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# California Investor Owned Utilities Comments - Title 20 Fryers CASE Report RFI Response Commercial Food Service

*Additional submitted attachment is included below.*

# Commercial Fryers

Codes and Standards Enhancement (CASE) Initiative

For PY 2024: Title 20 Standards Development

Analysis of Standards Proposal for
**Commercial Fryers**
**CEC Docket Number23-AAER-01**

July 16, 2024 DRAFT

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# Acknowledgments

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# 1. Executive Summary

## 1.1. CASE Team Proposal Objective

The Codes and Standards Enhancement (CASE) Team, herein referred to as the CASE Team, presents recommendations to support the California Energy Commission's (CEC) efforts to update California's Appliance Efficiency Regulations (Title 20). Three California Investor-Owned Utilities (CA IOUs), Pacific Gas and Electric Company, San Diego Gas and Electric, and Southern California Edison sponsored this effort. The program prepares and submits proposals for cost-effective enhancements to improve the energy and water efficiency of appliances sold in California. The CASE Report provides a technical and cost-effective analysis of the standards for commercial fryer appliances.

The CEC will evaluate proposals submitted by the CASE Team and other stakeholders and may revise or reject them. For more information about the rulemaking schedule and how to participate in the process, see the CEC's Appliance Efficiency Regulations – Title 20 website.

Sections 2 through 10 of this report cover the proposed appliance standards for commercial fryers and the supporting analysis. This report proposes standards for commercial gas fryers and a test and list requirement for commercial electric fryers. The analysis includes commercial electric fryers but did not find standards for commercial electric fryers to be cost effective, based on the available data and current analytical approach. Section 11 responds to the questions in the Request for Information docketed by the CEC on November 14, 2023.

## 1.2. Commercial Fryer Types

Commercial fryers are appliances designed to cook various food products quickly and efficiently. Typically found in restaurants, hotels, cafeterias, and other food service locations, these devices handle large quantities of food over extended periods.

Commercial fryers have two categories: standard and large vat. Commercial standard vat fryers typically have an oil capacity ranging from 35 to 50 lbs. and measure 14 inches in width and 12 to 14 inches in depth. Standard vat fryers can be as narrow as 12 inches and can have a capacity as large as 60 lbs. Commercial large vat fryers are generally 18 inches wide and 16 to 18 inches deep front-to-back, with oil capacities ranging from 65 to 80 lbs. The widest commercial large vat fryers reach 24 inches and accommodate up to 120 lbs. of oil. Large vat fryers are primarily used for cooking chicken because they provide more surface area, which allows the meat to float and cook properly.

Commercial fryers consist of a vat of oil heated by gas or electric energy. These appliances use thermostatic controls to set the temperature between 325˚F and 375˚F for deep frying. The ideal temperature for frying most foods is 350˚F. French fries are the most popular fried product, followed by fried chicken.

In California, commercial fryers are predominantly powered by gas. Most manufacturers use a tube design with three to five burners underneath the fry vat running from the front to the back. Commercial gas fryer efficiency varies significantly between models because of burner designs and flue routing.


**Figure 1: Commercial Standard Vat Fryer (Left) and Large Vat Fryer (Right)**

## 1.3. CASE Team Proposed Standards

The CASE Team proposes performance standards for commercial gas fryer types within the scope of the U.S. Environmental Protection Agency (U.S EPA) ENERGY STAR® program. Commercial electric fryers have a low market share, particularly large vat electric fryers. The CASE Team concluded that, on average, standards are not cost effective for commercial standard vat electric fryers. The CASE Team proposes that commercial electric fryers be required to test to industry-accepted procedures and report the results to the CEC's Modernized Appliance Efficiency Database System (MAEDbS) to determine their energy performance, support consumer choice, and provide the opportunity for future performance standards.

The CASE Team proposes that Title 20's scope and definitions for commercial fryers align with the well-understood and consensus-based ENERGY STAR Commercial Fryer Specification V3.0. The CASE Team proposes adopting the most recent American Society for Testing and Materials (ASTM) test procedures and aligning them with the ENERGY STAR Specification. Finally, the CASE Team proposes ensuring performance standards for commercial gas fryers are consistent with the ENERGY STAR Fryer Specification V2.0 to harmonize with standards adopted by other states. The CASE Team notes that the standards for commercial standard vat gas fryers remain the same for all versions of ENERGY STAR V1.0, V2.0, and V3.0. Commercial large vat fryers were added to V2.0, and standards for these fryers remained unchanged in V3.0.

The proposed standards and the test-and-list requirements address cooking and idle energy for all product classes. This proposal covers products powered by electricity, natural gas, and propane. It includes definitions for multiple product classes, reflecting the diversity of commercial fryer applications. Furthermore, the test procedures are grounded in those developed by the industry.

Commercial fryers within the proposal's scope would be required to comply with existing CEC certification and marking requirements. Although the requirements are similar, participation in the ENERGY STAR program is not mandatory for compliance.

The proposed effective date is March 1, 2026, allowing sufficient time for pre-rulemaking and rulemaking activities and for the one-year gap required by California statute between adoption and effective dates.

## 1.4. Market Analysis

The CASE Team studied commercial fryers in the California marketplace and engaged in discussions with manufacturers and industry representatives. The results presented below demonstrate that the proposed standards are technically feasible.

The CASE Team reviewed the V2.0 and V3.0 ENERGY STAR qualified products list and the State Appliance Standards Database (SASD) to assess the availability of existing products from various manufacturers that comply with the proposed standards. In 2022, ENERGY STAR estimated that V3.0 qualifying products represent 26 percent of all fryer sales. ENERGY STAR V3.0 does not differentiate market adoption by fuel type. The North American Association of Food Equipment Manufacturers (NAFEM) reported that most commercial fryers on the market are gas powered, so the relatively low adoption rate likely indicates a predominance of gas fryers (NAFEM, 2009). The 2011 update of ENERGY STAR V2.0 to V3.0 specifically impacted commercial electric standard vat fryers. The adoption rate of these commercial fryers did not significantly change, indicating a high market adoption rate. The data contradicts the typical trend where adoption rates decrease as the standard increases. Therefore, the adoption rate of commercial electric fryers was likely already high, and 26 percent of sales mainly reflect commercial gas fryers. The CASE Team concludes the proposed standards would not cause any loss of consumer utility.

## 1.5. Per Unit Energy Savings

The CASE Team used information from the California Electronic Technical Reference Manual (eTRM) to develop the appropriate inputs for the different types of commercial fryers, including the number of operational days, operational hours per day, cooking efficiency, pounds of food cooked per day, and ASTM energy to food ratio (CA eTRM, 2024). Assumptions for preheating time and energy, idle energy rate, and cooking efficiency vary from baseline to compliant models. The table below summarizes the per unit natural gas savings by fryer type from the proposed standards. The CASE Team analyzed the potential electric savings; however, there are no proposed standards for commercial electric fryers. Therefore, the savings examined in this report are not detailed here.

**Table 1 Annual Per Unit Energy Savings**

| Product Class | Per-unit Savings – Natural gas (therm/yr-unit) |
|---|---|
| Standard Vat Gas | 308 |
| Large Vat Gas | 597 |

## 1.6. Cost Effectiveness

The CASE Team calculated the cost effectiveness and potential impact on consumers by conducting a comparative analysis of the benefits and costs associated with the proposed standards. The CASE Team

studied commercial gas fryers with an assumed useful life of 11 years and commercial electric fryers with an assumed useful life of 12 years. The proposed standards for commercial gas fryers are cost effective, with the total life cycle benefits 3.75 times greater than the costs for commercial standard vat gas fryers and 4.46 times greater than those of commercial large vat gas fryers. The CASE Team suggests revisiting commercial standard vat electric fryer standards at a future date because total life cycle benefits are less than total average costs for commercial standard vat electric fryers aligned with ENERGY STAR V3.0 and V2.0. This analysis could be completed when the baseline energy performance is better understood, prices drop, rates change, or performance improves. Although commercial large vat electric fryer standards are cost effective, the CASE Team does not propose standards for this appliance due to its modest market share, as further discussed in the full report.

**Table 2 Per Unit Lifetime Economic Impacts for Products Purchased in the First Year**

| Product Class | Design Life (years) | Present Value of Benefits (2024 $) | Present Value of Incremental Costs (2024 $) | Net Present Value (2024 $) | Simple Payback Period (years) | Life Cycle Benefit-Cost Ratio |
|---|---|---|---|---|---|---|
| Standard Vat Electric V2.0 | 12 | 2,485 | 4,157 | -1,672 | 16.13 | 0.60 |
| Standard Vat Electric V3.0 | 12 | 5,073 | 6,239 | -1,166 | 11.9 | 0.81 |
| Standard Vat Gas | 11 | 4,729 | 1,001 | 3,728 | 1.88 | 4.72 |
| Large Vat Electric | 12 | 3,253 | 1,114 | 2,139 | 3.30 | 2.92 |
| Large Vat Gas | 11 | 9,166 | 2,444 | 6,722 | 2.36 | 3.75 |

## 1.7. Statewide Impacts

The CASE Team estimates that of the 4,600 commercial fryers annually sold in California, 3,900 are gas, and the remaining 700 are electric. The CASE Team determined the number of units sold for each product category using ENERGY STAR shipment data from 2022, normalized to California's population (U.S. EPA ENERGY STAR, 2022). ENERGY STAR reported in 2022 that 26 percent of the shipments met the V3.0 criteria (U.S. EPA ENERGY STAR, 2022). As all V3.0 certified commercial fryers meet V2.0 criteria, the CASE Team estimated that 26 percent of the commercial fryers on the market comply with the proposed energy thresholds. According to an NAFEM estimate, the market distribution for commercial fryers in the U.S. is 85 percent gas and 15 percent electric (NAFEM, 2009), which is what the CASE Team assumed as the breakdown between commercial gas and electric fryers.

Commercial fryers meeting the proposed standards are widely available and technically feasible. Therefore, the CASE Team does not predict any significant barriers to manufacturing compliant equipment.

The proposed standards would result in estimated annual statewide savings starting in 2037, the year of stock turnover, of 30.9 million therms of natural gas. Table 3 presents the statewide savings after all stock meets these standards. The incremental capital costs in the first full of implementation are $9.34 million, and utility bill savings in the first year are $3.80 million.

**Table 3 Estimated California Statewide Savings in the Year of Stock Turnover**

| Product Class | Year of Stock Turnover | Natural Gas (million therms/yr) | GHG Emissions (MT CO2e/yr) | Utility Bill Savings (million 2024 $/yr) |
|---|---|---|---|---|
| Standard Vat Gas | 2037 | 27.8 | 15,165 | $63.1 |
| Large Vat Gas | 2037 | 3.05 | 1,664 | $6.92 |
| TOTAL | 2037 | 30.9 | 16,829 | $70.0 |

# 2. Introduction

Restaurants, hotels, cafeterias, and other food service establishments use commercial fryers to cook a variety of foods. These products can consume substantial amounts of energy. California is estimated to have more than 170,000 commercial fryers in operation, with almost every restaurant having a fryer and most quick-service restaurants (QSR) having at least two fryer vats (Fisher-Nickel, 2014).

California does not regulate the energy use of commercial fryers. The commercial foodservice market does not adequately promote energy efficiency, with many fryer specification sheets only detailing the unit's input rate in kilo British thermal units per hour (kBtu/h) or kilowatts (kW). Equipment dealers often market commercial fryers with higher British thermal unit (Btu) ratings by suggesting that a higher number indicates quicker cook times and higher production capacity. However, this is a misconception. For example, a 120 kBtu/h commercial fryer that is 30 percent efficient (delivering 30 kBtu/h of energy to food) is slower than an 80 kBtu/h commercial fryer that is 50 percent efficient (delivering 40 kBtu/h of energy to food). Unfortunately, the amount of energy that goes into the food is usually unknown because commercial fryer efficiencies are generally only reported for compliant fryers.

Over the past two decades, developing and promoting more efficient products has drastically reduced commercial fryer energy consumption. ENERGY STAR has labeled energy-efficient commercial fryers since 2003, which were well received by the QSR industry. These commercial fryers provide a cooking performance comparable to or superior to that of inefficient commercial fryers. Initially, only large QSR chains used energy-efficient commercial fryers due to the higher initial purchase cost ($10k+). In the late 2010s, most major commercial fryer manufacturers developed budget gas fryers (around $2k), meeting the ENERGY STAR thresholds. Unfortunately, many inexpensive, inefficient fryers (<$1k) are sold today, and most independent restaurant operators buy the least expensive model available.

The California foodservice rebate program, active since the late 2000s, has proven that energy-efficient commercial fryers are popular among consumers and meet consumer demands, making them the most popular rebate item. The rebate bridged the gap between budget-friendly ENERGY STAR commercial fryers and their inexpensive, inefficient counterparts, saving restaurant owners and customers thousands of dollars over the fryer's lifetime.[1]

The CASE Team proposes a comprehensive approach to attaining energy savings by installing and using more efficient commercial fryers. This approach recommends:

1. Mandatory appliance standards: Establish energy performance standards in Title 20 for commercial gas fryers based on ENERGY STAR V2.0 thresholds for commercial standard and large vat gas fryers, saving California commercial foodservice customers over $300 annually per vat. Note that some commercial fryers have multiple cooking vats, particularly in QSRs.
2. Mandatory test-and-list requirements: Adopt industry-developed test procedures in Title 20 for commercial electric fryers and require energy use and performance reporting to MAEDbS. These test-and-list requirements provide consumers with additional information about product performance and enable the development of future standards for product categories that lack sufficient performance data.

This report provides a supporting analysis of performance standards for all commercial fryer types within the scope of the ENERGY STAR program. The CASE Team concluded that performance standards

[1] California Energy Wise, "Fryers & Griddles: The Heart of the Quick-Service Chain Restaurant," 2021, https://caenergywise.com/CEW_Burger_Restaurant_CaseStudy_V01.pdf

for commercial gas fryers are cost effective, whereas standards for most commercial electric fryers were not deemed cost effective. This proposal would establish energy efficiency standards for commercial gas fryers and require commercial electric fryers to test to industry-accepted procedures and report the performance to MAEDbS. This requirement would allow consumers to make informed purchasing decisions and enable potential future performance standards for those product categories. Requiring commercial electric fryers to test and list would establish an equitable market environment, mitigating potential distortions from imposing a testing requirement solely on one product category.

