**Work Paper SCE13RN018**

**Revision 1**

**Southern California Edison Company**

**Low ASH Display Doors**

# At-a-Glance Summary

|  |  |
| --- | --- |
| ****Applicable Measure Codes:**** | RF-43276  RF-25928 |
| **Measure Description:** | RF-43276: Replacement of standard low temperature (“freezer”) display case doors with special display case glass doors that have no anti-sweat heaters.  RF-25928: Replacement of old low temperature display cases with new low temperature display cases with special doors that have no anti-sweat heaters. |
| **Base Case Description:** | For door replacement (RF-43276), base case is the existing low-temperature reach-in display cases equipped with standard ASH glass doors. For replacing display cases (RF-25928), base case is reach-in display cases equipped with standard ASH glass doors, and LED lamps. |
| **Energy Impact Common Units:** | RF-43276: For door replacement the energy savings are based on a per door basis.  RF-25928: For replacing display cases with new low temperature display case savings are based on a per linear foot basis (case frontal width) |
| **Energy Savings :** | Refer to Excel Calculation Attachment A |
| **Gross Measure Cost ($/unit)** | Refer to Excel Calculation Attachment A |
| **Measure Incremental Cost ($/unit):** | Refer to Excel Calculation Attachment A |
| **Effective Useful Life (years):** | Source: DEER 2014-EUL-table-update-2014-02-05  12 years |
| **Measure Application Type:** | RF-43276: REF – Retrofit – First Baseline Only  RF-25928: ROB – Replacement on Burnout |
| **Net-to-Gross Ratios:** | Source: DEER2011\_NTGR\_2012-05-16.xls  0.6 |
| **Important Comments:** | Major changes for Revision 1 include: used the updated eQuest prototype from MASControl version 3.00.20 for vintage 2014, updated the weather data files to DEER2014 CZ2010, and also updated peak demand savings based on 2014 DEER Peak-Demand Periods.  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 |
| SCE13RN018, Revision 0 | No | 06/1/2012 | Yin Yin Wu/BASE Energy, Inc.  Chris Fernandez/BASE Energy, Inc. | This is the original work paper for the bridge cycle 2013-2014. This work paper combines SCE13RN018.0—Low ASH Display Doors and SCE13RN022.0—High Efficiency Refrigerated Display Case with Special Doors (Low Temp) |
| SCE13RN018, Revision 1 | Yes | 07/08/2014 | Yin Yin Wu/BASE Energy, Inc. | -Used the updated eQuest prototype from MASControl version 3.00.20 for vintage 2014  -Updated the eQuest model weather files per DEER2014 CZ2010 weather data files  - Updated peak demand savings based on 2014 DEER Peak-Demand Periods  - Updated work paper for reporting period effective 07/01/14 to 12/31/14 |

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

Refer to Table 1 below for the list of measures included in this workpaper.

**RF-43276**: This work paper details the replacement of standard low temperature (“freezer”) display case doors with special display case glass doors that have no anti-sweat heaters. For this measure, base case is the existing low-temperature reach-in display cases equipped with standard ASH glass doors, T12 lamps with magnetic ballast and shaded pole fan motors.

**RF-25928**: The work paper also details the replacement of the old low temperature display cases with new low temperature display cases with special doors that have no anti-sweat heaters. This measure is considered to be ROB – Replacement on Burnout. Since the state and federal standards do not specifically regulate the display case components (such as the evaporator fan motor, case lighting and ASH door types), the DEER prototype Code Baseline model of display case is considered as the baseline for this measure. The DEER Code Baseline model is the same as the DEER Baseline model, which is the existing equipment. Therefore, the base case of this measure is reach-in display cases equipped with standard ASH glass doors, T12 lamps with magnetic ballast and shaded pole fan motors. Refer to Section 1.4.2 of this work paper for details of codes and standards analysis.

