Work Paper SCE13CC004

**Revision 2**

**Southern California Edison**

**Commercial Electric Fryers**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | FS-57892 |
| **Measure Description** | Energy efficient electric fryer |
| **Base Case Description** | Standard efficiency electric fryer |
| **Units** | Unit |
| **Energy Savings** | Refer to Excel Calculation Attachment |
| **Full Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Incremental Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Effective Useful Life** | Cook-ElecFryer: 12 years |
| **Measure Installation Type** | Replace on Burnout (ROB) |
| **Net-to-Gross Ratio** | Com-Default>2yrs: 0.6 |
| **Important Comments** | This work paper has a complementary Ex Ante Database data set that will be provided in a separate submission to the California Public Utilities Commission (CPUC). |

# Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 5/1/12 | Ricson Chude/ SCE | * Converted WPSCNRCC0004 into new workpaper template, and changed name to WorkPaper SCE13CC004. * Revised cost and savings based on PGECOFST102 |
| 1 | 6/5/2014 | Ricson Chude/SCE | -Work paper updated for the reporting period, effective 7/1/14 – 12/31/14.  - Updated to include description and incorporate savings from Large Vat Fryers |
| 2 | 01/21/2016 | Ajay Wadhera/Solaris | -New template update for 2016 program year  -WP effective from 1/1/2016 thru 12/31/2016  -Removed SCE building types  -No value modifications |

# Commission Staff and Cal TF Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rev** | **Party** | **Submittal Date** | **Comment Date** | **Comments** | **WP Developer Response** |
|  |  |  |  |  |  |
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Cal TF website: <http://www.caltf.org/>

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

This work paper details the replacement of standard-efficiency commercial electric fryers with energy-efficient commercial electric fryers.

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | High efficiency electric fryer |
| Existing Condition | Standard efficiency electric fryer |
| Code/Standard | N/A |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
| N/A | N/A | FS-57892 | N/A | Commercial Electric Fryer: Cooking Efficiency ≥ 80% |

**Eligibility Requirements**

* **Commercial electric fryer (vat width < 18-inches):** Must meet ENERGY STAR® specifications for energy efficiency or must have a tested heavy load cooking energy efficiency of 80% and an idle energy rate less than or equal to 1,000 W, utilizing ASTM Standard F1361 [145].
* **Commercial electric large vat fryer (vat width ≥ 18-inches):** Must meet ENERGY STAR® specifications for energy efficiency or must have a tested heavy load cooking energy efficiency of 80% and an idle energy rate less than or equal to 1,100 W, utilizing ASTM Standard F2144 [438].
* Multiple vat configurations are paid per qualifying vat.

## 1.2 Technical Description

All fryers share a common basic design. The fry vat contains a sufficient amount of oil so that the cooking food is essentially supported by displacement of the oil rather than by the bottom of the vessel. Fryers are most often compared on the basis of width and energy-input rating. Taken together, these two numbers suggest the approximate amount of food a fryer can prepare in a given time, which is one of the most important factors in choosing the proper fryer for a kitchen.

Commercial electric fryers are among the most common pieces of cooking equipment in commercial food service facilities. Recent advances in equipment design have produced fryers that operate more efficiently, quickly, safely and conveniently. High efficiency commercial fryers reduce energy consumption primarily through the application of controls and insulation.

## 1.3 Installation Types and Delivery Mechanisms

The delivery method is Financial Support - Down-Stream Incentive – Deemed.

The install type is ROB (Replace-on-Burnout).

**Installation Type Descriptions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Installation Type** | **Savings** | | **Life** | |
| 1st Baseline (BL) | 2nd BL | 1st BL | 2nd BL |
| Replace on Burnout (ROB) | Above Code or Standard | N/A | EUL | N/A |

A delivery mechanism is a delivery method paired with an incentive method. Delivery mechanisms are used by programs to obtain program participation and energy savings.

