**Work Paper PGEREF110**

**Refrigerated Storage Auto Closer**

**Revision # 4**

**Pacific Gas & Electric Company**

**Customer Energy Solutions Department**

**Refrigerated Storage Auto Closer**

**Measure Codes R79, R80**

**PGECOREF110 R4 Auto Closers**

PG&E is using the SCE work paper Work Paper SCE13RN024 ex-ante values for PG&E measure codes R79 and R80.

The measure mapping is as follows:

SCE Solution Code RF-16925 = PG&E code R79

SCE Solution Code RF-32156 = PG&E code R80

**Work Paper Approvals**

The following Managers approved this work paper through the PG&E Electronic Data Routing System under Routing Requisition # 2014-67159

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| --- |
|  |
| **Grant Brohard**  Manager, Engineering Services |
| **Carolyn Weiner**  Manager, Products |

**Work Paper SCE13RN024**

**Revision 1**

**Southern California Edison Company**

**Refrigerated Storage Auto Closer**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Applicable Measure Codes:** | SCE Solution Code RF-16925 = PG&E code R79 Main Cooler Auto Closer  SCE Solution Code RF-32156 = PG&E code R80 Main Freezer Auto Closer |
| **Measure Description:** | Install automatic door closer on walk-in freezer or cooler doors |
| **Base Case Description:** | Existing walk-in freezers or coolers without an automatic door closer |
| **Energy Impact Common Units:** | Per unit (Freezer or Cooler) |
| **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):** | DEER14: 8 years |
| **Measure Application Type:** | Retrofit Add-On (REA) |
| **Net-to-Gross Ratios:** | DEER14: 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 |
| SCE13RN024.0 | Yes | 6/18/2013 | Thomas C. Tseng/SCE | Original workpaper for 2013 PC |
| SCE13RN024.1 | Yes | 7/1/2014 | Justin Westmoreland, PE/AESC | -Work paper updated for the reporting period, effective 7/1/14 – 12/31/14.  -All savings revised based on new eQUEST simulations. |

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

This work paper details the Retrofit Add-on (REA) of main door auto closers or walk in freezers and coolers. The measure is to install auto closers on walk-ins where none was present. The base case of the measure is an existing walk-in cooler or freezer door without a door closer.

Table 1 Measure Names

|  |  |
| --- | --- |
| Solution Code | Measure name |
| RF-16925 | Main Cooler Door Auto Closer |
| RF-32156 | Main Freezer Door Auto Closer |

**Implementation Requirements**

The measures in this work paper pertain to the following building types in all SCE and PGE climate zones:

* Education - Primary School
* Education - Community College
* Education - University
* Grocery
* Food Store
* Health/Medical - Hospital
* Health/Medical - Nursing Home
* Lodging - Hotel
* Misc - Commercial
* Office – Large
* Restaurant - Fast-Food
* Restaurant - Sit-Down
* Retail - Multistory Large
* Retail - Single-Story Large
* Retail – Small

**Eligibility Requirements**

* The auto-closer must be applied to the main insulated opaque door(s) of an existing walk-in cooler or freezer.
* The auto-closer must firmly close that door when it is within one inch of full closure.
* Auto-closer must be installed on a walk-in cooler or freezer manufactured before January 1, 2009.

## 1.2 Technical Description

Auto-closers on walk-in freezers and coolers can reduce the amount of time that doors are open, thereby reducing infiltration and refrigeration loads. The measures in this work paper are from DEER 2005 which assumes that auto-closers reduce infiltration by 40% on average. However, to update the measure to 2014 code, the C13 case model was used as the baseline for this work paper. The base case of the measure is an existing walk-in cooler or freezer door without a door closer.

