Work Paper SCE13LG072

**Revision 2**

**Southern California Edison**

**Upstream Interior 3-way CFLs**

**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** |
| Since this is a lamp replacement, shouldn’t 1,630 hours be used for “pre-existing” case and not the code hours? | Yun | 9/30/15 | For ROB, the template automatically uses Code baseline hours (1380). This is conservative and what DEER uses, so I will leave it as-is. |
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# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | LT-67349, LT-69524, LT-72839, LT-82135, LT-77992, LT-66979 |
| **Measure Description** | 3-way Compact Fluorescent Lamp (CFL) |
| **Base Case Description** | CFL or 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** | NonRes-sAll-mCFL: 0.54  Res-sAll-mCFL-up: 0.9 |
| **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 | 4/12/12 | Nick Bengtson (PECI) | Original work paper for 2013 PC |
| 4/12/12 | Brian V. O’Keefe (SCE) | * Installation rate was removed from the gross calculations for kW. This factor will be kept separate from the gross savings values until reporting. * Calculation Template was updated with the latest template for residential therm values. |
| 1 | 5/29/2014 | Jason Wang (SCE) | * Work paper updated for the reporting period, effective 7/1/14 – 12/31/14. * Updated 3-way CFL savings methodology to align with PG&E approach. |
| 2 | 9/17/15 | Jason Wang (SCE) | * Updated with DEER2016 HOU, CDF, NTG, EUL. * Updated base case from incandescent only to CFL or incandescent * Based on lack of use, removed most measures, leaving LT-67349, LT-69524, and LT-72839. * Separated residential and commercial measures, adding LT-82135, LT-77992, and LT-66979 * Updated measure names. * Removed Misc Commercial. |

# 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 (60%) or Incandescent lamp (40%), 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 = 3.57 x Msr Watts |
|  |  | LT-69524 |  | 29 Watt 3-Way CFL replacing Com CFL Base Case, Total Watts = 3.57 x Msr Watts |
|  |  | LT-72839 |  | 32 Watt 3-Way CFL replacing Com CFL Base Case, Total Watts = 3.57 x Msr Watts |
|  |  | LT-82135 |  | 26 Watt 3-Way CFL replacing Non-Refl CFL Base Case, Total Watts = 2.48 x Msr Watts |
|  |  | LT-77992 |  | 29 Watt 3-Way CFL replacing Non-Refl CFL Base Case, Total Watts = 2.48 x Msr Watts |
|  |  | LT-66979 |  | 32 Watt 3-Way CFL replacing Non-Refl CFL Base Case, Total Watts = 2.48 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 |
| 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 |
| Retrofit First Baseline Only (REF) | Above Customer Existing | N/A | EUL | N/A |
| Retrofit Add-on (REA) | Above Customer Existing | N/A | EUL | N/A |

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

**Delivery Method Descriptions**

|  |  |
| --- | --- |
| **Delivery Method** | **Description** |
| 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. |
| Commissioning and Retrocommissioning | The program modifies or repairs existing equipment to ensure that it works as intended. |
| Financial Support | The program motivates customers, through financial incentives such as rebates or low interest loans, to implement energy efficient measures or projects. |
| Innovative Design | The program funds new ideas that meet reasonable scientific scrutiny for potential energy savings. These innovative measures typically have small market penetration (less than 5%) or are targeted toward relatively unreached market segments. |
| New Construction | The program offers financial incentives and/or design assistance to customers involved with new building construction. This is intended is to motivate customer to exceed Title 24 building energy efficiency requirements (residential or nonresidential). |
| Partnership | The program implements projects through a partnership between the utility and an institutional, government, or community-based organization. |
| Performance Based | The program offers financial incentives that vary based on the energy efficiency performance of specific projects. |
| Up-Stream Programs | See Up-Stream Incentive and Up-Stream Buy Down in the Incentive Method 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. |
| Mid-Stream Incentive | The program gives a financial incentive to a midstream market actor, such as a retailer or contractor, to encourage the promotion of efficient measures. The incentive may or may not be passed on to the end-use customer. |
| Up-Stream Incentive | The program gives a financial incentive to an upstream market actor, such as a manufacturer or distributor, to encourage the manufacture, provision, or distribution of an efficient measure. The incentive may or may not be passed on to the end-use customer. |
| 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. |
| Giveaway | The program provides customers with energy efficiency equipment or services for free. |
| Exchange/Replacement | The utility program holds events where customers can trade functional equipment for similar but more energy efficient equipment, free of charge. |
| On-bill Finance/Loan | The program offers financing for the cost an efficient measure as part of the utility bill. This can be an add-on option to an existing program or can serve as an organizing principle for its own program. |

