

# Program Design Guidance

## Fryers<sup>1</sup>

Commercial fryers are used throughout the foodservice industry to meet a continuous demand for a variety of fried foods. Quick- and full-service restaurants typically have two or more fryers to meet customer demand, creating significant energy saving potential.

This document covers the following topics for fryers:

[Equipment Description](#)

[Product Use and Lifetimes](#)

[Specifications and Test Methods](#)

[Product Availability](#)

[Incremental Cost](#)

[Energy Savings](#)

[Program Design Tips](#)

[Additional Resources](#)

### Equipment Description<sup>2</sup>

All fryers have a similar design and are either fueled by natural gas, propane gas, or electricity. A reservoir contains a sufficient amount of cooking oil such that the food is essentially supported by the displacement of oil rather than by the bottom of the vessel during cooking. In gas fryers, the oil is typically heated by atmospheric or infrared gas burners underneath the fry pot (or vat) or in tubes that pass through the fry pot. Electric fryers use heating elements immersed in the cooking oil.

There are four types of fryers available in the marketplace: open-pot fryers; flat-bottom fryers; pressure or kettle fryers; and large vat fryers. Following is a discussion of each of the fryer types. *CEE and ENERGY STAR<sup>®</sup> efficiency specifications currently cover open-pot fryers only at this time.*

**Open-pot fryers** are the most common type of fryer. Within open-pot fryers, there are two subcategories of fryer, depending on how the heating elements are configured.

The first subcategory has an unobstructed heating area. Gas models heat the fry pot from the outside, and electric models have a ribbon-shaped element immersed in the oil, which folds upward for easy cleaning. This type of fryer is the easiest



**Figure 1. Open-pot fryer**

<sup>1</sup> Large vat fryers are excluded from this analysis at this time due to test method revisions under way. (Revisions to ASTM F2144-07, *Standard Test Method for the Performance of Large Open Vat Fryers*, are in balloting as of April 7, 2009.) Upon finalization of the test method revisions for large vat fryers, CEE anticipates exploring the potential to develop efficiency specifications and guidance for this product category.

<sup>2</sup> Equipment description information and images come in part from the “Buying Guides” at [www.foodservicewarehouse.com](http://www.foodservicewarehouse.com).

to clean, but has a smaller sediment zone<sup>3</sup> than tube-style fryers (discussed below), making it best for lightly breaded foods like french fries, cheese sticks, hot wings, and poppers. This type of fryer is usually value-priced and highly versatile to suit most frying needs.

The second subcategory of open-pot fryers uses tube-type heating elements permanently fixed in the fry pot, making them slightly more difficult to clean. They have larger sediment zones located below the burners, making them more suitable for heavy frying and heavily battered foods like fried chicken, fried fish, and onion blossoms. Tube-type fryers are generally priced higher than fryers with an unobstructed heating area.

Open-pot fryers are covered by the following test method: [American Society for Testing and Materials \(ASTM\) F1361, Standard Test Method for Performance of Open, Deep Fat Fryers.](#)

**Flat-Bottom Fryers** are designed for frying delicate items that float near the surface of the oil, such as tortilla chips, taco shells, and tempura. These fryers do not have a sediment zone, so they are not as suited for the high volume tasks accomplished with tube-style and open-pot fryer designs. In addition, flat-bottom fryers are generally considered more difficult to clean than other fryer types. The test methods for this type of fryer are [ASTM F1361, Standard Test Method for Performance of Open, Deep Fat Fryers](#) for fryers with a fat capacity of less than 60 pounds and [ASTM F2144 - 07 Standard Test Method for Performance of Large Open Vat Fryers](#) for fryers with a fat capacity of 60 pounds or more.



Figure 2. Flat-bottom fryer

**Pressure or Kettle Fryers** use controlled low pressure for faster cooking at lower temperatures. Pressure or kettle fryers are covered by a different test method from open-pot fryers. The test method for this type of fryer is: [ASTM F1964 - 99\(2005\) Standard Test Method for Performance of Pressure and Kettle Fryers.](#)



Figure 3 – Pressure fryer

**Large Vat Fryers** are those with a fat capacity of 60 pounds or more and an 18 inch or larger vat size. These are sometimes referred to as high volume fryers since their larger size allows for higher volume cooking. Large vat fryers often come with computerized controls and built in oil filtration systems. These fryers are also covered by a different test method from open-pot fryers with a fat capacity of less than 60 pounds. The large vat fryer test method, [ASTM F2144 -](#)



Figure 4 – Large vat fryer

<sup>3</sup> The sediment zone is a cold zone in the fry pot where sediments (such as breading) accumulate. The size and location of the sediment zone is important because it is undesirable for sediments to stay in contact with hot oil and food as sediments can burn and transfer the burned flavor to other foods.