## 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.

The program/install types for the above measures are:

* Retrofit Add-on (REA)

The delivery method that is available for these measures is:

* Financial Support - Down-Stream Incentive – Deemed
* Financial Support - Direct Install

## 1.4 Measure and Base Case Cost Effectiveness Data

**1.4.1 DEER Measure and Base Case Analysis**

The DEER Version 2014 1.0.5 [386] database contains measure energy savings and cost information for various measures as well as values from previous DEER versions. The applicable DEER Measure IDs D03-208 (RF-16925) and D03-209 (RF-32156) were not updated after DEER 2005. As a result, new simulation models using MASControl and eQUEST were generated to calculate the energy savings for solution code RF-16925 and RF-32156. DEER weather files and 2014 code updates were considered in the measure runs. The Grocery DEER prototype building was used to calculate savings for all building types covered in this work paper. See Section 2 for more information.

Table 2 DEER Difference Summary

|  |  |
| --- | --- |
| DEER Difference Summary Table | |
| Modified DEER Methodology | Yes |
| Scaled DEER Measure | No |
| DEER Building Prototypes Used | Yes |
| Deviation from DEER | DEER 2014 does not contain this type of 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 EEM with no evaluated NTGR; existing EEM with same delivery mechanism for more than 2 years | Com | Any | All | 0.6 |
| Ind-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Ind | Any | All | 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 | All | 0.6 |
| Com-Default-HTR-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Com | Any | DirInstall | 0.85 |
| Ind-Default-HTR-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Ind | Any | DirInstall | 0.85 |
| Agricult-Default-HTR-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Ag | Any | DirInstall | 0.85 |

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

Note that for the direct install delivery mechanism, a distinction between hard to reach and non-hard to reach markets will be made on a project by project basis. This work paper shows the NTG associated with a hard to reach direct install delivery mechanism and the non-residential defaulted NTG value, where in fact, a measure offered through direct install and is not “hard to reach” will receive a default NTG value.

**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 5 below.

Table 4 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 workpapers. 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 workpaper. For a full set of values associated with the measures in the workpaper refer the Excel calculation template.

Table 5 READi Tech IDs

|  |  |
| --- | --- |
| READi Field Name | Values included in this workpaper |
| Measure Case UseCategory | ComRefrig |
| Measure Case UseSubCats | Equipment |
| Measure Case TechGroups | Ref\_Storage |
| Measure Case TechTypes | Non-DEER Category |
| Base Case TechGroups | Ref\_Storage |
| Base Case TechTypes | Non-DEER Category |

### 1.4.2 Codes and Standards Analysis

The 2014 Appliance Efficiency Regulations (Title 20) [422] Section 1605.1(a)(4)(A) provides the following requirements for walk-in coolers and freezers manufactured on or after January 1, 2009:

“(4) **Walk-In Coolers and Walk-In Freezers.** Walk-in coolers and walk-in freezers manufactured on or after January 1, 2009 shall:

(A) have automatic door closers that firmly close all walk-in doors that have been closed to within one inch of full closure, except that this subparagraph shall not apply to doors wider than three feet nine inches or taller than seven feet;”

The code does not apply to retrofit add-on measures, and therefore does no impact the measures in this work paper. However, the requirement of auto-closers applies to walk-ins manufactured on or after January 1, 2009

Table 6 Code Summary

|  |  |  |
| --- | --- | --- |
| Code | Applicable Code Reference | Effective Dates |
| Title 20 (2014) | Section 1605.1(a)(4) | January 1, 2009 |

### 1.4.3 Non-DEER Study Review

### All references used in this work paper were from current or past DEER.

### 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 update documentation, DEER2014-EUL-table-update\_2014-02-05.xlsx [436], 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) |
| GrocWlkIn-DrClsr | Commercial | Refrigeration | Auto-Closer for Walk-In Cooler/Freezer Door | 8 | N/A |

# Section 2. Energy Savings & Demand Reduction Calculations

The measures in this work paper are not in DEER 2014, so the energy savings were determined through building simulation in eQUEST 3.65 Refrigeration. Only the Grocery building type was simulated, and its savings were used for other building types because walk-in coolers and freezers generally have the same characteristics regardless of building type.

