**Work Paper PGECOALL101**

**Occupancy Sensor Plug Load**

**Revision # 5**

**Pacific Gas & Electric Company**

**Customer Energy Solutions**

**Occupancy Sensor Plug Load**

**Measure Codes L65, PG068, PG069, PG070**

# At-a-Glance Summary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Applicable Measure Codes:** | **L65** | **PG068** | **PG069** | **PG070** |
| **Measure Description:** | Install plug load occupancy sensor in office or cubicle to control office equipment and task lighting when space is unoccupied. | Home Office Smart Power Strip | Home Office or Entertainment Center Smart Power Strip | Home Entertainment Center Smart Power Strip |
| **Energy Impact Common Units:** | each | each | each | each |
| **Base Case Description:** | No power strips or standard power strips where all the outlets are controlled with one manual switch. | No power strips or standard power strips where all the outlets are controlled with one manual switch. | No power strips or standard power strips where all the outlets are controlled with one manual switch. | No power strips or standard power strips where all the outlets are controlled with one manual switch. |
| **Base Case Energy Consumption:** | Varies | Varies | Varies | Varies |
| **Measure Energy Consumption:** | Varies | Varies | Varies | Varies |
| **Energy Savings**  **(Base Case – Measure):** | Source: Study - Office plug Load and Energy Savings Interventions [C]  0.02385 kW, 177.7 kWh,  -0.8223 therms | 24.6 kWh, 0.00429 kW,  -0.5779 therms | 24.8 kWh, 0.00443 kW,  -0.5832 therms | 25 kWh,  0.00455 kW,  -0.5885 therms |
| **Costs Common Units:** | each | each | each | each |
| **Base Case Equipment Cost ($/unit):** | $0 | $0 | $0 | $0 |
| **Measure Equipment Cost ($/unit):** | Source: Online Retailers [F]  $86.20  Source (DEER (2005-D03-857)  Labor cost: $35.00 | Source: Online Retailers [F]  $39.07  Source (DEER (2005-D03-857)  Labor cost: $35.00 | Source: Online Retailers [F]  $39.07  Source (DEER (2005-D03-857)  Labor cost: $35.00 | Source: Online Retailers [F]  $39.07  Source (DEER (2005-D03-857)  Labor cost: $35.00 |
| **Gross Measure Cost ($/unit)** | Downstream: $86.20  Direct Install: $121.20 | Direct Install: $74.07 | Direct Install: $74.07 | Direct Install: $74.07 |
| **Measure Incremental Cost ($/unit):** | Downstream: $86.20  Direct Install: $121.20 | Direct Install: $74.07 | Direct Install: $74.07 | Direct Install: $74.07 |
| **Effective Useful Life (years):** | Source: DEER2014  8 years | Source: DEER2014  8 years | Source: DEER2014  8 years | Source: DEER2014  8 years |
| **Measure Application Type:** | Retrofit Add-On (REA) | Retrofit Add-On (REA) | Retrofit Add-On (REA) | Retrofit Add-On (REA) |
| **Net-to-Gross Ratios:** | Source: DEER2014, Com-Default>2yrs  0.60 | Source: DEER2014, Res-Default>2  0.55 | Source: DEER2014, Res-Default>2  0.55 | Source: DEER2014, Res-Default>2  0.55 |
| **Important Comments:** |  |  |  |  |

**Work Paper SCE13CS002**

**Revision 2**

**Southern California Edison Company**

**Smart Power Strips**

At-a-Glance Summary

|  |  |
| --- | --- |
| **Applicable Measure Codes:** | *CS-43621; CE-56301; CE-57213; CE-69507; OE-49876* |
| **Measure Description:** | The replacement of standard power strips with smart and occupancy sensor power strips in home offices and home entertainment centers. |
| **Base Case Description:** | No power strips or standard power strips where all the outlets are controlled with one manual switch. |
| **Energy Impact Common Units:** | Per power strip |
| **Energy Savings :** | Refer to Excel Calculation Attachment |
| **Gross Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Measure Incremental Cost ($/unit):** | Refer to Excel Calculation Attachment |
| **Effective Useful Life (years):** | EUL = 8 |
| **Measure Application Type:** | Retrofit Add-On (REA) |
| **Net-to-Gross Ratios:** | NTG = 0.85 for direct-install measures. NTG’s vary between 0.55 and 0.6 for measures that are not direct-install-see Table 3. |
| **Important Comments:** | -See Document Revision History Rev #1 re OE-49876  -This work paper document does not contain a data set in conformance with the 4/1/14 CPUC Ex Ante Database Specification; SCE will provide that data set separately |

