**Work Paper SCE13CC012**

**Revision 1**

**Southern California Edison Company**

**Commercial Electric Deck Oven**

# At-a-Glance Summary

|  |  |
| --- | --- |
| ****Applicable Measure Codes:**** | FS-70944 |
| **Measure Description:** | Energy efficient commercial electric deck oven |
| **Base Case Description:** | Standard efficiency commercial deck oven |
| **Energy Impact Common Units:** | Unit |
| **Energy Savings :** | Refer to Excel Calculation Attachment |
| **Gross Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Measure Incremental Cost ($/unit):** | Refer to Excel Calculation Attachment |
| **Effective Useful Life (years):** | Cook-ElecCombOven: 12 years |
| **Measure Application Type:** | Replace on Burnout (ROB) |
| **Net-to-Gross Ratios:** | Com-Default>2yrs: 0.6, Agric-Default>2yrs: 0.6 |
| **Important Comments:** | This work paper document does not contain a data set in conformance with the 4/1/14 CPUC Ex Ante Database Specification; SCE will provide that data set separately. |

# Document Revision History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Workpaper and Revision # | Tech. Revision | MM/DD/YY | Author/Affiliation | Summary of Changes |
| SCE13CC012.0 | No | 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 |
| SCE13CC012.1 | No | 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 |

# 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.

Table 1 Measure Names

|  |  |
| --- | --- |
| Solution Code | Measure Name |
| FS-70944 | 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 Measure Application Type

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

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

## 1.4 Measure and Base Case Cost Effectiveness Data

### 1.4.1 DEER Measure and Base Case Analysis

DEER 2014 does not include this measure.

Table 2 DEER Difference Summary

|  |  |
| --- | --- |
| DEER Difference Summary Table | |
| Modified DEER Methodology | No |
| Scaled DEER Measure | No |
| DEER Building Prototypes Used | No |
| Deviation from DEER | DEER does not contain this measure |
| DEER Version | N/A |
| DEER Run ID and Measure Name (Sample) | N/A |

**Net to Gross**

The NTG value was obtained from the “DEER2011\_NTGR\_2012-05-16.xls” on the DEER website as required by Version 5 of the California Public Utilities Commission (CPUC) Energy Efficiency Policy Manual [351]. The relevant NTGR for this measure is shown in Table 3 below.

Table 3 Net-to-Gross Ratio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NTGR\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | NTG\* |
| 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 |

\*Denotes that the column is taken from the DEER NTG Table.

**Installation Rate**

The installation rate (IR) is identified in the calculation attachment. This value is obtained from the support table available in READi. Currently there is no versioning on the installation rate table. To address appropriate selection of the installation rate the date of the workpaper will serve as the last date checked for updated IR values. The installation rate varies by end use, sector, technology, application, and delivery method. The relevant IR values for this measure are shown in Table 4 below.

Table 4 Installation Rate

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GSIA\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | GSIAValue\* |
| Def-GSIA | Default GSIA values | Any | Any | Any | 1.0 |

**Spillage Rate**

Spillage rate will also be applied to measures however the values will not be tracked in the workpapers. The spillage rate will be tracked in an external table to be supplied to the Energy Division.

**READi Technology Fields**

Table 5 READi Tech IDs

|  |  |
| --- | --- |
| READi Field Name | Values included in this workpaper |
| Measure Case UseCategory | Food Service |
| Measure Case UseSubCats | Cooking |
| Measure Case TechGroups | Cooking Equipment |
| Measure Case TechTypes | Non-DEER |
| Base Case TechGroups | Cooking Equipment |
| Base Case TechTypes | Non-DEER |

### 1.4.2 Codes and Standards Analysis

Table 6 Code Summary

|  |  |  |
| --- | --- | --- |
| Code | Applicable Code Reference | Effective Dates |
| ASTM | F1965-99 | January 1, 2010 |

**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.

### 1.4.3 Non-DEER Study Review

### No Non-DEER studies were used in this work paper.

**1.4.4 Measure and Base Case Effective Useful Life**

DEER14 update documentation provides EUL and RUL information to be used for the 2013-14 program cycle on [www.deeresources.com](http://www.deeresources.com). The DEER documentation “DEER2014-EUL-table-update\_2014-02-05.xlsx” provides the RUL value as a flat 1/3 of the EUL value. The RUL value will only be applied to the first baseline period for retrofit measures that have applicable code that will affect the energy savings. In all other installation types and retrofit with no applicable code that affects the energy savings, the RUL is not applicable to either the first or second baseline period.