Prototype generation

MASControl v3.00.20 was used to generate the DEER 2014 Grocery prototype files using the following parameters:

•Building Type: Grocery

•Climate Zones: 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16

•Vintage: “14” (years 2014-2015)

•HVAC Type: Blank (Default)

•Thermostat Options: Blank (Default)

•Case Options: CAv (Customer Average), C13 (Code 2013)

•Tech ID: “D08-NE-HVAC-airAC-SpltPkg-135to239kBtuh-10p8eer”

The C13 case model was used as the baseline for this work paper. The Energy Division advised that the prototype’s refrigeration systems were not updated after DEER 2005 and therefore may not reflect industry standard practice and/or code. Since a non-refrigeration Tech ID was selected, the HVAC system, building envelope, and other systems should be compliant with Title 24 2013 standards.

Simulation

In order to create the measure cases, the baseline eQUEST model was edited. Infiltration into the coolers is modeled as a SOURCE load in the SPACE command. The measure applies a multiplier of 0.60 to the base case source load; effectively reducing infiltration by 40% on average.

This differs from the method used to estimate the energy savings in the DEER05 calculations. The DEER05 calculations assumed a 40% reduction in the source power of the cooler. The new method reduces the infiltration rate of the cooler as defined by the measure.

The simulation results were tabulated, and savings were determined; see Attachment 2. See Attachment 3 for the eQUEST files used.

Demand reduction: The DEER peak demand was calculated from the eQUEST hourly data by averaging the demand from 2pm to 5pm during the DEER peak period, which varies by climate zone.

A complete list of savings is in the Attachment.

The following table shows sample cooler energy and demand savings for this work paper.

**Table 8 Energy and Demand Savings**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Measure Name** | **Building Type** | **Climate Zone** | **Program Type (NEW, ROB, REA)** | **Annual Electricity Savings (kWh/unit)** | **kW Savings (kW/unit)** | **Therm Savings (Therm/unit)** |
| Main Cooler Door Auto Closer | Grocery | 1 | REA | 1416.80 | 0.44 | -0.09 |
| Main Cooler Door Auto Closer | Grocery | 2 | REA | 1798.93 | 0.64 | -0.61 |
| Main Cooler Door Auto Closer | Grocery | 3 | REA | 1836.79 | 0.58 | 0.12 |
| Main Cooler Door Auto Closer | Grocery | 4 | REA | 1910.31 | 0.52 | -0.12 |
| Main Cooler Door Auto Closer | Grocery | 5 | REA | 1725.22 | 0.31 | -0.10 |
| Main Cooler Door Auto Closer | Grocery | 6 | REA | 2327.34 | 0.30 | -0.98 |
| Main Cooler Door Auto Closer | Grocery | 8 | REA | 2429.11 | 0.56 | -0.11 |
| Main Cooler Door Auto Closer | Grocery | 9 | REA | 2298.13 | 0.65 | -0.08 |
| Main Cooler Door Auto Closer | Grocery | 10 | REA | 2264.48 | 1.24 | -0.07 |
| Main Cooler Door Auto Closer | Grocery | 11 | REA | 2110.15 | 0.79 | -0.13 |
| Main Cooler Door Auto Closer | Grocery | 12 | REA | 2074.98 | 0.46 | -0.60 |
| Main Cooler Door Auto Closer | Grocery | 13 | REA | 2342.68 | 0.79 | -0.06 |
| Main Cooler Door Auto Closer | Grocery | 14 | REA | 1813.65 | 1.22 | -0.05 |
| Main Cooler Door Auto Closer | Grocery | 15 | REA | 2356.39 | 0.37 | -0.05 |
| Main Cooler Door Auto Closer | Grocery | 16 | REA | 899.12 | 0.46 | -0.03 |

