Work Paper SCE17RN009

**Revision 1**

**Southern California Edison**

**Anti-Sweat Heater (ASH) Controls**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | RF-12098 and RF-48112 |
| **Measure Description** | Anti-Sweat Heater (ASH) controls based on humidity for reach-in display freezers and coolers |
| **Base Case Description** | Continuous and constant ASH operation for reach-in display freezers and coolers |
| **Units** | Energy impacts are shown per door of display cases |
| **Energy Savings** | Refer to Excel Calculation Attachment 1 |
| **Full Measure Cost ($/unit)** | Refer to Excel Calculation Attachment 1 |
| **Incremental Measure Cost ($/unit)** | Refer to Excel Calculation Attachment 1 |
| **Effective Useful Life** | 4.0 years, capped at the RUL of the relevant host equipment GrocDisp-FixtDoors. |
| **Measure Installation Type** | REA – Retrofit Add-on |
| **Net-to-Gross Ratio** | 0.6 (Com-Default>2yrs) |
| **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

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 02/15/2016 | Arvind Subramanya/TRC Solutions | - This work paper is an update of SCE13RN009.2  - New calculation template update for 2017 program year  - Savings calculations were updated to per door savings.  - Measure was updated to reflect industry standard pricing based on the study conducted by Northeast Energy Efficiency Partnerships (NEEP).  - All 16 climate zones were added in this revision to calculate the savings impact.  - Updated the EUL value in accordance with Draft Resolution E-4807 [C] (2015 ESPI) |
| 1 | 10/13/17 | Yin Yin Wu/BASE Energy, Inc. | - Updated Section 1.4.2 based on the latest 2017 Title-20 code version  - DEER2017 values are checked. No change is made.  - The costs are updated by using the values from Northeast Energy Efficiency Partnership (NEEP) with outliers removed.  - The work paper calculation template is updated using Version 6.7.4 |

# Commission Staff and Cal TF Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rev** | **Party** | **Submittal Date** | **Comment Date** | **Comments** | **WP Developer Response** |
|  |  |  | 9/21/2017 | * Agreed with the cost analysis based on the Study by NEEP |  |

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

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

The objective of this work paper is to detail the energy savings for installing anti-sweat heater (ASH) controls based on humidity for reach-in display freezers and coolers.

The base and measure cases are summarized as follows (Section 1.2 describes these cases in greater technical detail):

**Base Case**: Continuous and constant ASH operation (no control) in existing reach-in display freezers and coolers.

**Measure Case**: ASH controls based on humidity for reach-in display freezers and coolers.

As shown in the table below, measures evaluated in this work paper are segregated based on refrigeration operating temperature: low temperature (freezer) and medium temperature (cooler).

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | ASH controls based on humidity for reach-in display freezers and coolers. |
| Existing Condition | Continuous and constant ASH operation (no control) in existing reach-in display freezers and coolers. |
| Code/Standard | N/A |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
|  |  | RF-12098 |  | Low Temperature Display Case Anti-Sweat Heater (ASH) Controls |
|  |  | RF-48112 |  | Medium Temperature Display Case Anti-Sweat Heater (ASH) Controls |

**Eligibility**

The above-described measures are eligible for installations on existing reach-in display coolers and freezers according to the descriptions shown in **Base Cases** in Section 1.2 and is applicable for any commercial retail facility, including (but not limited to) supermarkets, grocery stores, hotels, restaurants and convenience stores. Proposed ASH controls must adjust the ASH duty cycle based on humidity of air on the glass surfaces of the display cases. This measure cannot be used in conjunction with the New Refrigeration Display Case with Doors measure. Energy savings credit for reduced use of display refrigerator anti-sweat heaters can only be taken if the display refrigerators are equipped with humidity-sensing controls that reduce the amount of power supplied to the heaters as the store dew point temperature decreases.