Table 1 Measure Names

|  |  |
| --- | --- |
| Solution Code | Measure name |
| RF-43276 | Low Anti-Sweat Heater (ASH) Door |
| RF-25928 | Low Temperature High Efficiency Display Case with Special Door |

This measure is applicable to any commercial retail facility, including (but not limited to) supermarkets, grocery stores, hotels, restaurants and convenience stores as identified in Table 10 and are applicable to both Southern California Edison’s and Pacific Gas and Electric’s service territory.

**Eligibility Requirements**

For door replacement (RF-43276) the energy savings are based on a per door basis. It is important to note that for replacing doors only, the anti-sweat heat (ASH) on the glass doors and frame is eliminated; the anti-sweat heat on the mullion of the cases continue to operate. The energy savings and cost figures are calculated per linear foot basis and account for the reduced ASH energy use of the doors only.

When replacing the whole display case with a new low temperature display case with special doors (RF-25928), they should be equipped with LED lights, electrically-commutated (EC) fan motors, and special low/no anti-sweat heater (ASH) glass doors. Rebate for replacing display cases with new low temperature display case is based on a per linear foot basis (case frontal width), and the display case must replace existing low-temperature, reach-in display cases equipped with standard ASH glass doors, T12 lamps with magnetic ballast and shaded pole fan motors.

**Express Requirements**

To qualify for the incentive for RF-43276, the following requirements must be met:

* An existing standard glass door with one glass pane of a low-temperature reach-in display case is being replaced with a special glass door that requires minimum to no anti-sweat heat (ASH). The replacement door is double-pane glass with heat-reflective treatment or gas filled. The display case temperature set point is between 5 and 24 degrees Fahrenheit.
* The new door will prevent condensation.
* The total wattage from the door rail, glass, and frame heater is not more than 7.1 watts per square foot (W/ft²) of door opening.
* This is the only Express Solution category under which the fixtures are receiving incentives. This solution cannot be used in conjunction with Anti-Sweat Heat (ASH) Controls category.

To qualify for the incentive for RF-25928, the following requirements must be met:

* A new high-efficiency reach-in display case is replacing an existing low-temperature self-contained or remote reach-in as shown in the table below.
* The new case length is equal to or shorter than the original case. Incentive is based on linear footage of the new display case.
* This is the only Express Solution category under which the fixtures are receiving incentives. This solution cannot be used in conjunction with Anti-Sweat Heat (ASH) Controls category.

Table 2 Express Requirements for RF-25928

|  |  |
| --- | --- |
| Existing | Replacement |
| T12 lamps with magnetic ballast | LED lamps |
| Shaded-pole fan motor | ECM fan |
| Standard glass door with anti-sweat glass double-pane doors | Standard glass door with low/no anti-sweat glass double-pane doors |

**Pacific Gas and Electric**

Requirements for R6:

* Installation address must have a commercial electric account with PG&E.
* Must replace an existing, standard glass door of a low temperature, reach-in display case with a special glass door that requires minimum to no anti-sweat heat.
* New doors must prevent condensation within the frame assembly.

Exclusions:

* Total door rail, glass, and frame heater amperage (at 120 volts) cannot exceed 0.925 amps per door.
* Cannot be used in conjunction with the “Anti-Sweat Heater (ASH) Controls” rebate.

Requirements for R87:

* Installation address must have a commercial electric account with PG&E.
* Must replace an existing low temperature self-contained or remote reach-in case with a new high-efficiency remote reach-in case as described in the Refrigeration Display Cases with Special Doors Table.
* New case length must be equal to, or shorter than, the original case.
* This measure is for remote cases only.
* Rebate is based on linear footage of new display case.

Exclusions:

* Cannot be used in conjunction with the “Anti-Sweat Heater (ASH) Controls” rebate.
* Deli cases, custom coolers/freezers and walk-in boxes with reach-in doors do not qualify.

