Work Paper SCE17LG103

**Revision 0**

**Southern California Edison**

**Interior LED Downlight Fixtures**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | LT-61219, LT-68701, LT-16307, LT-89884 |
| **Measure Description** | LED Downlights fixtures less than 15 Watts |
| **Base Case Description** | PAR30 incandescent or halogen lamps between 40 and 100 Watts |
| **Units** | Lamp |
| **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** | Varies by building type |
| **Measure Installation Type** | Replace on Burnout (ROB) |
| **Net-to-Gross Ratio** | 0.6 (DEER NTGR ID: Com-Default>2yrs, Ind-Default>2yrs, Agr-Default>2yrs)  0.55 (DEER NTGR ID: Res-Default>2yrs)  0.85 (DEER NTGR ID: Com-Default-HTG-di, Ind-Default-HTG-di, Agricult-Default-HTG-di, Res-Default-HTG-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 | 11/1/16 | Robert Hagstrom (SCE) | * Updated labor cost to RSMeans 2016. * Code language update * Updated WRR per 2016 Lighting Disposition |

# 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 pendant and recessed incandescent or halogen lamps that are between 40 and 100 watts, with LED down light modules that are less than 15 watts. The measures are shown in the table below. This work paper assumes that the LED down light fixtures are replacing PAR30 incandescent lamps.

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | LED Downlight |
| Existing Condition | Pendant & recessed incandescent or halogen lamps |
| Code/Standard | N/A |
| Industry Standard Practice | Pendant & recessed incandescent or halogen lamps |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
|  |  | LT-61219 |  | ≤ 15 Watt Down Light (Res) LED Fixture |
|  |  | LT-68701 |  | ≤ 15 Watt Down Light (Non Res) LED Fixture |
|  |  | LT-16307 |  | ≤ 15 Watt Down Light (Common Area) LED Fixture |
|  |  | LT-89884 |  | ≤ 15 Watt Down Light (Dwelling Area) LED Fixture |

## Measures in this work paper must be on Energy Star’s qualified product list (see attachments) to receive incentives.

## 1.2 Technical Description

Downlights are part of a fixture in a 4- or 6-inch can installed flush with the ceiling. LED downlights are typically sold as a retrofit-kit which doesn’t require installation of new fixture housing. They simply replace the existing lamp and its trim.

## 1.3 Installation Types and Delivery Mechanisms

The delivery method that is available for these measures is:

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

The program/install type for the above measures is:

* Replace on Burnout (ROB)
* New Construction (NC)

The Non Residential Direct Install program quality control ensures correct documentation of existing measure, base case, and specification of the energy efficient product installed. SCE requires a detailed Product Location Form (PLF) for each project submitted for rebate or incentive. The PLF is a form which information for measures installed in all building types related to the Non Residential Direct Install program. The PLF contains the following fields: Service Account Address, Measures Proposed/Installed, Product Make/Model, Install Locations (detailed to define separate spaces/floors, as well as specific locations within the space including but not limited to: Bathrooms, Hallways, Meeting Rooms, Offices, Warehouse, etc.).

Customers are solicited to participate primarily through field visits. Contractors conduct energy consultation and provide recommendation that can help eligible customers use less energy. If the customer agrees, the Direct Install contractor will help them complete an authorization form and schedule an installation appointment.

SCE can also provide photos to show measure functionality and a sample close up photos to substantiate the measure base case where applicable. These photos would be part of the required project package. The project package is identified with the Service Account Number and attached to SCE’s SMART database (SCE Project Tracking System) at each specific project level. The above described information is entered and tracked in the program’s tracking database. This level of data is provided in the Participation Data that is provided to the CPUC on a quarterly basis.