**Express Requirements**

The rebates for these measures are a part of the Express program. To qualify for the incentive, the following requirements must be met:

* The proposed device must sense the relative humidity in the air outside of the display case and reduce or turn off the glass door (if applicable) and frame anti-sweat heaters at low humidity conditions. Equivalent technologies that can reduce or turn off anti-sweat heater based on the amount of condensation formed on the inner glass pane may also qualify. Power reduction should occur when relative humidity levels reach 55% and lower. Power reduction should decrease by at least 2% for every percentage the humidity falls below 55%.
* This can be the only Express Solution category under which the fixtures are receiving incentives. This solution cannot be used in conjunction with New High-Efficiency Refrigeration Display Cases with Special Doors (Low Temp) and Special Doors with Low/no Anti-Sweat heat on Low Temperature Display Cases categories.

## 1.2 Technical Description

This work paper focuses on ASH controls based on humidity to prevent condensation (“sweating”) on the glass surface of refrigerated display cases. ASHs are electric resistance heaters installed at the following locations:

* Case mullion to prevent condensation on metal surfaces (Figure 1 **ASH Locations** Green )
* Door frame to prevent condensation on metal surfaces (Figure 1 **ASH Locations** Red)
* Glass edge to prevent condensation on the glass (Figure 1 **ASH Locations** Blue)



**Figure 1 ASH Locations**

A grocery store’s RH is closely related to the outdoor dew point (DP) temperature. Condensation occurs when the air temperature drops to the DP temperature. On warmer days when a customer opens the refrigerated display case glass door, warm moist air comes into contact with the cold glass surface which leads to condensation on the surface of the glass door. ASHs are used to evaporate this moisture from the glass surface, door frame and mullion of the cases.

In standard installations, the ASHs operate at full power 100% of the time. ASH controllers monitor the DP temperature of ambient air and adjust the duty cycle of the heaters accordingly. For example, when the air is dry and its dew point is low, the ASHs operate at a low duty cycle and surface is allowed to get cold since condensation will not form. On the other hand, when the air is humid and dew point is high, the ASHs operate at 100% duty cycle to keep the surface warm and above the dew point temperature. Between these extremes, the duty cycle is adjusted according to the measured DP.

Some of the heat generated by ASHs ends up as a load on the refrigeration system. Therefore, any reduction in ASH power not only will reduce the ASH electric demand, but also result in lower refrigeration loads. As a result, compressor run time and energy consumption are reduced. However, there will be a penalty incurred from the increased space heating energy use.

This measure applies to ASHs on both low temperature (freezer– below 32°F) and medium temperature (cooler – above 32°F) glass doors. Calculations for both coolers and freezers were carried out for all 16 California climate zones.

Also, according to the California Commercial Saturation Survey [D], page 8-20:" Anti-sweat heaters (ASH) are electric resistance heaters, installed on Glass Door Cases to prevent condensation on the glass and to ensure the refrigeration doors do not freeze shut. Without controllers, these heaters run continuously, resulting in continuous, additional load on the refrigeration system, increasing refrigeration run-times and refrigeration demand. ASH controls will sense the dew point temperature in the store (the temperature at which condensation will form, which depends on the amount of moisture in the air, surrounding the refrigeration equipment), modulate the heater accordingly. The measure is only eligible to applicants who confirm their existing cases do not already have controls. These ASH controls are found on almost 50% of Glass Door Cases. Anti-sweat heater controls are only applicable to Glass Door and Service Cases (which are also glass)."

## 1.3 Installation Types and Delivery Mechanisms

The delivery mechanisms for this measure are Financial Support-Down-Stream Deemed; Financial Support-On-bill Finance; and Financial Support-Direct Install. The install type for these delivery mechanisms is Retrofit Add-on (REA ).

**Installation Type Descriptions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Installation Type** | **Savings** | | **Life** | |
| 1st Baseline (BL) | 2nd BL | 1st BL | 2nd BL |
| 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.

**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. |
| Partnership | The program implements projects through a partnership between the utility and an institutional, government, or community-based organization. |

**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. |
| On-bill Finance – Loan (OBF) | The program offers financing for the cost of 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 savings presented in this workpaper were based on the DEER 2014 (DEER14) prototype Grocery Store building models extracted from MASControl V3.00.20 software. DEER14 was a major update to the DEER 2011 version and incorporates changes based on the new 2013 Title 24. The DEER14 MASControl database contains measures for ASH Controls on low and medium temperature refrigerated display cases (D03-230 and D03-231, respectively) which are incorporated in the prototype models. The table below summarizes the deviation from DEER.

