**Work Paper SCE13CC003**

**Revision 1**

**Southern California Edison Company**

**Commercial Insulated Holding Cabinets**

# At-a-Glance Summary

|  |  |
| --- | --- |
| ****Applicable Measure Codes:**** | FS-20224, FS-31559 |
| **Measure Description:** | Energy efficient commercial electric insulated hot food holding cabinet |
| **Base Case Description:** | Standard efficiency commercial hot food holding cabinet |
| **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-HoldCab: 12 years |
| **Measure Application Type:** | Replace on Burnout (ROB) |
| **Net-to-Gross Ratios:** | Com-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 |
| SCE13CC003.0 | No | 05/30/2012 | Ricson Chude/SCE | Updates from WPSCENRCC0003.4:   * Consolidated ½ size and ¾ size into a single measure. * Changed measure names to match new groupings (Full and ½ size) and W/cu .ft requirement * Updated description of full size and ½ size categories * Adjusted calculated savings based on actual averages of energy consumption data from CEE database/ Energy Star/CA IOU Rebate Qualified list * Updated NTG values to DEER 2011 |
| SCE13CC003.1 | No | 6/19/2014 | Jason Wang/SCE | -Work paper updated for the reporting period, effective 7/1/14 – 12/31/14.  -Changed Guest Rooms building type to Motel building type  -Updated all savings using the FSTC qualifying products list and CEC database  -Updated measure names |

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

### This work paper details the replacement of a standard efficiency commercial electric hot food holding cabinet with a high efficiency commercial electric insulated hot food holding cabinet.

Table 1 Measure Names

|  |  |
| --- | --- |
| Solution Code | Measure Name |
| FS-20224 | Full Size (≥ 15 cu. ft), ≤ 20 W/cu. ft Insulated Holding Cabinet |
| FS-31559 | Half Size (< 15 cu. ft), ≤ 20 W/cu. ft Insulated Holding Cabinet |

**Eligibility Requirements**

* Eligible holding cabinets must be fully insulated on all sides and have solid or transparent doors designed to maintain the temperature of hot food that has been cooked using a separate appliance.
* Cook-and-hold and retherm equipment is not eligible.
* Eligible cabinets must not exceed the maximum idle energy rate of 20 Watts per cubic foot in accordance with the ASTM Standard F2140 test method [140].
* Full-size holding cabinets are defined as any holding cabinet with an internal measured volume of greater than or equal to 15 cubic feet (≥ 15 cu. ft).
* Half-size holding cabinets are defined as any holding cabinet with an internal measured volume of less than 15 cubic feet (< 15 cu. ft).
* Eligible holding cabinets must be on the Food Service Technology Center pre-approved list.

## 1.2 Technical Description

Commercial insulated hot food holding cabinet models that meet program requirements incorporate better insulation for reduced heat loss and may also offer additional energy saving devices such as magnetic door gaskets, auto-door closers, or Dutch doors. The insulation of the cabinet also offers better temperature uniformity within the cabinet from top to bottom. This means that qualified hot food holding cabinets are more effective at maintaining food temperature while using less energy.

Holding cabinet performance is determined by applying the ASTM Standard Test Method for the Performance of Hot Food Holding Cabinets (F2140). The ASTM standard test method is considered to be the industry standard for quantifying the efficiency and performance of hot food holding cabinets.

## 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

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 |

\*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 | Electric Holding Cabinet |
| Base Case TechGroups | Cooking Equipment |
| Base Case TechTypes | Electric Holding Cabinet |

### 1.4.2 Codes and Standards Analysis

Table 6 Code Summary

|  |  |  |
| --- | --- | --- |
| Code | Applicable Code Reference | Effective Dates |
| Title 20 (2014) | Section 1605.3(r)(2) | July 1, 2014 |
| ASTM | F2140 | January 1, 2011 |

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

**California Title 20 2014:** Title 20 [422] provides the following requirement in Section 1605.3(r)(2), which is used as the baseline for this work paper:



### ASTM Standards: ASTM Standard Test Method for the Performance of Hot Food Holding Cabinets (F2140) is applicable for estimating 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 “Summary of EUL-RUL Analysis for the April 2008 Update to DEER” 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, EUL\_Summary\_10-1-08.xls [213], was consulted. 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-HoldCab | Non-Residential | Cooking | Commercial Insulated Holding Cabinet | 12 | 4 |

# Section 2. Energy Savings & Demand Reduction Calculations

## 2.1 Electric Energy Savings Estimation Methodologies

The base case for both half and full size hot food holding cabinets in this work paper is Title 20, which requires all new commercial hot food holding cabinets to have a maximum normalized idle energy rate of 40 W/ft³ based on ASTM F2140.

The measure case data was drawn from the Food Service Technology Center qualifying products list and the CEC Appliance database. Qualifying products met the specified idle energy rate of 20W/ft³ or less. Table 9 and Table 10 show the calculation results:

Table 9 Commercial Electric Full-Size Holding Cabinet Calculations

|  |  |  |
| --- | --- | --- |
| Performance | Base Case | Measure Case |
| Cabinet Volume (ft³) | 26.12 | 26.12 |
| Normalized Idle Energy Rate (W/ft³) | 40.00 | 11.13 |
| Idle Energy Rate (kW) | 1.04 | 0.29 |
| Operating Hours/Day | 15 | 15 |
| Operating Days/Year | 365 | 365 |
| Daily Energy Consumption (kWh) | 15.67 | 4.36 |
| Average Demand (kW) | 1.04 | 0.29 |
| Estimated Demand Reduction (kW) |  | 0.75424 |
| **Coincident Demand Reduction (kW)** |  | **0.67882** |
| Annual Energy Consumption (kWh) | 5,720.59 | 1,591.12 |
| **Estimated Energy Savings (kWh/yr)** |  | **4,129.46** |

Table 10 Commercial Half-Size Electric Holding Cabinet Calculations

|  |  |  |
| --- | --- | --- |
| Performance | Base Case | Measure Case |
| Cabinet Volume (ft³) | 8.57 | 8.57 |
| Normalized Idle Energy Rate (W/ft³) | 40.00 | 6.07 |
| Idle Energy Rate (kW) | 0.34 | 0.05 |
| Operating Hours/Day | 15 | 15 |
| Operating Days/Year | 365 | 365 |
| Daily Energy Consumption (kWh) | 5.14 | 0.78 |
| Average Demand (kW) | 0.34 | 0.05 |
| Estimated Demand Reduction (kW) |  | 0.29092 |
| **Coincident Demand Reduction (kW)** |  | **0.26183** |
| Annual Energy Consumption (kWh) | 1,877.79 | 285.01 |
| **Estimated Energy Savings (kWh/yr)** |  | **1,592.78** |

Energy usage calculations are based on 15 hours a day, 365 days per year operation at a typical temperature setting of 150°F.

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

## 2.2. Demand Reduction Estimation Methodologies

A holding cabinet’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 |
| 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 |
| Health/Medical - Nursing Home | NON\_RES | DEER:Indoor\_Non-CFL\_Ltg |
| Industrial | 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 |
| 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 |

# Section 4. Base Case & Measure Costs

High-efficiency holding cabinets typically have a higher list price than standard efficiency holding cabinets. 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 holding cabinets 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 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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Holding Cabinet Type | Baseline Unit Price | Energy Efficient Unit Price | Baseline Unit Cost | Energy Efficient Unit Cost | Incremental Measure Cost (IMC) |
| Full-Size  Hot Food Holding Cabinet | $7,156 | $11,828 | $3,578 | $5,914 | $2,336 |
| Half-Size  Hot Food Holding Cabinet | $4,527 | $5,289 | $2,263 | $2,644 | $381 |

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

## 4.3 Incremental Measure Cost

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

# Attachments

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 |
| [140] | Standard Test Method for the Performance of Hot Food Holding Cabinets. |
| [213] | EUL/RUL Values Provided through Excel Spreadsheet |
| [351] | Energy Efficiency Policy Manual-Version 5 |
| [422] | 2014 Appliance Efficiency Regulations (Title 20) |

# 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 |