Work Paper SCE17LG076

**Revision 0**

**Southern California Edison**

**Integrated Linear Fluorescent Occupancy Sensor**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | LT-76101, LT-41007 |
| **Measure Description** | Integrated Occupancy Sensor |
| **Base Case Description** | Manual Lighting Control |
| **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** | ILtg-OccSens: EUL 8yrs, RUL 2.7yrs |
| **Measure Installation Type** | Retrofit Add-on (REA) |
| **Net-to-Gross Ratio** | NonRes-sAll-mOccSens: 0.60, NonRes-sAll-mLtgCtrl-htr: 0.89, Com-Default>2yrs: 0.60 |
| **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 | 12/21/16 | Siobhan McCabe, TRC Energy Services | * This work paper is an update of SCE13LG076.3 * New calculation template for 2017 program year * Updated costs based on online research and WO017 * Updated code language for Title 24 2016 * Revised savings due to changes in DEER interactive effects for 2016 Lighting Summary |

# 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

This work paper documents the E3 calculator input values used to forecast the impacts of fixture integrated occupancy sensors controlling less than 150W and greater than 150W.

The base case fixture for ≥150W is equipped with four 46” 54W T5 HO lamps and electronic ballast without occupancy controls. The fixture consumes 234 Watts (F44PHL/2) which is obtained from the 2013 SPC Table of Standard Fixture Wattages [431].

The base case fixture for <150W is equipped with two 48” 32W T8 lamps and electronic ballast without occupancy controls. The fixture consumes 59 Watts (fixture code F42ILL) [431].

The measure case for both cases is to install an integrated occupancy sensor on the base case fixture. One occupancy sensor will control one fixture.

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | Integrated Occupancy Sensor |
| Existing Condition | Manual Lighting Control |
| Code/Standard | N/A |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
|  |  | LT-76101 |  | Integrated Occupancy Sensor (fixture wattage ≥ 150 Watts) |
|  |  | LT-41007 |  | Integrated Occupancy Sensor (fixture wattage < 150 Watts) |

This work paper is only eligible for fixtures that do not already have an occupancy sensor. The measures apply to all commercial building types and SCE climate zones in an interior space. The customer may be required to present an invoice documenting the installation of measure case equipment.

## 1.2 Technical Description

An integrated occupancy sensor is installed on the fixture itself, in contrast to typical occupancy sensors that are installed on walls or ceilings.

## 1.3 Installation Types and Delivery Mechanisms

The program/install type for the measures is:

* Retrofit Add-on (REA)

**Installation Type Descriptions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Installation Type** | **Savings** | | **Life** | |
| 1st Baseline (BL) | 2nd BL | 1st BL | 2nd BL |
| Retrofit Add-on (REA) | Above Customer Existing | N/A | EUL | N/A |

The delivery methods for this work paper are:

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

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.* |

**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 (distributor, vendor, or retailer) to encourage the promotion of efficient measures. |

## 1.4 Measure Parameters

### 1.4.1 DEER Data

These measures are included in READI v.2.4.7. However, the measures are limited to certain building types and the common units are expressed in “per kW controlled”. ED’s Lighting Control Disposition in Attachment 2 provides savings of all the DEER and ED Weighted building types expressed in both “per kW” and “per Sensor” which is used for this work paper. The Lighting Summary comes from a DEER 2016 update and contains different HVAC interactive effects.

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Workpaper?** |
| Modified DEER methodology | Yes |
| Scaled DEER measure | No |
| DEER Base Case | No |
| DEER Measure Case | Yes |
| 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 all building types, different common unit |
| 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-mOccSens | Occupancy Sensors | Com | Any | PreRebDown | 0.60 |
| NonRes-sAll-mLtgCtrl-htr | Lighting controls (not listed elsewhere) | Com | Any | DirInstall | 0.89 |
| 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 |

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 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 and RUL values were obtained in accordance with Draft Resolution E-4807 [510].

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| ILtg-OccSens | Occupancy Sensors | Com | Lighting | 5 | N/A |

### 1.4.2 Codes and Standards Analysis

Occupancy sensors are not affected by Title 24 2016 [496] due to the following:

**EXCEPTION 1 to Section 141.0(b)2K.** Alterations strictly limited to addition of lighting controls**.**

Also, if an occupancy sensor is required by or used to comply with code, then it cannot be used to claim energy and demand savings. Therefore, this measure is only eligible in buildings built before July 1, 2014 in which the lighting fixtures are not being replaced.

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 24 (2016) | 2016 Non-Residential Compliance manual, Section 141.0(b) | January 1, 2017 |

## 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.

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# Section 2. Calculation Methodology

This work paper contains two measures as shown in table below with the measure type and controlled wattages.

**Measure Types**

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure Code** | **Measure Name** | **Controlled Fixtures** | **Controlled Wattage** |
| LT-76101 | Integrated Occupancy Sensor (fixture wattage ≥ 150 Watts) | 46” 4-lamp 54W T5 HO with Electronic Ballast (F44PHL/2) | 234 |
| LT-41007 | Integrated Occupancy Sensor (fixture wattage < 150 Watts) | 48” 2-lamp 32W T8 with Electronic Ballast (F42ILL) | 59 |

All savings in this work paper are provided by the Energy Division’s 2013‒2014 Workpaper Disposition for Occupancy Sensor Lighting Controls. See Attachment 3.

