Work Paper SCE17LG020

**Revision 0**

**Southern California Edison**

**Wall Mounted Occupancy Sensors – Multifamily**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | LT-78685 |
| **Measure Description** | Wall-mounted occupancy sensor controlling a lighting system in a mobile home or multi-family building |
| **Base Case Description** | Lighting system without automated controls. |
| **Units** | Sensor |
| **Energy Savings** | Refer to Excel Calculation Attachment 1 |
| **Full Measure Cost ($/unit)** | Refer to Excel Calculation Attachment 2 |
| **Incremental Measure Cost ($/unit)** | Refer to Excel Calculation Attachment 2 |
| **Effective Useful Life** | ILtg-OccSens: 5 years |
| **Measure Installation Type** | Retrofit Add-on (REA) |
| **Net-to-Gross Ratio** | Res-Default>2: 0.55  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 | 12/2/16 | Jay Schuyler (TRC) | * The work paper is an update of SCE13LG020.2 * New calculation template for the 2017 program year * Revised code language to reflect update Title 24 and Title 20. * Updated EUL * All (16) climate zones were added to the calculation template. * Removed LT-60934 since programs do not utilize this measure. |

# 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 | Lighting system with wall-mounted occupancy sensor |
| Existing Condition | Lighting system without controls |
| Code/Standard | Lighting system with occupancy sensor and high efficacy fixtures |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** | **Area Description** |
| SCG | SDG&E | SCE | PG&E |
|  |  | LT-78685 |  | Occupancy Sensor (Res Common Area) Control | Laundry Rooms, Clubhouses, etc. |

**Eligibility Requirements**

* Only wall-mounted sensors are eligible. Ceiling-mounted sensors and integrated sensors in fixtures are not eligible.
* There may be additional eligibility requirements based upon contractual agreements with entities receiving incentives as part of this program.

**Implementation Requirements**

* This measure is approved for installation in bathroom and common areas of Residential Multi-family and Mobile Home - Double-Wide buildings.

**Documentation Requirements**

The programs offering the measures in this work paper may require submitted paid invoices for approval.

## 1.2 Technical Description

A lighting occupancy sensor is a device that automatically turns lights on when a person enters into a room, and turns lights off when a specified period of time has passed after an area is vacated. Energy savings are achieved by reducing the typical run time of the lights.

## 1.3 Installation Types and Delivery Mechanisms

The measures will be offered through the Multifamily Energy Efficiency Rebate Program and the Comprehensive Manufactured Home Program.

The delivery mechanism is Financial Support - Direct Install.

The install type 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 |

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

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 |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | No |
| DEER Version | DEER 2017, READI v2.4.7 |
| Reason for Deviation from DEER | DEER does not have residential occupancy sensor measures. |
| DEER Measure IDs Used | N/A |

**Net-to-Gross Ratio**

The NTG values were obtained using the DEER READI tool. V2.4.7. 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 |
| 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 v2.4.7. 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.

For REA measures, the EUL is typically 1/3 of the EUL of the equipment being modified because the add-on is also removed when the equipment fails. In this case the equipment is assumed to be a linear fluorescent fixture, and the add-on is the occupancy sensor. However, the typical full life of linear fluorescent fixture is 16 and the RUL is 5.3, therefore the RUL of linear fluorescent fixture is used as the EUL and first baseline life for this work paper.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| ILtg-Lfluor-fix | Linear Fluorescent - Fixtures | Com | Lighting | 5.3 | N/A |

### 1.4.2 Codes and Standards Analysis

The sensors associated with the measures in this work paper must comply with Section 1605.3(l) (2) (G) of Title 20 2015 California Appliance Efficiency Regulations [493].

**Title 24 (2016) [496]**

Section 150.0(k) Residential Lighting of Title 24 requires automatic controls that include occupancy sensors (see excerpt below). Since the measures in this work paper are Retrofit Add-on, they are not affected by this code.