## 1.2 Technical Description

This work paper details the replacement of standard low temperature (“freezer”) display case doors with special display case glass doors that have no anti-sweat heaters (RF-43276), as well as replacing old low temperature display cases with new low temperature display cases with special doors that have no anti-sweat heaters (RF-25928).

Traditional clear glass display case doors consist of two-pane glass and aluminum doorframes and door rails. Anti-Sweat Heaters (ASH) are included to eliminate condensation on the door or glass surface. The heaters are traditionally designed to overcome the highest humidity conditions as cases are built for nation-wide applications. Typical case construction requires three sets of heaters:

* Case mullion heaters – located inside the case frame to keep the doors from freezing shut.
* Door frame heaters – located in the door frame to keep the doors from freezing shut and provide some heat to the glass.
* Glass heaters – located on the glass itself to raise its surface temperature and prevent condensation

In standard installations, the ASH operates at full power 100% of the time. Some of the heat generated by ASH ends up as a load on the refrigeration system. Therefore, any reduction in ASH power not only will reduce the ASH electric demand, it will also result in secondary benefits on the refrigeration side. As a result, compressor run time and energy consumption are reduced.

## 1.3 Measure Application Type

Note: See Appendix A for a comparison of the application types used by and incorporated into SCE systems versus the application types available in the newest revision of DEER 2014. Appendix A will serve as a translation between the outputs of this work paper and application types used by READi.

This work paper addresses retrofit (REF – Retrofit – First Baseline Only) of new low heat/no heat doors (RF-43276),and replacement on burnout (ROB) installations of new low-temperature refrigerated display case with new doors that prevent formation of condensation on the glass surface (RF-25928). The delivery method is Financial Support - Down Stream Incentive – Deemed.

## 1.4 Measure and Base Case Cost Effectiveness Data

### 1.4.1 DEER Measure and Base Case Analysis

The energy savings methodology proposed in this work paper is based on the 2005 DEER measure ID No. D03-228. The main difference between the DEER savings and the savings reported in this work paper is that DEER savings are presented per climate zone, per building, for 6 different vintages. These vintages are: Built between 2002 and 2005, Built 2006 and later, Built before 1978, Built between 1978 and 1992, Built between 1993 and 2001, and Built 2006 and later. The savings in this work paper are presented per clime zone per building type and for vintage 2014. The updated eQuest prototypes from MASControl version 3.00.20 for vintage 2014 were used to calculate the savings in this work paper. The eQuest model weather files were updated with DEER2014 CZ2010 weather data files.

Table 3 DEER Measure Summary

|  |  |
| --- | --- |
| DEER Measure Summary Table | |
| DEER ID | D03-228 |
| Measure Description | Eliminate anti-sweat heaters from doors |
| Baseline Characteristics | Standard air-cooled multiplex, with door and frame heaters,  214W/door, humidity controlled |
| Code Baseline Characteristics | Standard air-cooled multiplex, with door and frame heaters,  214W/door, humidity controlled |
| Measure Characteristics | Eliminate door heaters, 54W/door frame heat only, fixed output |
| Savings Reporting Units | Per door |

Table 4 DEER Difference Summary

|  |  |
| --- | --- |
| DEER Difference Summary Table | |
| Modified DEER Methodology | No |
| Scaled DEER Measure | No |
| DEER Building Prototypes Used | Yes |
| Deviation from DEER | DEER presents savings per building vintage. Savings in this work paper are based on vintage 2014, v14. The updated eQuest prototypes from MASControl version 3.00.20 for vintage 2014 were used in this work paper. The eQuest model weather files were updated per DEER2014 CZ2010 weather data files |
| DEER Version | DEER 2014 |
| DEER Run ID and Measure Name (Sample) | D03-228 |

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 5 below.

Table 5 Net-to-Gross Ratio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NTGR\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | NTG\* |
| Com-Default>2yr | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Com | Any | All | 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 work paper 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 6 below.

Table 6 Installation Rate

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

**Spillage Rate**

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

**READi Technology Fields**

To support the development of the ED ex ante tables, select fields from the ex ante database will be identified in the work paper. For a full set of values associated with the measures in the work paper refer the Excel calculation template.