# 3 Product and Technology Description

Commercial fryers consist of a vat of oil heated by either gas or electric energy. These appliances use thermostatic controls to set the temperature between 325˚F and 375˚F. The ideal temperature for frying most foods is 350˚F. French fries are the most popular fried product, followed by fried chicken. While fried chicken may be cooked in any commercial fryer, restaurants that serve it as their main dish have specialized chicken fryers.

**Figure 1 Commercial Six Bank Multi-Vat Fryer**

Source: https://www.hennypenny.com/products/pressure-fryers/

Most commercial fryers are freestanding. Smaller commercial countertop electric models exist but are rare. The vat width and shortening (usually oil) capacity determine the size of a commercial fryer. Commercial fryers can be configured in a single bank with one vat or multiple banks, accommodating up to four vats arranged side by side. QSRs with multiple bank commercial fryers can use a single filtration system to filter oil from the vats. Filtration is essential for effective oil management, ensuring high food quality and prolonging oil life. While built-in oil filtration is only available in high-end commercial fryers, manually filtering the oil using external devices is possible for any fryer.

**Figure 2 Fryer Oil Drained into the Filtration Tank Before Being Pumped Through a Filter**

Source: https://foodservice.winstonind.com/blog/key-features-to-look-for-when-buying-the-best-pressure-fryer/

**Figure 3 Commercial Dual Vat Fryer with Built-In Filtration Underneath**

Source: https://www.frymaster.com/product/fam_vsvxcy/High-Efficiency-Gas-Fryers-with-Filtration

Commercial fryers in California are mainly gas powered. They use an atmospheric tube burner design with three to five burners under the fry vat, running from the front to the back. ENERGY STAR-certified commercial gas fryers and those without the label often use advanced burner designs with forced air burners, including either infrared (IR) box burners beneath the fry vat or heat exchangers directly submerged in the oil vat. Manufacturers can achieve ENERGY STAR qualification by improving the efficiency of commercial fryers through the use of well-designed atmospheric tube burners and flues. All commercial gas fryers have a flue at the back that directs the combustion byproducts into the kitchen hood. Baseline commercial fryers produce higher flue temperatures as more heat is wasted. Commercial gas fryer efficiency varies significantly among different models, due to varying burner designs and flue routing.

**Figure 4 Commercial Gas Tube Fryer**

Source: https://external-content.duckduckgo.com/iu/?u=https%3A%2F%2Ftse1.mm.bing.net%2Fth%3Fid%3DOIP.xB8pyQygxy7rvimX-Ox2wQHaHa%26pid%3DApi&f=1&ipt=307ee364241790095e1ad3bfc9616058a2bf1e4e1669671fea984307216b3280&ipo=images

**Figure 5 Commercial Gas IR Heat Exchanger Fryer**

Source: https://resources.centralrestaurant.com/commercial-fryer-buying-guide/

**Figure 6 Commercial Electric Resistance Element Fryer**

Source: https://www.washpro.co.nz/products/frymaster-with-warranty-1?variant=39901171253306

Commercial electric fryers are less prevalent in California, as operating costs are higher, and many restaurants do not have the electrical infrastructure to support them. All commercial electric fryers have a resistance heating element submerged in the oil vat. Because of the uniform nature of their heating technology, they typically exhibit consistent energy efficiency across different models.


**Figure 7 Commercial Standard Vat 14-inch-wide 50lb. Fryer**

Source: https://www.katom.com/169-SG14SNG.html?utm_source=google&utm_medium=cpc&utm_campaign=%5BROI%5D%20Shopping%20-%20PMax%20-%20Push%20Harder%20SKUs&utm_id=17563307644&utm_content=&utm_term=&gad_source=1&gclid=CjwKCAiA1-6sBhAoEiwArqlGPklw3swersOvSjihjlO-XUkw60B5xrWtRnR38naHH5D7D9r7ohmfKRoCrf0QAvD_BwE

**Figure 8 Commercial Large Vat 18-inch-wide 80lb. Fryer**

Source: https://www.katom.com/386-AF75NG.html?utm_source=google&utm_medium=cpc&utm_campaign=%5BROI%5D%20Shopping%20-%20PMax%20-%20Push%20SKUs&utm_id=17563307671&utm_content=&utm_term=&gad_source=1&gclid=CjwKCAiA1-6sBhAoEiwArqlGPioAvJlnf52Oo_5zc807JWxaKSxCSvrIEzVykqVZTIuqp0nnx95_cRoCSdEQAvD_BwE

## 3.1. Commercial Standard Vat Fryer

A commercial standard vat fryer typically measures 14 inches in width (measure from the outside) and has a 12- to 14-inch depth. The cooking vat is generally half an inch narrower than the outside dimensions. The oil capacity of these appliances ranges from 35 to 50 pounds. They can be as narrow as 12 inches and as large as 60 lbs. Commercia low-oil volume fryers with a capacity of 30 to 35 lbs. are used by QSRs to cook french fries.

Some commercial standard vat fryers may come in split vat configuration, where a single vat is divided into two to prevent flavor transfer. Split vats cook low-volume items like seafood or onion rings or keep vats allergen-free for individuals with dairy, gluten, or shellfish allergies. Commercial split vat fryers feature separate heating sources and controls for each split side, housed within the same fryer chassis.

**Figure 9 Dual 14-inch Vat Electric Fryer, Standard Vat on the Left, Split Vat on the Right**

Source: https://blueflamealliance.com/food-service-resources/equipment/natural-gas-fryers/

## 3.2. Commercial Large Vat Fryer

Commercial large vat fryers are usually 18 inches wide and 16 to 18 inches deep and have an oil capacity ranging from 65 to 80 lbs. They can be as wide as 24 inches and hold up to 120 pounds of oil. Large commercial vat fryers cook chicken in high-volume food service operations. The vat's service area allows for efficient frying of larger quantities of chicken. One feature of large commercial vat fryers is their larger cold zone. This design element prevents breading from accumulating at the bottom of the vat, ensuring it does not stick to the burners and foul the cooking oil. Although pressure fryers are also used for cooking chicken, the proposed regulation applies only to open-vat commercial fryers.

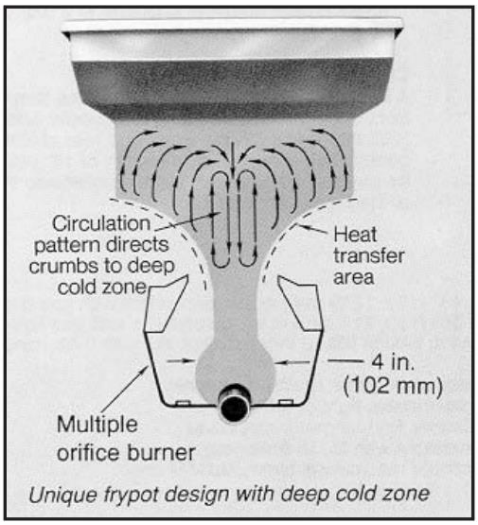


**Figure 10 Illustration of a Fryer Cold Zone on the Bottom of the Vat**

Source: http://fm-xweb.frymaster.com/products/pdf%20files/mj35spec.pdf

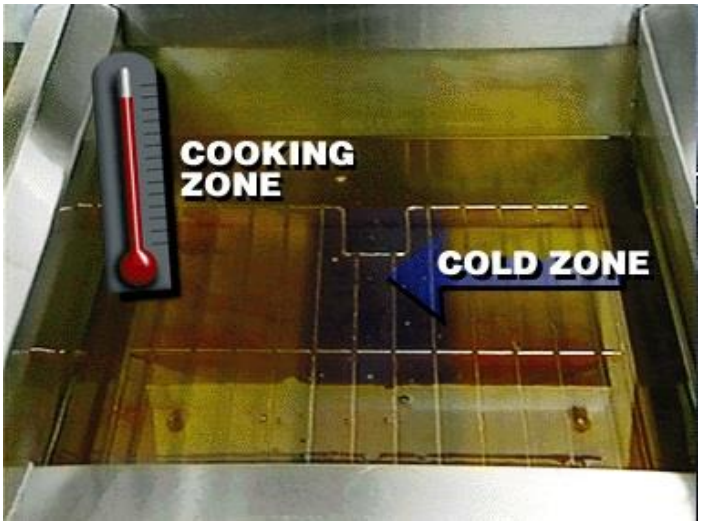


**Figure 11 Demonstration of a Commercial Fryer Cold Zone with Oil Filled**

Source: https://c03.apogee.net/mvc/home/hes/land/el?utilityname=gulfpower&spc=cel&id=1131

# 4 Proposed Standards

## 4.1 Proposal Description

The CASE Team proposes a comprehensive approach to achieving energy savings by selling and using more efficient commercial fryers.

The report provides an analysis supporting the Title 20 proposal. It focuses on the performance standards for commercial gas fryer types within the scope of the ENERGY STAR V2.0 program, as described in Section **Error! Reference source not found.** of this report and with the additional information provided in this section. The CASE Team proposes that Title 20 align with ENERGY STAR thresholds for commercial gas fryers. However, the proposed standards are not cost effective for standard commercial vat electric fryers. They are cost effective for large vat commercial electric fryers, which have a limited market presence. Therefore, the CASE Team does not recommend standards for any commercial electric fryers. Instead, the CASE Team proposes a test-and-list requirement according to industry-accepted procedures for commercial electric fryers to assess their energy performance. These products would have a certified performance, empowering consumers to make informed purchasing decisions and enabling future performance standards for these product categories.

The ENERGY STAR requirements for commercial standard vat gas fryers have remained unchanged from the initial V1.0, which became effective in 2003, until V3.0, finalized in 2016 (U.S. EPA). The ENERGY STAR added commercial large vat gas fryer requirements to V2.0 (U.S. EPA) in 2011 and has maintained these requirements in V3.0 (U.S. EPA, n.d.). The ENERGY STAR updated V2.0 thresholds for commercial electric fryer energy in 2011 and 2016 for V3.0. The proposal does not include standard levels for commercial electric fryers, only for commercial gas fryers. Aligning Title 20 with ENERGY STAR V2.0 or V3.0 for commercial gas fryers is shown to be cost effective and is discussed further in Section 7 of this report. Section 7 also includes the cost-effectiveness analysis for commercial electric fryers. The tables below depict the history of the ENERGY STAR fryer specification version and the levels for Versions 2.0 and 3.0.

**Table 4: ENERGY STAR Fryer Version History**

| ENERGY STAR Version | Standard Vat Gas | Large Vat Gas | Standard Vat Electric | Large Vat Electric |
|---|---|---|---|---|
| **V1.0** | Introduced | NA | Introduced | NA |
| **V2.0** | Unchanged | Introduced | Unchanged | Introduced |
| **V3.0** | Unchanged | Unchanged | Higher energy efficiency and lower idle rates | Unchanged |

**Table 5: ENERGY STAR Version 2.0**

| **Fuel Type** | Gas | Gas | Electric | Electric |
|---|---|---|---|---|
| **Vat Size** | Standard | Large | Standard | Large |
| **Efficiency** | 50% | 50% | 80% | 80% |
| **Idle Rate** | 9,000 Btu/h | 12,000 Btu/h | 1,000 W | 1,100 W |

**Table 6: ENERGY STAR Version 3.0**

| **Fuel Type** | Gas | Gas | Electric | Electric |
|---|---|---|---|---|
| **Vat Size** | Standard | Large | Standard | Large |
| **Efficiency** | 50% | 50% | 83% | 80% |
| **Idle Rate** | 9,000 Btu/h | 12,000 Btu/h | 800 W | 1,100 W |

**Included Products** are products that meet the definition of a commercial open deep-fat fryer (per section 4.2), including countertop, floor type, and drop-in designs. These 12- to 24-inch-wide commercial open vat fryers can hold between 25 and 120 lbs. of shortening (oil).

**Table 7: Proposal Scope**

| Mandatory Standards | Test-and-list | Out of Scope |
|---|---|---|
| Gas Standard Vat Fryers<br><br>Gas Large Vat Fryers | Electric Standard Vat Fryers<br><br>Electric Large Vat Fryers | Fryers with less than 25lbs. oil capacity and greater than 120lb. oil capacity<br><br>Pressure Fryers<br><br>Countertop Ventless<br><br>Air Fryers and Combi Ovens with Air Fry Mode<br><br>Donut Fryers |

## 4.1 Proposed Changes to the Title 20 Code Language

### 4.1.1. Proposed Definitions

The CASE Team proposes a scope and definition aligned with ENERGY STAR V3.0, as the industry has vetted these definitions based on twenty years of engagement with this market. The CASE Team proposes adding the following new definitions to Title 20:

- A definition for “Commercial Open, Deep-Fat Fryer” to define the scope of the coverage. This definition would apply to standard, large, and split vat fryers, all considered commercial open, deep-fat fryers.

- Definitions for commercial fryers, including “Standard Fryers” and “Large Vat Fryers.” These definitions would differentiate the two based on their size and capacity.
- Definitions for a “Split Vat Fryer,” referencing how they can be standard or large vat fryers.

The ENERGY STAR standard does not address the following commercial fryer types. The CASE Team proposes excluding these types of fryers from the scope of Title 20 regulations:

- Closed vat or pressure fryers,
- Air fryers or any fryer with less than 25 lbs. of shortening capacity,
- Propane-fueled fryers (includes food trucks),
- Countertop ventless fryers,
- Fryers with vats measuring less than 12 inches wide or more than 24 inches wide
- Fryers with single vat oil capacity exceeding 120 lbs.
- Flat bottom or donut, funnel cake fryers

The CASE Team recommends that the CEC investigate commercial propane fryers further for potential inclusion. Food trucks and restaurants in remote locations use commercial propane fryers. The difference between a natural gas fryer and a propane fryer is the location of the gas regulator on the gas inlet. Additionally, the gas orifices may also require replacement. Natural gas fryers operate around a 4-inch water column (WC), and propane fryers operate around 10-inch WC pressure. A service technician can easily replace the regulator. Most manufacturers offer the same commercial fryer models in natural gas or propane configurations. Propane fryers are estimated to account for less than 5 percent of commercial gas fryer sales in California.