# Document Revision History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Workpaper and Revision # | Tech. Revision | MM/DD/YY | Author/Affiliation | Summary of Changes |
| SCE13CS002.0 | No | 2/12/2014 | Margaret Pigman/PL Energy | Original work paper draft for 2013-2014 program cycle.  -Updated version of 2010-2012 work paper WPSCNRCS002 |
| Brian O’Keefe/SCE – SP&TS – EEG | Updated the calculation template to the latest statewide collaboration workpaper |
| SCE13CS002.1 | Yes | 5/30/2014 | David Pruitt / PL Energy | -New template for 2014 program year.  - Included new Readi fields.  - Updated cost data for market accuracy.  - Updated Excel Calculator template using latest interactive effects values.  - Office measure, OE-49876, savings are estimated with a university study. Previously this measure was estimated with DEER 2005. |
| Jack Melnyk/SCE | -added background and description for the measures  -adds a note to section 1.4.2 Codes & Standards Analysis per CA Title 24 2013 ( effective July 1 2014) |
| SCE13CS002.2 | Yes | 8/28/2014 | Jason Wang/SCE | - Fixed kW savings to a per-strip value. |

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

This work paper details the replacement of standard power strips with smart and occupancy sensor power strips in home offices and home entertainment centers.

The purpose of a smart power strip is to prevent phantom power drain, which occurs when electronic devices continue to draw power even after they are supposedly turned off.

Like all electrical power strips, smart power strips have a bank of electrical outlets. They also have special circuitry that controls these outlets. When an electronic device goes into standby mode, it doesn't use as much power as it does when it is fully functioning. The circuitry in a smart power strip can detect this drop in power, so it disables the outlet and cuts off the device's power supply. Meanwhile, the rest of the outlets on the strip stay on. Smart power strips typically come with several outlets that can provide "always-on" current.

Occupancy sensor power strips have outlets that are controlled by a motion detector. Devices plugged into them can automatically turn off or on in response to your physical presence, or after a user-defined period of time elapses (e.g., anywhere from 30 seconds to 60 minutes).

The basecase is no power strip or standard power strips where all the outlets are controlled with one manual switch.

Table 1 Measure Names

|  |  |
| --- | --- |
| Solution Code | Measure name |
| CE-43621 | Home Office Smart Power Strip |
| CE-56301 | Home Office or Entertainment Center Smart Power Strip |
| CE-57213 | Home Office Occupancy Sensor Power Strip |
| CE-69507 | Home Entertainment Center Smart Power Strip |
| OE-49876 | Plug Load Occupancy Sensor Controls |

For solution codes CE-43621, CE-56301, CE-57213, and CE-69507 smart power strips and occupancy sensor power strips that are installed in home offices or home entertainment centers, as described in the measure name, are eligible for these measures. Upgrades in all California climate zones and in the following eight building types are eligible.

* Residential Single Family
* Residential Multi-family
* Residential Mobile Home - Double-Wide
* Education - Community College
* Education – University
* Lodging – Hotel
* Lodging - Guest Rooms
* Lodging – Motel

Solution code OE-49876 has the following eligibility requirements:

* The power strip must have passive infrared and/or ultrasonic detectors that turn plugged-in equipment off during no occupancy.
* The occupancy sensor timer delay adjustment must not exceed 30 minutes.
* Any non-controlled plugs should be used for devices such as PCs and fax machines.
* The plug load occupancy sensors must control electric equipment in offices or cubicles, or control shared copy machines and/or printers.
* The occupancy sensor should be capable of sensing in areas up to 300 feet and may not be installed in hallways, commons areas, bathrooms, and hotel or motel guest rooms
* Control sensing areas for multiple power strip occupancy sensors shall not overlap or coincide with each other.
* The sensor should be positioned correctly so that nearby foot traffic, other activity outside of work area, or other sources of light do not activate the power strip.
* The plug load sensors must control a minimum of 50 watts.
* Controlled equipment should include devices such as space heaters, fans, monitors, task lighting, speakers, and other equipment that can be turned off without disrupting operations.
* Eligible in Small and Large Office building types

## 1.2 Technical Description

The power consumed by an electronic device in standby or off mode is referred to as a vampire load. According to a 2008 technical brief conducted by the California Energy Commission’s Public Interest Energy Research (PIER) Program, vampire loads account for roughly 4% of the total household electricity used in California [[[1]](#endnote-1)]. Vampire loads can be eliminated if the user unplugs the device or turns the device’s power source off when the device is not in use. However, users typically leave electronic devices plugged into power sources (walls or power strips) and never unplug the devices or turn the power off. Households that do not turn off their power strips consume more power due to vampire loads than households that do turn off their power strips.