# 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 these measures are shown below. See Table 9 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 9 Building Types and Load Shapes

|  |  |  |  |
| --- | --- | --- | --- |
| Measure | Building Type | E3 Alt. Building Type | Load Shape |
| RF-16925: Main Cooler Door Auto Closer  RF-32156: Main Freezer Door Auto Closer | Education - Primary School | NON\_RES | Refrigeration |
| Education - Community College | NON\_RES | Refrigeration |
| Education - University | NON\_RES | Refrigeration |
| Grocery | NON\_RES | Refrigeration |
| Food Store | NON\_RES | Refrigeration |
| Health/Medical - Hospital | NON\_RES | Refrigeration |
| Health/Medical - Nursing Home | NON\_RES | Refrigeration |
| Lodging - Hotel | NON\_RES | Refrigeration |
| Misc - Commercial | NON\_RES | Refrigeration |
| Office – Large | NON\_RES | Refrigeration |
| Restaurant - Fast-Food | NON\_RES | Refrigeration |
| Restaurant - Sit-Down | NON\_RES | Refrigeration |
| Retail - Multistory Large | NON\_RES | Refrigeration |
| Retail - Single-Story Large | NON\_RES | Refrigeration |
| Retail – Small | NON\_RES | Refrigeration |

# Section 4. Base Case & Measure Costs

## 4.1 Base Case Cost

For REA measures, the base case cost is equal to zero.

Table 10 Base Case Material Cost

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Solution Code | DEER Cost Case ID/  DEER05 ID | Base Case Description | Base Equipment Cost | Base Labor Cost | Total Base Cost |
| RF-16925 | D03-208 | No door closer | $0 | $0 | $0 |
| RF-32156 | D03-209 | No door closer | $0 | $0 | $0 |

## 4.2 Measure Case Cost

**Measure Case Cost**

The measure case costs were taken from DEER2008 [215]. The cost of a cooler and freezer auto closer was directly from cost case IDs: Auto-closer for Walk-in Cooler (Main Solid Door) and Auto-closer for Walk-in Freezer (Main Solid Door), and then applying the climate zone cost factor from table HVAC50. These values are listed in Table 11.

Table 11 Measure Case Material Cost

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Solution Code | DEER Cost Case ID/  DEER05 ID | Measure Case Description | Measure Equipment Cost | Measure Labor Cost | Total Measure Cost |
| RF-16925 | D03-208 | Auto-closer for Walk-in Cooler (Main Solid Door) | $120.00 | $36.82 | $156.82 |
| RF-32156 | D03-209 | Auto-closer for Walk-in Freezer (Main Solid Door) | $120.00 | $36.82 | $156.82 |

## 

## 4.3 Gross and Incremental Measure Cost

### 4.3.1 Gross Measure Cost

For REA measures, the gross measure cost is equal to the incremental costs taken from DEER2008. Incremental costs are described in Section 4.2.

### 4.3.2 Incremental Measure Cost

### Incremental Measure Cost (IMC) is the cost to install an energy efficient measure over a standard efficiency measure or code baseline measure. While IMC has a straight forward definition depending on the install type, the equation does vary. The incremental cost is only used to help determine program incentives and is not affected by the RUL and EUL-RUL periods and may differ from the cost used for reporting.

### In the case of REA the IMC and GMC end up having the same equation and hence the same value.

### IMC = GMC

The incremental measure cost is the measure material cost minus the base material cost, as shown in the following table.

Table 12 Incremental Measure Cost

|  |  |  |
| --- | --- | --- |
| Solution Code | DEER Cost Case ID/  DEER05 ID | Incremental Measure Cost |
| RF-16925 | D03-208 | $156.82 |
| RF-32156 | D03-209 | $156.82 |

# Attachments

Files are stored separately and not embedded in the Word Document

1. 2. 3. 4.

# References

Reference file is stored separately and not embedded in the Word Doc

[31]

[213]

[351]

[355]

[386]

# 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 |