Work Paper SCE13LG119

**Revision 0**

**Southern California Edison**

**Residential LED Exterior Fixtures**

**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** |
| E.g. Please remove measure LT-12345 (LD123) from this work paper because it is no longer eligible for incentives. | Reviewer 1 | 6/1/15 | E.g. Comment incorporated. LT-12345 was removed. |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | Refer to Excel Calculation Attachment |
| **Measure Description** | Residential LED Exterior Fixtures |
| **Base Case Description** | CFL/Halogen/Incandescent Fixtures using A19 screw-in lamps or integrated modules |
| **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** | OLtg-Res-LED-50000hr: 16 years EUL, 5.33 years RUL |
| **Measure Installation Type** | Replace on Burnout (ROB), Retrofit First Baseline Only (REF) |
| **Net-to-Gross Ratio** | All-Default<=2yrs: 0.7, Res-Default-HTR-di: 0.85 |
| **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 | 9/17/15 | Yun Han | * New template for 2016 program year * WP effective from 1/1/2016 |

# 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 Residential exterior CFL/Incandescent/Halogen light fixtures using A19 lamps with exterior LED fixtures ranging from 8 to 41 Watts. The list of measures is shown in tables below. There are also Dwelling area and Common area measures which are in the calculation template [Attachment 1].

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | Residential LED exterior fixture |
| Existing Condition | Residential incandescent/halogen/CFL exterior fixture |
| Code/Standard | N/A |
| Industry Standard Practice | N/A |

For this workpaper, the term Residential LED Exterior Fixtures is used to describe all the exterior fixture products that are to be installed via direct install method utilizing authorized SCE contractors. The fixtures include Wall Mounted (porch/patio), Ceiling Mounted, and Post Mounted fixtures. Due to how measures are implemented, processed and tracked under SCE Residential Energy Efficiency Programs, the three different types of fixtures are reported as a single measure – Residential Exterior LED Fixtures with one Watt increments.

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
|  |  | LT-58086 |  | 8-9 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-59486 |  | 9-10 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-68565 |  | 10-11 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-91328 |  | 11-12 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-86319 |  | 12-13 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-64625 |  | 13-14 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-66429 |  | 14-15 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-93998 |  | 15-16 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-65029 |  | 16-17 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-94330 |  | 17-18 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-90592 |  | 18-19 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-51807 |  | 19-20 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-54882 |  | 20-21 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-69099 |  | 21-22 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-89726 |  | 22-23 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-91126 |  | 23-24 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-50205 |  | 24-25 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-54680 |  | 25-26 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-82985 |  | 26-27 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-98069 |  | 27-28 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-66097 |  | 28-29 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-85453 |  | 29-30 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-53943 |  | 30-31 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-98473 |  | 31-32 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-88326 |  | 32-33 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-68768 |  | 33-34 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-77442 |  | 34-35 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-77976 |  | 35-36 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-76374 |  | 36-37 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-81181 |  | 37-38 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-66761 |  | 38-39 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-60020 |  | 39-40 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |
|  |  | LT-66963 |  | 40-41 Watt Exterior Fixture LED replacing A19 Basecase, Total Watts = 2.96 x Msr Watts |

To qualify for incentives, the residential LED exterior fixture must be on the Energy Star Certified Light Fixtures Qualified Products List (QPL) [A]. Any fixtures requiring the use of A19 lamps must use LEDs and also be on the Energy Star’s QPL. Energy Star fixtures using A19 lamps must have GU-24 sockets. The base case fixture must have a standard E26 base.

**Residential Energy Efficiency Programs**

Multifamily Energy Efficiency Rebate Program

The SCE Multifamily Energy Efficiency Rebate (MFEER) Program offers rebates on a wide variety of energy-saving products, including select energy-efficient products and services implemented via Direct Install. The program provides for installation of energy-efficient measures in dwelling and common areas of qualified multifamily properties.

Comprehensive Manufactured Homes Program

The Comprehensive Manufactured Home Program (CMHP) is a direct install program designed to provide a comprehensive energy efficiency program to manufactured home customers. The program provides for installation of energy-efficient measures in manufactured home dwellings and common areas of manufactured home parks, at no charge to the customers.

