload Energy Consumption (kWh 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.

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.

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.

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

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.

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

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 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.

Appendix B

MANUFACTURER'S PRODUCT SPECIFICATIONS

Appendix C

ENERGY MONITORING SYSTEM

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. Electronic pulses are generated by the meter, which measures the flow of electricity or gas to the appliance. Each pulse corresponds to a specific quantity of electric or 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 noninteger 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.

Appendix D

FREQUENCY DISTRIBUTION OF DATASET

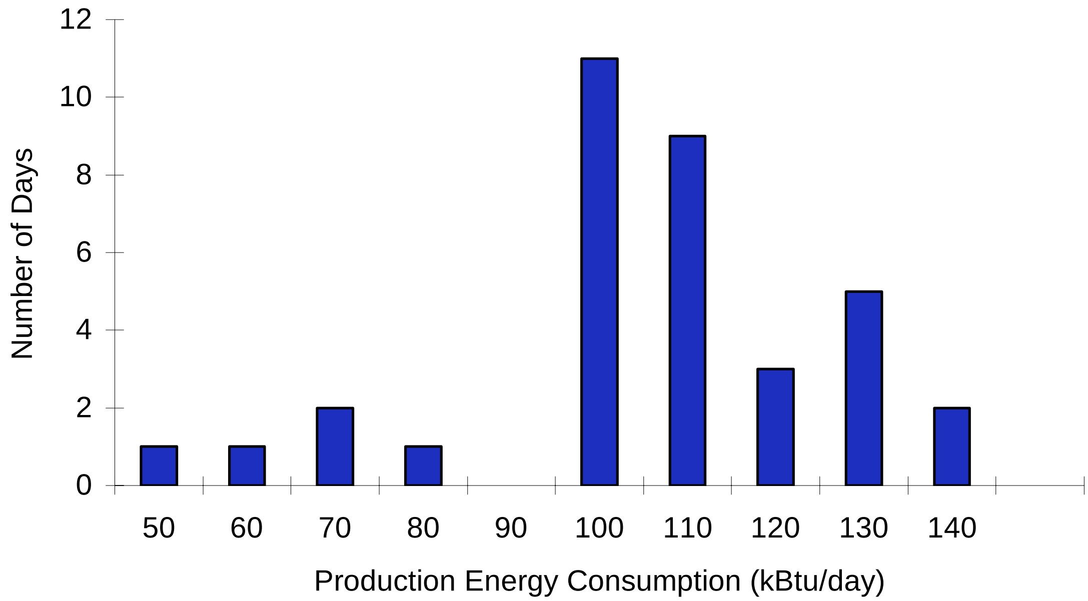

Figure D-1. Frequency of fryer daily production energy consumption.

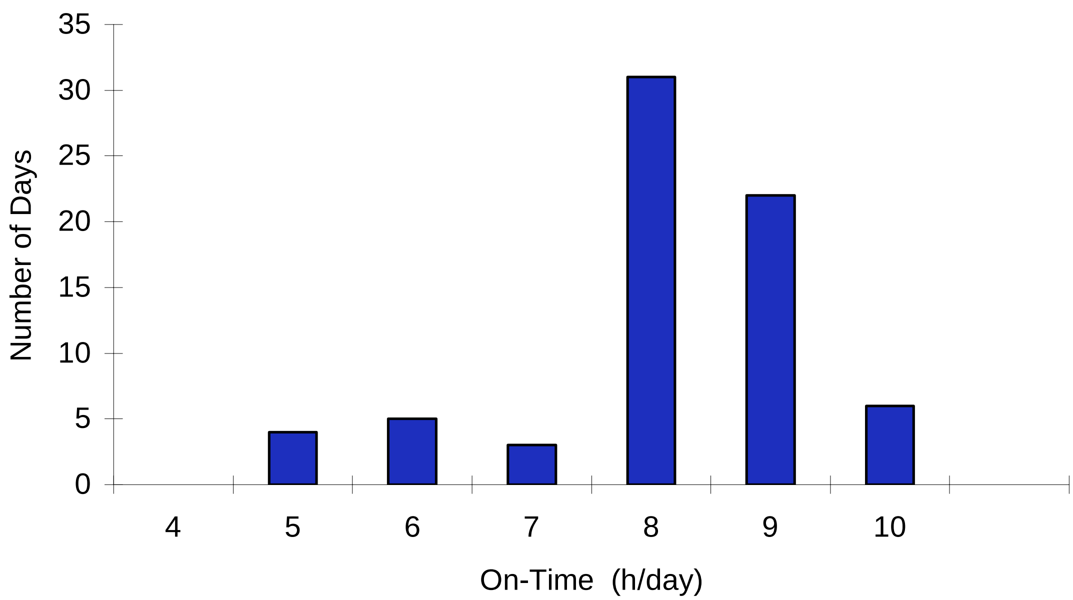

Figure D-2. Frequency of fryer daily operating hours.

Appendix E

PG&E ENERGY RATES

PG&E ENERGY RATES

CORE COMMERCIAL GAS RATES

Small Commercial: G-NR1

	Per Month	$ Per Therm Summer	$ Per Therm Winter
Customer Charge	13.42		
Delivered Commodity Charge		.45093	0.60876
Transport Rates		.23137	0.38920

Effective January 1, 1996

Seasons

Summer: April 1 through October 31

Winter: November 1 through March 31

WEIGHTED AVERAGE OF PG&E SUMMER AND WINTER GAS RATES

Summer		Winter		
(7/12 × $0.45093)	+	(5/12 × $0.60876)		
$0.26304	+	$0.25365	=	**$0.5167 per therm**