Work Paper SCE13CC012

**Revision 2**

**Southern California Edison**

**Commercial Electric Deck Oven**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | FS-70944 |
| **Measure Description** | Energy efficient commercial electric deck oven |
| **Base Case Description** | Standard efficiency commercial deck oven |
| **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-ElecCombOven: 12 years |
| **Measure Installation Type** | Replace on Burnout (ROB) |
| **Net-to-Gross Ratio** | Com-Default>2yrs: 0.6, Agric-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 | 06/11/2012 | Ricson Chude/SCE | WorkPaper for EE 13-14 Program Cycle. Changes from WPSCNRCC0012.0:   * Added new NTG * Revised savings based on sample average under ASTM 1965. * Dropped measure FS-63594 (Deck area less than 1200 sq.inch) * Revised product costs |
| 1 | 7/14/2014 | Jason Wang/SCE | -Work paper updated for the reporting period, effective 7/1/14 – 12/31/14.  -Corrected measure name from “70%” to “60%”  -Savings have been updated |
| 2 | 01/20/2016 | 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** |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

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 deck ovens with energy-efficient commercial electric deck ovens.

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | Energy-efficient commercial electric deck oven |
| Existing Condition | Standard-efficiency commercial electric deck oven |
| 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-70944 | N/A | Cooking Efficiency ≥ 60% Commercial Electric Deck (Deck Area ≥ 1200 in2) Oven |

**Eligibility Requirements**

Eligible deck ovens must:

* Have a heavy load cooking energy efficiency of 60% or greater based on the heavy-load pizza test in ASTM F1965-99(2010) [289].
* Have an idle energy rate of 1.3 kW or less.
* Be on the Food Service Technology Center pre-approved list.

## 1.2 Technical Description

Commercial electric deck ovens are appliances that cook the food product within a heated chamber. The food product can be placed directly on the floor of the chamber during cooking and energy may be delivered to the food product by convective, conductive, or radiant heat transfer. The chamber may be heated by electric forced convection, radiation, or quartz tubes. Top and bottom heat may be independently controlled.

Deck ovens are available in various sizes measured by the surface area of the oven cavity floor. Sizes range from approximately 1000 in2 to 2200 in2. Deck ovens are typically stackable to allow for multiple ovens in a single floor space.

Deck oven performance is determined by applying the American Society for Testing and Materials (ASTM) Standard Test Method for Performance of Deck Ovens F1965-99(2010) [289], which is the industry standard for quantifying the efficiency and performance of commercial deck ovens.

## 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 2014 does not include this measure.

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 | No |
| 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 |
| Agric-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Ag | 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-ElecCombOven | Combination Oven - Electric | 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:** Title 20 [422] has a category for cooking appliances, but deck ovens are not included.

### ASTM Standards: ASTM Standard Test Method for Performance of Deck Ovens (F1965-99, reapproved 2010) [289] is applicable for estimating deck oven energy use and cooking performance. It was 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 | F1965-99 | January 1, 2010 |

## 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 were 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 F1965-99(2010) 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 deck ovens, there is little incentive on equipment manufacturers to have their baseline equipment tested. Therefore, the ASTM performance parameters for baseline equipment were drawn from a sample of economy grade equipment tested by the PG&E Food Service Technology Center and the Southern California Edison Foodservice Technology Center.

Baseline ASTM test results for Commercial Deck Ovens

|  |  |  |
| --- | --- | --- |
| **Idle Energy Rate** | **Cooking-Energy Efficiency\*** | **Production Capacity**  **(lb/h)\*** |
| 1,900 W | 40% | 60 |

\*Based on the Heavy-load Pizza test in ASTM F1965.

Measure ASTM test results for Commercial Deck Ovens

|  |  |  |
| --- | --- | --- |
| **Idle Energy Rate** | **Cooking-Energy Efficiency\*** | **Production Capacity**  **(lb/h)\*** |
| 1,300 W | 60% | 60 |

\*Based on the Heavy-load Pizza test in ASTM F1965.

Table below shows the calculation results:

Commercial Electric Deck Oven Cost Effectiveness Example

|  |  |  |
| --- | --- | --- |
| **Performance** | **Baseline Model** | **Energy Efficient Model** |
| Preheat Time (min) | 30 | 30 |
| Preheat Energy (kWh) | 6.50 | 3.00 |
| Idle Energy Rate (kW) | 1.90 | 1.30 |
| Heavy Load Cooking Energy Efficiency (%) | 40% | 60% |
| Production Capacity (lbs/hr) | 60 | 60 |
| Operating Hours/Day | 12 | 12 |
| Operating Days/Year | 365 | 365 |
| Pounds of Food Cooked per Day | 200 | 200 |
| ASTM Energy to Food (kWh/lb) | 0.0732 | 0.0732 |
| Daily Energy Consumption (kWh) | 52.1 | 35.0 |
| Average Demand (kW) | 4.9 | 3.2 |
| Estimated Demand Reduction (kW) | - | 1.7 |
| **DEER Peak Demand Reduction (kW)** |  | **1.5** |
| Annual Energy Consumption (kWh) | 21,395 | 13,876 |
| **Estimated Energy Savings (kWh/yr)** | **-** | **7,519** |

***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 the ASTM test method |
| 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 deck oven’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. A coincidence factor of 0.9 from DEER 2005 [26] is applied to demand reduction; see Section 2.1 for final values.



Figure 1 DEER 2005 Cooking Coincidence Factor

# 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** |
| Assembly | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Education - Community College | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Education - Primary School | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Education - Secondary School | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Education - University | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Grocery | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Health/Medical - Hospital | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Health/Medical - Nursing Home | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Lodging - Hotel | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Lodging - Motel | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Manufacturing - Bio/Tech | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Manufacturing - Light Industrial | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Office - Large | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Office - Small | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Restaurant - Fast-Food | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Restaurant - Sit-Down | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Retail - Multistory Large | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Retail - Small | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |

# Section 4. Costs

High-efficiency deck ovens typically have a higher list price than standard efficiency deck ovens. 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 deck ovens 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.

## 4.2 Measure Case Cost

Measure 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.

## 4.3 Full and Incremental Measure Cost

Table below shows the calculation of full measure cost:

Full and Incremental Measure Cost

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure** | **Baseline Unit Price** | **Energy Efficient Unit Price** | **Baseline Unit Cost** | **Energy Efficient Unit Cost** | **Full and Incremental Measure Cost (IMC)** |
| Electric Deck Oven | $ 8,233 | $ 11,382 | $ 4,117 | $ 5,691 | $ 1,574 |

**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 Deck Oven | ROB | $ 1,574 | $ 1,574 | N/A |

# Attachments

1. 

1. 

1. 

# References



|  |  |
| --- | --- |
| [26] | 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study - Final Report - Itron Inc. - Dec. 2005 |
| [289] | Standard Test Method for Performance of Deck Ovens |
| [422] | 2014 Appliance Efficiency Regulations (Title 20) |