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Workpaper?** |
| Modified DEER methodology | Yes |
| Scaled DEER measure | Yes |
| DEER Base Case | Yes |
| DEER Measure Case | Yes |
| DEER Building Types | Yes |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | Yes |
| DEER Version | DEER14 |
| Reason for 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 Measure IDs Used | D03-230 and D03-231 |

**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 | All | 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 version 2.4.7. Currently there is no versioning on the installation rate table. There are currently no IR specific for this measure and the default value of 1 has been presented 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 version 2.4.7. DEER defines the RUL as 1/3 of the EUL value. The RUL value is only applicable to the first baseline period for an REA measure with an applicable code baseline. The relevant EUL and RUL values for the measures in this work paper are in the table below. For REA measures, the EUL and RUL values were obtained in accordance with Resolution E-4807 [C] (2015 ESPI) with the lesser EUL between the RUL of the host equipment and the added measure. Also, according to Resolution E-4818 [B], the EUL of REA measures is capped at the RUL of the host equipment.

The relevant host equipment available from the EUL table of DEER2017 is *New case with Doors* (EUL ID: GrocDisp-FixtDoors), which has an EUL of 12 and a RUL of 4. The EUL from DEER2017 of the *Anti-Sweat Heat (ASH) Controls* measure is 12 years. Therefore, the EUL of the measure is capped at 4 years.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| GrocDisp-ASH | Anti-Sweat Heat (ASH) Controls | Com | ComRefrig | 4.0\* | N/A |

\* Capped at the RUL of the host equipment. See paragraph above for explanation.

### 1.4.2 Codes and Standards Analysis

This work paper deals with REA-type measures for refrigerated display cases whose savings are not impacted by code standards.

The 2017 Appliance Regulations [A] addresses Walk-in Coolers and Freezers with Transparent Reach-in Doors and specifies the limit of ASH power draw based on square footage. Note that this workpaper is applicable to refrigerated display cases, which does not cover walk-ins. Discussion on the standards summarized in table below and presented here is for information purposes only.

Section 1605.1(a)(5)(C)(2) states:

*(5) Walk-In Coolers with Transparent Reach-in Doors and Walk-In Freezers with*

*Transparent Reach-In Doors. In addition to the design standards in Section 1605.1(a)(4), walkin*

*coolers equipped with transparent reach-in doors and walk-in freezers equipped with*

*transparent reach-in doors and manufactured on or after January 1, 2009 shall also meet the*

*following design standards:*

*(C) If the appliance has an anti-sweat heater*

*1. without antisweat heat controls, the appliance shall have a total door rail, glass,*

*and frame heater power draw of not more than 7.1 watts per square foot (W/ft2) of door opening*

*(for freezers) and 3.0 watts per square foot (W/ft2) of door opening (for coolers);*

*2. with anti-sweat heat controls, and the total door rail, glass, and frame heater power draw is more than 7.1 watts per square foot (W/ft²) of door opening (for freezers) and 3.0 watts per square foot (W/ft²) of door opening (for coolers], the anti-sweat heat controls shall reduce the energy use of the anti-sweat heater in a quantity corresponding to the relative humidity in the air outside the door or to the condensation on the inner glass pane.*

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 20 (2017) | 2017 Appliance Efficiency Regulations, Section 1605.1(a)(5)(C)(2) | April, 2017 |

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

### 1.5.1 Non-DEER Study Review

All data was taken from either DEER14 or Title 20 2017 code standards.

# Section 2. Calculation Methodology

The savings presented in this workpaper were based on the DEER 2014 (DEER14) prototype Grocery Store building models extracted from MASControl V3.00.20 software, which contain the measures of ASH Controls on low and medium temperature refrigerated display cases (D03-230 and D03-231, respectively). The extracted models were modified using DEER2014 CZ2010 weather data files and based on vintage 2014.

**Assumptions**

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

1. The DEER14 prototype building models (after 1989 vintage) were generated for a Grocery Store with multiplex-refrigeration systems for the reach-in refrigerated fixtures using the MAS Control software. 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 for this work paper will also be applied to fixtures with single-compressor systems.
2. This work paper is applied to fixtures located inside a space which has space heating and space cooling. The energy savings is represented per door. The resulting savings involve refrigeration load reduction and space cooling load reduction. Note that it also results in an increase to the space heating energy consumption. Since the heat gain to a fixture mainly depends on the temperature maintained for the fixture and the surrounding space temperature, it is assumed that the building types would not have significant impact on the energy savings. Thus, the resulting savings for Grocery Store is applied to all other building types considered in this work paper.