* + The MFEER program quality control ensures correct documentation of existing measure, base case, and specification of the energy efficient product installed. SCE requires a detailed Product Location Form (PLF) for each project submitted for rebate or incentive. The PLF is an Excel spreadsheet with a tab for measures installed in dwelling areas and another for measures installed in common area locations. The PFL contains the following fields: Apartment Address, Measure Installed, Product Make/Model, Install Locations (detailed to Kitchen, Bathroom, Hallway, Living Room, Bedroom, Dining Room, Laundry Room, and Porch/Patio), as well as Common Area locations. This information is entered and tracked in the program’s tracking database. This level of data is provided in the Participation Data that is provided to the CPUC on a quarterly basis.

**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 |

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. |
| 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. |

**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  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. |

## 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, with the exception of GsR. Mapped GsR to DEER Mtl building type. |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | No |
| DEER Version | used Lighting Disposition (Attachment 2) |
| Reason for Deviation from DEER | DEER does not contain this measure. |
| DEER Measure IDs Used | R-In-LED-CanRet(8w)-dWP19  C-In-LED-CanRet(8w)-dWP19  R-InCmn-LED-CanRet(8w)-dWP19 |

**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** |
| Res-Default>2 | All other EEM with no evaluated NTGR; existing EEM with same delivery mechanism for more than 2 years | Res | Any | Any | 0.55 |
| 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 |
| Res-Default-HTR-di | All other EEM with no evaluated NTGR; direct install hard-to-reach only. | Res | Any | DirInstall | 0.85 |
| 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 includes measures that are offered via direct install activities into hard-to-reach (HTR) customer homes. “Final Resolution E-4700”, dated December 18, 2014, defines specific criteria to classify customer homes as HTR. 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.

SCE’s Multi-Family Energy Efficiency Rebate (MFEER) program addresses the ongoing concern with “split incentives”, where the residents are not the owners of the property, so they lack incentive to improve their energy usage. Similarly, the property owners do not live on-site and pay higher utility expenses due to inefficient appliances, thus lack any incentive to upgrade. The MFEER is designed to drive this customer segment toward participation by offering property owners a variety of energy efficiency measures and services. The MFEER program will offer and track measure installations in both common and dwelling areas of multifamily complexes and common areas of mobile home parks and condominiums. Measures offered via direct install activities in both common and dwelling areas of multifamily complexes and common areas of mobile home parks and condominiums will receive the HTR NTG. Other measures in the MFEER program will receive default NTG (NTGR\_ID: Res-Default>2), unless otherwise specified in DEER.

This work paper also includes measures that are 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** | **Use Category** | **EUL (Years)** | **RUL (Years)** |
| ILtg-Com-LED-20000hr | LED Lamp - Indoor- Commercial | Com | Lighting | Varies by building type  EUL = Rated Life of Lamp (20,000 hrs) / Annual Usage | Varies by building type  RUL = (5,500/ Annual Usage)/3 |
| ILtg-Res-LED-20000hr | LED lamp - Indoor - Residential | Res | Lighting | 16 | 5.33 |

### 1.4.2 Codes and Standards Analysis

Title 24 2016 [496] Section 150.0(k)1 contains codes related to Residential lighting which includes a minimum 50 percent of total rated wattage in kitchen to be high efficacy, and non-high efficacy lighting to be controlled by vacancy sensors in certain areas for new construction. The measures in this work paper for Residential building types are not affected by this code.

Title 24 2016 Section 141.0 (b)2J contains codes related to Nonresidential lighting additions, alterations, and repairs for Luminaire Component Modifications as shown below. The measures in this work paper do change the light source in a luminaire and replace the optical system of a luminaire, which triggers Modifications-in-Place. Triggering Modifications-in-Place requires mandatory control provisions for each enclosed space that includes Area, Shut-off, Multi-level, and if applicable, Daylighting Controls, with some exceptions as outlined below.

