**Work Paper PGEREF110**

**Refrigerated Storage Auto Closer**

**Revision # 6**

**Pacific Gas & Electric Company**

**Customer Energy Solutions Department**

**Refrigerated Storage Auto Closer**

**Measure Codes R79, R80**

**PGECOREF110 R5 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 SCE13RN024**

**Revision 2**

**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.** |

# 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. |
| SCE13RN024.2 | Yes | 5/5/2016 | Yin Yin Wu, P.E./  BASE Energy, Inc.  Mark Ritchie, P.E./  BASE Energy, Inc. | -Updated measure case cost using WO017 [A] instead of DEER2008.  -Updated report format per the most recent Statewide Work Paper Template. |

# Commission Staff and Cal TF Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rev | Party | Submittal Date | Comment Date | Comments | WP Developer Response |
|  |  |  |  | N/A |  |

Cal TF website: <http://www.caltf.org/>

# 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 Base, Standard and Measure Cases

|  |  |
| --- | --- |
| Case | Description of Typical Scenario |
| **Measure #1: RF-16925** | |
| Measure | Main Cooler Door Auto Closer |
| Existing Condition | Cooler Door without Auto Closer |
| Code/Standard | Cooler Door with Auto Closer |
| Industry Standard Practice | Cooler Door with Auto Closer |
| **Measure #2: RF-32156** | |
| Measure | Main Freezer Door Auto Closer |
| Existing Condition | Freezer Door without Auto Closer |
| Code/Standard | Freezer Door with Auto Closer |
| Industry Standard Practice | Freezer Door with Auto Closer |

**Table 2 Measures and Codes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Measure Codes | | | | Measure Name |
| SCG | SDG&E | SCE | PG&E |
|  |  | RF-16925 | R79 | Main Cooler Door Auto Closer |
|  |  | RF-32156 | R80 | 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 Installation Types and Delivery Mechanisms

The installation 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

**Table 3 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 |
| New Construction (NEW/NC) | Above Code or Standard | N/A | EUL | N/A |
| Retrofit or Early Replacement (RET/ER) | Above Customer Existing | Above Code or Standard | RUL | EUL-RUL |
| Retrofit First Baseline Only (REF) | Above Customer Existing | N/A | EUL | N/A |
| Retrofit Add-on (REA) | Above Customer Existing | 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.

**Table 4 Delivery Method Descriptions**

|  |  |
| --- | --- |
| Delivery Method | Description |
| Appliance Turn-in and Recycling | The program motivates customers, through financial incentives, to recycle appliances that are functional but inefficient. This prevents the continued use of those appliances, by both the current owner and potential future owners. |
| Audit/Information/Testing Services | The program performs a free assessment of a customer’s facility and provides the customer with information and guidance on energy efficiency opportunities. |
| Commissioning and Retrocommissioning | The program modifies or repairs existing equipment to ensure that it works as intended. |
| Financial Support | The program motivates customers, through financial incentives such as rebates or low interest loans, to implement energy efficient measures or projects. |
| Innovative Design | The program funds new ideas that meet reasonable scientific scrutiny for potential energy savings. These innovative measures typically have small market penetration (less than 5%) or are targeted toward relatively unreached market segments. |
| New Construction | The program offers financial incentives and/or design assistance to customers involved with new building construction. This is intended is to motivate customer to exceed Title 24 building energy efficiency requirements (residential or nonresidential). |
| Partnership | The program implements projects through a partnership between the utility and an institutional, government, or community-based organization. |
| Performance Based | The program offers financial incentives that vary based on the energy efficiency performance of specific projects. |
| Up-Stream Programs | See Up-Stream Incentive and Up-Stream Buy Down in the Incentive Method table. |

**Table 5 Incentive Method Descriptions**

|  |  |
| --- | --- |
| Incentive Method | Description |
| Direct Install | The program implements energy efficiency measures for qualifying customers, at no cost to the customer. |
| 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. |
| Mid-Stream Incentive | The program gives a financial incentive to a midstream market actor, such as a retailer or contractor, to encourage the promotion of efficient measures. The incentive may or may not be passed on to the end-use customer. |
| Up-Stream Incentive | The program gives a financial incentive to an upstream market actor, such as a manufacturer or distributor, to encourage the manufacture, provision, or distribution of an efficient measure. The incentive may or may not be passed on to the end-use customer. |
| Up-Stream Buy Down | The program gives a financial incentive to an upstream market actor, such as a manufacturer or distributor, with specific requirements to pass down the incentive to the end use customer. Such an incentive buys-down the cost of an efficient measure for the end-use customer by at least the amount of the financial incentive. |
| Giveaway | The program provides customers with energy efficiency equipment or services for free. |
| Exchange/Replacement | The utility program holds events where customers can trade functional equipment for similar but more energy efficient equipment, free of charge. |
| On-bill Finance/Loan | The program offers financing for the cost an efficient measure as part of the utility bill. This can be an add-on option to an existing program or can serve as an organizing principle for its own program. |

## 1.4 Measure Parameters

### 1.4.1 DEER Data

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 6 DEER Difference Summary

|  |  |
| --- | --- |
| DEER Item | Used for Workpaper? |
| Modified DEER methodology | Yes |
| Scaled DEER measure | No |
| DEER Base Case | No |
| DEER Measure Case | No |
| DEER Building Types | Yes |
| DEER Operating Hours | No |
| DEER eQUEST Prototypes | Yes |
| DEER Version | N/A |
| Reason for Deviation from DEER | DEER 2014 does not contain this type of measure. |
| DEER Measure IDs Used | 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 below.