**Delivery Method Descriptions**

|  |  |
| --- | --- |
| **Delivery Method** | **Description** |
| Financial Support | The program motivates customers, through financial incentives such as rebates or low interest loans, to implement energy efficient measures or projects. |

**Incentive Method Descriptions**

|  |  |
| --- | --- |
| **Incentive Method** | **Description** |
| Down-Stream Incentive | The customer installs qualifying energy efficient equipment and submits an incentive application to the utility program. Upon application approval, the utility program pays an incentive to the customer. Such an incentive may be deemed or customized. |

## 1.4 Measure Parameters

### 1.4.1 DEER Data

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Workpaper?** |
| Modified DEER methodology | No |
| Scaled DEER measure | No |
| DEER Base Case | No |
| DEER Measure Case | No |
| DEER Building Types | No |
| DEER Operating Hours | No |
| DEER eQUEST Prototypes | N/A |
| DEER Version | N/A |
| Reason for Deviation from DEER | DEER does not contain this measure |
| DEER Measure IDs Used | N/A |

**Net-to-Gross Ratio**

The NTG values were obtained using the DEER READI tool. The relevant NTG values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NTGR ID** | **Description** | **Sector** | **BldgType** | **Measure Delivery** | **NTGR** |
| Com-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Com | Any | Any | 0.6 |

**Spillage Rate**

Spillage rates are not tracked in work papers; they are tracked in an external document which will be supplied to the Commission Staff.

**Installation Rate**

The IR values were obtained using the DEER READI tool. The relevant IR values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GSIA ID** | **Description** | **Sector** | **BldgType** | **ProgDelivID** | **GSIAValue** |
| Def-GSIA | Default GSIA values | Any | Any | Any | 1 |

**Effective and Remaining Useful Life**

The EUL and RUL values were obtained using the DEER READI tool. DEER defines the RUL as 1/3 of the EUL value. The RUL value is only applicable to the first baseline period for an RET measure with an applicable code baseline. The relevant EUL and RUL values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| Cook-ElecFryer | Electric Fryer | Com | FoodServ | 12 | 4 |

### 1.4.2 Codes and Standards Analysis

**California Title 24 2013:** These measures do not fall under Title 24 of the California Energy Regulations.

**California Title 20 2014:** State of California Title 20 Appliance Efficiency Regulation [422] has a category for cooking appliances, but fryers are not included.

### ASTM Standards: ASTM Standard Test Method for the Performance of Open Deep Fat Fryers (F1361) and Large Vat Fryer (F2144) are applicable for estimating energy use and cooking performance. They were used to estimate the energy consumption of the base case and measure equipment.

**Federal Standards:** These measures do not fall under Federal DOE or EPA Energy Regulations.

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| ASTM | F1361 | January 1, 2013 |
| ASTM | F2144 | January 1, 2009 |

## 1.5 EM&V, Market Potential, and Other Studies – Base Case and Measure Case Information

### 1.5.1 Non-DEER Study Review

No Non-DEER studies are used in this work paper.

## 1.6 Data Quality and Future Data Needs

N/A

# Section 2. Calculation Methodology

## 2.1 Electric Energy Savings Estimation Methodologies

This work paper uses ASTM Standard Test Method for the Performance of Open Deep Fat Fryers (F1361) and the ASTM Standard Test Method for the Performance of Large Vat Fryers (F2144) for calculation of energy use and demand, based on testing in an approved and qualified laboratory. In the absence of mandatory regulations for testing commercial fryers, there is little incentive on the part of equipment manufacturers to have their baseline equipment tested. Therefore, the ASTM performance parameters for baseline and measure equipment were drawn from a sample of economy grade equipment tested by the Food Service Technology Center and is summarized in table below.

Baseline ASTM Test Results for Commercial Fryers

|  |  |  |  |
| --- | --- | --- | --- |
| **Fryer Type** | **Idle Energy Rate** | **Cooking-Energy Efficiency\*** | **Production Capacity\*** |
| Baseline Model | 1200 W | 75% | 71 lb/h |
| Efficient Model | 860 W | 85% | 71 lb/h |

Table below shows the calculation results for fryers. Note that Baseline/Efficient Model represents an average of the Standard Fryer and Large Vat Fryer.

Commercial Electric Fryer Calculations

|  |  |  |
| --- | --- | --- |
| **Performance** | **Baseline Model** | **Avg. Efficient Model** |
| Preheat Time (min) | 15 | 15 |
| Preheat Energy (kWh) | 2.40 | 1.90 |
| Idle Energy Rate (kW) | 1.20 | 0.86 |
| Heavy Load Cooking Energy Efficiency (%) | 75% | 85% |
| Production Capacity (lbs/hr) | 71 | 71 |
| Operating Hours/Day | 14 | 14 |
| Operating Days/Year | 365 | 365 |
| Pounds of Food Cooked per Day | 150 | 150 |
| Electric Cost ($/kWh) | $0.13 | $0.13 |
| ASTM Energy to Food (kWh/lb) | 0.167 | 0.167 |
| Daily Energy Consumption (kWh) | 49.8 | 41.4 |
| Average Demand (kW) | 3.6 | 3.0 |
| **Estimated Demand Reduction kW**  **(CDF 0.9 applied)** | **-** | **0.54** |
| Annual Energy Consumption (kWh) | 18,177 | 15,111 |
| **Estimated Energy Savings (kWh/yr)** | **-** | **3,066** |