Middle Income Direct Install Program

The Middle Income Direct Installation (MIDI) Program is a direct install program offered to eligible residential customers. The program provides for installation of energy-efficient measures in dwellings of income qualified customers.

The SCE MFEER, CMHP, and MIDI Programs offer rebates on a wide variety of energy-saving products and services to motivate the multifamily property owners/managers to install energy efficient products in both common and dwelling areas of multifamily complexes.  The MFEER 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, CMHP, and MIDI programs’ 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.

This measure applies to all Residential building types including Single Family, Multi-family, and Mobile Home – Double-Wide in all SCE Climate Zones.

## 1.2 Technical Description

Wall Mounted Fixtures are typically used for illumination of porches, patios, walkways, and breezeways. Ceiling Mounted Fixtures are mounted on the surface of the ceiling as opposed to recessed downlights, in which the fixture installs flush to the ceiling. Post Mounted Fixtures are installed on top of poles next to walkways and in open spaces.

All three LED fixtures described typically use two to four A19 lamps with a GU-24 socket or contain integrated LED modules instead of an A19 GU-24 lamp.

## 1.3 Installation Types and Delivery Mechanisms

The delivery method that is available for these measures is:

* Financial Support – Direct Install

The program/install type for the above measures is:

* Retrofit – First Baseline Only (REF)
* 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 |
| Retrofit First Baseline Only (REF) | 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. |

**Incentive Method Descriptions**

|  |  |
| --- | --- |
| **Incentive Method** | **Description** |
| Direct Install | The program implements energy efficiency measures for qualifying customers, at no cost to the customer. |

## 1.4 Measure Parameters

### 1.4.1 DEER Data

Although the fixture savings in this work paper are based on A19 lamps with a 2.96 WRR, the LED A19 lamps listed in the READI tool do not provide 1 Watt increments up to the wattage range needed and also does not provide the proper EUL for a lighting fixture.

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Workpaper?** |
| Modified DEER methodology | No |
| Scaled DEER measure | Yes |
| 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** |
| All-Default<=2yrs | All other EEM with no evaluated NTGR; new technology in program for 2 or fewer years | All | Any | Any | 0.7 |
| Res-Default-HTR-di | All other EEM with no evaluated NTGR; direct install hard-to-reach only. | Res | 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.

**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)** |
| OLtg-Res-LED-50000hr | LED Fixture - Outdoor- Residential | Res | Lighting | 16 | 5.3 |
| OLtg-Res-LED-50000hr-Cmn | LED Fixture - Outdoor- Residential Common Area | Res | Lighting | 16 | 5.3 |

### 1.4.2 Codes and Standards Analysis

**Title 20 2014** [422], Section 1605.1(k) – Lamps section lists the minimum requirements for incandescent reflector lamps, medium base compact fluorescent lamps, and general service incandescent lamps which affect the measures in this work paper.

**Energy Star:** Energy Star issued a document, ENERGY STAR Program Requirements for Integral LED Lamps – Partner Commitments Version 1.1 [488] which details the Energy Star requirements for Integral LED Lamps. The requirements in the document consist of two parts; general requirement for all LED lamps and lamp type specific requirement. Those requirements are the minimum requirements for an integral LED lamp to be adopted by any SCE energy efficiency program.

**Title 24 2013** [355] does not affect fixture replacements in Residential building types.

Although code exists, this work paper uses recommended wattage reduction ratios from the Energy Division’s Workpaper Disposition for Lighting Retrofits (30 May2014 [481]) to calculate the base case wattage. Therefore, Title 20 code is not used.

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 20 (2014) | Section 1605.1(k) | July 1, 2014 |
| Energy Star | Version 1.1 | September 30, 2014 |

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

N/A

## 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). Since the baseline fixtures use A19 lamps, the A-lamp WRR of 2.96 provided by the Energy Division [481] is used to calculate the baseline wattage. The 2.96 WRR factors in a mixed CFL/halogen/incandescent baseline that yields a single multiplier that can be applied to the LED wattage to calculate the baseline wattage.