### 4.1.2. Proposed Test Procedure

The ASTM F1361 test procedure, with its latest revisions finalized in 2021, provides guidelines for measuring efficiency, production capacity, and idle energy rates of commercial standard vat fryers. ASTM F2144, its latest revisions finalized in 2021, applies to commercial large vat fryers with a vat size of 18 inches or larger or with 50 lbs. or more of oil capacity. ENERGY STAR V3.0 references the 2020 version of ASTM F1361 and the 2017 version of ASTM F2144. The CASE team recommends using the current versions of the ASTM F1361 and F2144 test standards for commercial fryers, instead of the versions incorporated by ENERGY STAR, because of the improved repeatability and reproducibility in testing and the removal of ambiguity from test results.

ASTM F1361 and ASTM F2144 are well established in the industry. They are widely used to report cooking energy efficiency, idle energy rate, and production capacity. The commercial fryers are tested by cooking frozen shoestring french fries to a weight loss of 30 percent in 350˚F oil.

The CASE Team recommends adopting the 2021 versions of the ASTM F1361 and F2144 standard test procedure for all fryer product classes under the proposed standards. The CASE Team also recommends allowing certification based on testing using any test method version from 2007 or later, noting that 2021 is the most current version to align with ENERGY STAR.[2]

Existing CEC regulations require the manufacturer to test units for each basic appliance. In the Title 20 Appliance Efficiency Regulations, the CEC defines a basic model as "all units of a given type of appliance

[2] ENERGY STAR V3.0 references the 2020 version of F1361 and 2017 version of F2144. V2.0 references the 2007 version of F1361 and 2009 version of F2144.

(or class thereof) that are manufactured by one manufacturer that have the same primary energy source, and that do not have any differing electrical, hydraulic, physical, or functional characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency" (Section 1602). The CASE Team proposes using the existing basic model definition and testing requirements.

### 4.1.3. Proposed Standard Level

It is proposed that commercial standard gas fryers shall have cooking energy efficiencies above 50 percent and idle rates below 9 kBtu/h. Commercial large vat fryers shall also have cooking energy efficiencies above 50 percent and idle rates below 12 kBtu/h. These levels align with the ENERGY STAR V2.0 and V3.0 commercial gas fryers standards, presented in the table below.

**Table 8: Proposed Commercial Gas Fryer Standards**

| Fuel Type | Gas | Gas |
|---|---|---|
| Vat Size | Standard | Large |
| Efficiency | > 50% | > 50% |
| Idle Rate | < 9,000 Btu/h | < 12,000 Btu/h |

### 4.1.4. Proposed Reporting Requirements

All commercial gas and electric standard and large vat fryers must report the following information to be listed in MAEDbS (Modernized Appliance Efficiency Database System (MAEDbS), n.d.). The CASE team proposes the following fields:

**Table 9: Proposed Reporting Requirements**

| Field | Source and Explanation | Example Values and Units |
|---|---|---|
| Manufacturer Name | The company name | Crispy Fryer Co |
| Brand Name | The name under which the product is sold or known | Crispy Fryer |
| Model Name | Usually, the base name of the model family, indicating the oil capacity and alphabetic model line | **50FG** |
| Individual Model Number | Usually, an alphanumeric distinct model designation, which includes the vat permutations, controller code, and options like oil filtration | 3**50FG**DO |
| **Fryer Type | Standard 12-17” wide and has the shortening capacity of less than or equal to 50 lbs. or large vat 18-24” wide and has shortening capacities over 50 lbs. | Standard or Large Vat |

| Field | Source and Explanation | Example Values and Units |
|---|---|---|
| | These two types of commercial fryers have different efficiency criteria | |
| Installation (optional) | Location of installation | Floor or Countertop |
| Primary Fuel Source | To determine whether an efficiency standard applies. | Gas or Electric |
| Width | The primary size designation to verify correctly whether a fryer is a standard or large vat, and to provide consumers with information to compare products. | 12-24” |
| Depth | The distance measured from the front of the fryer vat to the back of the fryer vat, necessary to provide consumers with information to compare products. | 12-18” |
| Shortening Capacity (Per Vat) | Oil capacity in lbs., necessary to verify whether a product is correctly categorized as a standard or large vat, and provide consumers with information to compare products. | 25-150 lbs/vat |
| Cooking Efficiency | ASTM F1361 and F2144 Section 10.8 Heavy Load | % |
| Ready To Cook Idle Energy Rate Gas | ASTM F1361 and F2144 Section 10.5 | Btu/h per vat |
| Ready To Cook Idle Energy Rate Electric | ASTM F1361 and F2144 Section 10.5 | W per vat |
| *Number of Vats | Commercial fryers come in multiple vat configurations | 1,2,3,4 |
| *Vat Type | A single vat can be separated by a partition that prevents flavor transfer. A fryer width can be mislabeled if measured for a single side of a split vat. Round vat fryers are usually used for chicken frying. | Standard, Split Vat, or Round |

| Field | Source and Explanation | Example Values and Units |
|---|---|---|
| *Electric Input Rate | For electric fryers only, not required for gas fryers | kW per vat |
| *Gas Input Rate | For gas fryers only, not required for electric fryers | Btu/h per vat |
| *Production Capacity | ASTM F1361 and F2144 Section 10.8 Heavy Load | lbs/h per vat |

*Not in SASD or ENERGY STAR, ** in ENERGY STAR but not SASD

Commercial gas fryers sold in California must comply with the proposed standard levels described in Section 4.2.3 of this CASE Report. Commercial electric fryers sold in California must test and list their units with the mandatory reporting requirements above. Commercial fryers outside the scope described in Section 4.1 are not required to report.

The proposed reporting requirements mostly align with the SASD and ENERGY STAR V2.0, with additional fields indicated by asterisks above. Manufacturers currently report to SASD to comply with Massachusetts, New Jersey, New York, and Rhode Island state appliance standards.

In addition to the reporting fields required by SASD, the CASE Team proposes adding the number of vats, vat type, and input rate. These important identifiers help differentiate between models with similar name extensions and are available on any commercial fryer specification sheet. The CASE Team recommends reporting the number of vats because idle energy efficiency data is shown for a single vat. However, duplicate entries may appear for commercial fryers with multiple vats. The SASD database has multiple rows with identical data for all fields except for the basic model number. The different model numbers for commercial fryers have varying vat configurations, which are not collected.

The CASE Team proposes adding production capacity to this important consumer metric, alleviating concerns that energy-efficient commercial fryers do not adequately perform. Production capacity is expressed in the maximum amount of frozen french fries cooked per hour, measured in pounds. This metric also accounts for the time required for the fryer to reheat the oil to 340˚F (within 10˚F of 350˚F target cooking temperature) at the end of the cook cycle, which is considered ready to cook. Lower-performance fryers that take longer to heat the oil to 340˚F are not suitable for high-volume operations. High-performance commercial fryers do not need to heat the oil to 340˚F at the end of the cook cycle, allowing the operator to “drop” the next fries into the oil immediately after removing the previous batch. Conversations with manufacturers have indicated that reporting this metric is essential to ensure the adequate performance of energy-efficient commercial fryers for the end users. No additional test burden is added for this reporting requirement as production capacity is collected during the heavy load ASTM F1361 and F2144 cooking efficiency tests.

### 4.1.5. Proposed Marking and Labeling Requirements

All appliances must be permanently marked with the manufacturer’s name, brand name or trademark, model number, and manufacturing date, clearly and prominently displayed in an easily accessible location on the unit. The CASE Team does not propose additional marking or labeling requirements for commercial fryers.

# 5. Market Analysis

Data derived from a commercial foodservice survey conducted in 2009 and published in 2014 (Fisher-Nickel, 2014) estimated that California has 170,000 commercial fryer vats currently in operation, with approximately 1.7 vats per facility and an estimated 100,000 facilities statewide (Fisher-Nickel, 2014).[3] The commercial foodservice survey documented cooking appliance lineups in commercial and institutional foodservice facilities. According to the study, California restaurants employed 136,000 commercial fryer vats in 2009. Independent full-service restaurants used half of these, and large QSRs used a quarter. The survey estimated that institutional foodservice facilities used 23,000 commercial fryer vats, including hotels, recreational facilities, schools, and healthcare. The CASE Team extrapolated the 2009 survey numbers to 2023 based on California population growth.[4]

The NAFEM estimates that 85 percent of the commercial fryers sold in the U.S. are gas and assumes the remaining 15 percent to be electric (NAFEM, 2009). ENERGY STAR shipment data from 2022 estimates that 39,000 fryers are sold in the U.S. (U.S. EPA ENERGY STAR, 2022). After adjusting for the number of California restaurants[5] and considering ENERGY STAR national estimates, the CASE Team estimates that approximately 4,600 ENERGY STAR-qualified commercial fryers are sold yearly in the state. However, the actual market penetration is much higher due to a robust California commercial fryer rebate program (California Foodservice Instant Rebates QPL, n.d.). The CASE Team estimated consumers received approximately 4,200 commercial fryer rebates in 2022-2023. With the national ENERGY STAR market penetration reaching 26 percent in 2022 and factoring in California's rebates, the overall ENERGY STAR compliant commercial fryer market penetration increased to 49 percent. This figure indicates that approximately 8,200 and 8,700 ENERGY STAR-compliant commercial fryers are sold yearly in California. Table 10 describes the compliance rate breakdown in more detail.

**Table 10: Fryers Sold in California Per Year**

| | Total | Non-compliant | ENERGY STAR V2.0 compliant | ENERGY STAR V3.0 and V2.0 compliant |
|---|---|---|---|---|
| Standard Vat Gas | 14,647 | 8,232 | 6,415* | 6,415* |
| Large Vat Gas | 835 | 469 | 366* | 366* |
| Standard Vat Electric | 2,541 | 254 | 534 | 1,752 |
| Large Vat Electric | 145 | 15 | 31 | 100 |
| Total | 18,168 | | | |

*ENERGY STAR V2.0 and V3.0 specifications are the same for commercial gas fryers; therefore, the compliance estimates are the same.

Although no data is available on the market share of commercial large vat fryers compared with commercial standard vat fryers, the CASE Team estimates that it is less than 10 percent for commercial

[3] The number of vats per facility assumes approximately 100,000 facilities with vats in California.
[4] 36,960,000 in 2009 and 39,240,000 in 2021 with 0.514% year-over-year growth
[5] Analysis of nationwide restaurants vs. CA shows that 12.1% of U.S. restaurants are in CA based on calculations using numbers from the National Restaurant Association.

(https://restaurant.org/research-and-media/research/industry-statistics/state-statistics/)

large vat fryers due to the popularity of the 14-inch commercial standard vat fryer. The figure below depicts the 2022 NAFEM breakdown of commercial fryer sales by category based on cost. Commercial banked fryers have multiple vats on the same chassis. Commercial freestanding fryers have a single vat but could be either standard or large.

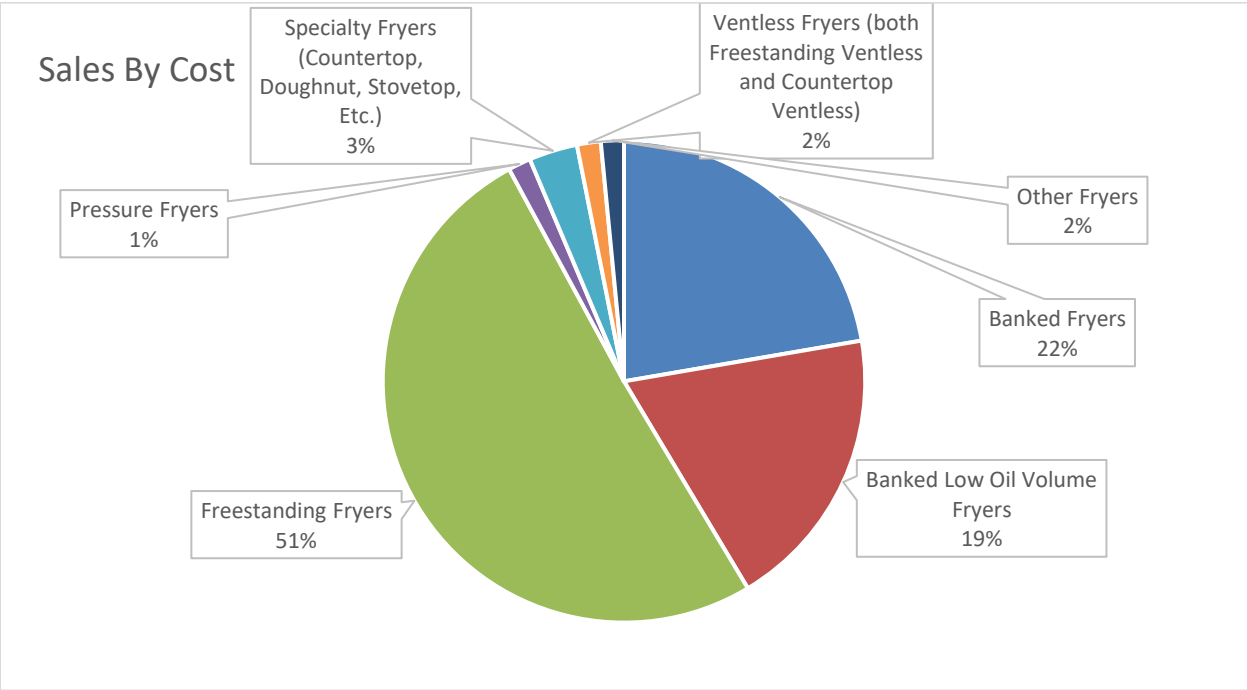


**Figure 12 2022 NAFEM Sales Breakdown by Cost of Fryers**

## 5.1. Product Efficiency Opportunities

Sections 2 and 3 describe significant opportunities to improve the efficiency of commercial gas fryers. Baseline commercial gas fryers are expected to be less than the 37 percent efficient ENERGY STAR criteria. The average efficiency of ENERGY STAR V3.0 commercial gas fryers currently on the market is 56 percent, with some models as high as 69 percent. Energy efficiency improvements to commercial fryers include advanced burner design, flue gas routing, vat insulation, and advanced controls. Most energy-efficient commercial gas fryers use power burners with a submerged heat exchanger design. The least efficient commercial fryers use atmospheric tube burner designs to compensate for an inefficient design with higher input rates. Many inefficient fryers do not have insulation around their vat. Therefore, aligning with ENERGY STAR V3.0 presents a significant opportunity to improve the efficiency of these fryers.