|  |
| --- |
| **J. Luminaire Component Modifications.** Luminaire component modifications in place that include  replacing the ballasts or drivers and the associated lamps in the luminaire, permanently changing the  light source of the luminaire, or changing the optical system of the luminaire, where 70 or more  existing luminaires are modified either on any single floor of a building or, where multiple tenants  inhabit the same floor, in any single tenant space, in any single year, shall not prevent or disable the  operation of any multi-level, shut-off, or daylighting controls, and shall:  i. Meet the lighting power allowance in Section 140.6 and comply with Table 141.0-E; or  ii. In office, retail, and hotel occupancies have at least 50 percent, and in all other occupancies have at least 35 percent, lower rated power at full light output as compared to the original luminaires prior to being modified, and meet the requirements of Sections 130.1(a)1, 2, and 3, 130.1(c)1A through C, 130.1(c)2, 130.1(c)3, 130.1(c)4, 130.1(c)5, 130.1(c)6A, and for parking garages 130.1(c)7B.  Lamp replacements alone and ballast replacements alone shall not be considered a modification of the luminaire provided that the replacement lamps or ballasts are installed and powered without modifying the luminaire.  **EXCEPTION 1** to Section 141.0(b)2J. Modification of portable luminaires, luminaires affixed to  moveable partitions, or lighting excluded by Section 140.6(a)3.  **EXCEPTION 2** to Section 141.0(b)2J. In an enclosed space where two or fewer luminaires are  modified.  **EXCEPTION 3** to Section 141.0(b)2J. Modifications that would directly cause the disturbance of  asbestos, unless the modifications are made in conjunction with asbestos abatement.  **EXCEPTION 4** to Section 141.0(b)2J. Acceptance testing requirements of Section 130.4 are not  required for modifications where lighting controls are added to control 20 or fewer luminaires. |

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 24 2016 | Section 141.0 (b)2J Luminaire Component Modifications. | January 1, 2017 |

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

ET07.15 – Recessed LED Downlights [416] report was used to qualify the technologies in this work paper.

### 1.5.1 Recessed LED Downlight

## Southern California Edison (SCE) conducted the recessed LED downlights Emerging Technologies (ET) Scaled Field Placement project to explore whether LED downlights can achieve market penetration in SCE service territory, targeting customers who make lighting system purchasing decisions. SCE deployed and tested LED retrofit kits and LED screw-in replacements at six customer sites with high foot traffic: two hotels, a timeshare, two homes, and a mall. A light meter was used to measure the intensity of the light and customer surveys were conducted before and after installations.

## 1.6 Data Quality and Future Data Needs

N/A

# Section 2. Calculation Methodology

The methodology of the wattages to be used for energy savings is based on the LED wattage being offered and the Wattage Reduction Ratio (WRR). The Calculation Methodology uses the document “Disposition for Workpapers Covering LED Lamps and Fixtures That Use Wattage Reduction Ratio Savings Methods” by the California Public Utilities Commission, Energy Division, on July 22, 2016 (See Attachment 2). This workpaper is referenced in the aforementioned document, and includes workpapers submitted since December of 2015 supporting LED lighting measures that utilize Wattage Reduction Ratios (WRR) to calculate the savings. Per the disposition direction, a WRR of 3.42 was applied to the measure watts to calculate the baseline wattage. The delta watts between baseline to measure was then multiplied with the Interactive effects and the DEER approved Hours of Usage (HOU) for the respective climate zone and building type to calculate the energy savings.

The energy savings estimates are calculated as follows:



The following is a sample energy savings calculation for ≤ 15 Watt Down Light (Non Res) LED Fixture Basecase, Total Watts = 3.42 x Msr Watts for Assembly building type in Climate Zone 6.

The demand reduction estimates are calculated as follows:



The following is a sample demand reduction calculation for ≤ 15 Watt Down Light (Non Res) LED Fixture Basecase, Total Watts = 3.42 x Msr Watts for Assembly building type in Climate Zone 6.