Table 7 READi Tech IDs

|  |  |
| --- | --- |
| READi Field Name | Values included in this workpaper |
| Measue Case UseCategory | Commercial Refrigeration |
| Measure Case UseSubCats | Refrigerated Display |
| Measure Case TechGroups | Grocery Refrigeration system |
| Measure Case TechTypes | Reach-In Storage |
| Base Case TechGroups | Grocery Refrigeration system |
| Base Case TechTypes | Reach-In Storage |

### 1.4.2 Codes and Standards Analysis

**Title 20**

California Title 20 Appliance Efficiency Standards [422] does regulate the overall performance of low temperature, vertical display cases with doors in terms of maximum daily energy consumption. However, the standard does not specifically regulate the display case components, such as the evaporator fan motor, case lighting and ASH door types.

*Section 1605.1(a)(2) Commercial Refrigerators, Commercial Refrigerator-Freezers, and Commercial Freezers*

*(B) The daily energy consumption (in kilowatt hours per day) of each commercial refrigerator and commercial freezer manufactured on or after the effective dates shown shall be not greater than the applicable values shown in Tables A-4 and A-5.*

*Table A-4 Standards for Commercial Refrigerators and Freezers with a Self-Contained Condensing Unit That are Not Commercial Hybrid Units*

* *Effective January 1, 2010*
* *For Self Contained, Vertical Closed Transparent, Low Temperature (VCT, SC, L), the maximum daily energy consumption (kWh) is: 0.75 × V + 4.10*

*Table A-5 Standards for Commercial Refrigerators and Freezers with a Remote Condensing Unit That are Not Commercial Hybrid Units*

* *Effective January 1, 2010*
* *For Remote, Vertical Closed Transparent, Low Temperature (VCT, RC, L), the maximum daily energy consumption (kWh) is: 0.56 × TDA + 2.61*

**Title 24**

Nonresidential Compliance Manual for the 2013 Building Energy Efficiency Standards (Title 24) [359] includes excerpts from the Appliance Efficiency Regulations in Appendix B. Table A-4 in Appendix B of Title 24 summarizes *Standards for Commercial Refrigerators, Refrigerator‐Freezers*, which is taken from Table A-4 of Title 20 discussed above.

**Federal Standards**

Federal Standard 10CFR § 431.66 (2013) [C] addresses the same overall performance for display cases as discussed in the Title 20 section above.

Table 8 Code Summary

|  |  |  |
| --- | --- | --- |
| Code | Applicable Code Reference | Effective Dates |
| Title 20 (2014) | N/A | May, 2014 |
| Title 24 (2013) | N/A | July, 2014 |
| FS 10CFR (2013) | N/A | January, 2013 |

### 1.4.3 Non-DEER Study Review

All of the data used or reviewed in the preparation of this work paper comes from DEER Database.

### 1.4.4 Measure and Base Case Effective Useful Life

DEER14 update documentation provides EUL and RUL information to be used for the 2015 program cycle extension 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 documentation, DEER2014-EUL-table-update\_2014-02-05.xlsx [436], was consulted. Table 9 below identifies the value/methodology used for the measures in this work paper.

Table 9 DEER14 EUL Value/Methodology

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| READi EUL ID | Market | Enduse | Measure | EUL (Years) | RUL (Years) |
| GrocDisp-ZeroHtDrs | Non-Residential | Refrigeration | Zero Heat Reach-in Glass Doors | 12 | N/A |

# Section 2. Energy Savings & Demand Reduction Calculations

The following assumptions were made for the calculations of this work paper:

* The building simulation models were generated for a Grocery Store with multiplex-compressor systems for the refrigeration display cases. Single-compressor systems are less efficient than multiplex-compressor systems. According to the DEER Report [26], single-compressor systems were typically designed prior to 1980. To be conservative, it is assumed that the generated energy savings of this work paper will also be applied to display cases with single-compressor systems.
* This work paper is applied to display cases located inside a space which has space heating and space cooling. The building simulation models were generated for a Grocery Store. Since the heat gain of a display case mainly depends on the temperature maintained for the display case and the surrounding space temperature, it is assumed that the building types would not have significant impact on the energy savings. Thus, the resulted savings of Grocery Store is applied to all other building types considered in this work paper.