Due to similar heating element designs across commercial fryer models, electric fryer energy efficiency opportunities are limited. Vat insulation and advanced controls can improve energy efficiency. No published data on commercial electric fryers with less than 80 percent efficiency is available. The average efficiency of ENERGY STAR V3.0 commercial electric fryers currently on the market is 87 percent, and select models have efficiencies as high as 92 percent. The range in efficiency between baseline models and compliant electric fryers is much narrower than commercial gas fryers.

## 5.2. Technical Feasibility

### 5.2.1. Future Market Adoption of Qualifying Products

In 2022, ENERGY STAR estimated that 26 percent of commercial fryers met the ENERGY STAR V3.0 product criteria, which became effective in 2016. In 2015, ENERGY STAR estimated that 21 percent of commercial fryers met the ENERGY STAR V2.0 product criteria (U.S. EPA). The market penetration of ENERGY STAR-qualified commercial fryers in California may be higher than in the rest of the country due to long-standing rebate programs that have transformed dealer stocking practices. QSRs have chosen ENERGY STAR commercial fryers for over a decade due to their superior performance and energy savings. Below is a summary of energy-efficient models already on the market.

**Table 11: Number of ENERGY STAR V3.0 Qualified Models in 2023**

| Fuel | Type | Avg Efficiency (%) | Avg Idle Rate (W or Btu/h) | Number of Models | Number of Manufacturers |
|---|---|---|---|---|---|
| Electric | Standard | 86.7 | 692 | 35 | 5 |
| Electric | Large Vat | 87.0 | 1,005 | 15 | 6 |
| Gas | Standard | 56.0 | 6,743 | 56 | 12 |
| Gas | Large Vat | 58.9 | 9,083 | 39 | 7 |

The only change between ENERGY STAR V2.0 and V3.0 was a more stringent standard vat electric fryer threshold, modified from 80 to 83 percent efficiency and 1000 to 800W idle.

**Table 12: Number of ENERGY STAR V2.0 Qualified Models in 2016**

| Fuel | Type | Avg Efficiency (%) | Avg Idle Rate (W or Btu/h) | Number of Models | Number of Manufacturers |
|---|---|---|---|---|---|
| Electric | Standard | 85.4 | 759 | 100 | 10 |
| Electric | Large Vat | 87.5 | 982 | 16 | 5 |
| Gas | Standard | 57.3 | 5,995 | 78 | 9 |
| Gas | Large Vat | 59.3 | 6,946 | 35 | 6 |

The CASE Team reviewed the V2.0 and V3.0 ENERGY STAR-qualified products list and SASD to assess the availability of qualifying products meeting the proposed standards. The results of that analysis are presented and discussed further in Section **Error! Reference source not found.**.

When EPA adopted the ENERGY STAR V1.0 criteria in 2003 to evaluate energy-efficient commercial fryers, it thoroughly assessed the market to ensure the availability of qualified products from various manufacturers. The EPA sought to establish recognition criteria that do not rely on proprietary technology.

In 2022, ENERGY STAR estimated that V3.0 qualifying products accounted for 26 percent of the entire fryer market, indicating a low consumer adoption at this level (U.S. EPA ENERGY STAR, 2022). Although ENERGY STAR V3.0 does not differentiate market adoption by fuel type, other data sources indicate that gas fryers are the preferred choice for commercial kitchens (NAFEM, 2009). Therefore, the low adoption rate likely represents mainly gas fryers. The 2011 transition from ENERGY STAR V2.0 to V3.0 only impacted commercial electric standard vat fryers. This change indicates a relatively high market adoption rate for commercial electric fryers, which would typically decrease when the standard increases. Therefore, the high adoption rate of commercial electric fryers suggests that the 26 percent figure represents primarily commercial gas fryers.

### 5.2.2. Consumer Utility and Acceptance

Energy-efficient commercial fryers typically consume less energy, resulting in lower input rates. They are also proven to have quicker recovery times between cooking batches and maintain production capacities comparable to or exceeding those of less efficient models (Southern California Gas Company, 2015). Because baseline commercial fryers are more affordable, they continue to be mass produced. Their affordability leads most consumers to replace rather than repair the fryer when they malfunction.

Compliant commercial fryers utilize energy-efficient technologies such as electronic ignition and power burners, which are more complicated than standing pilots and atmospheric burners. Therefore, replacing parts or repairing energy-efficient fryers can be more challenging and costly.

Compliant commercial fryers may include built-in oil filtration systems, which are unrelated to energy efficiency and, therefore, not included in the analysis presented here. These systems increase the initial cost but prolong the oil's usability, saving thousands of dollars over the fryer's lifespan (Southern California Gas Company).

Consumers have widely adopted products that meet the proposed specification level, and many products sold already meet the criteria. Throughput and efficacy for efficient and less efficient products are generally the same, as demonstrated below.

- Electric baseline units had production capacities between 52 and 105 lbs./hr, averaging 69 lbs/hr.
- Electric compliant units had production capacities between 59 and 72 lbs./hr, averaging 62 lbs/hr
- Gas baseline units had production capacities between 39 and 97 lbs./hr, averaging 58 lbs./hr.
- Gas compliant units had production capacities between 39 and 110 lbs./hr, averaging 67 lbs./hr.

### 5.2.3. Commercial Fryer Market Structure

The market structure for commercial fryer sales is consistent with the overall market structure for commercial food service equipment and has been in place for decades. Prominent commercial fryer manufacturers include Frymaster, Pitco, and Vulcan. Frymaster, Pitco, and Henny Penny make multibank fryer models with built-in filtration specific to QSRs. Other notable U.S. manufacturers include Imperial, Royal Range, Southbend, Montague, Keating, Anets, American Range, Giles, Alto-Shaam, Wells, and Ultrafryer. Giles, Ultrafryer, and Winston specialize in chicken fryers. Imperial, Royal Range, and American Range are the largest companies on the West Coast, with manufacturing facilities in Los Angeles.

The commercial fryer market has many inexpensive gas models manufactured overseas. Some U.S. fryer companies also manufacture their lower-end models in Mexico or Asia. Notable inexpensive (less than $1,000) commercial fryer brands that do not meet ENERGY STAR standards include Kintera, Avantco, Main Street, MoTak, Empura, Kratos, Migali, and Dukers.

Below are the key stakeholders within the commercial food service market:

- **Equipment Manufacturers:** Manufacturers of commercial food service equipment design, fabricate, and assemble equipment. Manufacturers seldom engage in direct sales to end customers. Instead, they collaborate with equipment representatives—such as vendors or dealers—to distribute products, assist customers, and facilitate sales. However, major restaurant chains purchase directly from equipment manufacturers and collaborate with a

representative. These large restaurant chains and manufacturers typically have experience with existing state standards and integrate them into their sales process.

- **Manufacturer Representatives:** Manufacturer representatives work with equipment dealers, commercial kitchen designers, and consultants to promote and educate the market on the manufacturer's products, specify products for new kitchen designs, and facilitate sales. Additionally, they demonstrate the operation and commissioning of equipment after the sale. Typically, manufacturer representatives do not directly order or distribute equipment. They are paid commissions on equipment ordered through dealers in their territory.
- **Equipment Vendors/Dealers:** Vendors are brick-and-mortar stores or online retailers that sell equipment directly to consumers or through large regional retailers like Action Sales, Chef's Toys, Restaurant Depot, and Trimark. These retailers may have experience with fryer standards in other states. Consumers work with dealers to choose equipment from stocked items or order for specific requirements. Larger vendors offer design-build services where sales staff work with clients to specify products for new kitchens and extensive remodels. These vendors often participate in contract-bid activities where they propose a suite of kitchen equipment based on customer specifications and compete with other vendors for the equipment sales contract. Some restaurant operators will buy equipment from major online retailers like Webstaurant Store, Wasserstrom, and Katom. However, they are less popular and do not offer local support like equipment representatives. These resources generally provide search tools for consumers to identify more efficient products. Many online sales now provide details of compliance with other state standards that align with the proposed standards. Therefore, these systems have already adjusted to state standards and will not require significant changes to incorporate California standards into their sales processes.
- **Buying Groups:** Buying groups comprise various equipment vendors and dealers who sell a high enough volume of equipment to qualify for participation. Buying groups negotiate with manufacturers for the best prices for equipment vendors and dealers. Participating in a buying group can benefit equipment vendors, as they can access lower prices, additional rebates, and promotions on specific equipment. However, customers may have a limited choice of brands when purchasing through a buying group.
- **Designers and Consultants:** Designers and consultants do not generally have a brick-and-mortar sales floor or offer online sales. However, they often have showrooms where they meet with customers to design custom kitchens based on existing specifications or from scratch. A kitchen consultant will collaborate with an architect when building a new restaurant or dining facility. These consultants have brand loyalty and will specify equipment within a purchasing group unless the customer has specific requests.
- **Installers:** General contractors, plumbers, and electricians install equipment but do not buy or sell equipment.

The CASE Team anticipates that the market will continue to adopt compliant models due to the variety of commercial fryers meeting the proposed standards in the baseline and compliant product class.

The CASE Team does not anticipate that the standards proposal will significantly impact the existing manufacturer structure or supply because nearly half of all sales already meet the proposed standards. If the proposed standards are adopted, providing at least one year between the adoption and effective date would allow manufacturers and supply chains sufficient time to adjust their operations to comply with the changes.

# 6. Per Unit Energy Savings

## 6.1. Key Assumptions

The CASE Team used the eTRM's findings and calculators (CA eTRM, 2024) to decide the appropriate inputs for the number of operational days, operational hours per day, cooking efficiency, pounds of food cooked per day, and ASTM energy to food ratio for various commercial fryer types. Preheat time and energy, idle energy rate, and cooking efficiency have different assumptions from baseline to compliant models.

The CASE Team averaged the above assumptions for noncompliant baseline models that do not meet the criteria for ENERGY STAR V2.0. and compliant models that qualify for ENERGY STAR V2.0 and V3.0. The idle energy rate has the most significant impact on annual energy consumption. Appendix A (Fryers Energy Use Assumptions) shows each commercial fryer type's average efficiencies and idle rates.

Commercial fryer energy consumption is compared between baseline and compliant units, using the fryer's eTRM for static operating assumptions:

- 12 hours of operation per day
- 351 days per year
- 111 lbs. of food cooked per day
- ASTM energy to food ratio: 570 Btu/lb.

The following tables outline the differences between baseline and compliant ENERGY STAR V2.0 and V3.0 commercial standard vat fryers. Appendix A: Commercial Fryer Energy Use Assumptions contains additional assumption details.

**Table 13: Key Commercial Gas Standard Vat Fryer Assumptions**

| Gas Standard Vat Fryer Assumptions | Baseline | ENERGY STAR V2.0 and 3.0 |
|---|---|---|
| Idle energy rate | 12,847 Btu/hr | 9,000 Btu/hr |
| Cooking efficiency | 37% | 50% |

**Table 14: Key Commercial Electric Standard Vat Fryer Assumptions**

| Electric Standard Vat Fryer Assumptions | Baseline | ENERGY STAR V2.0 | ENERGY STAR V3.0 |
|---|---|---|---|
| Idle energy rate | 1.0 kW | 0.86 kW | 0.68 kW |
| Cooking efficiency | 80% | 83.7% | 86.2% |

Due to insufficient market or laboratory testing data to determine commercial electric fryer energy use, the CASE Team used the ENERGY STAR V2.0 threshold as the baseline fryer assumption. The CASE Team used ENERGY STAR V2.0 and V3.0 scenarios separately to analyze the data for compliant energy-efficient commercial electric fryers. In each instance, the compliant model consisted of the average efficiency and idle energy of models that qualify for either ENERGY STAR V2.0 or V3.0.

Appendix A presents more detailed assumptions for commercial standard vat and large vat fryers.

## 6.2. Methodology

This section describes the CASE Team's methodology and approach for assessing the implications of the proposed standards for baseline and compliant fryer models in the same product category.

The CASE Team used averages of products meeting the proposed ENERGY STAR standards with those that do not for a comparative analysis to determine the impact on energy consumption and environmental factors. The method calculates the power consumption of a compliant product by using the average energy consumption of all products compliant with those standards.

The CASE Team conducted a secondary analysis of the energy savings and cost-effectiveness, assuming commercial fryers meet only the minimum threshold for ENERGY STAR V2.0 and V3.0 proposed standards for cooking efficiency and standby idle energy rate. The alternative method estimates the power consumption of a compliant product that just meets the minimum performance required by the standards. Appendix A (Fryers Energy Use Assumptions) further outlines this analysis.

Annual fryer consumption is calculated for the entire year by adding daily energy consumption for the following activities:

- Preheat
- Cooking
- Idle energy use in idle mode

Cooking energy is calculated by multiplying the amount of food cooked per day by the theoretical ASTM energy-to-food ratio and dividing it by the cooking energy efficiency. The eTRM provides a more detailed calculation methodology (CA eTRM, 2024).

## 6.3. Per Unit Energy Saving Results

The CASE Team assessed energy savings for commercial fryers by comparing compliant models against baseline models. Table 15 provides insights into the annual energy consumption for baseline commercial fryers calculated by the CASE Team. The baseline commercial gas fryers consume between 1,108 and 1,306 therms of natural gas per unit per year, while the baseline commercial electric fryers use 12,278 to 13,713 kWh per unit annually.

