Work Paper SCE17LG072

**Revision 1**

**Southern California Edison**

**Upstream Interior 3-way CFLs**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | LT-67349, LT-69524, LT-72839, LT-82135, LT-77992, LT-66979, LT-18900, and LT-18899 |
| **Measure Description** | 3-way Compact Fluorescent Lamp (CFL) |
| **Base Case Description** | CFL, LED and Incandescent lamp |
| **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** | ILtg-CFL-Com: Rated Life of Lamp (10,000 hours) / HOU, OR 15 years, whichever is less  ILtg-CFL-Res: 3.5 years |
| **Measure Installation Type** | Replace on Burnout (ROB) |
| **Net-to-Gross Ratio** | Refer to Net to Gross Ratio Table |
| **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 | 11/2/16 | David Douglass-Jaimes (TRC) | * This work paper is an update of SCE13LG072.2 * New calculation template for 2017 program year * Revised labor costs per WO17 * Updated references to DEER2017 * Added LT-18900 and LT-18899 |
| 1 | 6/19/2017 | Lake Casco (TRC) | The following updates were made based on CPUC Lighting dispositions provided on March 1st and May 26th of 2017.   * New WRR values used for savings. * Updated NTG values for upstream measures. * Costs updated for baseline equipment based on new assumed fractions of technologies in the baseline. |

# Commission Staff and Cal TF Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rev** | **Party** | **Submittal Date** | **Comment Date** | **Comments** | **WP Developer Response** |
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Cal TF website: <http://www.caltf.org/>

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | 3-way screw-in compact fluorescent lamp |
| Existing Condition | N/A |
| Code/Standard | CFL (50%), LED (25%) and Incandescent lamp (25%), with wattage determined by multiplying the measure case wattage by a wattage reduction ratio |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
|  |  | LT-67349 |  | 26 Watt 3-Way CFL replacing Com CFL Base Case, Total Watts = 1.59 x Msr Watts |
|  |  | LT-69524 |  | 29 Watt 3-Way CFL replacing Com CFL Base Case, Total Watts = 1.59 x Msr Watts |
|  |  | LT-72839 |  | 32 Watt 3-Way CFL replacing Com CFL Base Case, Total Watts = 1.59 x Msr Watts |
|  |  | LT-18899 |  | 33 Watt 3-Way CFL replacing Com CFL Base Case, Total Watts = 1.59 x Msr Watts |
|  |  | LT-82135 |  | 26 Watt 3-Way CFL replacing Non-Refl CFL Base Case, Total Watts = 1.56 x Msr Watts |
|  |  | LT-77992 |  | 29 Watt 3-Way CFL replacing Non-Refl CFL Base Case, Total Watts = 1.56 x Msr Watts |
|  |  | LT-66979 |  | 32 Watt 3-Way CFL replacing Non-Refl CFL Base Case, Total Watts = 1.56 x Msr Watts |
|  |  | LT-18900 |  | 33 Watt 3-Way CFL replacing Non-Refl CFL Base Case, Total Watts = 1.56 x Msr Watts |

## 1.2 Technical Description

3-way lamps are composed of two filaments that enable three different power and light levels to simulate dimming. These require an appropriate socket and a 3-way 2-circuit switch. Like dimmable CFLs, the color temperature stays the same at each level.

## 1.3 Installation Types and Delivery Mechanisms

**Installation Types:**

* ROB

**Delivery Mechanisms:**

These measures are offered by the SCE Upstream Primary Lighting Program.

* Upstream Programs – Up-Stream Buy Down

**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** |
| Up-Stream Programs | See Up-Stream Incentive and Up-Stream Buy Down in the Incentive Method table. |

**Incentive Method Descriptions**

|  |  |
| --- | --- |
| **Incentive Method** | **Description** |
| Up-Stream Buy Down | The program gives a financial incentive to an upstream market actor, such as a manufacturer or distributor, with specific requirements to pass down the incentive to the end use customer. Such an incentive buys-down the cost of an efficient measure for the end-use customer by at least the amount of the financial incentive. |

## 1.4 Measure Parameters

### 1.4.1 DEER Data

DEER 2017 has measures for screw-in CFLs, but not for 3-way CFLs. This work paper uses DEER methodology and correction factors but not DEER values.

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Workpaper?** |
| Modified DEER methodology | Yes |
| Scaled DEER measure | Yes |
| DEER Base Case | No |
| DEER Measure Case | Yes |
| DEER Building Types | Yes |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | No |
| DEER Version | DEER 2017, READI v2.4.7 |
| Reason for Deviation from DEER | New WRR values provided in CPUC Lighting Disposition [Attachment 5] |
| DEER Measure IDs Used | N/A |

**Net-to-Gross Ratio**

The NTG values were obtained from the CPUC Lighting disposition provided on March 1st, 2017 [Attachment 4]. The relevant NTG values for the measures in this work paper are provided in the table below..