To calculate energy savings and demand reduction for ED weighted building types, the Workpaper Disposition provides the occupancy reduction factor for kWh and lighting peak demand reduction factor for kW reduction. These factors are used with the building operating hours, interactive effects, and wattage controlled to come up with the energy savings and demand reduction.

The DEER building types use the “per kW Controlled” value from READI 2.4.7 with the wattage controlled to obtain the energy savings and demand reduction.

Due to no updates to those particular items above, significant changes to the methodology were not made. DEER interactive values and hours of use (HOU) were updated based on the DEER 2016 lighting summary.

Note that the savings for building type Lodging – Guest Room (GsR) are the same as building type Motel.

## Energy Savings Methodology for ED Weighted Building Type

## Per Sensor

The annual energy savings is the product of the annual hours of use, energy interactive effects (EIE), occupancy sensor percent time off (PTO), and controlled kW as shown in Equation 1.

Equation 1



The energy savings vary by solution code, building type, and climate zone because of different values for controlled wattage, operating hours, percent time off, and interactive effects. For example, Equation 2 shows the calculation for a sensor controlling less than 150 Watts in an Assembly building located in climate zone 6. The operating hours and interactive effects values were taken from DEER 2017

Equation 2

## Demand Reduction Methodology for ED Weighted Building Type

## Per Sensor

The demand reduction per sensor is the product of the controlled kW, interactive effects (DIE), and lighting peak demand reduction factor as shown in Equation 3.

Equation 3

As with the energy savings, the demand reduction varies by solution code, building type, and climate zone because of different values for controlled wattage, interactive effects, and peak demand reduction. For example, Equation 4 shows the calculation for a sensor controlling less than 150 Watts in an Assembly building type located in climate zone 6.

Equation 4

The calculation spreadsheet attached at the end of this document (Attachment 1) shows the calculation for all the permutations of solution code, building type, and climate zone.

# 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 | Occupancy Sensor | Misc.\_Commercial |
| Education - Primary School | Occupancy Sensor | K\_thru\_12\_School |
| Education - Secondary School | Occupancy Sensor | K\_thru\_12\_School |
| Education - Relocatable Classroom | Occupancy Sensor | K\_thru\_12\_School |
| Education - Community College | Occupancy Sensor | K\_thru\_12\_School |
| Education - University | Occupancy Sensor | K\_thru\_12\_School |
| Grocery | Occupancy Sensor | Misc.\_Commercial |
| Lodging - Guest Rooms | Occupancy Sensor | Hotel\_Motel |
| Health/Medical - Hospital | Occupancy Sensor | Misc.\_Commercial |
| Lodging - Hotel | Occupancy Sensor | Hotel\_Motel |
| Manufacturing - Bio/Tech | Occupancy Sensor | Industrial |
| Manufacturing - Light Industrial | Occupancy Sensor | Industrial |
| Lodging - Motel | Occupancy Sensor | Hotel\_Motel |
| Health/Medical - Nursing Home | Occupancy Sensor | Misc.\_Commercial |
| Office - Large | Occupancy Sensor | Large\_Office |
| Office - Small | Occupancy Sensor | Small\_Office |
| Restaurant - Fast-Food | Occupancy Sensor | Misc.\_Commercial |
| Restaurant - Sit-Down | Occupancy Sensor | Misc.\_Commercial |
| Retail - Multistory Large | Occupancy Sensor | Large\_Retail\_Store |
| Retail - Single-Story Large | Occupancy Sensor | Large\_Retail\_Store |
| Retail - Small | Occupancy Sensor | Small\_Retail\_Store |
| Storage - Conditioned | Occupancy Sensor | Misc.\_Commercial |
| Storage - Unconditioned | Occupancy Sensor | Misc.\_Commercial |
| Warehouse – Refrigerated | Occupancy Sensor | Misc.\_Commercial |

# Section 4. Costs

## 4.1 Base Case Cost

For REA measures there is no base case cost.

## 4.2 Measure Case Cost

Since the cost was based on DEER 2008 data, the measure cost was updated to current prices according to online retailers from December 2016. The DEER costs were defined as “per KW controlled,” which created the cost difference between measures. Due to improvements with the equipment, there is no longer a cost difference between measures; the same control applies to both wattage groups. The average costs for integrated fixture mounted occupancy sensors from various online retailers was used to find the material costs. The costs include material, shipping, tax and labor (from Table 4-6 in WO017 [475]). The material costs were $58.25 per fixture and labor costs were $90.46. Attachment 4 contains the research findings and calculations for full and incremental measure costs, which are the same for REA.

## 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** |
| 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-76101 | REA | $148.71 | $148.71 | N/A |
| LT-41007 | REA | $148.71 | $148.71 | N/A |

# Attachments

1. SCE17LG076.0 A1 - Calculation Template\_Final.xlsm
2. SCE17LG076.0 A2 - Lighting Control Disposition.pdf
3. SCE17LG076.0 A3 - Cost Calculations 12092016.xlsx
4. SCE17LG076.0 A4 - Savings Calculations 12092016.xlsx

# References

1. References\_12122016\_100741.xlsx

[431]

[475]

[496]