**Table 15: Annual Per Unit Energy Use for Baseline Case**

| Product Class | Base case per-unit consumption - electricity (kWh/yr-unit) | Base case per-unit consumption - peak demand (kW/unit) | Base case per-unit consumption - natural gas (therms/yr-unit) |
|---|---|---|---|
| Standard Vat Electric V2.0 | 12,300 | 1.74 | - |
| Standard Vat Gas | - | - | 1,110 |
| Large Vat Electric V2.0 or V3.0 | 13,700 | 1.95 | - |
| Large Vat Gas | - | - | 1,310 |

Table 16 summarizes the energy consumption for compliant commercial fryer models per unit per year calculated by the CASE Team. Commercial standard vat electric V2.0 models use 11,411 kWh per year, standard vat electric-V3.0 models use 10,508 kWh, and both large vat electric V2.0 and V3.0 models consume 12,578 kWh annually. Compliant commercial standard vat gas fryers use 800 therms of natural gas per unit per year, and compliant large vat gas models use 709 therms.

**Table 16: Annual Per Unit Energy Use for Measure Case**

| Product Class | Measure case per-unit consumption - electricity (kWh/yr-unit) | Measure case per-unit consumption - peak demand (kW/unit) | Measure case per-unit consumption - natural gas (therms/yr-unit) |
|---|---|---|---|
| Standard Vat Electric V2.0 | 11,400 | 1.62 | - |
| Standard Vat Electric V3.0 | 10,500 | 1.49 | - |
| Standard Vat Gas | - | - | 800 |
| Large Vat Electric V2.0 or V3.0 | 12,600 | 1.79 | - |
| Large Vat Gas | - | - | 709 |

Table 17 highlights the energy savings for compliant commercial fryers per unit per year. Commercial standard vat electric-V2.0 models save 867 kWh per year, standard vat electric-V3.0 models save 1,770 kWh, and both large vat electric-V2.0 and V3.0 models save 1,135 kWh annually. The commercial standard vat gas fryers save 308 therms of natural gas per unit per year, and large vat gas fryers save 597 therms. These savings illustrate the improved efficiency of compliant models over non-compliant ones, underscoring potential operational cost reductions and environmental benefits.

**Table 17: Annual Per Unit Energy Savings**

| Product Class | Per-unit savings - electricity (kWh/yr-unit) | Per-unit savings - peak demand (kW/unit) | Per-unit savings - natural gas (therm/yr-unit) |
|---|---|---|---|
| Standard Vat Electric V2.0 | 867 | 0.123 | - |
| Standard Vat Electric V3.0 | 1,770 | 0.252 | - |
| Standard Vat Gas | - | - | 308 |
| Large Vat Electric V2.0 or V3.0 | 1,140 | 0.161 | - |
| Large Vat Gas | - | - | 597 |

# 7. Cost-Effectiveness

This section describes the CASE Team's methodology for analyzing the economic impacts of the proposed standards.

## 7.1. Incremental Cost

The CASE Team analyzed commercial fryers by comparing the established baseline fryer with commercial fryers that meet the requirements of ENERGY STAR V2.0 and V3.0.

In December 2023, the CASE Team conducted the commercial fryer analysis using data from major online foodservice equipment retailers. The following websites provide retail pricing data:

- Webstaurant Store
- Katom
- CKitchen
- JES Restaurant Equipment
- Chef's Deal
- A City Discount

Title 20 is a mandatory California code requirement; however, most consumers base their commercial kitchen equipment purchasing decisions on the lowest price. Therefore, the CASE Team used the lowest-cost commercial fryers as the base case. Pricing was averaged for the 11 lowest-cost commercial gas fryers and six commercial lowest-cost electric fryers on the market to determine baseline costs.

Table 18 outlines the equipment costs for different commercial fryer classes, comparing the baseline and compliant cases to calculate incremental costs. ENERGY STAR V2.0 and V3.0-qualified commercial standard vat electric fryers are $4,157 and $6,239, respectively. The cost of compliant commercial fryers increases significantly from a baseline cost of $2,674 to $6,831 and $8,913, respectively. In contrast, commercial standard vat gas fryers have a more modest incremental cost of $1,001, from a baseline cost of $1,319 to a compliant cost of $2,320. The commercial large vat electric meeting V2.0 and V3.0 has an incremental cost of $1,114, increasing the baseline cost of $10,255 to a compliant case cost of $11,369. The commercial large vat gas model experiences a higher incremental cost of $2,444, escalating from a base case cost of $2,211 to a compliant case cost of $4,655. This data provides a detailed view of the investment needed to upgrade to more compliant commercial fryer models under the new standards.

**Table 18: Equipment Per Unit Costs**

| Product Class | Base Case Equipment Cost (2024 $) | Compliant Case Equipment Cost (2024 $) | Incremental Equipment Cost (2024 $) |
|---|---|---|---|
| Standard Vat Electric V2.0 | 2,674 | 6,831 | 4,157 |
| Standard Vat Electric V3.0 | 2,674 | 8,913 | 6,239 |
| Standard Vat Gas | 1,319 | 2,320 | 1,001 |
| Large Vat Electric | 10,255 | 11,369 | 1,114 |
| Large Vat Gas | 2,211 | 4,655 | 2,444 |

While most commercial fryers on the ENERGY STAR-qualified product list are expensive units (>$10k) geared toward the large QSR market, a large majority of sales are economy priced units to independently owned restaurants. Some features increase the price of commercial fryers without increasing efficiency, such as digital controls with timers and oil filtration, these features are desirable to QSRs. Large QSRs can purchase fryers in bulk directly from the manufacturer and negotiate much lower prices than independent restaurant operators. Energy-efficient pricing analysis was only conducted on lower-cost ENERGY STAR units available for sale to independent restaurant operators and did not include cost-added features that do not affect energy efficiency, such as oil filtration and programmable thermostats.

The CASE Team averaged the price of eight budget ENERGY STAR V3.0-qualified commercial gas models. These models were at most $3,500, with the two lowest-price models just above $1,500. Energy-efficient pricing analysis included models from major U.S. manufacturers, such as Frymaster, Pitco, Vulcan, and several others.

ENERGY STAR-qualified commercial electric fryers were significantly more expensive than their gas counterparts. The CASE Team averaged the price of six of the least costly ENERGY STAR V3.0-qualified models and the four lowest-priced ENERGY STAR V2.0-qualified models that do not meet V3.0 specifications. All compliant electric fryers were between $7,000 and $11,000, except for one fryer made by Imperial, which cost only $2,200 and met the ENERGY STAR V2.0 criteria.

All pricing analyses were conducted on comparable 14- to 15-inch wide commercial standard vat fryers between 35 and 50 lbs. of oil capacity. Energy-efficient commercial gas fryers are cost effective due to the relatively low incremental cost of $1,000, compared with the much higher incremental cost of $4,000 to more than $6,000 for commercial electric fryers, depending on the ENERGY STAR version threshold.

## 7.2. Design Life

According to the eTRM, the design life of commercial fryers is 11 years for commercial gas fryers and 12 years for commercial electric fryers (CA eTRM, 2024). See Table 19 for more details.

**Table 19: Effective Useful Lifetime by Product Class**

| Product Class | Effective Useful Life of Equipment (years) |
|---|---|
| Standard Vat Electric | 12 |
| Standard Vat Gas | 11 |
| Large Vat Electric | 12 |
| Large Vat Gas | 11 |

## 7.3. Life Cycle Cost and Net Benefit

Table 20 details the present value costs and benefits of the proposed standards per unit and the total life cycle benefit-cost ratio. These standards are cost effective for commercial standard and large vat gas fryers and commercial large vat electric fryers. However, commercial standard vat electric fryers are not cost effective because, on average, life cycle benefits over the lifespan are less than life cycle costs, yielding a life cycle benefit-cost ratio of less than one. The CASE Team suggests revisiting commercial electric fryer standards until more baseline product data becomes available, prices decrease, or performance improves. The CASE Team also notes that while this analysis did not find commercial standard vat electric fryer standards to be cost effective, ENERGY STAR V3.0-qualified commercial standard vat electric fryers may be cost effective in a particular use case or location, increasing the importance of a test-and-list requirement to collect baseline performance data. This information enables consumers to compare products that likely yield cost-effective energy savings.

The incremental cost of the proposed standards ranges from $1,001 to $6,239, depending on the product class. The analysis does not include additional costs, such as added maintenance or installation costs. The CASE Team has not found any differences in installation costs between compliant and baseline commercial fryers. The CASE Team assumes no additional maintenance costs but recommends working with stakeholders to understand if compliant commercial fryers have maintenance costs different from commercial baseline fryers. See Section 7.1 for a more detailed cost breakdown. The electricity and natural gas prices were estimated using the latest U.S. Energy Information Administration (EIA) data to reflect California consumer's average price. (U.S. Energy Information Administration, 2024). The annual escalation rates were estimated using price forecasts. The electricity price forecast was derived from the CEC's 2022 California Energy Demand Forecast (California Energy Commission, n.d.). The natural gas price forecast was derived from "Utility Costs and Affordability of the Grid of the Future: An Evaluation of Electric Costs, Rates and Equity Issues." (Utility Costs and Affordability of the Grid of the Future: An Evaluation of Electric Costs, Rates and Equity Issues, 2021)

As indicated in Table 20, the CASE Team estimates the total life cycle benefits per unit compliant with the proposed standards range from $2,484.70 to $9,166.39, based on product class. The costs for commercial standard vat electric fryers, ranging from $4,157 to $6,239, exceed these benefits, yielding a life cycle benefit ratio of 0.60 and 0.81 depending on the ENERGY STAR qualification version. The costs for commercial gas fryers standard and large vat electric fryers range from $1,001 to $2,444 and are less than the life cycle benefits, yielding a life cycle benefit-to-cost ratio between 2.92 to 4.72. As previously noted, the CASE Team found standards for commercial large vat electric fryers to not be cost effective and do not propose standards due to their low market share.

**Table 20: Per Unit Lifetime Economic Impacts for Products Purchased in the First Year**

| Product Class | Design Life (years) | Present Value of Benefits (2024 $) | Present Value of Incremental Costs (2024 $) | Net Present Value (2024 $) | Simple Payback Period (years) | Life Cycle Benefit-Cost Ratio |
|---|---|---|---|---|---|---|
| Standard Vat Electric V2.0 | 12 | 2,485 | 4,157 | -1,672 | 16.10 | 0.60 |
| Standard Vat Electric V3.0 | 12 | 5,073 | 6,239 | -1,166 | 11.9 | 0.81 |
| Standard Vat Gas | 11 | 4,729 | 1,001 | 3,728 | 1.88 | 4.72 |
| Large Vat Electric | 12 | 3,253 | 1,114 | 2,139 | 3.30 | 2.92 |
| Large Vat Gas | 11 | 9,166 | 2,444 | 6,722 | 2.36 | 3.75 |

# 8. Statewide Impacts

## 8.1. Annual Sales and Stock

A commercial foodservice survey conducted in 2009 and published in 2014 estimated that California has 172,000 commercial fryer vats in operation, or 1.7 commercial fryer vats per facility (Fisher-Nickel, 2014).[6] This survey documented cooking appliance lineups in commercial and institutional foodservice facilities. According to the study, California restaurants employed 136,000 commercial fryer vats in 2009. Independent full-service restaurants used half of these, and large QSRs used a quarter. Institutional foodservice facilities used 23,000 commercial fryer vats, including hotels, recreational facilities, schools, and healthcare. The CASE Team extrapolated the 2009 survey numbers to 2023 based on California's population growth.[7]

NAFEM estimates that 85 percent of the commercial fryers sold in the U.S. are gas, and the rest are assumed to be electric (NAFEM, 2009). ENERGY STAR shipment data from 2022 estimated that 39,000 fryers were sold in the U.S. (U.S. EPA ENERGY STAR, 2022). Section 5 indicates that California sells over 8,000 ENERGY STAR fryers annually.

### 8.1.1. Current Market Share

The CASE Team gathered estimates of commercial fryer sales market penetration that comply with the proposed ENERGY STAR V2.0 standard levels.

The ENERGY STAR criteria became more stringent in 2016 when the EPA updated the qualification from V2.0 to 3.0. ENERGY STAR estimated in 2015 that 21 percent of national commercial fryer shipments met the V2.0 criteria (U.S. EPA ENERGY STAR, 2015). In 2022, ENERGY STAR estimated that 26 percent of the shipments met the V3.0 criteria. As all V3.0-certified fryers meet V2.0 criteria, the CASE Team estimates that 26 percent of commercial fryers on the market meet the proposed energy thresholds. The criteria revision only affected commercial standard vat electric fryers. Section 5 describes the California fryer rebate program, which provides a $900 commercial gas fryer rebate and has increased the ENERGY STAR-certified commercial fryer market penetration for from 26 to 49 percent in California. The per fuel breakdown is shown in Table 21.

ENERGY STAR does not differentiate between commercial gas and electric fryer market penetration. Commercial electric fryers represent less than 15 percent of the market share (NAFEM, 2009). As laboratory test data for commercial standard vat electric fryers meeting ENERGY STAR V2.0 is not available, and not every model and brand on the market has been tested, the CASE Team estimates that 10 percent of commercial electric fryers could not meet ENERGY STAR V2.0. Twenty out of 29 (69 percent) ENERGY STAR V2.0 compliant commercial fryers also qualify for ENERGY STAR V3.0. If 90 percent of the commercial electric fryers cannot meet ENERGY STAR V2.0 and 62 percent (69 percent of the 90 percent) of the commercial electric standard vat fryers can meet V3.0, this means that approximately 28 percent of standard vat electric fryers can meet ENERGY STAR V2.0 but not V3.0.

The ENERGY STAR rating was updated to V3.0 for commercial standard vat electric fryers but remained unchanged for commercial gas fryers. The market penetration for commercial gas fryers remains at 44

[6] 1.7 commercial fryer vats per facility assumes there are 100,000 facilities in California.
[7] 36,960,000 in 2009 and 39,240,000 in 2021 with 0.514% year over year growth

percent for both standard and large vat versions. While not part of the proposed standard, note that the 76 percent market penetration for commercial large vat electric fryers is assumed to be an average of commercial standard vat electric fryers for ENERGY STAR V2.0 and V3.0 (90 percent and 62 percent). The table below summarizes the compliance rates assumed for this analysis.