Smart power strips are energy-saving power strips where one outlet controls the power supplied to other outlets on the same strip. Smart power strips can automatically eliminate vampire loads of electronic peripheral devices that are not needed (computer printer, scanner, DVD player, etc.) when an electronic control device (personal computer or television) is in standby or off mode.

Occupancy sensor power strips are energy-saving power strips with occupancy sensors placed at desk level to determine occupancy. When the occupancy sensor detects that the occupant is not present for a predetermined amount of time, the power strip turns off the power to the outlets on the power strip identified as controlled outlets.

Vampire loads can be eliminated by manually shutting off a standard power strip or by unplugging the device(s). The percentage of households that can benefit from using smart power strips (they currently use wall outlets or power strips and leave power strips on) is 85.8% for home offices and 95.0% for home entertainment centers [[[2]](#endnote-2)].

## 1.3 Measure Application Type

The incentive delivery methods are the following:

• Financial Support / Down-Stream Incentive - Deemed

• Financial Support / Direct Install

• Financial Support / Giveaway

• Midstream Programs / Mid-Stream Incentive

• Partnership / Down-Stream Incentive - Deemed

• Partnership / Direct Install

• Partnership / Giveaway

The installation type for these measures is retrofit add-on (REA).

## 1.4 Measure and Base Case Cost Effectiveness Data

### 1.4.1 DEER Measure and Base Case Analysis

The differences from DEER are shown in Table 2 below.

Table 2 DEER Difference Summary

|  |  |
| --- | --- |
| DEER Difference Summary Table | |
| Modified DEER Methodology | No |
| Scaled DEER Measure | No |
| DEER Building Prototypes Used | No |
| Deviation from DEER | DEER does not contain home office or home entertainment center power strip measures. The most recent DEER measure for the office plug load power strips is DEER 2005. Therefore, non-DEER studies were used to estimate savings for all the solution code measures in this Workpaper. |
| DEER Version | Not Applicable |
| DEER Run ID and Measure Name (Sample) | Not Applicable |

**Net to Gross**

The NTG value was obtained from the “DEER2011\_NTGR\_2012-05-16.xls” on the DEER website as required by Version 5 of the California Public Utilities Commission (CPUC) Energy Efficiency Policy Manual [351]. The relevant NTGR for this measure is shown in Table 3 below.

Table 3 Net-to-Gross Ratio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NTGR\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | NTG\* |
| Res-Default>2 | All other EEM with no evaluated NTGR; existing EEM with same delivery mechanism for more than 2 years | Res | Any | All | 0.55 |
| 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 | All | 0.6 |
| Ind-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Ind | Any | All | 0.6 |
| Agric-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Ag | Any | All | 0.6 |
| Res-Default-HTR-di | All other EEM with no evaluated NTGR; direct install hard-to-reach only. | Res | Any | DirInstall | 0.85 |
| Com-Default-HTR-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Com | Any | DirInstall | 0.85 |
| Ind-Default-HTR-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Ind | Any | DirInstall | 0.85 |
| Agricult-Default-HTR-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Ag | Any | DirInstall | 0.85 |

\*Denotes that the column is taken from the DEER NTG Table.

Note that for the direct install delivery mechanism, a distinction between hard to reach and non-hard to reach markets will be made on a project by project basis. This work paper shows the NTG associated with a hard to reach direct install delivery mechanism and the residential/non-residential defaulted NTG value, where in fact, a measure offered through direct install and is not “hard to reach” will receive a default NTG value.

**Installation Rate**

The installation rate (IR) is identified in the calculation attachment. This value is obtained from the support table available in READi. Currently there is no versioning on the installation rate table. To address appropriate selection of the installation rate the date of the workpaper will serve as the last date checked for updated IR values. The installation rate varies by end use, sector, technology, application, and delivery method. The relevant IR values for this measure are shown in Table 4 below.

Table 4 Installation Rate

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GSIA\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | GSIAValue\* |
| Def-GSIA | Default GSIA Values | Any | Any | Any | 1 |

**Spillage Rate**

Spillage rate will also be applied to measures however the values will not be tracked in the workpapers. The spillage rate will be tracked in an external table to be supplied to the Energy Division.