**Daily Energy Consumption Calculation and Definitions**

EDAY = (LBFOOD x EFOOD) ÷ EFFICIENCY + [IDLERATE x (TON - LBFOOD/PC – nP x TP/60)] + nP x EP

Where:

|  |  |
| --- | --- |
| **EDAY =** | **Calculated Daily Energy Consumption (kWh/day)** |
| LBFOOD = | Estimated Pounds of Food Cooked per Day |
| EFOOD = | ASTM Energy to Food (kWh/lb) = kWh/pound of energy absorbed by food product during cooking based on ASTM F1361 |
| EFFICIENCY = | Measured Heavy Load Cooking Energy Efficiency % |
| IDLE RATE = | Measured Idle Energy Rate (kW) |
| TON = | Estimated Operating Hours/Day |
| PC = | Measured Production Capacity (lbs/hr) |
| TP = | Estimated Preheat Time (min) |
| nP = | Estimated Number of preheats/Day |
| EP = | Measured Preheat Energy (kWh) |

See Attachment 2 for all calculations. See Attachment 1 for a complete list of savings.

## 2.2. Demand Reduction Estimation Methodologies

A fryer’s actual contribution to a building’s peak demand may vary significantly depending on its usage pattern in relation to that of other electric equipment in the facility (operating schedule, appliance on time, etc.). The probability of an appliance drawing its average rate during the period that the building peak is set is significantly higher than for any other input rate for that appliance. Therefore, it has been assumed that the probable contribution to the building’s peak demand is equal to the appliance’s average demand with a coincidence factor of 0.9 from DEER 2005 [26] applied to demand reduction. See Section 2.1 for final values.



# 

# Section 3. Load Shapes

The ideal load shape for net benefits estimates would represent the difference between the base case and measure case. The closest load shapes that are applicable to the measures in this work paper are listed in the table below.

Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| **Building Type** | **Load Shape** | **E3 Alternate Building Type** |
| Restaurant – Fast Food | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Restaurant-Sit-Down | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Retail-Small | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Retail - Single-Story Large | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Retail-Multistory Large | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Large\_Office | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |

# Section 4. Costs

High-efficiency fryers typically have a higher list price than standard efficiency fryers. However, high-efficiency designs are often bundled with other features such as all stainless steel construction and high quality components and controls. In addition to lower operating costs, high-efficiency fryers exhibit better uniformity and higher production rates that increase their cost-effectiveness.

## 4.1 Base Case Cost

Base case costs are calculated by applying an industry-standard 50% discount to manufacturer published list prices. It is assumed that the labor cost is the same in base and measure cases, so only equipment costs are presented here.

Equipment prices for this work paper were compiled from a number of sources including quotes, equipment sales representatives, and manufacturer sources. Since equipment pricing in food service is closely held information and prices vary widely according to buying volume and other factors, the sources for prices cannot be listed explicitly.

## 4.2 Incremental Measure Cost

Table below shows the calculation of full measure cost:

Full and Incremental Measure Cost

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Fryer Type** | **Baseline Unit Price** | **Energy Efficient Unit Price** | **Baseline Unit Cost** | **Energy Efficient Unit Cost** | **Incremental Measure Cost (IMC)** |
| Electric Fryer | $8,215 | $9,753 | $4,108 | $4,876 | $769 |

\*Estimated purchase price and Incremental Measure Cost (IMC) were based on an industry-standard 50% discount off the manufacturer’s list price.

**Full and Incremental Measure Cost Equations**

|  |  |  |  |
| --- | --- | --- | --- |
| **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| ROB | (MEC + MLC) – (BEC + BLC) | (MEC + MLC) – (BEC + BLC) | N/A |
| NEW/NC |

MEC = Measure Equipment Cost; MLC = Measure Labor Cost

BEC = Base Case Equipment Cost; BLC = Base Case Labor Cost

**Full and Incremental Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| Electric Fryer | ROB | $769 | $769 | N/A |

# Attachments





# References



|  |  |
| --- | --- |
| [26] | 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study - Final Report - Itron Inc. - Dec. 2005 |
| [145] | Standard Test Method for the Performance of Open Deep Fat Fryers |
| [422] | 2014 Appliance Efficiency Regulations (Title 20) |
| [438] | Standard Test Method for the Performance of Large Open Vat Fryers |