The energy savings estimates are calculated as follows:



The following is a sample energy savings calculation for a 15 Watt LED Exterior Fixture in Multi-Family (Common Area) building type, Climate Zone 6.

The demand reduction estimates are calculated as follows:



The following is a sample demand reduction calculation for a 15 Watt LED Exterior Fixture in Multi-Family (Common Area) building type, Climate Zone 6.

.00062

A complete list of energy savings and demand reduction for other measures in different building types and climate zones can be found in the attachment [Attachment 1].

# 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** |
| Residential Single Family | Outdoor Lt | Misc.\_Commercial |
| Residential Multi-family | Outdoor Lt | Misc.\_Commercial |
| Residential Mobile Home - Double-Wide | Outdoor Lt | Misc.\_Commercial |

# Section 4. Costs

For Direct Install measures, SCE directly utilizes one or more contractors as part of the program. The actual cost can vary by contractor, the date in which the work occurred, and by the volume of business. Contractor costs are confidential information and are based upon contractually agreed upon pricing as established in their purchase order with SCE; therefore, the SCE program tracking system is the only source for this data.

## 4.1 Base Case Cost

Base case costs are taken from online retailers and averaged [attachment 2]. Fixtures are 1-lamp incandescent and either 60 or 100 Watts. There was no relationship between wattage and price, so all base case costs are the same. Labor cost is taken from RSMeans 2010 [408].

**Base Case Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Base Equipment Cost** | **Base Labor Cost** | **Total Base Cost** |
| LT-58086 | ROB | $23.56 | $8.75 | $32.31 |
| LT-59486 | ROB | $23.56 | $8.75 | $32.31 |
| LT-68565 | ROB | $23.56 | $8.75 | $32.31 |
| LT-91328 | ROB | $23.56 | $8.75 | $32.31 |
| LT-86319 | ROB | $23.56 | $8.75 | $32.31 |
| LT-64625 | ROB | $23.56 | $8.75 | $32.31 |
| LT-66429 | ROB | $23.56 | $8.75 | $32.31 |
| LT-93998 | ROB | $23.56 | $8.75 | $32.31 |
| LT-65029 | ROB | $23.56 | $8.75 | $32.31 |
| LT-94330 | ROB | $23.56 | $8.75 | $32.31 |
| LT-90592 | ROB | $23.56 | $8.75 | $32.31 |
| LT-51807 | ROB | $23.56 | $8.75 | $32.31 |
| LT-54882 | ROB | $23.56 | $8.75 | $32.31 |
| LT-69099 | ROB | $23.56 | $8.75 | $32.31 |
| LT-89726 | ROB | $23.56 | $8.75 | $32.31 |
| LT-91126 | ROB | $23.56 | $8.75 | $32.31 |
| LT-50205 | ROB | $23.56 | $8.75 | $32.31 |
| LT-54680 | ROB | $23.56 | $8.75 | $32.31 |
| LT-82985 | ROB | $23.56 | $8.75 | $32.31 |
| LT-98069 | ROB | $23.56 | $8.75 | $32.31 |
| LT-66097 | ROB | $23.56 | $8.75 | $32.31 |
| LT-85453 | ROB | $23.56 | $8.75 | $32.31 |
| LT-53943 | ROB | $23.56 | $8.75 | $32.31 |
| LT-98473 | ROB | $23.56 | $8.75 | $32.31 |
| LT-88326 | ROB | $23.56 | $8.75 | $32.31 |
| LT-68768 | ROB | $23.56 | $8.75 | $32.31 |
| LT-77442 | ROB | $23.56 | $8.75 | $32.31 |
| LT-77976 | ROB | $23.56 | $8.75 | $32.31 |
| LT-76374 | ROB | $23.56 | $8.75 | $32.31 |
| LT-81181 | ROB | $23.56 | $8.75 | $32.31 |
| LT-66761 | ROB | $23.56 | $8.75 | $32.31 |
| LT-60020 | ROB | $23.56 | $8.75 | $32.31 |
| LT-66963 | ROB | $23.56 | $8.75 | $32.31 |

## 4.2 Measure Case Cost

Measure case costs are taken from online retailers and inserted to the LED Wattage ranges as shown in the table below. Same labor cost is used from the base cost.