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NTGR ID** | **Description** | **Sector** | **BldgType** | **Measure Delivery** | **NTGR** |
| NonRes-sAll-mCFL | All nonresidential CFLs, all delivery mechanisms | NonRes | Any | Any | 0.85 |
| Res-sAll-mCFL | All residential CFLs, all delivery mechanisms | Res | Any | Any | 0.85 |

**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. The GSIA “Com-CFL-SCE” was not used because it is not for upstream.

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

**Effective and Remaining Useful Life**

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.

Per the guidance document “Ex Ante Update for ESPI Uncertain Measures, Compact Fluorescent Lamps 30 Watts and Less, 21 May 2015”, the EUL for residential CFLs is 3.5 years. For non-residential measures the EUL is 10,000 hours divided by the building type’s annual hours of operation. The RUL would be based on a weighting of CFL (60%) and Incandescent (40%) lamp life, but for simplicity, only the CFL EULs are used to determine RUL. Therefore the EUL and RUL IDs are the same.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| ILtg-CFL-Res | Value from 5/21/15 Uncertain Measures CFL 30 Watts and Less guidance document | Res | Lighting | 3.5 | 3.5 / 3 = 1.2 |
| ILtg-CFL-Com | CFL Lamps – Indoor – Commercial – 10,000 Hours | Com | Lighting | Rated Life of Lamp (10,000 hours) / HOU, OR 15 years, whichever is less | EUL / 3 |

### 1.4.2 Codes and Standards Analysis

Title 24 2016 [496] does not impact the measures in this work paper.

Title 20 2015 [493] includes standards for the lamp electrical power input of state-regulated general service incandescent lamps. However, instead of using Title 20 standards to determine maximum base case wattages, wattage ratios provided by the Energy Division (ED) are used. Title 20 also includes standards for medium base compact fluorescent lamps and dimmable systems. Eligible CFLs will comply with these requirements.

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 20 (2015) | Table K-5 Standards for Medium Base Compact Fluorescent Lamps | July 1, 2015 |

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

### 1.5.1 California Baseline Lighting Efficiency Technology (CBLET) Report

The 1997 CBLET Report Volume I [29] examined characteristics of lighting in residential and commercial buildings, including energy use patterns and hours of operation. It provided % Watts and % hours energy correction factors for several lighting control types. These factors are meant to be applied to self-reported lighting characteristics. The two values for 3-way (0.57 and 1.25) are used in this work paper.



**CBLET Energy Correction Factors**

### 1.5.2 2006–08 Upstream Lighting Program (ULP) Final Evaluation Report

The ULP Report Volumes 1 and 2 [328, 432] present results of the 2006–08 ULP impact evaluation. Part of the evaluation was a detailed lighting inventory. Table 6 shows the statewide results by location. These are used to determine what percentages of the building will receive the High and Low 3-way energy correction factors from the CBLET.



## 1.6 Data Quality and Future Data Needs

No additional data needs are required.

# Section 2. Calculation Methodology

**Energy Correction Factors**

The 2011 PG&E Work Paper Review (Attachment 2), specified which factors from the CBLET and the ULP report should be used to calculate energy savings:

*3-way Residential = 0.67 \* 0.57 + 0.33 \* 1.25 = 0.79*

*3-way Non-residential = 0.5 \* 0.57 + 0.5 \* 1.25 = 0.91*

The final correction factors are:

|  |  |  |
| --- | --- | --- |
| **Measure Type** | **Watts Factor** | **Hours Factor** |
| Residential 3-way | 0.8 | 0.79 |
| Non-residential 3-way | 0.8 | 0.91 |

Note: The DEER hours of use for Residential 3-way CFLs have already been reduced to 541 \* 0.79 = 427 hours/year. Therefore, the 0.79 factor is not reapplied.

**Wattage Reduction Ratios (WRRs)**

All savings in this work paper were calculated using base case wattages determined by multiplying the measure case wattage by the following WRRs provided by the CPUC in the disposition provided on May 26th, 2017[Attachment 5]:

|  |  |
| --- | --- |
| **Lamp Type** | **WRR** |
| Residential interior non-reflector | 1.56 |
| Commercial interior | 1.59 |

As the measures in this work paper specify exact wattages, not wattage ranges, no midrange wattages were used in the savings.

**Energy Savings and Demand Reduction**

Examples of savings calculations for a 26W 3-way CFL measure, climate zone 06, are provided below:

Residential: Single Family Home

Non-residential: Office – Small

See the calculation template (Attachment 1) for all results.

# 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** |
| Office - Small | DEER:Indoor\_CFL\_Ltg | NON\_RES |
| Restaurant - Sit-Down |
| Retail - Small |
| Residential Single Family | DEER:Indoor\_CFL\_Ltg | RES |

# Section 4. Costs

## 4.1 Base Case Cost

The base cost values include material costs for incandescent, CFL and LED lamps based on the mix of technologies given in the CPUC disposition for screw in lamps provided on March 1st, 2017. The disposition uses the following fractions to estimate baseline costs: 50% CFLs, 25% LEDs and 25% incandescent. The base costs for each of the technologies were found in the following ways:

* CFL Costs: The lamp costs are the same as the measure costs and are from the latest ex ante database through the READI tool v.4.7.1. The CFL costs for the 33W spiral lamp were assumed be equal to the 32W lamp.
* Incandescent Costs: Baseline incandescent lamp wattage was estimated based on the WRR values provided by the CPUC for each measure. The wattages were placed into bins of common incandescent lamp wattages for each style. A survey of online retailers was used to find the cost for each binned wattage and style.
* LED Costs: A survey of online retailers was also used to find the LED costs. Suitable LED lamp products were estimated using the binned incandescent wattage for each measure, assuming the standard replacement suggested by the online retailer or manufacturer.