The 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study final Report [26] has included the measure of Zero Heat Reach-in Glass Doors (ID D03-228). Please refer to the DEER Report Section 6 for details of DEER Building Prototypes generated by eQuest (a graphical interface to DOE-2.2), Section 7.3 for general description for grocery refrigeration measures, and Page 7-90 for detail descriptions of this measure. The DEER measure ID D03-228 replaces conventional low temperature reach-in glass door display cases, utilizing doors with both door heaters and frame heaters, with doors having frame heaters only (no door heaters).

The DEER measure considers multiplex-compressor systems as the refrigeration type. The baseline of the Zero Heat Reach-in Glass Doors (ID D03-228) measure considers the anti-sweat heater (ASH) power of 214 Watt/door for the door and frame heaters with humidity control. The measure case of this measure considers the ASH power of 54 Watt/door for door frame heat only (eliminating door heaters). The energy savings methodologies of this DEER measure ID D03-228 is applied to the two solution codes of this work paper.

***RF-43276: Low Anti-Sweat Heater (ASH) Door***

The energy savings of DEER measure ID D03-228 for sixteen climate zones and vintage 2014 was extracted from DEER 2014 prototypes from MASControl version 3.00.20. The eQuest baseline and measure models were modified based on values provided in Measure ID "D08-NE-GrocRefg-FixtDoors-AllTemp-Dr&FrmHt-FxdDrHt" for the D03-228 DEER measure. The weather files were updated using DEER2014 CZ2010 weather data files. Table 10 below summarizes the baseline and measure inputs extracted from the DEER prototype models on D03-228.

The reporting unit energy savings is per door (kWh/dr) for this measure.

Table 10 Summary of Built-In Display ASH Inputs from DEER Prototypes

|  |  |  |
| --- | --- | --- |
| **Input Component** | **Standard ASH Door**  **(Baseline)** | **Efficient ASH Door**  **(Measure)** |
| ASH Heater Power | 0.214 kW/dr | 0.054 kW/dr |
| ASH Heater Control | Humidity-Ration | Fixed |

***RF-25928: Low Temperature High Efficiency Display Case with Special Door***

In addition to the simulation methodology discussed for RF-43276 above, RF-25928 also includes savings due to the higher efficiency LED lighting and ECM motors included in the new display case. Table 11 below summarizes the baseline and measure inputs in the eQuest simulation for this measure.

The reporting unit energy savings is per feet (kWh/ft) for this measure. The per door savings have been converted to per feet based on the conversion value of 2.6 ft/dr extracted from eQuest model.

Table 11 Summary of Built-In Display ASH Inputs from DEER Prototypes

|  |  |  |
| --- | --- | --- |
| **Input Component** | **Standard ASH Door**  **(Baseline)** | **Efficient ASH Door**  **(Measure)** |
| ASH Heater Power | 0.214 kW/dr | 0.054 kW/dr |
| ASH Heater Control | Humidity-Ration | Fixed |
| Canopy Lighting Power | 0.078 kW/dr  (T12 Lighting) | 0.0492 kW/dr\*  (LED Lighting) |
| Evaporator Fan Power | 0.055 kW/dr  (Shaded-Pole Motor) | 0.02475 kW/dr  (ECM Motor) |

\* Provided in a DOE report [443].

**Peak Demand Savings**

The baseline and measure peak demands were averaged for the hourly demand outputs between 2 P.M. and 5 P.M. on the DEER peak days. Table 11 summarizes the 2014 DEER Peak-Demand periods for all climate zones considered in this work paper. The measure results were subtracted from the baseline results to determine the demand reduction.