## 1.4 Measure Parameters

### 1.4.1 DEER Data

DEER 2016 has measures for screw-in CFLs, but not for 3-way CFLs. This work paper uses DEER methodology and correction factors but not DEER measures directly.

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Workpaper?** |
| Modified DEER methodology | Yes |
| Scaled DEER measure | No |
| DEER Base Case | Yes |
| DEER Measure Case | Yes |
| DEER Building Types | Yes |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | No |
| DEER Version | DEER 2016, READI v2.3.0 |
| Reason for Deviation from DEER | Uses DEER methodology and correction factors |
| 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** |
| NonRes-sAll-mCFL | CFL-screw in, All. | Com | Any | PreRebUp | 0.54 |
| Res-sAll-mCFL-up | CFL-screw in,All. | Res | Any | PreRebUp | 0.9 |

**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**

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.

Per the guidance document “Ex Ante Update for ESPI Uncertain Measures, Compact Fluorescent Lamps 30 Watts and Less, 21 May 2015” (Attachment 4), 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 2013 [355] 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 3), 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)**

The base case wattages for CFLs are determined by multiplying the measure case wattage by the following WRRs:

|  |  |
| --- | --- |
| **Lamp Type** | **WRR** |
| Residential interior reflector | 2.86 |
| Residential interior non-reflector | 2.48 |
| Commercial interior | 3.57 |

The values 2.48 and 3.57 are used in this work paper.

**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

CostIDs and equipment costs are from DEER. Labor cost is from WO017. 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.

## 4.1 Base Case Cost

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Code** | **DEER CostID** | **Description** | **Equipment Cost** | **Labor + Misc Cost** |
| LT-67349 | Std\_CFLscw-3way(26w)\_60pInc-r0248 | Base case cost for mix of 60% CFL and 40% Incandescent for CFL TechID: CFLscw-3way(26w) | $5.35 | $5.75 |
| LT-69524 | Std\_CFLscw-3way(29w)\_60pInc-r0248 | Base case cost for mix of 60% CFL and 40% Incandescent for CFL TechID: CFLscw-3way(29w) | $5.55 | $5.75 |
| LT-72839 | Std\_CFLscw-3way(32w)\_60pInc-r0248 | Base case cost for mix of 60% CFL and 40% Incandescent for CFL TechID: CFLscw-3way(32w) | $5.74 | $5.75 |

## 4.2 Measure Case Cost

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Code** | **DEER CostID** | **Description** | **Equipment Cost** | **Labor + Misc Cost** |
| LT-67349 | CFLscw-3way(26w) | CFL Lamp: Non-Reflector, 3-Way, 26 Watts | $10.70 | $5.75 |
| LT-69524 | CFLscw-3way(29w) | CFL Lamp: Non-Reflector, 3-Way, 29 Watts | $11.18 | $5.75 |
| LT-72839 | CFLscw-3way(32w) | CFL Lamp: Non-Reflector, 3-Way, 32 Watts | $11.66 | $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 |
| 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-67349 | ROB | $5.35 | $5.35 | N/A |
| LT-69524 | ROB | $5.63 | $5.63 | N/A |
| LT-72839 | ROB | $5.92 | $5.92 |  |

# Attachments

1. 
2. 
3. 

# References



[29]

[328]

[355]

[432]

[493]