**Table 21: California Energy-Efficient Fryer Market Penetration Estimates with the Active California Energy Wise Fryer Rebate Program**

| | % total market share | Non-compliant | ENERGY STAR V2.0 compliant only | ENERGY STAR V3.0 and V2.0 compliant | Total |
|---|---|---|---|---|---|
| Standard Vat Gas | 80.7% | 56% | 44% | 44% | 100% |
| Large Vat Gas | 4.6% | 56% | 44% | 44% | 100% |
| Standard Vat Electric | 14.0% | 10% | 28% | 62% | 100% |
| Large Vat Electric | 0.8% | 24% | 76% | 76% | 100% |
| Total | 100% | | | | |

### 8.1.2. Future Market Adoption of Qualifying Products

Commercial fryers meeting the proposed standards are readily accessible. However, they are a relatively inexpensive cooking appliance, resulting in a limited supply of used or refurbished products. More expensive commercial fryers, like pressure fryers not covered by this proposal, may be purchased, used, and refurbished. Given the small size of the refurbishment market, its impact on the statewide savings outlined in this report would be negligible. The CASE Team is confident that a broad range of models from many manufacturers will meet the proposed standards and anticipates no significant obstacles for consumers in obtaining such models.

## 8.2. Statewide Energy Savings – Methodology

The CASE Team calculated statewide savings estimates by factoring in the per-unit energy savings, the statewide stock, and the shipments forecast. The CASE Team analyzed models from four categories (commercial standard vat electric fryers, large vat electric fryers, standard vat gas fryers, and large vat gas fryers), aggregating them to arrive at the statewide total. The CASE Team used the ENERGY STAR unit shipment data for all commercial fryers to determine the distribution between the four categories using the Characterizing the Energy Efficiency Potential of Gas Fired Commercial Foodservice Equipment CEC-500-06-028 Report and the NAFEM 2010 Size and Shape of the Industry Report, latest report that split sales numbers by fuel type. Section 8.1 of the report displays the market split of the four categories.

The estimates presented in this report represent the savings estimated through implementing the ENERGY STAR V2.0 and V3.0 standards. As previously noted, the energy savings estimates pertain only to nonresidential buildings. The CASE Team assumed when calculating statewide impacts that 26

percent of commercial fryers sold each year would meet the proposed standards, even if not adopted into Title 20.

## 8.3. Statewide Energy Use – Non-Standards and Standards Case

Table 22 and Table 23 present the estimated first-year statewide energy use for the baseline and compliant cases.

The proposed standard would result in a total first-year statewide savings of 2.81 million therms of natural gas, as shown in Table 24. Although no standards are proposed for commercial electric fryers, the electricity and on-site electricity demand savings from a standard aligned with ENERGY STAR V2.0 and V3.0 are included for reference.

**Table 22: Estimated First-Year California Statewide Energy Use for Baseline Case**

| Product Class | Electricity (GWh/yr) | On-site Electricity Demand (MW) | Natural Gas (million therms/yr) |
|---|---|---|---|
| Standard Vat Electric V2.0 | 29.2 | 4.14 | 0.00 |
| Standard Vat Electric V3.0 | 28.1 | 3.99 | 0.00 |
| Standard Vat Gas | 0.00 | 0.00 | 14.2 |
| Large Vat Electric | 1.86 | 0.26 | 0.00 |
| Large Vat Gas | 0.00 | 0.00 | 0.86 |

**Table 23: Estimated First-Year California Statewide Energy Use for Compliant Case**

| Product Class | Electricity (GWh/yr) | On-site Electricity Demand (MW) | Natural Gas (million therms/yr) |
|---|---|---|---|
| Standard Vat Electric V2.0 | 28.9 | 4.11 | 0.00 |
| Standard Vat Electric V3.0 | 26.7 | 3.79 | 0.0 |
| Standard Vat Gas | 0.0 | 0.0 | 11.7 |
| Large Vat Electric | 1.81 | 0.3 | 0.0 |
| Large Vat Gas | 0.0 | 0.0 | 0.59 |

**Table 24: Estimated First-Year California Statewide Savings**

| Product Class | Potential Electricity (GWh/yr) | Potential On-site Electricity Demand (MW) | Natural Gas (million therms/yr) | Utility Bill Savings (million 2024 $/yr) |
|---|---|---|---|---|
| Standard Vat Electric V2.0 | 0.22 | 0.03 | 0.00 | 0.06 |

| Product Class | Potential Electricity (GWh/yr) | Potential On-site Electricity Demand (MW) | Natural Gas (million therms/yr) | Utility Bill Savings (million 2024 $/yr) |
|---|---|---|---|---|
| Standard Vat Electric V3.0 | 1.39 | 0.20 | 0.00 | 0.40 |
| Standard Vat Gas | 0.00 | 0.00 | 2.53 | 3.42 |
| Large Vat Electric | 0.05 | 0.01 | 0.00 | 0.01 |
| Large Vat Gas | 0.00 | 0.00 | 0.28 | 0.38 |

Table 25 summarizes the estimated statewide savings in the stock turnover year, which varies by equipment class based on effective useful lifetime. The CASE team estimates the savings for the proposed standard to be 30.9 million therms of natural gas. Note that savings from commercial electric fryers aligned with ENERGY STAR V2.0 and V3.0 are included only for reference.

**Table 25: Estimated California Statewide Savings in the Year of Stock Turnover**

| Product Class | Year of Stock Turnover | Potential Electricity (GWh/yr) | Potential On-site Electricity Demand (MW) | Natural Gas (million therms/yr) | GHG Emission (MT CO2e/yr) | Utility Bill Savings (million 2024 $/yr) |
|---|---|---|---|---|---|---|
| Standard Vat Electric V2.0 | 2038 | 2.64 | 0.38 | 0.00 | 6.50 | 0.00 |
| Standard Vat Electric V3.0 | 2038 | 16.7 | 2.37 | 0.00 | 41.1 | 0.01 |
| Standard Vat Gas | 2037 | 0.00 | 0.000 | 27.8 | 15,165 | 2.48 |
| Large Vat Electric | 2038 | 0.61 | 0.086 | 0.00 | 1.50 | 0.00 |
| Large Vat Gas | 2037 | 0.00 | 0.000 | 3.05 | 1,664 | 0.27 |

## 8.4. Impact on California's Economy

The consumers most impacted by the proposed standards are the owners and operators of commercial kitchens, including commercial food service establishments (restaurants and hotels) and institutional kitchens (hospitals, schools, and prisons). As noted in Section 8.1, California has approximately 100,000 food service facilities (76,750 commercial food service facilities and 20,110 institutional facilities). Most restaurants are considered small businesses because they employ fewer than 50 people, although this number includes many chain restaurants and those owned by larger firms. (National Statistics, n.d.) Additionally, in California, 58 percent of restaurants are minority-owned, and 32 percent are majority-

owned by women (Restaurant Owner Demographics, n.d.). The increased upfront costs of purchasing a new commercial fryer are the most significant impact on owners and operators. However, as indicated above, these owners and operators will experience considerable life cycle cost benefits and rapid paybacks from purchasing and operating higher efficiency equipment.

At least 100 commercial food service dealers sell to the state of California, not including online retailers (Participating Dealer List for Instant Rebates, 2022). Depending on the products they currently make, stock, and sell, manufacturers, retailers, and distributors would be impacted differently. As previously discussed, several manufacturers make compliant products, representing 26 percent of current sales, and the impact on manufacturers and distributors that sell these products would be minimal. Anyone who sells or offers products for sale in California must update their stock and comply with the standards, resulting in increased administrative costs. The increased incremental costs of compliant commercial fryer products will result in larger profit margins for these manufacturers and distributors, offsetting these compliance costs. However, products with no incremental costs may experience reduced profit margins. The standards would likely adversely impact manufacturers that predominately make non-compliant products and the distributors that stock and sell these models. These manufacturers would shift distribution towards compliant product lines, develop new compliant products, or exit the California market. As noted, the proposed standards provide significant consumer choice from various manufacturers. These manufacturers have spent over two decades developing products aligned with the ENERGY STAR V2.0 and V3.0 specifications. Distributors and other market actors who predominantly sell non-compliant products may have to change suppliers or alter current practices.

The CASE Team considered only the direct energy savings for consumers when calculating the life cycle benefits. This analysis does not incorporate savings due to reduced HVAC loads or ancillary benefits from more efficient equipment.

To estimate the first-year statewide utility bill savings, the CASE Team multiplied the statewide electricity and fuel savings in the standard's first effective year by the corresponding energy prices. Similarly, the Team calculated the statewide savings for the stock turnover year by multiplying the year's fuel savings with the year's electricity and fuel prices.

The incremental capital costs for commercial gas fryers in Table 26 range from $1.13 million for large vat gas fryers to $8.21 million for standard vat gas fryers. Standards are not proposed for commercial electric fryers. The total first-year cost of proposed commercial gas fryer standards is $9.34 million, and the total utility bill savings for gas fryers in the first year are $3.80 million. Information for commercial electric fryers is included for reference only.

**Table 26: Statewide Economic Impacts Occurring in the First Year**

| Product Class | Incremental Capital Costs (million 2024 $) | Utility Bill Savings (million 2024 $) |
|---|---|---|
| Standard Vat Electric V2.0 | 1.05 | 0.06 |
| Standard Vat Electric V3.0 | 4.91 | 0.40 |
| Standard Vat Gas | 8.21 | 3.42 |
| Large Vat Electric | 0.05 | 0.01 |
| Large Vat Gas | 1.13 | 0.38 |

Table 27 presents the statewide lifetime economic impacts for products purchased in the first year. The total value of benefits, realized by the end of the effective useful 11-year lifetime for commercial gas fryers, is projected to be worth $43.1 million in the effective year (2024), with incremental costs amounting to $9.33 million, resulting in a net present value of $33.7 million.

**Table 27: Statewide Lifetime Economic Impacts for Products Purchased in the First Year**

| Product Class | Present Value of Benefits (million 2024 $) | Present Value of Incremental Costs (million 2024 $) | Net Present Value (million 2024 $) |
|---|---|---|---|
| Standard Vat Electric V2.0 | 0.63 | 1.05 | -0.42 |
| Standard Vat Electric V3.0 | 3.99 | 4.9 | -0.92 |
| Standard Vat Gas | 38.8 | 8.2 | 30.6 |
| Large Vat Electric | 0.15 | 0.05 | 0.10 |
| Large Vat Gas | 4.26 | 1.13 | 3.12 |

## 8.5. Environmental and Societal Impacts

More efficient commercial fryers provide owners and operators with significant energy savings. Most costs associated with building and operating a utility infrastructure are fixed. Thus, overall utility costs are treated as relatively consistent, even if using more efficient commercial fryers decreases electric or gas demands. Although unlikely, significant energy use reductions could increase utility rates, resulting in more offsetting costs. This proposal is unlikely to impact electric or gas grid capacity or result in fuel-switching.

The proposed standards would not significantly modify the type or quantity of materials used in commercial fryers or the manufacturing process, nor are they expected to have significant societal impacts. This proposal should not impact aesthetics, biological resources, geology, hydrology, recreation, agriculture, cultural resources, land use, transportation, housing, mineral resources, public services, or tribal cultural resources.

# 9. Implementation Plan

The CASE Team foresees a straightforward implementation process for the proposal. The team anticipates active outreach and engagement from Energy Code Ace to help manufacturers understand the compliance process and support product certification. Furthermore, the MAEDbS system can work with SASD and ENERGY STAR to facilitate multi-jurisdictional compliance, reduce regulatory burdens, and enhance industry collaboration. Manufacturers have expressed a desire for this coordination ininterviews conducted during the report's development.

# 10. Other Legislative and Regulatory Considerations

## 10.1. Federal Legislative and Regulatory Background

Commercial fryers are currently not regulated by the United States (U.S.) Department of Energy (DOE). Furthermore, the DOE lacks the authority to regulate these products under current law (U.S. Code § 6311, n.d.) The proposed standards for commercial fryers are similar to the voluntary requirements set forth by the EPA for the ENERGY STAR program.

## 10.2. California Legislative and Regulatory Background

Title 20 does not have existing requirements for commercial fryers. California Title 24, Part 6 Section 140.9(b) contains specific prescriptive requirements for commercial kitchens, but these sections address ventilation, not commercial fryer performance.

### 10.2.1. Utility and Other Incentive Programs

CA IOUs offer $900 per vat incentives for commercial gas fryers and $200 per vat incentives for commercial electric fryers, regardless of vat size (standard and large vat), meeting current ENERGY STAR requirements via the California Energy Wise point-of-sale commercial food service rebate program.

ENERGY STAR's website lists 50 utilities outside of California that offer rebates for commercial fryers. (ENERGY STAR, n.d.) The CASE Team has not independently verified this information (ENERGY STAR 2023). The CASE Team has also not identified other utilities offering rebates for California commercial fryers.

## 10.3. Other State Standards

Commercial fryers are part of the Model Bill developed by the Appliance Standards Awareness Project (ASAP). Eighteen states have adopted standards for these products that generally align with the ENERGY STAR V2.0 criteria for commercial fryers. The first standards for these products were adopted by Vermont in 2018, with several additional states following shortly after. However, many states lack a significant compliance and enforcement mechanism. Therefore, many manufacturers and market actors may not be aware of these existing standards. Several states, including New York and Massachusetts, use the SASD to determine compliance. The proposed standards align with those in other states and provide consistency across the industry.

## 10.4. Model Codes and Voluntary Standards

Government and non-government organizations have made significant progress in creating model building codes and voluntary standards. These codes and standards were developed through an inclusive process that involved public review and the participation of industry stakeholders to enhance

the efficiency of commercial fryers. The CASE Team evaluated several model building codes and voluntary standards, which are listed below:

**Leadership in Energy and Environmental Design (LEED) Commercial Interiors, Version 4.1:** Developed by the U.S. Green Building Council through public vetting. Although energy-efficient commercial fryers are not a prerequisite for LEED, having ENERGY STAR-rated commercial food service equipment can earn up to two LEED points (one point for 70 percent of appliances and two points for 90 percent of all ENERGY STAR appliances) (USGBC, 2024). LEED is currently reviewing Version 5.0 Criteria. More information is available at: http://www.usgbc.org/leed.