**Measure Case Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Base Equipment Cost** | **Base Labor Cost** | **Total Base Cost** |
| LT-58086 | ROB | $35.31 | $8.75 | $44.06 |
| LT-59486 | ROB | $35.31 | $8.75 | $44.06 |
| LT-68565 | ROB | $35.31 | $8.75 | $44.06 |
| LT-91328 | ROB | $35.31 | $8.75 | $44.06 |
| LT-86319 | ROB | $35.31 | $8.75 | $44.06 |
| LT-64625 | ROB | $35.31 | $8.75 | $44.06 |
| LT-66429 | ROB | $41.20 | $8.75 | $49.95 |
| LT-93998 | ROB | $41.20 | $8.75 | $49.95 |
| LT-65029 | ROB | $41.20 | $8.75 | $49.95 |
| LT-94330 | ROB | $41.20 | $8.75 | $49.95 |
| LT-90592 | ROB | $41.20 | $8.75 | $49.95 |
| LT-51807 | ROB | $57.19 | $8.75 | $65.94 |
| LT-54882 | ROB | $57.19 | $8.75 | $65.94 |
| LT-69099 | ROB | $57.19 | $8.75 | $65.94 |
| LT-89726 | ROB | $57.19 | $8.75 | $65.94 |
| LT-91126 | ROB | $57.19 | $8.75 | $65.94 |
| LT-50205 | ROB | $57.19 | $8.75 | $65.94 |
| LT-54680 | ROB | $57.19 | $8.75 | $65.94 |
| LT-82985 | ROB | $57.19 | $8.75 | $65.94 |
| LT-98069 | ROB | $57.19 | $8.75 | $65.94 |
| LT-66097 | ROB | $57.19 | $8.75 | $65.94 |
| LT-85453 | ROB | $57.19 | $8.75 | $65.94 |
| LT-53943 | ROB | $57.19 | $8.75 | $65.94 |
| LT-98473 | ROB | $57.19 | $8.75 | $65.94 |
| LT-88326 | ROB | $57.19 | $8.75 | $65.94 |
| LT-68768 | ROB | $57.19 | $8.75 | $65.94 |
| LT-77442 | ROB | $57.19 | $8.75 | $65.94 |
| LT-77976 | ROB | $57.19 | $8.75 | $65.94 |
| LT-76374 | ROB | $57.19 | $8.75 | $65.94 |
| LT-81181 | ROB | $57.19 | $8.75 | $65.94 |
| LT-66761 | ROB | $57.19 | $8.75 | $65.94 |
| LT-60020 | ROB | $57.19 | $8.75 | $65.94 |
| LT-66963 | ROB | $57.19 | $8.75 | $65.94 |