[07 Standard Test Method for Performance of Large Open Vat Fryers](#), is currently [under revision](#).<sup>4</sup>

### Product Performance Metrics

Commercial fryers are compared in the marketplace through a number of different criteria. The most significant are as follows:

- Frying capacity (usually expressed as pounds of fries cooked per hour)
- Fry oil holding capacity
- Fry oil consumption
- Overall construction (quality of parts, stainless steel versus mild steel, galvanized or enamel parts)
- Depth of cold zone
- Controls (computerized versus manual, automated operations, programmable)
- Recovery time (time it takes the fryer to bring the oil up to cooking temperature immediately after cooking a batch of fries)
- Ignition system (electronic, manual)
- Built-in filtration system

### Product Use and Lifetimes

As with most commercial kitchen equipment, product use varies widely by establishment. Energy savings calculations in this document assume operation of 12 hours per day, 365 days per year, which are the assumptions used in the Pacific Gas and Electric (PG&E) Food Service Technology Center (FSTC) [Life Cycle Cost Calculators](#). A typical exception to these assumptions is school foodservice facilities, which may shut down all equipment during summer break periods.

A typical fryer is expected to last 7–15 years.<sup>5</sup>

### Specifications and Test Methods

CEE and ENERGY STAR have both developed efficiency specifications for commercial fryers. Both specifications are the same with only one CEE level of efficiency at this time. ENERGY STAR maintains a list of qualified products. Links to the current CEE and ENERGY STAR specifications as well as the qualified product list are below. The efficiency criteria are detailed in the two specifications.

- CEE Specification  
<http://www.cee1.org/com/com-kit/files/FryerSpecificationFINAL20080620.pdf>

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<sup>4</sup> ASTM F2144 - 07 *Standard Test Method for Performance of Large Open Vat Fryers* currently includes both a chicken and a potato test. The proposed revision would remove the chicken test. As of April 7, 2009 the proposed revision was in balloting.

<sup>5</sup> Pacific Gas and Electric Company, “*High Efficiency Electric Fryers*,” PG&E Energy Efficiency Information, May 1997.

- ENERGY STAR Specification  
[www.energystar.gov/ia/partners/product\\_specs/eligibility/commer\\_fryer\\_elig.pdf](http://www.energystar.gov/ia/partners/product_specs/eligibility/commer_fryer_elig.pdf)
- ENERGY STAR Qualified Products List  
[www.energystar.gov/ia/products/prod\\_lists/Fryers\\_prod\\_list.xls](http://www.energystar.gov/ia/products/prod_lists/Fryers_prod_list.xls)

Fryers eligible for qualification under these specifications are covered by the following test method: [ASTM F1361, Standard Test Method for Performance of Open, Deep-Fat Fryers](#).

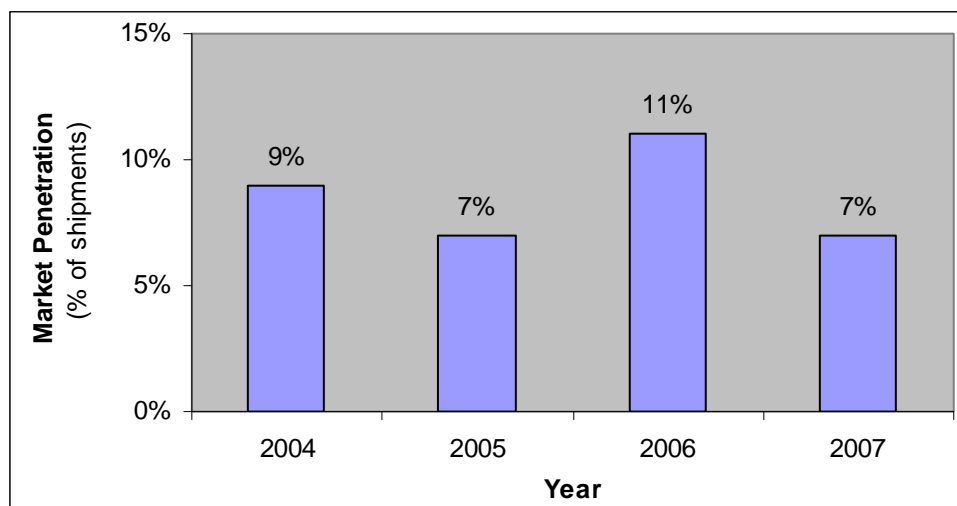
Large vat fryers are covered by [ASTM F2144 - 07 Standard Test Method for Performance of Large Open Vat Fryers](#). CEE and ENERGY STAR anticipate development of specifications for large vat fryers once the test method revision process is complete. Some energy efficiency programs are offering incentives for large vat fryers based on the specifications for open-pot fryers. These programs most often cite specifications developed by California efficiency programs. For more information on California efficiency program specifications, see the Food Service Technology Center Web site at [www.fishnick.com](http://www.fishnick.com).