**ENERGY STAR**: Developed by the EPA through a process that relies on market, engineering, and pollution savings analyses and includes input from other EPA programs and industry and non-industry stakeholders. More information is available at: http://www.energystar.gov.

ENERGY STAR is considered the most influential among the model codes and voluntary standards mentioned above. Most model codes establish efficiency requirements that are in alignment with ENERGY STAR, which was initiated in 2003 with input from the industry.

**Commercial Energy Codes (ASHRAE 90.1-2022 and 2024 International Energy Conservation Code (IECC))**: The most recent version of the national model commercial energy codes adopted by states other than California includes a section (Chapter 11 in ASHRAE 90.1-2022 and Section C406 in the 2024 IECC) that requires commercial buildings following the prescriptive pathway to attain a certain number of energy credits from a list of options. Choosing more efficient electric or gas fryers that meet ENERGY STAR V3.0 criteria is one of the options in the national model codes that will allow one to achieve energy credits and comply with the code through the prescriptive pathway.

# 11. Response to Request for Information

This section, presented in a question-and-answer format, contains the 18 questions reprinted without modifications from the Request for Information docketed by the CEC on November 14, 2023, to Docket 23-AAER-01 (California Energy Commission, 2023). The CASE Team's answers are specific to commercial fryers, the technology addressed in this report. Future CASE Reports will cover other food service technologies separately.

**1. Based on RFI Table 1, are there additional classifications that should be considered in scope or out-of-scope? Based on what factors?**

**Table 28: RFI Table 1 Commercial Food Service Equipment Scope from CEC**

| Commercial Food Service Equipment Appliance | Classifications |
|---|---|
| Commercial Steam Cookers | Natural Gas |
| Commercial Steam Cookers | Electric |
| Commercial Dishwashers | Electric |
| Commercial Convection Ovens | Natural Gas |
| Commercial Convection Ovens | Electric |
| Commercial Fryers | Natural Gas |
| Commercial Fryers | Electric |

Source: California Energy Commission

For the equipment scope, the CASE Team suggests that the CEC adjust its existing classifications as follows:

- Commercial Gas Standard Vat
- Commercial Gas Large Vat
- Commercial Electric Standard Vat
- Commercial Electric Large Vat

Commercial pressure and automatic fryers with a dispensing mechanism or built-in fire suppression are out of scope. Commercial fryers with oil capacities of less than 25 lbs. or greater than 120 lbs. are also out of scope. The most popular commercial standard vat fryers are 14 inches wide but can range from 12 to 17 inches. The most popular commercial large vat fryers are 18 inches wide but can range from 18 to 24 inches. Commercial large vat fryers with a cylindrical vat are in scope if they are an open vat fryer

and the oil capacity is within range. Commercial fryers with oil capacities less or equal to 50 lbs. are usually considered standard vat, and fryers with higher capacities are generally regarded large vat.

Refer to Section 3 (Product and Technology Description) for additional insight into these classifications and the equipment subclassifications of commercial fryers.

**2. What definitions are useful to describe Steam Cookers, Dishwashers, Ovens, and Fryers? Are there distinct characteristics within Steam Cookers, Dishwashers, Ovens, and Fryers that would allow multiple uses?**

The CASE Team has several proposed definitions for the CEC's review, including "commercial standard vat fryer," "commercial large vat fryer," and "commercial split vat fryer."

Refer to Section 4.1.1 (Proposed Definitions) for specific details on these definitions.

**3. Steam Cookers, Dishwashers, Ovens, and Fryers are found in commercial and institutional settings such as hospitals, schools, etc., are there other unique settings that staff should investigate?**

The CASE Team has no suggestions for unique commercial and institutional settings that utilize commercial fryers for the CEC to investigate.

**4. Are there other efficient technologies available on the market for Steam Cookers, Dishwashers, Ovens, and Fryers? Are there new or upcoming technological developments for Steam Cookers, Dishwashers, Ovens, and Fryers?**

Fryer robots are becoming increasingly popular, and some quick-service restaurant chains use them in their pilot program. These robots operate on regular floor-standing commercial standard vat fryers, which are in the scope of this proposal. The robot is separate from the fryer and should not affect the fryer's performance.

**5. Are there alternatives for Steam Cookers, Dishwashers, Ovens, and Fryers used by the food service industry that would achieve the same functions of those appliances? For example, are air fryers a viable efficient alternative to Fryers that use oil?**

Most applications require fryers and have no substitutes. Air fryers are gaining popularity in the residential appliance segment. According to most consumers, these fryers are not used commercially because of their low production capacity and less palatable flavor. Advanced braising pans, advertised as multifunctional cooking devices, may be used for frying, but these pans are much more expensive than fryers and offer lower production capacity. Baking chicken wings in a conveyor oven instead of frying is possible; however, the texture is less crisp, and most dedicated chicken wing restaurants use fryers.

**6. The ENERGY STAR program provides a voluntary way to certify the efficiency of very efficient options on the listed appliances of RFI Table 1, are there other approaches available that CEC should be aware of? Please include references to publicly available sources.**

The CASE Team would like to inform the CEC of alternative certification approaches for commercial fryers beyond the ENERGY STAR program. Manufacturers have three additional voluntary methods to certify the appliance's efficiency:

1. International Green Construction Code 2021 (IgCC) section 701.4.7.3.1
2. Leadership in Energy and Environmental Design (LEED) Building Design and Construction Rating System, Version 4.1

For additional and more specific information on these voluntary methodologies, refer to Section 10.4 (Model Codes and Voluntary Standards).

**7. What inspections or test methods should CEC staff use to verify compliance with each efficiency requirement?**

The CASE Team suggests that CEC staff incorporate the ASTM Standard F1361-21 for commercial standard vat fryers and F2144-17 for large vat fryers as additional testing components for fryers in California. These well-established standards can effectively determine commercial fryer energy efficiency and production capability. The test procedure involves using frozen french fries as a test medium and outlines how to measure commercial fryer idle energy rates. Refer to Section 4.2.2 (Proposed Test Procedure).

**8. Is there current research or advancement by industry to improve the efficiency of the appliances listed in Table 1?**

Commercial fryer manufacturers continue to advance their designs to maximize production capacity and increase energy efficiency. Advanced technologies are integrated into high-end fryers, while budget fryers remain inefficient. Electric fryer energy advancements are limited due to the difficulty in improving the efficiency of heated resistance elements submerged in oil. Commercial gas and electric fryers can benefit from vat insulation. However, most heat losses occur from the top of the vat, which is open to ambient conditions. Commercial gas and electric fryers can use advanced digital controls that detect when food is added to the oil and compensate for the temperature drop to reduce recovery time between cook cycles. Engaging setback temperatures during a long period of inactivity can reduce idle energy.

There are significant opportunities to improve the efficiency of commercial gas fryers, such as advanced burner and heat exchanger design. Power burners using IR mesh burners and air blowers are more efficient than standard atmospheric burners. Multipass heat exchangers are more efficient at transferring heat into the oil than standard tube fryer designs.

The advancements described above increase efficiency and reduce the idle rate. The commercial fryer industry has recently focused on extending oil life through automatic filtration and oil quality sensing. Many high-end fryers also use touchscreen controls, which make recipe programming and troubleshooting more accessible for users. These advancements do not reduce energy usage but can save operators on oil and labor costs.

**9. What is the market share of each identified classification of each appliance listed in RFI Table 1? Based on RFI Table 1, are there additional examples that should be considered in scope or out-of-scope? Based on what factors?**

California currently has 172,000 commercial fryer vats in operation, with an estimated 4,600 commercial fryers sold per year: 3,900 gas and 700 electric. For additional information, refer to Section 8.1 (Annual Sales and Stock Turnover).

Commercial open vat fryers between 25 and 120 lbs. are within the proposed regulation's scope. Pressure, donut, and ventless fryers are out of scope due to their low market share and lack of available data. As shown in Section 5, excluded products are projected to account for less than eight percent of the market share by cost.

**10. What percent of the listed appliances in RFI Table 1 are leased or sold in California?**

The leased market for commercial fryers is projected to be minimal, as these appliances are more affordable to purchase than other foodservice equipment.

**11. Please provide an estimate of the current installed stock in California for each of the appliances listed in RFI Table 1. What sources of information are available to estimate current and projected stock in California?**

California currently has 172,000 commercial fryer vats in operation: 138,600 are standard vat gas, 7,800 are large vat gas, 24,000 are standard vat electric, and the remaining 1,400 are large vat electric. Section 8.1 describes the latest survey, conducted in 2009, on California food service facilities.

**12. What is the retail cost per unit or differential within each appliance category for Steam Cookers, Dishwashers, Ovens, and Fryers?**

Commercial fryer costs vary significantly, depending on the make and model and if the fryer includes premium features. For example, commercial standard vat gas fryers can cost anywhere from $1,000 to $20,000. The lowest-cost ENERGY STAR commercial gas fryers are less than $2,000. The cost difference between commercial baseline and compliant fryers is greater for electric fryers. The least expensive baseline standard vat electric fryers are around $2,000, while compliant units start around $5,000.

Refer to Section 7.1 (Incremental Cost) for a more in-depth explanation of the research analysis.

**13. What is the installation cost per unit? What is the replacement cost per unit?**

The installation costs for commercial baseline fryers and compliant fryers are the same. Fryer installation or replacement is usually not labor intensive. It involves physically removing the fryer and replacing the connector and gas line from the wall to the unit. Fryer replacement requires one technician labor hour at approximately $200, and installation of ¾ inch gas lines with connectors should cost around $100. Reusing the old line and connector is possible if they are in good condition.

**14. What is the average lifetime of each appliance listed in RFI Table 1? What assumptions for product lifetime should staff consider for the listed appliances and why? How do product lifetimes vary per product type within each appliance listed in RFI Table 1? Please provide published sources of information.**

The CASE Team's research and analysis of eTRM data indicates that commercial gas fryers have an average lifetime of 11 years, while commercial electric fryers last slightly longer, averaging 12 years. The analysis revealed no notable variance in longevity between fryers that comply with current standards and those that do not. For a detailed explanation of how these average lifespan figures were determined, see Section 7.2 (Design Life).

**15. What is the average run time for each of the appliances listed in RFI Table 1? Do they vary by product type?**

The CASE Team estimates run time per assumptions in Sections 6.1 and 6.2. See also Appendix B for assumptions used to estimate fryer energy use.

**16. Do manufacturers provide a broad product offering for the listed appliances?**

Manufacturers provide customers with a broad list of commercial fryers based on institution size, food volume, and preferred energy source, i.e., gas or electricity. The CASE Team reviewed products from six online retailers to understand the variety of offerings by major market manufacturers. The CASE Team used this information to develop its analysis of California commercial fryers.

**17. How many small businesses are involved in the manufacturing, sale, or installation of the listed appliances in California? How might small businesses be affected by any changes to the listed appliances?**

The largest U.S. commercial fryer manufacturers are Frymaster and Pitco, located outside California. California's largest fryer manufacturers and distributors include Imperial, Royal Range, American Range, Montague, and Atosa. These manufacturers have less than 1,000 employees.

Businesses specializing in commercial fryer repair should be unaffected as energy-efficient fryers will continue to need service. California equipment distributors should continue to sell commercial fryers that comply with regulations and should not be affected.

**18. What are the potential impacts and benefits the proposed standards may have for consumers (i.e., users of these appliances)?**

Based on the CASE Team's research methodology, the proposed standard would save 3.4 million therms of natural gas in its first year statewide. See Section 8 (Statewide Impacts) for a complete list of the proposed standards' potential impacts and benefits for consumers and businesses using commercial fryers.

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# Appendix A: Commercial Fryer Energy Use Assumptions

Section 6.2 of the report describes the methodology for calculating energy savings. Table 29 presents the assumptions using the average performance of commercial electric models compliant with ENERGY STAR V3.0 criteria. This analysis compares the cost effectiveness of using ENERGY STAR V3.0 vs. V3.0 as the energy-efficient threshold. The only affected category is commercial standard vat electric fryers shown in bold.

Table 30 shows each category's key assumptions, preheat time, preheat energy, idle energy rate, and cooking efficiency for baseline and compliant commercial fryers.

Table 29 and Table 31 describe the savings methodology assumptions used in the report. They highlight the differences between ENERGY STAR V2.0 and V3.0, with variations only affecting commercial standard vat electric fryers. Most ENERGY STAR commercial standard gas fryers sold just met the ENERGY STAR threshold, while most ENERGY STAR commercial large electric and gas vat fryers surpassed it. The bolded items in the tables below vary according to the analysis methods.

**Table 29: CASE Report Energy Savings Methodology ENERGY STAR V2.0**

| Assumptions | Standard Vat Gas | Large Vat Gas | Standard Vat Electric | Large Vat Electric |
|---|---|---|---|---|
| **Baseline** | Average of units that do not meet ENERGY STAR V2.0 or V3.0 | Average of units that do not meet ENERGY STAR V2.0 or V3.0 | ENERGY STAR V2.0 threshold | Average of units that do not meet ENERGY STAR V2.0 or V3.0 |
| **Compliant** | ENERGY STAR V2.0 or V3.0 threshold | Average of units that meet ENERGY STAR V2.0 or V3.0 | **Average performance of units that meet ENERGY STAR V2.0 but not V3.0** | Average of units that meet ENERGY STAR V2.0 or V3.0 |

Table 30 presents the assumptions using the average performance of commercial electric models compliant with ENERGY STAR V3.0 criteria. This analysis compares the cost effectiveness of using ENERGY STAR V2.0 versus V3.0 as the energy-efficient threshold. The only affected category is commercial standard vat electric fryers in bold.