Similar to the energy savings the unit demand reduction, in kW/ft, was calculated by dividing the total demand reduction by the total line-up length for RF-25928.

The unit demand reduction, in kW/dr, was calculated by dividing the total demand reduction by the total doors for RF-43276.

Refer to Attachment-B for the eQuest output savings summary.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Table 11. 2014 DEER Peak-Demand Periods**   |  |  |  |  | | --- | --- | --- | --- | | Climate Zone | Dates | Climate Zone | Dates | | CZ01 | Sep 16-18 | CZ09 | Sep 1-3 | | CZ02 | Jul 8-10 | CZ10 | Sep 1-3 | | CZ03 | Jul 8-10 | CZ11 | Jul 8-10 | | CZ04 | Sep 1-3 | CZ12 | Jul 8-10 | | CZ05 | Sep 8-10 | CZ13 | Jul 8-10 | | CZ06 | Sep 1-3 | CZ14 | Aug 26-28 | | CZ07 | Sep 1-3 | CZ15 | Aug 25-27 | | CZ08 | Sep 1-3 | CZ16 | Jul 8-10 | |

# 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 Refrigeration load shape. See Table 12 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 12 Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| Building Type | E3 Alt. Building Type | Load Shape |
| Assembly | Assembly | Refrigeration |
| Grocery | Grocery\_Store | Refrigeration |
| Food Store | Food\_Store | Refrigeration |
| Restaurant - Fast-Food | Fast\_Food\_Restaurant | Refrigeration |
| Restaurant - Sit-Down | Sit\_Down\_Restaurant | Refrigeration |
| Retail - Multistory Large | Large\_Retail\_Store | Refrigeration |
| Retail - Single-Story Large | Large\_Retail\_Store | Refrigeration |
| Retail - Small | Small\_Retail\_Store | Refrigeration |

# Section 4. Base Case & Measure Costs

## 4.1 Base Case Cost

**RF-25928: *For installing New Low Temperature Display Case with New Doors (ROB):***

For this measure category, the base case cost is to be used to calculate the incremental measure cost. Department of Energy’s (DOE) Commercial Refrigeration Equipment Final Rule Technical Support Document [A] lists a 5 door (12.7ft.) vertical closed transparent, remote condensing, low display case as $7,356. $579.21/linear ft. was calculated as the base cost for this measure.

**RF-43276: For installing New Low Heat/No Heat Doors (REF):**

The base case assumes low temperature display cases with standard glass doors that are equipped with ASH. According to DEER there is no cost ($0.00 per door) associated with the base case. [26]

## 4.2 Measure Case Cost

## 4.3 Gross and Incremental Measure Cost

### 4.3.1 Gross Measure Cost

**RF-25928: For installing New Low Temperature Display Case with New Doors (ROB)**

For this measure category, the gross measure cost is used in the calculation of the incremental cost. For ROB measures labor need not be included in the calculation of the gross measure cost because it is not used for reporting, only as a step to calculating the incremental measure cost which does include labor in the calculation.

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**Figure 1 DOE’s Technical Support Document**

The measure cost is extrapolated from DOE’s Commercial Refrigeration Equipment Final Rule Technical Support Document as shown in Figure 1 [A]. The price of the measure was obtained by taking the difference of design level AD3 and AD4 to isolate the cost of the high-performance doors. Then, the difference in cost was divided by the baseline (AD1) for a percentage value that was applied to the baseline cost of $7356 for a measure cost of $8639.74. Measure cost of $8639.74 converted to per linear foot yields $680.29.

The gross measure cost for ROB measures can be calculated as follows:

∆cost/unit:

The gross measure cost (∆cost/unit) is defined as the difference in costs between the base case and the measure equipment. Installation labor costs are assumed to be the same.