**READi Technology Fields**

To support the development of the ED ex ante tables, select fields from the ex-ante database will be identified in the workpaper. For a full set of values associated with the measures in the workpaper refer the Excel calculation template.

Table 5 READi Tech IDs

|  |  |
| --- | --- |
| READi Field Name | Values included in this workpaper |
| Measure Case UseCategory | Appliances and Plug Loads |
| Measure Case UseSubCats | Consumer Electronics (CE-43621, CE-56301, CE-57213, CE-69507) and Office Equipment (OE-49876) |
| Measure Case TechGroups | Business and Consumer Electronics |
| Measure Case TechTypes | Occupancy Sensor Plug Strip (CE57213, OE-49876), Non-DEER (CE-43621, CE-56301, CE-69507) |
| Base Case TechGroups | Business and Consumer Electronics |
| Base Case TechTypes | Occupancy Sensor Plug Strip (CE57213, OE-49876), Non-DEER (CE-43621, CE-56301, CE-69507) |

### 1.4.2 Codes and Standards Analysis

There are no federal, state, or regional code requirements that apply to this measure for existing buildings. However, for new construction CA Title 24 2013 [355] effective July 1 2014 (Section 130.5(d) item 6 and related wording in Exception 1) occupancy sensored power strips are not allowed.

Table 6 Code Summary

|  |  |  |
| --- | --- | --- |
| Code | Applicable Code Reference | Effective Dates |
| Title 24 (2013) | 2013 Non-Residential Compliance manual | July 1, 2014 |

### 1.4.3 Non-DEER Study Review

## Non-Residential Measure Code OE-49876

A University of Idaho study [[[3]](#endnote-3)] was used to estimate the savings associated with the non-residential measure code. This study surveyed and monitored six office sites in Boise, Idaho. At the sites, total plug load energy was logged at the distribution panel level in order to obtain aggregate plug loads and profiles over time. This logging occurred for approximately 12 months to establish baseline consumption and a usage profile. After the baseline was established occupancy sensor plug strips were installed. The strips installed were WattStopper Isole IDP-3050 devices, which have six controlled outlets and two uncontrolled outlets. The strip turns power off to all the devices plugged into the controlled outlets when the sensor does not detect occupancy, via passive infrared technology. After the plug strips were installed, plug energy was again logged for three months to determine post-installation energy consumption.

## Residential Measure Codes CE-43621, CE-56301, CE-57213, CE-69507

An analysis of a 2008 Home Electronics Survey Summary Report [B] was used to estimate the savings for the residential measure codes. Along with the analysis in this workpaper, a review of a NYSERDA study (Advanced Power Strip Research Report, New York State Energy Research and Development Authority, Final Report August 2011) was conducted and compared to the methodology in this workpaper. The methodology of this work paper differs slightly from that of the NYSERDA study but is more appropriate in the current circumstances. First, the NYSERDA study includes DVRs and other equipment with built-in DVRs as peripherals for home entertainment centers. This is inappropriate because DVRs must be on all of the time to fulfill their function, so their energy consumption will not be affected by a smart power strip. Second, the NYSERDA study uses statistics about the prevalence of each peripheral to calculate savings. This work paper bases savings on how often each piece of equipment is in the same room as the control device because both units must be plugged into the same power strip to achieve energy savings. And finally, the last difference is the source of the data: this work paper is based on a California survey, whereas the NYSERDA study uses data from New York and from across the country.

### 1.4.4 Measure and Base Case Effective Useful Life

DEER14 update documentation provides EUL and RUL information to be used for the 2015 program cycle extension on [www.deeresources.com](http://www.deeresources.com). The DEER documentation “Summary of EUL-RUL Analysis for the April 2008 Update to DEER” provides the RUL value as a flat 1/3 of the EUL value. The RUL value will only be applied to the first baseline period for retrofit measures that have applicable code that will affect the energy savings. In all other installation types and retrofit with no applicable code that affects the energy savings, the RUL is not applicable to either the first or second baseline period.

To obtain the EUL value the DEER14 update documentation, EUL\_Summary\_10-1-08.xls [213], was consulted. Table 7 below identifies the value/methodology used for the measures in this work paper.

Table 7 DEER14 EUL Value/Methodology

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| READi EUL ID | Market | Enduse | Measure | EUL (Years) | RUL (Years) |
| Plug-OccSens | Non-Residential | Plug Loads | Occupancy Sensors | 8 | 2.7 |

# Section 2. Energy Savings & Demand Reduction Calculations

## The energy/demand savings for the non-residential and residential measure codes follow the methodology described below.