## Product Availability

According to the [North American Association of Food Equipment Manufacturers' directory](#), as of November 2008 there were 42 commercial fryer manufacturers. As of September 2008, there were 9 manufacturers marketing 149 CEE and ENERGY STAR qualified fryers:

- [Aga Foodservice, Inc.](#)
- [Alto-Shaam, Inc.](#)
- [Frymaster, LLC](#)
- [Henny Penny Corporation](#)
- [Hobart Corporation](#)
- [Keating of Chicago, Inc.](#)
- [Pitco Frialator](#)
- [Ultrafryer Systems, Inc.](#)
- [Vulcan-Hart Company](#)

Market penetration of ENERGY STAR qualified fryers was 7% in 2007 and has ranged from 7% to 11% from 2004 through 2007 (see Figure 5).

**Figure 5. Market Penetration of ENERGY STAR Qualified Fryers 2004 to 2007**

Product availability figures can be slightly misleading when compared to market penetration for two reasons. First, even though there are a large number of qualified models available in the marketplace, these include models with single fry pots, for lower volume frying needs, as well as fryers with multiple pots in a line for higher volume frying needs. Given a specified level of frying needed, a customer would choose either a single-pot fryer or a multiple-pot fryer—they are not interchangeable. Second, qualified models also include those manufactured specifically for chains. Models manufactured for chains are generally not available for purchase by customers other than the chain the model is manufactured for.

When multiple-pot models and models that are manufactured for chains are excluded from the qualified products list, as of September 2008, there were five manufacturers marketing 12 single-pot CEE and ENERGY STAR qualified electric fryers.<sup>6</sup> There were four manufacturers marketing seven single-pot CEE and ENERGY STAR qualified gas fryers.

### **Incremental Cost<sup>7</sup>**

The following incremental cost analysis is based on estimates of the average prices for standard efficiency versus high efficiency single-pot, floor model, electric, and gas fryers. It is important to note that fryers are often sold as “banks,” which have multiple pots or vats, in addition to single-pot units. The cost of a bank of fryers is generally slightly less than the cost of a single-pot fryer multiplied by the number of fryer vats in the fryer bank.

Most independent foodservice establishment operators purchase the least expensive fryer available in the market that will meet their frying needs. Therefore, end user pricing for standard

<sup>6</sup> This estimate of product availability is based on single-pot qualifying fryers listed in AutoQuotes. Fryers made especially for chains are not included in AutoQuotes.

<sup>7</sup> All pricing research was conducted on November 14, 2008.

efficiency models is based on a survey of the least expensive fryers listed in AutoQuotes<sup>8</sup> combined with searches of available fryers at online dealerships.<sup>9</sup> The end user cost for a CEE or ENERGY STAR qualified fryer is based on pricing of the qualified fryers listed in AutoQuotes.

The difference in end user pricing between single-pot, floor model standard efficiency fryers, and high efficiency fryers is approximately \$2,800 for electric models and \$3,400 for gas models. Table 1 below shows more detailed information on typical standard and high efficiency prices ranges and average pricing for the end user.

**Table 1. Price Range and Average Cost for High Efficiency and Standard Efficiency Fryers**

Fryer Type	CEE/ENERGY STAR Qualified Fryers – End User price Range @ 50% Off List	CEE/ENERGY STAR Qualified Fryers - Average End User price @ 50% Off List	Standard Efficiency Fryers - End User price Range	Standard Efficiency Fryers - Average End User Price	End User Average Price Differential
<b>Electric</b>	\$1,900–\$6,300	\$4,168	\$1,300–\$1,500	\$1,400	\$2,768
<b>Gas</b>	\$2,500–\$6,300	\$4,355	\$700–\$1,200	\$950	\$3,405

### Energy Savings<sup>10</sup>

Fryers designed with energy efficiency in mind can save considerable electricity or fuel when compared to traditional fryer designs. Design attributes that can help realize these savings for electric fryers include:

- Induction heating
- Fry pot insulation
- Low watt density heating elements
- TRIAC controls

Design attributes that can realize these savings for gas fryers include:

- Advanced burner types
- Recirculation tubes
- Fry pot insulation

<sup>8</sup> AutoQuotes provides list price information only. End user prices are often calculated as a percent off the list price. End user prices can vary based on a number of factors, including manufacturer, dealer, purchase volume, etc. It is typical to estimate end user prices at approximately 50% off list price, which is the assumption used in this analysis.