**Table 30: Efficiency Calculations for Baseline and Compliant Commercial Fryers (Using Average of Compliant Commercial Fryers That Meet ENERGY STAR V2.0 But Not V3.0)**

| Fuel | Vat Size | Efficiency | Preheat time (min) | Preheat energy (kWh or Btu) | Idle energy rate (kW or Btu/h) | Cooking efficiency (%) | Production capacity (lb./h) |
|---|---|---|---|---|---|---|---|
| Electric | Standard | Baseline | 9.11 | 1.61 | 1.00 | 83.0 | 67.0 |
| **Electric** | **Standard** | **Compliant** | **9.11** | **1.61** | **0.86** | **83.7** | **67.0** |
| Electric | Large Vat | Baseline | 16.7 | 3.93 | 1.28 | 85.9* | 102 |
| Electric | Large Vat | Compliant | 10.0 | 3.47 | 1.10 | 85.9 | 94.3 |
| Gas | Standard | Baseline | 7.00 | 16,609 | 12,847 | 37.0 | 58.0 |
| Gas | Standard | Compliant | 7.00 | 10,278 | 9,000 | 50.0 | 62.8 |
| Gas | Large Vat | Baseline | 10.8 | 21,400 | 16,534 | 46.2 | 99.3 |
| Gas | Large Vat | Compliant | 12.6 | 16,534 | 12,000 | 50.0 | 92.1 |

*Although the energy efficiency threshold is 80 percent, the average of inefficient commercial fryers was 85.9 percent but did not meet the threshold based on the idle rate.

**Table 31: CASE Report Energy Savings Methodology ENERGY STAR V3.0**

| Assumptions | Standard Vat Gas | Large Vat Gas | Standard Vat Electric | Large Vat Electric |
|---|---|---|---|---|
| **Baseline** | Average of units that do not meet ENERGY STAR V2.0 or V3.0 | Average of units that do not meet ENERGY STAR. V2.0 or V3.0 | ENERGY STAR V2.0 threshold | Average of units that do not meet ENERGY STAR V2.0 or V3.0 |
| **Compliant** | ENERGY STAR V2.0 or V3.0 threshold | Average of units that meet ENERGY STAR V2.0 or V3.0 | **Average of units that meet ENERGY STAR V3.0** | Average of units that meet ENERGY STAR V2.0 or V3.0 |

Table 32 presents the assumptions using the average performance of commercial electric models compliant with ENERGY STAR V2.0 but not ENERGY STAR V3.0. The available energy efficiency data for models currently on the market pertains to models that meet ENERGY STAR V2.0. Other commercial

electric fryers on the market may not meet the ENERGY STAR V2.0 criteria, but no published data is available.

**Table 32: Efficiency Calculations for Baseline and Compliant Fryers (Using Average of Compliant Fryers That Meet ENERGY STAR V3.0)**

| Fuel | Vat Size | Efficiency | Preheat time (min) | Preheat energy (kWh or Btu) | Idle energy rate (kW or Btu/h) | Cooking efficiency (%) | Production capacity (lb./h) |
|---|---|---|---|---|---|---|---|
| Electric | Standard | Baseline | 9.11 | 1.61 | 1.00 | 83.0 | 67.0 |
| **Electric** | **Standard** | **Compliant** | **8.93** | **1.56** | **0.68** | **86.2** | **62.1** |
| Electric | Large Vat | Baseline | 16.7 | 3.93 | 1.28 | 85.9* | 102.0 |
| Electric | Large Vat | Compliant | 10.0 | 3.47 | 1.10 | 85.9 | 94.3 |
| Gas | Standard | Baseline | 7.00 | 16,609 | 12,847 | 37.0 | 58.0 |
| Gas | Standard | Compliant | 7.00 | 10,278 | 9,000 | 50.0 | 62.8 |
| Gas | Large Vat | Baseline | 10.8 | 21,400 | 16,534 | 46.2 | 99.3 |
| Gas | Large Vat | Compliant | 12.6 | 16,534 | 12,000 | 50.0 | 92.1 |

*Although the energy efficiency threshold is 80 percent, the average of inefficient commercial fryers was 85.9 percent but did not meet the threshold based on the idle rate.

# Appendix B: Alternative Commercial Fryer Savings Assumptions

The CASE Team used a different methodology for calculating the energy savings of commercial fryers, enabling a comparative analysis of the results. This appendix shows energy savings using the methods described in Table 33. The table uses the ENERGY STAR V2.0 or V3.0 threshold for the energy-efficient assumption rather than the average of models meeting the threshold used in the report. This approach is more consistent with CEC's historical assumptions of energy-efficient units. However, these assumptions underestimate savings because the average ENERGY STAR commercial electric fryer exceeds the proposed threshold, affecting all categories highlighted in bold except commercial standard vat gas fryers.

**Table 33: Alternative Energy Savings Methodology (ENERGY STAR V3.0 Threshold)**

| Assumptions | Standard Vat Gas | Large Vat Gas | Standard Vat Electric | Large Vat Electric |
|---|---|---|---|---|
| **Baseline** | Average of units that do not meet ENERGY STAR V2.0 or V3.0 | Average of units that do not meet ENERGY STAR V2.0 or V3.0 | ENERGY STAR V2.0 threshold | Average of units that do not meet– ENERGY STAR V2.0 or V3.0 |
| **Compliant** | ENERGY STAR V2.0 or V3.0 threshold | ENERGY STAR **V2.0 or V3.0 threshold** | ENERGY STAR **V3.0 threshold** | ENERGY STAR **V2.0 or V3.0 threshold** |

**Table 34: Efficiency Calculations for Baseline and Compliant Commercial Fryers (Using ENERGY STAR V3.0 Threshold)**

| Fuel | Vat Size | Efficiency | Preheat time (min) | Preheat energy (kWh or Btu) | Idle energy rate (kW or Btu/h) | Cooking efficiency (%) | Production capacity (lb./h) |
|---|---|---|---|---|---|---|---|
| Electric | Standard | Baseline | 9.11 | 1.61 | 1.00 | 83.0 | 67.0 |
| **Electric** | **Standard** | **Compliant** | **8.93** | **1.56** | **0.80** | **80.0** | **62.1** |
| Electric | Large Vat | Baseline | 16.7 | 3.93 | 1.28 | 85.9* | 102.0 |
| **Electric** | **Large Vat** | **Compliant** | **10.0** | **3.47** | **1.10** | **85.9** | **94.3** |
| Gas | Standard | Baseline | 7.00 | 16,609 | 12,847 | 37.0 | 58.0 |

| Fuel | Vat Size | Efficiency | Preheat time (min) | Preheat energy (kWh or Btu) | Idle energy rate (kW or Btu/h) | Cooking efficiency (%) | Production capacity (lb./h) |
|---|---|---|---|---|---|---|---|
| Gas | Standard | Compliant | 7.00 | 10,278 | 9,000 | 50.0 | 62.8 |
| Gas | Large Vat | Baseline | 10.8 | 21,400 | 16,534 | 46.2 | 99.3 |
| **Gas** | **Large Vat** | **Compliant** | **12.6** | **16,534** | **12,000** | **50.0** | **92.1** |

*Although the energy efficiency threshold is 80 percent, the average of inefficient commercial fryers was 85.9 percent but did not meet the threshold based on the idle rate.

**Table 35: Annual Per Unit Energy Savings**

| Product Class | Per-unit savings - electricity (kWh/yr-unit) | Per-unit savings - peak demand (kW/unit) | Per-unit savings - natural gas (therm/yr-unit) |
|---|---|---|---|
| Standard Vat Electric | 1,063 | 0 | - |
| Standard Vat Gas | - | - | 308 |
| Large Vat Electric | 803 | 0 | |
| Large Vat Gas | - | - | 358 |

Table  provides economic impacts and cost-effectiveness values of the alternative calculation. The cost effectiveness of commercial large vat gas fryers is lower as the increase in performance is less, while the incremental cost remains the same as the CASE Report analysis. Note that savings from commercial electric fryers aligned with ENERGY STAR V2.0 and V3.0 are included only for reference.

**Table 36: Per Unit Lifetime Economic Impacts for Products Purchased in the First Year**

| Product Class | Design Life (years) | Present Value of Benefits (2024 $) | Present Value of Incremental Costs (2024 $) | Net Present Value (2024 $) | Simple Payback Period (years) | Life Cycle Benefit-Cost Ratio |
|---|---|---|---|---|---|---|
| Standard Vat Electric | 12 | 3,046 | 6,239 | -3,193 | 19.7 | 0.49 |
| Standard Vat Gas | 11 | 4,729 | 1,001 | 3,728 | 1.88 | 4.72 |
| Large Vat Electric | 12 | 2,301 | 1,114 | 1,187 | 4.67 | 2.07 |
| Large Vat Gas | 11 | 5,497 | 2,444 | 3,053 | 3.94 | 2.25 |

Table 37 shows the alternative calculation method's statewide savings in the stock turnover year. The statewide savings for commercial large vat gas fryers are lower than the CASE Report savings due to the compliant products' lower performance assumption. The compliance rate and stock numbers use the same assumptions as the CASE Report analysis.

**Table 37: Estimated California Statewide Savings in the Year of Stock Turnover**

| Product Class | Year of Stock Turnover | Electricity (GWh/yr) | On-site Electricity Demand (MW) | Natural Gas (million therms/yr) | GHG Emissions (MT CO2e/yr) | Utility Bill Savings (million 2024 $/yr) |
|---|---|---|---|---|---|---|
| Standard Vat Electric | 2038 | 10.03 | 1.43 | 0.00 | 24.7 | 0.00 |
| Standard Vat Gas | 2037 | 0.00 | 0.00 | 27.8 | 15,165 | 2.48 |
| Large Vat Electric | 2038 | 0.43 | 0.06 | 0.00 | 1.1 | 0.00 |
| Large Vat Gas | 2037 | 0.00 | 0.00 | 1.83 | 998 | 0.16 |
| **TOTAL** | | **10.5** | **1.49** | **29.6** | 16,188 | 2.65 |

Table 38 compares the simple payback period and life cycle benefit-to-cost ratio of different product classes when using averaged assumptions/methodology and threshold assumptions/methodology. It shows the simple payback period increases, and the life cycle benefit-to-cost ratio reduces for all product classes except for commercial standard vat gas fryers when moving from the averaged to the threshold methodology for calculating cost effectiveness and energy savings. Note the savings from commercial electric fryers aligned with ENERGY STAR V2.0 and V3.0 are included only for reference.

**Table 38: Comparison of Per Unit Economic Impacts for Products Purchased in the First Year for Averaged Methodology and Threshold Methodology**

| Product Class | Averaged Methodology Simple Payback Period (years) | Averaged Methodology Life Cycle Benefit-Cost Ratio | Threshold Methodology Simple Payback Period (years) | Threshold Methodology Life Cycle Benefit-Cost Ratio |
|---|---|---|---|---|
| Standard Vat Electric V3.0 | 11.9 | 0.81 | 19.8 | 0.49 |
| Standard Vat Gas | 1.88 | 4.72 | 1.88 | 4.72 |
| Large Vat Electric | 3.30 | 2.92 | 4.67 | 2.07 |
| Large Vat Gas | 2.36 | 3.75 | 3.94 | 2.25 |

# Appendix C: Electricity and Natural Gas Price Forecasts

Table 39 shows the electricity and natural gas price forecasts for 2022 to 2050. The average electricity and natural gas prices paid by California commercial consumers were derived using two sources from the U.S. Energy Information Administration (EIA): "Electric Power Monthly" [8] and "California Price of Natural Gas Sold to Commercial Consumers." [9] The CASE Team used August 2023 for the average electricity price and July 2023 for the average natural gas price.

The annual electricity and natural gas escalation rates were calculated based on price forecasts. The electricity price forecast was derived from the California Energy Demand Forecast published by CEC in 2022,[10] and the natural gas price forecast was derived from the California Public Utility Commission's 2021 report "Utility Costs and Affordability of the Grid of the Future: An Evaluation of Electric Costs, Rates and Equity Issues."[11] The CASE Team forecasted actual future marginal electricity and natural gas prices by applying the calculated annual escalation rates to the current marginal prices. The CASE Team found that the sources used for price forecasts were often less specific to California and less recent than those used for current marginal prices. The CASE Team forecasted future marginal prices in 2024 dollars, ensuring consistent comparability across different years without adjusting for inflation. This approach enabled the CASE Team to calculate the present value of anticipated utility bill savings using the selected real discount rate.

[8] U.S. Energy Information Administration (EIA), Electric Power Monthly, 2023. https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a

[9] U.S. Energy Information Administration (EIA), California Price of Natural Gas Sold to Commercial Consumers. https://www.eia.gov/dnav/ng/hist/n3020ca3m.htm

[10] California Energy Commission, "California Energy Demand Update, 2022–2035". https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2022-integrated-energy-policy-report-update-2

[11] California Public Utility Commission, "Utility Costs and Affordability of the Grid of the Future: An Evaluation of Electric Costs, Rates and Equity Issues," 2021, https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/office-of-governmental-affairs-division/reports/2021/senate-bill-695-report-2021-and-en-banc-whitepaper_final_04302021.pdf

**Table 39: Electricity and Natural Gas Price Forecasts**

| Year | Electricity (Cents per kWh) | Natural Gas (Dollar per million Btu) |
|---|---|---|
| 2022 | 19.74 | 11.24 |
| 2023 | 19.21 | 11.78 |
| 2024 | 19.01 | 12.35 |
| 2025 | 19.43 | 12.94 |
| 2026 | 19.51 | 13.56 |
| 2027 | 19.68 | 14.21 |
| 2028 | 19.96 | 14.89 |
| 2029 | 20.15 | 15.61 |
| 2030 | 20.22 | 16.36 |
| 2031 | 20.2 | 17.14 |
| 2032 | 20.31 | 17.96 |
| 2033 | 20.46 | 18.83 |
| 2034 | 20.61 | 19.73 |
| 2035 | 20.81 | 20.68 |
| 2036 | 20.9 | 21.67 |
| 2037 | 20.98 | 22.71 |
| 2038 | 21.07 | 23.8 |
| 2039 | 21.16 | 24.94 |
| 2040 | 21.24 | 26.14 |
| 2041 | 21.33 | 27.39 |
| 2042 | 21.42 | 28.71 |
| 2043 | 21.51 | 30.09 |
| 2044 | 21.59 | 31.53 |
| 2045 | 21.68 | 33.04 |
| 2046 | 21.77 | 34.63 |
| 2047 | 21.86 | 36.29 |
| 2048 | 21.95 | 38.03 |
| 2049 | 22.04 | 39.86 |
| 2050 | 22.13 | 41.77 |