# 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\_CFL\_Ltg | NON\_RES |
| Education - Primary School | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Education - Secondary School | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Education - Relocatable Classroom | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Education - Community College | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Education - University | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Grocery | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Health/Medical - Hospital | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Health/Medical - Nursing Home | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Lodging - Hotel | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Lodging - Motel | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Lodging - Guest Room | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Manufacturing - Bio/Tech | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Manufacturing - Light Industrial | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Office - Large | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Office - Small | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Restaurant - Fast-Food | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Restaurant - Sit-Down | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Retail - Multistory Large | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Retail - Single-Story Large | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Retail - Small | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Storage - Conditioned | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Storage - Unconditioned | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Warehouse - Refrigerated | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Residential Single Family | DEER:Indoor\_CFL\_Ltg | RES |
| Residential Multi-family | DEER:Indoor\_CFL\_Ltg | RES |
| Residential Mobile Home - Double-Wide | DEER:Indoor\_CFL\_Ltg | RES |

# Section 4. Costs

## 4.1 Base Case Cost

Base case cost of $7.00 (average of incandescent and halogen) is from a Navigant LED study [495]; see the figure below. Labor cost, $9.40, is calculated using RSMeans 2016 [503] labor rate of $56.40/hour and divide it by 6.



Base Case Cost

|  |  |  |  |
| --- | --- | --- | --- |
| Measure Name | Base Equipment Cost | Labor Cost | Total Cost |
| ≤ 15 Watt Down Light (Res) LED Fixture | $7.00 | $9.40 | $16.40 |
| ≤ 15 Watt Down Light (Non Res) LED Fixture | $7.00 | $9.40 | $16.40 |
| ≤ 15 Watt Down Light (Common Area) LED Fixture | $7.00 | $9.40 | $16.40 |
| ≤ 15 Watt Down Light (Dwelling Area) LED Fixture | $7.00 | $9.40 | $16.40 |

## 4.2 Measure Case Cost

Measure case cost of $23.00 is from a Navigant LED study [495]. Same labor cost is used from the base labor case cost.

Measure Case Cost

|  |  |  |  |
| --- | --- | --- | --- |
| Measure Name | Measure Equipment Cost | Labor Cost | Total Cost |
| ≤ 15 Watt Down Light (Res) LED Fixture | $23.00 | $9.40 | $32.40 |
| ≤ 15 Watt Down Light (Non Res) LED Fixture | $23.00 | $9.40 | $32.40 |
| ≤ 15 Watt Down Light (Common Area) LED Fixture | $23.00 | $9.40 | $32.40 |
| ≤ 15 Watt Down Light (Dwelling Area) LED Fixture | $23.00 | $9.40 | $32.40 |

## 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-61219 | ROB | $16.00 | $16.00 | N/A |
| LT-68701 | ROB | $16.00 | $16.00 | N/A |
| LT-16307 | ROB | $16.00 | $16.00 | N/A |
| LT-89884 | ROB | $16.00 | $16.00 | N/A |
| LT-61219 | RET | $16.00 | $32.40 | $16.00 |
| LT-68701 | RET | $16.00 | $32.40 | $16.00 |
| LT-16307 | RET | $16.00 | $32.40 | $16.00 |
| LT-89884 | RET | $16.00 | $32.40 | $16.00 |

# Attachments

1. SCE17LG103.0 A1 – Calculation Template\_Final.zip
2. SCE17LG103.0 A2 – LED-WRR-Workpaper Disposition\_22Jul2016-Final.docx

**References**

1. References\_12122016\_100741.xlsx

[416] ET07SCE1150 - Residential LED Down Lighting

[495] California LED Workpaper Update Study, Navigant Consulting, Inc. California LED Workpaper Update Study. Vancouver, WA, 2015. Web. 30 Nov. 2015

[496] 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24)

[503] RSMeans Electrical Cost Data 2016, 39th Annual Edition, by [John H. Chiang](http://www.amazon.com/s/ref=dp_byline_sr_book_1?ie=UTF8&text=John+H.+Chiang&search-alias=books&field-author=John+H.+Chiang&sort=relevancerank) (Editor)