Work Paper SCE13LG070

**Revision 2**

**Southern California Edison**

**Replace Neon Open Sign with LED Open Sign**

**For Work Paper Reviewer Use Only**

**List all major comments that occurred during the review. This table may only be removed during management review.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Major Comment** | **Reviewer Name** | **Date** | **Outcome/Resolution** |
| Please confirm that latest interactive effects are used for determining measure impacts. | AF | 10/7/2015 | Confirmed that latest IEs used for calcs. |
| Not quite sure how measure impacts where generated within calculation template. We these directly adopted from other source | AF | 10/7/2015 | In attachment, see hidden tab, “ES Calc,” for kWh/kW/thm calculations. |
|  |  |  |  |
|  |  |  |  |

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | LT-19583 |
| **Measure Description** | LED Open Sign |
| **Base Case Description** | Neon Open Sign |
| **Units** | Per fixture |
| **Energy Savings** | Refer to Excel Calculation Attachment |
| **Full Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Incremental Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Effective Useful Life** | 16 years (DEER EUL ID: LED-sign) |
| **Measure Installation Type** | Replace on Burnout (ROB) |
| **Net-to-Gross Ratio** | 0.6 (DEER NTGR ID: Com-Default>2yrs)  0.6 (DEER NTGR ID: Ind-Default>2yrs)  0.6 (DEER NTGR ID: Agr-Default>2yrs)  0.85 (DEER NTGR ID: Com-Default-HTR-di)  0.85 (DEER NTGR ID: Ind-Default-HTR-di)  0.85 (DEER NTGR ID: Agr-Default-HTR-di) |
| **Important Comments** | This work paper has a complementary Ex Ante Database data set that will be provided in a separate submission to the California Public Utilities Commission (CPUC). |

# Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 3/28/14 | James Gowen (Matrix) | Updated work paper to new template |
| 1 | 5/12/14 | Yun Han (SCE) | •New WP template w/updated IE & OpHrs.  •WP updated for reporting period, effective 7/1/14-12/31/14  •Added Mid-Stream program  •Updated Title 24 code language to 2013  •Added all Non-Res BTs to DI Program  •Updated NTGs |
| 2 | 10/1/15 | Cassie Cuaresma (SCE) | •Added HTR description for MFEER program  •Added labor cost to Section 4  •New WP template |

# Commission Staff and Cal TF Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rev** | **Party** | **Submittal Date** | **Comment Date** | **Comments** | **WP Developer Response** |
| 0 | CS |  |  |  |  |
| 0 | Cal TF |  |  |  |  |
|  |  |  |  |  |  |

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

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

This work paper details the replacement of a neon OPEN sign, consuming 46 Watts per sign when “on” and 0 Watts when “off”, with a light emitting diode (LED) OPEN sign, consuming 14.9 Watts when “on” and 0.7 Watts when “off”.

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | LED OPEN Sign |
| Existing Condition | Neon OPEN Sign |
| Code/Standard | N/A |
| Industry Standard Practice | Neon OPEN Sign |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
|  |  | LT-19583 |  | Open Sign LED replacing Neon Open Sign |
|  |  |  |  |  |

The existing OPEN sign must be a neon OPEN sign for interior application. The measure in this work paper applies to all commercial building types in all climate zones.

## 1.2 Technical Description

LED OPEN signs use LED technology as an alternative to traditional neon technology. Instead of a neon transformer and gas-filled neon tubes that have been bent and shaped to form the word, “OPEN,” the LED signs use an LED driver and various colored LEDs that are arranged to form the word, “OPEN.” OPEN signs are used primarily in retail store fronts to indicate that the store is open for business. Neon has been the traditional light source for OPEN signs, but like LED EXIT signs, light emitting diode (LED) technology is emerging as another light source for the OPEN sign market. Although LED typically has a different look up close, some LED models have been made to look like the traditional neon signs.

## 1.3 Installation Types and Delivery Mechanisms

The delivery methods that are available for these measures are:

* Mid-Stream Programs / Mid-Stream Incentive
* Financial Support – Direct Install

The program/install type for the above measures is:

* Replace on Burnout (ROB)

**Installation Type Descriptions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Installation Type** | **Savings** | | **Life** | |
| 1st Baseline (BL) | 2nd BL | 1st BL | 2nd BL |
| Replace on Burnout (ROB) | Above Code or Standard | N/A | EUL | N/A |

A delivery mechanism is a delivery method paired with an incentive method. Delivery mechanisms are used by programs to obtain program participation and energy savings.