<sup>9</sup> Online dealers surveyed included [www.foodservicewarehouse.com](http://www.foodservicewarehouse.com), [www.atlantafixtures.com](http://www.atlantafixtures.com), and [www.bigtray.com](http://www.bigtray.com).

<sup>10</sup> The information in this section draws upon Section 2 of the Food Service Technology Center “Commercial Cooking Appliance Technology Assessment,” available at: <http://www.fishnick.com/equipment/techassessment/>.

For more information on these technologies, see:  
[www.fishnick.com/equipment/techassessment/2\\_fryers.pdf](http://www.fishnick.com/equipment/techassessment/2_fryers.pdf).

Table 2 and Table 3 below depict the energy consumption of standard efficiency gas fryers and CEE or ENERGY STAR qualified fryers. A standard electric fryer consumes approximately 13,000 kWh annually, whereas a CEE or ENERGY STAR qualified fryer consumes a maximum of approximately 12,200 kWh (a 7% savings). A standard gas fryer consumes approximately 1,200 therms annually, whereas a CEE or ENERGY STAR qualified fryer consumes a maximum of approximately 800 therms (over 30% savings). These calculations were made using the life cycle cost calculator at [www.fishnick.com](http://www.fishnick.com) assuming usage of 12 hours per day, 365 days a year, and a life expectancy of eight years.

**Table 2. Energy Savings Potential of Electric Fryers**

	Standard Efficiency Fryer	CEE / ENERGY STAR Qualified Fryer	Energy Savings
<b>Cooking Energy Efficiency (%)</b>	75	80	-
<b>Idle Energy Rate (kW)</b>	1	1	-
<b>Annual Energy Consumption (kWh)</b>	13,072	12,191	881
<b>Life Cycle Energy Consumption (kWh)</b>	104,576	97,528	7,048

**Table 3. Energy Savings Potential of Gas Fryers**

	Standard Efficiency Fryer	CEE / ENERGY STAR Qualified Fryer	Energy Savings
<b>Cooking Energy Efficiency (%)</b>	35	50	-
<b>Idle Energy Rate (Btu/hour)</b>	14,000	9,000	-
<b>Annual Energy Consumption (therms)</b>	1,168	808	360
<b>Life Cycle Energy Consumption (therms)</b>	9,344	6,464	2,880

### Program Design Tips

- ✓ Fryers are often sold in “banks” of multiple fryers in addition to single-pot units. Make sure your program is clear about how banks of fryers are handled. Most programs specify that financial incentives are “per vat” so that customers know that they qualify for multiple rebates based on how many vats are in the bank of fryers purchased, if applicable.
- ✓ Some energy efficiency programs are offering incentives for large vat fryers based on the specifications for open-pot fryers. These programs most often cite specifications developed by California efficiency programs. For more information on California efficiency program specifications, see the Food Service Technology Center Web site at [www.fishnick.com](http://www.fishnick.com).

## **Additional Resources**

- **ENERGY STAR Fryers Web page:** [http://www.energystar.gov/index.cfm?c=fryers.pr\\_fryers](http://www.energystar.gov/index.cfm?c=fryers.pr_fryers). ENERGY STAR includes specifications, qualified product lists, case studies, and general savings information about commercial fryers. Links to other commercial foodservice equipment categories are also provided.
- **Pacific Gas and Electric Food Service Technology Center Life Cycle Cost Calculators:** <http://www.fishnick.com/saveenergy/tools/calculators/>. On this Web page, the FSTC provides life cycle cost calculators for gas and electric fryers with the ability for users to modify fryer performance, usage, and utility rate characteristics. Calculators for other commercial cooking equipment categories are also provided.
- **Pacific Gas and Electric Food Service Technology Center Commercial Kitchen Appliance Technology Assessment:** <http://www.fishnick.com/equipment/techassessment/>. On this Web page, the FSTC provides a comprehensive description and energy performance assessment for commercial fryers and other commercial cooking equipment categories.