**Methodology**

The energy savings and demand reduction for this work paper is based on installing controllers on the existing anti-sweat heater (ASH) on freezers (including low temperature display cases) and coolers (including medium temperature display cases). The fixtures are applicable to, but not limited to, grocery stores. The baseline of this work paper is the ASHs operating constantly and continuously. Installing ASH control will reduce the ASH operating hours significantly, resulting in savings on the refrigeration cooling load and space cooling load.

The measures are weather sensitive and the building energy simulation tool eQuest Refrigeration 3-65 was used to determine the annual impacts. The 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study final Report [26] included the measures of Freezer ASH Controls (D03-230) and Cooler ASH Controls (D03-231). Table below summarizes the DEER measure IDs corresponding to each solution code. Please refer to the 2005 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. The DEER measures consider multiplex-compressor systems as the refrigeration type.

Summary of DEER Measures and Corresponding Solution Codes

|  |  |  |  |
| --- | --- | --- | --- |
| **Solution Code** | **Measure Name** | **DEER05 Measure ID** | **DEER08 Measure ID** |
| RF-12098 | Freezer ASH Controls | D03-230 | D08-NE-GrocRefg-FixtDoors-LowTemp-FxdAntiSwt-HmdAntiSwt |
| RF-48112 | Cooler ASH Controls | D03-231 | D08-NE-GrocRefg-FixtDoors-MedTemp-FxdAntiSwt-HmdAntiSwt |

The baseline of the Freezer ASH Controls (D03-230) and Cooler ASH Controls (D03-231) measures considers the anti-sweat heaters operating at fixed full power all the time. The measure models consider ASH control based on humidity. The DEER 2014 prototypes were generated from MASControl version 3.00.20 with the weather files updated using DEER2014 CZ2010 weather data files. The built-in ASH control types based on the fixture temperature are included in table below.

Summary of Built-In ASH Control Types from DEER Prototypes

|  |  |  |
| --- | --- | --- |
| **Component** | **Freezer** | **Cooler** |
| HEATER-CTRL | Humidity-Ratio | Humidity-Ratio |
| MAX-HUMIDITY | 80% | n/a |
| MIN-HUMIDITY | 60% | n/a |
| MAX-HUMIDITY-RAT | 0.0111 | 0.0111 |
| MIN-HUMIDITY-RAT | 0.0054 | 0.0054 |

**Electrical and Natural Gas Energy Savings**

Once the base case and measure case model simulations were completed (and assuming a FIXED HEATER-CTRL), the energy savings and demand reduction could be determined. Comparing the total energy consumption (electricity and natural gas) of both models, the total energy savings were determined. The unit energy savings, in kWh/yr-door for electricity and therm/yr-doorfor natural gas, were calculated by the following formula:

**Energy savings per door** **(kWh/door)** = (Total energy savings for the entire line-up / Length of total line-up) x 2.6 ft. typical door length.

**Peak Demand Savings**

Peak demand savings were calculated by taking the average electrical power draw between 2-5 pm in the 3 consecutive peak days specified in the DEER2014 Update documentation [386] for each climate zone. DEER2017 Peak-Demand periods remain the same as DEER2014. Therefore, DEER 2017 is the reference in this revision. Table below summarizes the 2017 DEER Peak-Demand periods for 16 climate zones considered in this work paper.

|  |  |
| --- | --- |
|  | **2017 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 |

The difference in the baseline and measure peak demands represents the peak demand savings. Similar to the energy savings, the unit demand reduction was calculated using the below formula:

**Demand reduction per door (kW/door)** = (Total demand reduction for the entire line-up / Length of total line-up) x 2.6 ft. typical door length.

**Typical Length of line-up**

Length of Total Line-up for Medium Temperature Display Cases – 203 ft.

Length of Total Line-up for Low Temperature Display Cases – 283 ft.

Refer to the Attachment 2 for the savings summary for all measures in 16 CZs.