To obtain the EUL value the DEER14 update documentation, “DEER2014-EUL-table-update\_2014-02-05.xlsx” [436], was consulted. Since no EUL value was provided for electric deck ovens, the EUL for electric combination ovens was used. Table 7 below identifies the value/methodology used for the measures in this work paper.

Table 7 DEER14 EUL Value/Methodology

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| READi EUL ID | Market | Enduse | Measure | EUL (Years) | RUL (Years) |
| Cook-ElecCombOven | Non-Residential | Cooking | Commercial Deck Oven | 12 | 4 |

# Section 2. Energy Savings & Demand Reduction Calculations

## 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.

Table 8 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.

Table 9 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 10 shows the calculation results:

Table 10 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 difference between the base case load shape and the measure load shape would be the most appropriate load shape; however, only end-use profiles are available. Therefore, the closest load shape chosen for this measure is the DEER:Indoor\_Non-CFL\_Ltg load shape. See Table 11 for a list of all Building Types and Load Shapes. See the KEMA report [31] for a more thorough discussion regarding the load shapes for this measure.

Table 11 Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| Building Type | E3 Alt.  Building Type | Load Shape |
| Agricultural | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Assembly | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Education - Community College | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Education - Primary School | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Education - Secondary School | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Education - University | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Food Store | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Grocery | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Health/Medical - Hospital | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Health/Medical - Nursing Home | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Lodging - Hotel | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Lodging - Motel | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Manufacturing - Bio/Tech | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Manufacturing - Light Industrial | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Misc - Commercial | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Office - Large | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Office - Small | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Restaurant - Fast-Food | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Restaurant - Sit-Down | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Retail - Multistory Large | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Retail - Small | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |

# Section 4. Base Case & Measure 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. See Table 12 for all costs.

## 4.3 Gross and Incremental Measure Cost

## 4.3 Gross Measure Cost

For ROB measures, assuming the labor cost is the same in base and measure cases, the gross measure cost is determined using the following equation:

*Gross Measure Cost = Measure Case Material Cost – Base Case Material Cost*

Table 12 shows the calculation of gross measure cost:

Table 12 Gross and Incremental Measure Cost

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

## 4.4 Incremental Measure Cost

The incremental cost is the same as the gross measure cost and is shown in Table 12.

# Attachments

1. 

1. 

1. 

# References



|  |  |
| --- | --- |
| [26] | 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study - Final Report - Itron Inc. - Dec. 2005 |
| [31] | Load Shape Update Initiative - KEMA / JJ Hirsch and Assoc. / Itron Inc. - November 17, 2006 |
| [289] | Standard Test Method for Performance of Deck Ovens |
| [351] | Energy Efficiency Policy Manual-Version 5 |
| [422] | 2014 Appliance Efficiency Regulations (Title 20) |
| [436] | 2014 DEER EUL Table - Update |

# Appendix A – SCE/ED Application Types

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SCE Program Type | ED Application Type | 1st Baseline Savings | 2nd Baseline Savings | 1st Baseline Cost | 2nd Baseline Cost | 1st Baseline Life | 2nd Baseline Life |
| New | New Construction (Nc) | Above Code/Standard | N/A | Incremental Cost | N/A | EUL | 0 |
| Replace on Burnout (ROB) | Replace on Burnout (Rob)/Normal Replacement (NR) | Above Code/Standard | N/A | Incremental Cost | N/A | EUL | 0 |
| Retrofit (RET) | Early Replacement (ER) | Above Cust. Existing | Above Code/Standard | Full Cost | Incremental Cost | RUL | EUL-RUL |
| Retrofit – First Baseline Only (REF) | Early Replacement RUL (ErRul) | Above Cust. Existing | N/A | Full Cost | N/A | EUL | 0 |
| Retrofit Add-on (REA) | N/A | Above Cust. Existing | N/A | Full Cost | N/A | EUL | 0 |