These material costs and calculations are found in Attachment 3.

Labor cost is from WO017[475]. In WO017, the labor cost for a CFL A-Lamp or Twister is 0.08 hours at an hourly rate of $72.26/hour, totaling $5.75. There were no miscellaneous costs involved.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Code** | **CostID** | **Description** | **Equipment Cost** | **Labor + Misc Cost** |
| LT-67349 | SCE17LG072\_01\_B001 | Base case cost for mix of 50% CFL, 25% LED and 25% Incandescent | $10.48 | $5.75 |
| LT-69524 | SCE17LG072\_01\_B002 | Base case cost for mix of 50% CFL, 25% LED and 25% Incandescent | $10.72 | $5.75 |
| LT-72839 | SCE17LG072\_01\_B003 | Base case cost for mix of 50% CFL, 25% LED and 25% Incandescent | $11.71 | $5.75 |
| LT-18899 | SCE17LG072\_01\_B004 | Base case cost for mix of 50% CFL, 25% LED and 25% Incandescent | $11.71 | $5.75 |
| LT-82135 | SCE17LG072\_01\_B001 | Base case cost for mix of 50% CFL, 25% LED and 25% Incandescent | $10.48 | $5.75 |
| LT-77992 | SCE17LG072\_01\_B002 | Base case cost for mix of 50% CFL, 25% LED and 25% Incandescent | $10.72 | $5.75 |
| LT-66979 | SCE17LG072\_01\_B003 | Base case cost for mix of 50% CFL, 25% LED and 25% Incandescent | $11.71 | $5.75 |
| LT-18900 | SCE17LG072\_01\_B004 | Base case cost for mix of 50% CFL, 25% LED and 25% Incandescent | $11.71 | $5.75 |

## 4.2 Measure Case Cost

All material cost values are from the latest ex ante database through the READI v2.4.7. The CFL costs for the 33W spiral lamp were assumed be equal to the 32W lamp.

Labor cost is from WO017 [475]. In WO017, the labor cost for a CFL A-Lamp or Twister is 0.08 hours at an hourly rate of $72.26/hour, totaling $5.75. There were no miscellaneous costs involved.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Code** | **CostID** | **Description** | **Equipment Cost** | **Labor + Misc Cost** |
| LT-67349 | CFLscw-3way(26w) | CFL Lamp: Non-Reflector, 3-Way, 26 Watts | $12.55 | $5.75 |
| LT-69524 | CFLscw-3way(29w) | CFL Lamp: Non-Reflector, 3-Way, 29 Watts | $13.03 | $5.75 |
| LT-72839 | CFLscw-3way(32w) | CFL Lamp: Non-Reflector, 3-Way, 32 Watts | $13.51 | $5.75 |
| LT-18899 | SCE17LG072\_00\_M001 | CFL Lamp: Non-Reflector, 3-Way, 33 Watts | $13.51 | $5.75 |
| LT-82135 | CFLscw-3way(26w) | CFL Lamp: Non-Reflector, 3-Way, 26 Watts | $12.55 | $5.75 |
| LT-77992 | CFLscw-3way(29w) | CFL Lamp: Non-Reflector, 3-Way, 29 Watts | $13.03 | $5.75 |
| LT-66979 | CFLscw-3way(32w) | CFL Lamp: Non-Reflector, 3-Way, 32 Watts | $13.51 | $5.75 |
| LT-18900 | SCE17LG072\_01\_M001 | CFL Lamp: Non-Reflector, 3-Way, 33 Watts | $13.51 | $5.75 |

## 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 |

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-67349 | ROB | $2.07 | $2.07 | N/A |
| LT-69524 | ROB | $2.31 | $2.31 | N/A |
| LT-72839 | ROB | $1.80 | $1.80 | N/A |
| LT-18899 | ROB | $1.80 | $1.80 | N/A |
| LT-82135 | ROB | $2.07 | $2.07 | N/A |
| LT-77992 | ROB | $2.31 | $2.31 | N/A |
| LT-66979 | ROB | $1.80 | $1.80 | N/A |
| LT-18900 | ROB | $1.80 | $1.80 | N/A |

# Attachments

1. SCE17LG072.1 A1 - Calculation TemplatesSCE17LG072.1 A2 - PG&E Lighting Study
2. SCE17LG072.1 A3 - Cost Calculations
3. SCE17LG072.1 A4 - 2017SCrewInLampDisposition – 1March2017-Final
4. SCE17LG072.1 A5 - 2017SCrewInLampDisposition – Revisions-26May2017

# References



[29]

[328]

[432]

[493]

[496]