# 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** |
| Grocery | Refrigeration | Grocery\_Store |
| Lodging - Hotel | Refrigeration | Hotel\_Motel |
| Restaurant - Fast-Food | Refrigeration | Fast\_Food\_Restaurant |
| Restaurant - Sit-Down | Refrigeration | Sit\_Down\_Restaurant |
| Retail - Multistory Large | Refrigeration | Large\_Retail\_Store |
| Retail - Single-Story Large | Refrigeration | Large\_Retail\_Store |
| Retail - Small | Refrigeration | Small\_Retail\_Store |

# Section 4. Costs

## 4.1 Base Case Cost

The base case cost is $0 since the existing ASH can continue to operate without duty cycling controls.

## 4.2 Non-Adjusted and Adjusted Measure Case Cost

Costs have been revised in the work paper to match the Incremental Cost Study published in 2015 by Northeast Energy Efficiency Partnership (NEEP) on anti-sweat door heater control. Below is the cost calculation methodology:

**Cost Methodology**

Please refer to Attachment #3 for cost calculation specific to this work paper. Below is the methodology:

1. Northeast Energy Efficiency Partnership conducted an Incremental Cost Study in 2015 for various measures including anti-sweat door heater control. This study was commissioned by the Evaluation, Measurement and Verification (EM&V) Forum Research Subcommittee (Subcommittee) to investigate and update incremental costs for a number of common measures employed in energy efficiency programs. Overall goal was to determine baseline and efficient measure costs for a series of energy efficiency prescriptive measures of interest to the Subcommittee as well as the incremental costs of moving from baseline to efficient measures. The Cost calculation from the study is presented as Attachment #5 in this work paper.
2. The above study was done for a total of 10 cooler doors and 4.5 freezer doors.
3. Average material cost of $1,050.55 per controller with outliers removed was taken from “Data Analysis” tab from the EM&V study in Attachment #4. The cost per controller was for 8 cooler doors and 4.5 freezer doors with outliers removed. The labor cost of $202.71 per control was also taken from the “Data Analysis” tab.
4. Material and labor cost per door was calculated by dividing costs by number of doors in Step 3.
5. Costs calculation in Step 4 represented the nation average cost; hence, it had to be adjusted based on the location of the measure. Therefore average location factors for 37 cities in California were taken from 2017 RSMeans Mechancial Cost Data. The average location factors were Material: 101.2% and Labor: 132.3%.

Using the method and numbers summarized above, the cost per door is calculated and shown in table below for each measure code.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Equipment** | **Per Controller** | | **# of Doors** | **Per Door** | | |
| **Material Cost** | **Labor Cost** | **Material Cost** | **Labor Cost** | **Installed Cost** |
| RF-12098: Freezer Door | 1,050.55 | 202.71 | 4.5 | $236.35\* | $59.60\* | $295.95 |
| RF-48112: Cooler Door | 8 | $132.95\* | $33.53\* | $166.47 |

\* Adjusted based on the average location factors in California of Material: 101.2% and Labor: 132.3%.

## 4.3 Full and Incremental Measure Cost

**Full and Incremental Measure Cost Equations**

|  |  |  |  |
| --- | --- | --- | --- |
| **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| 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

**Full and Incremental Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| RF-12098 | REA | $278.50/door | $278.50/door | N/A |
| RF-48112 | REA | $156.66/door | $156.66/door | N/A |

# Attachments

1. SCE17RN009.1 Calculation Template V6.7.4

2. SCE17RN009.1 Savings Summary

3.SCE17RN009.1 eQuest Files

4. SCE17RN009.1 NEEP Analysis

# References



[215]

[386]

[509]

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[A] California Energy Commission. (April 2017). California Code of Regulations Title 20. Retrieved from <http://www.energy.ca.gov/2017publications/CEC-140-2017-002/CEC-140-2017-002.pdf>

[B] Resolution E-4818. D. 16-08-019 / CT6. March 3, 2017. Retrieved from <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M179/K264/179264220.PDF>

[C] Resolution E-4807 Final. December 15, 2016. Retrieved from <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M171/K329/171329677.PDF>

[D] California Commercial Saturation Survey, Prepared for California Public Utilities Commission. Itron. July 15, 2014.