**Delivery Method Descriptions**

|  |  |
| --- | --- |
| **Delivery Method** | **Description** |
| 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. |
| Financial Support | The program motivates customers, through financial incentives such as rebates or low interest loans, to implement energy efficient measures or projects. |
| Mid-Stream Programs | *See Mid-Stream Incentive in the Incentive Method Descriptions table.* |
| Partnership | The program implements projects through a partnership between the utility and an institutional, government, or community-based organization. |
| Up-Stream Programs | *See Up-Stream Incentive in the Incentive Method Descriptions table.* |

**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. |
| Exchange - Replacement | The utility program holds events where customers can trade functional equipment for similar but more energy efficient equipment, free of charge. |
| Giveaway | The program provides customers with energy efficiency equipment or services for free. |
| Mid-Stream Incentive  Mid-Stream Buy Down | The program gives a financial incentive to a midstream market actor (distributor, vendor, or retailer) to encourage the promotion of efficient measures. Buy Down means that the incentive is required to be passed down to the end-use customer. |
| 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. |
| Up-Stream Incentive  Up-Stream Buy Down | The program gives a financial incentive to an upstream market actor (manufacturer or distributor) to encourage the manufacture, provision, or distribution of efficient measures. Buy Down means that the incentive is required to be passed down to the end-use customer. |

## 1.4 Measure Parameters

### 1.4.1 DEER Data

DEER Difference Summary

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

**Net-to-Gross Ratio**

The NTG values were obtained using the DEER READI tool. The relevant NTG values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NTGR ID** | **Description** | **Sector** | **BldgType** | **Measure Delivery** | **NTGR** |
| Com-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Com | Any | Any | 0.60 |
| 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 | Any | 0.60 |
| 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 | Any | 0.60 |
| 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 |

Note: Direct install measures that are not hard-to-reach will use the default NTG value.

This work paper also includes a measure that is offered via direct install activities into hard-to-reach (HTR) customer facilities. “Final Resolution E-4700”, dated December 18, 2014, defines specific criteria to classify customer facilities as HTR and also states that two criteria are sufficient to identify HTR customers if one of the criteria met is the geographic criteria.

SCE’s Commercial Direct Install program delivers free and low cost energy efficiency hardware retrofits through installation contractors to reduce peak demand and energy savings for small and medium commercial customers. The barriers for customer participation include limited capital resources, lack of expertise and understanding of the understanding of the benefits of energy efficiency, a suspicion of the “free offer” and its legitimacy, and language and cultural barriers. The program also addresses the ongoing concern with “split incentives”, where the customer is not the owner of the property, and therefore, lack incentive to improve their energy usage. SCE’s Commercial Direct Install program will track the following three (3) customer data points to identify direct install activities in HTR customer facilities. If geography and business size criteria are satisfied, SCE will identify the customer as HTR. If geography and language criteria are satisfied, SCE will identify the customer as HTR. Other measures in the Commercial Direct Install program will receive default NTG (NTGR\_ID: Com-Default>2), unless otherwise specified in DEER.

o **Business Size** – Customer must have less than ten employees

o **Language** – Customer’s primary language spoken is not English

o **Geography** – Businesses in areas other than the United States Office of Management and Budget (OMB) Combined Statistical Areas (CSA) of the San Francisco Bay Area, the Greater Los Angeles Area and the Greater Sacramento Area or the OBM metropolitan statistical areas or San Diego County

The “Required Corrections to Measure Level Input Parameters Identified by Commission Staff per D.14-10-046 Order Paragraph 16”, dated November 3, 2014, includes additional clarification for the geographic criteria:

“Notes on OMB CSA designations:

The OMB has designated a 12-county CSA titled the San Jose-San Francisco-Oakland, CA Combined Statistical Area which includes the nine counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma which border the San Francisco Bay plus the three counties of San Joaquin, Santa Cruz, and San Benito that are economically tied to the nine counties that that border the San Francisco Bay.”

The OMB definition of this CSA includes Los Angeles, Orange, San Bernardino, Riverside and Ventura counties.

The OMB definition of this CSA includes Sacramento, Yolo, El Dorado, Placer, Sutter, Yuba, and Nevada counties.”

**Spillage Rate**

Spillage rates are not tracked in work papers; they are tracked in an external document which will be supplied to the Commission Staff.

**Installation Rate**

The IR values were obtained using the DEER READI tool. The relevant IR values for the measures in this work paper are in the table below.

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

**Effective and Remaining Useful Life**

The EUL and RUL values were obtained using the DEER READI tool. DEER defines the RUL as 1/3 of the EUL value. The RUL value is only applicable to the first baseline period for an RET measure with an applicable code baseline. The relevant EUL and RUL values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| LED-sign | LED Open Signs | Com | Lighting | 16 | N/A |

### 1.4.2 Codes and Standards Analysis

Title 24 2013 [A] Section 130.3 and 140.8 contains requirements for signs.