|  |
| --- |
| **Section 150.0(k) Residential Lighting**  **2.** Interior Lighting Switching Devices and Controls.  D. Lighting controls and equipment shall be installed in accordance with the manufacturer's  Instructions.  E. No controls shall bypass a dimmer or vacancy sensor function where that dimmer or  Vacancy sensor has been installed to comply with Section 150.0(k).  F. Lighting controls shall comply with the applicable requirements of Section 110.9.   1. In bathrooms, garages, laundry rooms, and utility rooms, at least one luminaire in each of these spaces shall be controlled by a vacancy sensor. 2. Dimmers or vacancy sensors shall control all luminaires required to have light sources compliant with Reference Joint Appendix JA8.   EXCEPTION 1 to Section 150.0(k)2K: Luminaires in closets less than 70 square feet.  EXCEPTION 2 to Section 150.0(k)2K: Luminaires in hallways.  **6. Interior Common Areas of Low-rise Multi-Family Residential Buildings.**   1. In a low-rise multifamily residential building where the total interior common area in a single building equals 20 percent or less of the floor area, permanently installed lighting for the interior common areas in that building shall be high efficacy luminaires and controlled by an occupant sensor. 2. In a low-rise multifamily residential building where the total interior common area in a single building equals more than 20 percent of the floor area, permanently installed lighting in that building shall: 3. Comply with the applicable requirements in Sections 110.9, 130.0, 130.1, 140.6 and 141.0; and 4. Lighting installed in corridors and stairwells shall be controlled by occupant sensors that reduce the lighting power in each space by at least 50 percent. The occupant sensors shall be capable of turning the light fully On and Off from all designed paths of ingress and egress. |
|  |

This workpaper assumes that all base case lighting fixtures are either linear fluorescent or compact fluorescent, both of which classify as high efficacy lighting.

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 24 (2016) | §150.0(k)2,6 | January 1, 2017 |
| Title 20 (2015) | Section 1605.3(l)(2)(G) | July 1, 2015 |

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

No studies were used to develop this work paper.

## 1.6 Data Quality and Future Data Needs

No future data needs are anticipated.

# Section 2. Calculation Methodology

**Controlled Wattage Assumptions**

* For common areas, it is assumed that the occupancy sensor controls four linear fluorescent T8 fixtures.

The fixture code, type, wattage, and total controlled wattages are shown in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Fixture Code\*** | **Location** | **Number of Controlled Fixtures** | **Fixture Type\*** | **Fixture Wattage (W)\*** | **Total Controlled Wattage (W)** |
| F42ILL-R | Common Area | 4 | 2-lamp, 48”, 32-Watt T8 | 52 | **208** |

\*Obtained from Appendix B Table of Standard Fixture Wattages [382].

\*\*The vanity fixture would have used the wattage of a 4-lamp, 13-Watt CFL fixture, but this fixture type was not in Appendix B.

**Occupancy Sensor Percentage Time Off (PTO)**

DEER 2005 [26] provides assumptions for how operating hours are affected by occupancy sensors. The following table and equation show how the DEER assumptions were used to determine the PTO value for this work paper.

DEER Occupancy Sensor Measure Assumptions

|  |  |
| --- | --- |
| **Scenario** | **Annual Hours of Operation** |
| Normal building hours of operation (60 hours/week, 50 weeks/year) | 3000 |
| **Base case:** Occupants manually switch off the lighting 15% of the time | 2550 |
| **Measure Case:** Occupancy sensors switch off lighting 1050 hours/year | 1950 |

The PTO is calculated as follows:

**Energy Savings and Demand Reduction Calculation Example**

The energy savings were calculated as shown in the following example for the Residential Common Area measure, Multi-family building type, climate zone 6:

The demand reduction is calculated as follows:

Complete calculations are in 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 Mobile Home - Double-Wide | Occupancy Sensor | Misc.\_Commercial |
| Residential Multi-family | Occupancy Sensor | Misc.\_Commercial |

# Section 4. Costs

Material and labor costs are from WO017 [Attachment 2]. Material costs vary by the area (sq ft) covered by the occupancy sensor. For both measures it is assumed that the coverage area is 500 sq ft.

## 4.1 Base Case Cost

For REA measures, the base case cost is $0.

## 4.2 Measure Case Cost

Using the WO017 cost model, the equipment cost for an occupancy sensor covering 500 sq ft is $140.45. The labor required is 1.19 install hours at a rate of $71.25/hr, totaling $85.12. Miscellaneous costs of $6.73 are added to the labor cost for a final labor cost of $91.85. The full material and labor cost is $232.30.

## 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

For REA, the incremental cost is the full measure cost of $232.30.

**Full and Incremental Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| Occupancy Sensor (Res Common Area) Control | REA | $232.30 | $232.30 | N/A |

# Attachments

1. SCE17LG020.0 A1 - Calculation Template\_Final.xlsm
2. SCE17LG020.0 A2 – Costs.xlsm

# References

1. References\_12122016\_100741.xlsx

[26]

[382]

[493]

[496]