Therefore: X = Base Case Cost = $579.21/ft

Y = Measure Equipment Cost = $680.29/ft

∆cost/unit = Y- X = $101.08/ft

**RF-43276: *For installing New Low Heat/No Heat Doors (REF)***

The full measure cost is not available in Revised DEER Measure Cost Summary table, therefore, the actual equipment cost of projects [B] implemented and rebated in 2006 by PG&E’s Deemed Rebate Program (Small Business and Existing Facilities) under the Refrigeration catalog was used. The measure cost data from 2006-08 was converted to 2014 cost based on the Historical Cost Indexes table from 2014 RS Means Mechanical Cost Data. According to RS Means, the cost index in 2014 in 100 while the cost index is 79.9 in 2006. Table 13 summarizes the full measure cost including material and labor cost. Table 14 summarizes the material cost. The labor cost is estimated based on data given in Tables 13 and 14.

**Table 13 Full Measure Cost based on PG&E R6 rebate applications for 2006-08**

|  |  |  |  |
| --- | --- | --- | --- |
| Invoice Date | Qty | Invoice Amount  (Material + labor) | $/door |
| Oct-06 | 7 | $5,149.43 | $735.63 |
| Nov-06 | 127 | $43,183.00 | $340.02 |
| Dec-06 | 8 | $2,712.00 | $339.00 |

The full measure cost per door = (100/79.9)\*($735.63 + $340.02 + $339.00)/3 = $590.17.

**Table 14 Material Cost based on PG&E R6 rebate applications for 2006-08**

|  |  |  |  |
| --- | --- | --- | --- |
| Invoice Date | Qty | Invoice Amount  (Material) | $/door |
| Oct-06 | 7 | $4,199.43 | $599.92 |
| Nov-06 | 127 | $35,563.00 | $280.02 |
| Dec-06 | 8 | $2,232.00 | $279.00 |

The material cost per door = (100/79.9)\*($599.92 + $280.02 + $279.00)/3 = $483.50.

The labor cost per door = $590.17 - $483.50 = $106.67.

### 4.3.2 Incremental Measure Cost

**RF-25928: For installing New Low Temperature Display Case with New Doors (ROB)**

The incremental measure cost is the same as the gross measure cost as shown in Section 4.2.

**RF-43276: For installing New Low Heat/No Heat Doors (REF)**

For retrofit deemed measures, the Incremental Measure Cost (IMC) section is not intended to be used for reporting purposes, but rather to provide guidance in determining program level incentives only. The incremental measure cost can be calculated as follows:

[Equation 1] ∆cost/unit:

The IMC (∆cost/unit) is defined as the difference in costs between the base case equipment and the measure case equipment. Installation labor costs are assumed to be the same. Since base case cost is zero, the IMC equals to GMC

IMC = GMC

# Attachments

1. 

1. 
2. 

# References



[26]

[31]

[189]

[351]

[355]

[422]

[436]

[443]

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[A] Energy Savings Potential and R&D Opportunities for Commercial Refrigeration, September 23, 2009. Submitted to U.S. Department of Energy Efficiency and Renewable Energy Building Technologies Program by Navigant Consulting, Inc. Chapter 8 - Life-Cycle Cost and Payback Period Analysis, pg.12, Appendix B, pg.6 & 18.

[B] Average of actual costs from R6 rebate customers’ invoices, including freight charges, based on projects implemented and rebated in 2006 by PG&E’s Deemed Rebate Program (Small Business and Existing Facilities) under the Refrigeration catalog.

[C] Title 10 – Energy, Chapter II - DEPARTMENT OF ENERGY, Subchapter D - ENERGY CONSERVATION, Part 431 - ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT, Subpart C - Commercial Refrigerators, Freezers and Refrigerator-Freezers, Section 431.66 - Energy conservation standards and their effective dates, January 1, 2013.

<http://www.gpo.gov/fdsys/granule/CFR-2013-title10-vol3/CFR-2013-title10-vol3-sec431-66/content-detail.html>

# 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 |