Work Paper SCE13CC003

**Revision 2**

**Southern California Edison**

**Commercial Insulated Holding Cabinets**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **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 |
| **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-HoldCab: 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 | 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 |
| 1 | 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 |
| 2 | 01/15/2016 | Ajay Wadhera/Solaris | -New template update for 2016 program year  -WP effective from 1/1/2016 thru 12/31/2016  -Removed SCE building types (Agr, FSt, Cli, Ind, MiC, TCU)  -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 a standard efficiency commercial electric hot food holding cabinet with a high efficiency commercial electric insulated hot food holding cabinet.

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | High efficiency commercial electric insulated hot food holding cabinet |
| Existing Condition | Standard efficiency commercial electric hot food holding cabinet |
| 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-20224 | N/A | Full Size (≥ 15 cu. ft), ≤ 20 W/cu. ft Insulated Holding Cabinet |
| N/A | N/A | FS-31559 | N/A | 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 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 | Measure not available in DEER |
| 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-HoldCab | Non-Residential | Cooking | Commercial Insulated Holding Cabinet | 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] 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.

Code Summary

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

## 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

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. Tables below show the calculation results:

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** |

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.



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** |
| 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 |
| 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 |
| 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 |

# Section 4. 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 Full and Incremental Measure Cost

Table below shows the calculation of full measure cost:

Full and Incremental Measure Cost

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Holding Cabinet Type** | **Baseline Unit Price** | **Energy Efficient Unit Price** | **Baseline Unit Cost** | **Energy Efficient Unit Cost** | **Full and 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.

**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** |
| Full-Size  Hot Food Holding Cabinet | ROB | $2,336 | $2,336 | N/A |
| Half-Size  Hot Food Holding Cabinet | ROB | $381 | $381 | N/A |

# Attachments







# References



|  |  |
| --- | --- |
| [26] | 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study - Final Report - Itron Inc. - Dec. 2005 |
| [140] | Standard Test Method for the Performance of Hot Food Holding Cabinets. |
| [422] | 2014 Appliance Efficiency Regulations (Title 20) |