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 24 (2013) | Section 141.0(b)2Iii Lighting System Alterations, 141.0(b)2Iii Luminaire Modifications-in-Place | July 1, 2014 |

**Section 130.3**

1. **Controls for Sign Lighting.** All sign lighting shall meet the requirements below as applicable:
   1. **Indoor Signs.** All indoor sign lighting shall be controlled with an automatic time-switch control or astronomical time-switch control.
   2. **Outdoor Signs.** Outdoor sign lighting shall meet the following requirements as applicable:
      1. All outdoor sign lighting shall be controlled with a photocontrol in addition to an automatic time-switch control, or an astronomical time-switch control.

**EXCEPTION to Section 130.3(a)2A:** Outdoor signs in tunnels, and signs in large permanently covered outdoor areas that are intended to be continuously lit, 24 hours per day and 365 days per year.

* + 1. All outdoor sign lighting that is ON both day and night shall be controlled with a dimmer that provides the ability to automatically reduce sign lighting power by a minimum of 65 percent during nighttime hours. Signs that are illuminated at night and for more than 1 hour during daylight hours shall be considered ON both day and night.

**EXCEPTION to Section 130.3(a)2B:** Outdoor signs in tunnels and large covered areas that are intended to be illuminated both day and night.

* 1. **Demand Responsive Electronic Message Center Control.** An Electronic Message Center (EMC) having a new connected lighting power load greater than 15 kW shall have a control installed that is capable of reducing the lighting power by a minimum of 30 percent when receiving a demand response signal.

**EXCEPTION to Section 130.3(a)3:** Lighting for EMCs that is not permitted by a health or life safety statute, or regulation to be reduced by 30 percent

**Section 140.8**

1. **Maximum Allowed Lighting Power.**
   1. For internally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 12 watts per square foot. For double-faced signs, only the area of a single face shall be used to determine the allowed lighting power.
   2. For externally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 2.3 watts per square foot. Only areas of an externally lighted sign that are illuminated without obstruction or interference, by one or more luminaires, shall be used.
   3. Lighting for unfiltered light emitting diodes (LEDs) and unfiltered neon shall comply with Section 140.8(b).
2. **Alternate Lighting Sources.** The sign shall comply if it is equipped only with one or more of the following light sources:
   1. High pressure sodium lamps; or
   2. Metal halide lamps that are:
      1. Pulse start or ceramic served by a ballast that has a minimum efficiency of 88 percent or greater; or
      2. Pulse start that are 320 watts or smaller, are not 250 watt or 175 watt lamps, and are served by a ballast that has a minimum efficiency of 80 percent. Ballast efficiency is the measured output wattage to the lamp divided by the measured operating input wattage when tested according to ANSI C82.6-2005.
   3. Neon or cold cathode lamps with transformer or power supply efficiency greater than or equal to following:
      1. A minimum efficiency of 75 percent when the transformer or power supply rated output current is less than 50 mA; or
      2. A minimum efficiency of 68 percent when the transformer or power supply rated output current is 50 mA or greater.

The ratio of the output wattage to the input wattage is at 100 percent tubing load.

* 1. Fluorescent lighting systems meeting one of the following requirements:
     1. Use only lamps with a minimum color rendering index (CRI) of 80; or
     2. Use only electronic ballasts with a fundamental output frequency not less than 20 kHz.
  2. Light emitting diodes (LEDs) with a power supply having an efficiency of 80 percent or greater; or

**EXCEPTION to Section 140.8(b)5:** Single voltage external power supplies that are designed to convert 120 volt AC input into lower voltage DC or AC output, and have a nameplate output power less than or equal to 250 watts, shall comply with the applicable requirements of the Appliance Efficiency Regulations (Title 20).

* 1. Compact fluorescent lamps that do not contain a medium screw base sockets (E24/E26). **EXCEPTION 1 to Section 140.8:** Unfiltered incandescent lamps that are not part of an electronic message center (EMC), an internally illuminated sign, or an externally illuminated sign.

**EXCEPTION 2 to Section 140.8:** Exit signs. Exit signs shall meet the requirements of the Appliance Efficiency Regulations.

**EXCEPTION 3 to Section 140.8:** Traffic Signs. Traffic signs shall meet the requirements of the Appliance

For this measure, the LED OPEN signs will require controls to comply with Title 24. These signs already comply with the Sign Lighting Power Requirements because LEDs are specified as an efficient lighting source. This measure claims full customer savings as the code does not force the consumer to LED signs since the choice to install an LED sign is a discretionary decision.

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

ET06.16 – LED OPEN Signs project [B] was used to qualify the measure in this work paper.