## 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 |
| REF | (MEC + MLC) – (BEC + BLC) | 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 – REF Install Type**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| LT-58086 | REF | $11.76 | $44.06 | N/A |
| LT-59486 | REF | $11.76 | $44.06 | N/A |
| LT-68565 | REF | $11.76 | $44.06 | N/A |
| LT-91328 | REF | $11.76 | $44.06 | N/A |
| LT-86319 | REF | $11.76 | $44.06 | N/A |
| LT-64625 | REF | $11.76 | $44.06 | N/A |
| LT-66429 | REF | $17.64 | $49.95 | N/A |
| LT-93998 | REF | $17.64 | $49.95 | N/A |
| LT-65029 | REF | $17.64 | $49.95 | N/A |
| LT-94330 | REF | $17.64 | $49.95 | N/A |
| LT-90592 | REF | $17.64 | $49.95 | N/A |
| LT-51807 | REF | $33.63 | $65.94 | N/A |
| LT-54882 | REF | $33.63 | $65.94 | N/A |
| LT-69099 | REF | $33.63 | $65.94 | N/A |
| LT-89726 | REF | $33.63 | $65.94 | N/A |
| LT-91126 | REF | $33.63 | $65.94 | N/A |
| LT-50205 | REF | $33.63 | $65.94 | N/A |
| LT-54680 | REF | $33.63 | $65.94 | N/A |
| LT-82985 | REF | $33.63 | $65.94 | N/A |
| LT-98069 | REF | $33.63 | $65.94 | N/A |
| LT-66097 | REF | $33.63 | $65.94 | N/A |
| LT-85453 | REF | $33.63 | $65.94 | N/A |
| LT-53943 | REF | $33.63 | $65.94 | N/A |
| LT-98473 | REF | $33.63 | $65.94 | N/A |
| LT-88326 | REF | $33.63 | $65.94 | N/A |
| LT-68768 | REF | $33.63 | $65.94 | N/A |
| LT-77442 | REF | $33.63 | $65.94 | N/A |
| LT-77976 | REF | $33.63 | $65.94 | N/A |
| LT-76374 | REF | $33.63 | $65.94 | N/A |
| LT-81181 | REF | $33.63 | $65.94 | N/A |
| LT-66761 | REF | $33.63 | $65.94 | N/A |
| LT-60020 | REF | $33.63 | $65.94 | N/A |
| LT-66963 | REF | $33.63 | $65.94 | N/A |

**Full and Incremental Costs – ROB Install Type**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| LT-58086 | ROB | $11.76 | $11.76 | N/A |
| LT-59486 | ROB | $11.76 | $11.76 | N/A |
| LT-68565 | ROB | $11.76 | $11.76 | N/A |
| LT-91328 | ROB | $11.76 | $11.76 | N/A |
| LT-86319 | ROB | $11.76 | $11.76 | N/A |
| LT-64625 | ROB | $11.76 | $11.76 | N/A |
| LT-66429 | ROB | $17.64 | $17.64 | N/A |
| LT-93998 | ROB | $17.64 | $17.64 | N/A |
| LT-65029 | ROB | $17.64 | $17.64 | N/A |
| LT-94330 | ROB | $17.64 | $17.64 | N/A |
| LT-90592 | ROB | $17.64 | $17.64 | N/A |
| LT-51807 | ROB | $33.63 | $33.63 | N/A |
| LT-54882 | ROB | $33.63 | $33.63 | N/A |
| LT-69099 | ROB | $33.63 | $33.63 | N/A |
| LT-89726 | ROB | $33.63 | $33.63 | N/A |
| LT-91126 | ROB | $33.63 | $33.63 | N/A |
| LT-50205 | ROB | $33.63 | $33.63 | N/A |
| LT-54680 | ROB | $33.63 | $33.63 | N/A |
| LT-82985 | ROB | $33.63 | $33.63 | N/A |
| LT-98069 | ROB | $33.63 | $33.63 | N/A |
| LT-66097 | ROB | $33.63 | $33.63 | N/A |
| LT-85453 | ROB | $33.63 | $33.63 | N/A |
| LT-53943 | ROB | $33.63 | $33.63 | N/A |
| LT-98473 | ROB | $33.63 | $33.63 | N/A |
| LT-88326 | ROB | $33.63 | $33.63 | N/A |
| LT-68768 | ROB | $33.63 | $33.63 | N/A |
| LT-77442 | ROB | $33.63 | $33.63 | N/A |
| LT-77976 | ROB | $33.63 | $33.63 | N/A |
| LT-76374 | ROB | $33.63 | $33.63 | N/A |
| LT-81181 | ROB | $33.63 | $33.63 | N/A |
| LT-66761 | ROB | $33.63 | $33.63 | N/A |
| LT-60020 | ROB | $33.63 | $33.63 | N/A |
| LT-66963 | ROB | $33.63 | $33.63 | N/A |

# Attachments

1. 2.

# References



[355]

[408]

[422]

[481]

[488]

[A] <http://www.energystar.gov/productfinder/download/certified-light-fixtures/>