Table 7 Net-to-Gross Ratio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NTGR\_ID\* | Description\* | Sector\* | BldgType\* | Measure Delivery\* | NTGR\* |
| 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.

**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 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 8 below.

Table 8 Installation Rate

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

**Effective and Remaining 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 9 below identifies the value/methodology used for the measures in this work paper.

Table 9 DEER14 EUL Value/Methodology

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| EUL ID | Description | Sector | UseCategory | EUL (Years) | RUL (Years) |
| GrocWlkIn-DrClsr | Auto-Closer for Walk-In Cooler/Freezer Door | Com | Refrigeration | 8 | N/A |

### 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 not 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 10 Code Summary

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

## 1.5 EM&V, Market Potential, and Other Studies – Base Case and Measure Case Information

This section is not applicable

## 1.6 Data Quality and Future Data Needs

This section is not applicable

# Section 2. Calculation Methodology

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 11 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 |

Demand reduction estimates must consider the DEER peak demand period, which is 2:00 PM to 5:00 PM during specific weekday periods and varies by climate zone:

**Table 12 DEER Peak Periods**

|  |  |
| --- | --- |
| Climate Zone | 3-Weekday Period |
| 1 | Sep 16 – Sep 18 |
| 2 | July 8 – July 10 |
| 3 | July 8 – July 10 |
| 4 | Sep 1 – Sep 3 |
| 5 | Sep 8 – Sep 10 |
| 6 | Sep 1 – Sep 3 |
| 7 | Sep 1 – Sep 3 |
| 8 | Sep 1 – Sep 3 |
| 9 | Sep 1 – Sep 3 |
| 10 | Sep 1 – Sep 3 |
| 11 | July 8 – July 10 |
| 12 | July 8 – July 10 |
| 13 | July 8 – July 10 |
| 14 | Aug 26 – Aug 28 |
| 15 | Aug 25 – Aug 27 |
| 16 | July 8 – July 10 |

# Section 3. Load Shapes

The ideal load shape for net benefits estimates would represent the difference between the base case and measure case; however, only end-use profiles are available. Therefore, the closest load shape chosen for these measures are shown below. See the table below 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 13 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. Costs

Values and methodologies are taken from the 2010-2012 WO017 Ex Ante Measure Cost Study Final Report (WO017) [A] prepared by Itron for the California Public Utilities Commission.

## 4.1 Base Case Cost

For this measure category, the base case cost is assumed to be zero because these are discretionary modifications (retrofit add-on) to the customers’ existing equipment. Their alternative is to make no changes to their existing system.

## 4.2 Measure Case Cost

The measure case costs were taken from WO017, Measure 1 of Appendix C. WO017 evaluated the costs of auto-closers in two subdivisions based on door sizes. Since each measure of this workpaper was analyzed for all door sizes, the WO017 cost data was averaged out as the measure case costs. On average, the material cost is $536.5 per closer. The installation labor cost is $75 per closer. Hence, the total measure cost = $536.5 (material) + $75 (labor) = $611.5 per closer.

## 4.3 Full and Incremental Measure Cost

**Table 14 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 |
| RET/ER | (MEC + MLC) – (BEC + BLC) | MEC + MLC | (MEC + MLC) – (BEC + BLC) |
| REF | (MEC + MLC) – (BEC + BLC) | MEC + MLC | N/A |
| REA | MEC + MLC | MEC + MLC | N/A |

MEC = Measure Equipment Cost; MLC = Measure Labor Cost

BEC = Base Case Equipment Cost; BLC = Base Case Labor Cost

**Table 15 Full and Incremental Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Measure | Installation Type | Incremental Measure Cost | Full Measure Cost | |
| **1st Baseline** | **2nd Baseline** |
| RF-16925: Auto-closer for Walk-in Cooler (Main Solid Door) | REA | $611.5/closer | $611.5/closer | N/A |
| RF-32156: Auto-closer for Walk-in Freezer(Main Solid Door) | REA | $611.5/closer | $611.5/closer | N/A |

# 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]

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[A] “2010-2012 WO017 Ex Ante Measure Cost Study Final Report”, prepared for California Public Utilities Commission, prepared by Itron, Inc., May 27, 2014.