### 1.5.1 LED OPEN SIGNS

This report was prepared by Southern California Edison (SCE) in December 2007 and funded by California utility customers under the auspices of the California Public Utilities Commission. The objective of this study was to investigate the demand reduction and energy savings potential of LED technology for OPEN signs over standard neon OPEN signs. The project verifies claimed energy savings and demand reductions by measuring the technology in a laboratory environment at the Southern California Lighting Technology Center (SCLTC). Photometric tests are also conducted at the SCLTC to demonstrate the photometric differences and similarities between the LED and neon OPEN signs.

## 1.6 Data Quality and Future Data Needs

No additional data needs are required.

# Section 2. Calculation Methodology

This work paper details the replacement of neon signs with LED open signs. The base case and measure case wattage values were obtained from the LED Open Sign Project [B]. The demand of 10 different LED and 10 neon signs were averaged in both the “on” and “off” states.

Unlike high voltage neon signs, LED open signs can be turned off while leaving the driver powered on, which results in slight energy consumption. Also, neon signs can internally disconnect power to part of the transformer, causing energy consumption in the off state. Some LED signs, like neon signs, disconnect power to the entire system, resulting in zero energy consumption.

The average demand for LED and neon signs in the “on” and “off” state are from the LED Open Signs Report and are shown in the table below.

Measured Average Demand Data

|  |  |  |  |
| --- | --- | --- | --- |
| **State** | **LED Wattage** | **Neon Wattage** | **Wattage Difference** |
| Off | 0.7 W | 0.0 W | -0.7 W |
| On | 14.9 W | 46.0 W | 31.1 W |

The ΔWatts is the difference in wattage from the base case to the measure case. The ΔWatts for the “on” state accounts for the higher demand scenario as shown below.

ΔWatts = *Base Case Wattage - Measure Wattage* = 46 – 14.9 = 31.1 Watts

The energy savings estimates are calculated as shown in Equation 1.

Equation 1



The annual energy savings are based on wattage difference per fixture, DEER annual hours, and interactive effects by building type.

The following is a sample energy savings calculation for the measure in an Assembly building type in Climate Zone 6. The LED’s “Off” wattage is subtracted from the energy savings for the remainder of the time the OPEN Sign is not being operated.

Equation 2



The demand reduction is calculated as shown in Equation 3.

Equation 3



The following is a sample demand reduction calculation for the measure in an Agricultural building type in Climate Zone 6.

Equation 4



For a full list of savings, refer to the calculation attachment. There are no second baseline calculations because there is no applicable code that affects energy or demand savings calculations.

# 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** |
| Assembly | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Education - Community College | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Education - Primary School | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Education - Relocatable Classroom | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Education - Secondary School | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Education - University | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Grocery | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Health/Medical - Hospital | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Health/Medical - Nursing Home | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Lodging - Guest Rooms | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Lodging - Hotel | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Lodging - Motel | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Manufacturing - Bio/Tech | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Manufacturing - Light Industrial | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Office - Large | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Office - Small | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Restaurant - Fast-Food | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Restaurant - Sit-Down | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Retail - Multistory Large | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Retail - Single-Story Large | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Retail - Small | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Storage - Conditioned | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Storage - Unconditioned | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |
| Warehouse - Refrigerated | DEER:Indoor\_Non-CFL\_Ltg | NON\_RES |

# Section 4. Costs

## 4.1 Base Case Cost

Since the cost data in the LED Open Sign project report is 8 years old, online product research was conducted for a better representation of current costs. The base case cost for a neon sign is $253.05, which is based off of multiple online retailers. See attachments for detailed summary of cost sources.

The labor rate used for the base case in this work paper is based on DEER2016 labor rate, NR-IL-ALL, which is: $67.88/hour. The assumed labor hours is 0.08 hours/unit and is based on Work Order 017 (WO017) Measure Cost Study, Results Matrix - Volume I [C] estimates for CFL lighting retrofits. These combined yield a labor cost of: $67.88 \* 0.08 = $5.43/unit.

## 4.2 Measure Case Cost

The measure cost for an LED sign is $233.23, which is also based off of multiple online retailers. See attachments for detailed summary of cost sources.

The labor rate used for the measure case in this work paper is assumed to be the same as the base case, at $5.43/unit.

## 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** |
| 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

**Full and Incremental Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| LT-19583 | ROB | -$19.82 | -$19.82 | N/A |

# Attachments



# References

[A] California Energy Commission. "2013 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24)." CEC‐400‐2012‐004-CMF-REV2

[B] LED OPEN Signs, Design & Engineering Services, ET06.16

[C] 2010-2012 WO017 Ex Ante Measure Cost Study Final Report. (2014)