## Non-Residential Measure Code OE-49876

A University of Idaho study [C] was used to estimate the savings associated with the non-residential measure code. This study surveyed and monitored six office sites in Boise, Idaho. At the sites, total plug load energy was logged at the distribution panel level in order to obtain aggregate plug loads and profiles over time. This logging occurred for approximately 12 months to establish baseline consumption and a usage profile. After the baseline was established occupancy sensor plug strips were installed. After the plug strips were installed, plug energy was again logged for three months to determine post-installation energy consumption.

The energy usage savings per occupancy sensor plug was summarized in the study and is shown in Table 8 below:

Table 8 Summarized Plug Strip Energy Savings

|  |  |  |  |
| --- | --- | --- | --- |
| Plug strips used | Controlled devices | Controlled devices per strip | Average savings per plug strip |
| 33 | 108 | 3.27 | 163 kWh/yr |

The weekday demand was also summarized in the study. These summary results are used to estimate the DEER peak demand reduction savings for this Workpaper. This is shown in Table 9 below:

Table 9 Summarized Plug Strip Peak Demand Savings

|  |  |
| --- | --- |
| Average weekday demand savings | Average weekday demand savings per strip |
| 0.63 kW | 0.019 |

## Residential Measure Codes CE-43621, CE-56301, CE-57213, CE-69507

For the residential codes, this work paper bases savings on how often each piece of equipment is in the same room as the control device because both units must be plugged into the same power strip to achieve energy savings. This work paper is based on a California survey.

Smart power strips and occupancy sensor power strips eliminate vampire loads from peripheral electronic devices that can be shut off when a control device is in standby or off mode. Therefore the energy savings for a smart power strip is the sum of all the savings from turning off the peripheral devices. The energy savings from each peripheral device is calculated as follows:

EES = HOFF × [(STB × KWSTB) + (OFF × KWOFF)] × PCD × PPH

Where,

EES = average energy savings per peripheral per home

HOFF = annual hours controlling device is not used [B]

STB = percentage of time peripheral is in standby or left on and not used [B]

WSTB = power draw of peripheral while in standby [B, [[4]](#endnote-4)]

OFF = percentage time peripheral is turned off [B]

WOFF = power draw of peripheral while it is turned off [B, D]

PCD = percentage of time peripheral is used with a control device [B]

PPH = percentage of homes that have the peripheral in the same room as the control device [B]

The control device for a home office is a personal computer. Table 10 is a summary of the average savings per smart power strip used in a home office for each controlled peripheral. Of the home office equipment described in the 2008 Home Electronics Survey [B], only those pieces whose functionality is not compromised by being turned off are included as peripherals. For example, fax machines and multifunction printers with fax are not included.

Table 10 Home Office Electrical Energy Savings Summary

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Peripheral | HOFF | STB | WSTB | OFF | WOFF | PCD | PPH | EES |
|  | (h/yr) | (%) | (W) | (%) | (W) | (%) | (%) | (kWh/yr) |
| Printer | 7573 | 38% | 6.63 [[[5]](#endnote-5)] | 62% | 3.5 [E] | 90% | 50% | 15.92 |
| Multifunction Printer without Fax | 7573 | 47% | 7.85 [E] | 52% | 7.75 [E] | 99% | 4% | 2.31 |
| Router | 7573 | 86% | 5.36 [E] | 14% | 1.7 [D] | 98% | 12% | 4.32 |
| Modem | 7573 | 90% | 4.6 [E] | 10% | 2.7 [D] | 99% | 8% | 2.64 |
| Scanner | 7573 | 22% | 3.6 [D] | 78% | 2.1 [D] | 99% | 8% | 1.46 |
| Copier | 7573 | 26% | 2.8 [D] | 75% | 1.5 [D] | 97% | 5% | 0.68 |
| Computer speakers | 7573 | 10% | 3.7 [D] | 90% | 2.3 [D] | 100% | 1% | 0.18 |
| Flat Panel | 7573 | 0% | 1.9 [D] | 100% | 1.1 [D] | 100% | 1% | 0.08 |
| CRT | 7573 | 0% | 7.6 [D] | 100% | 1.5 [D] | 100% | 1% | 0.11 |
| External hard drive | 7573 | 13% | 7.4 [D] | 87% | 3 [D] | 100% | 1% | 0.27 |
| Total |  |  |  |  |  |  |  | 28.05 |

These calculations are presented more fully in the attached spreadsheet “Savings and cost derivations 2.xlsx”.

The total savings potential from using a smart power strip for a home office is the sum of the savings potential for the individual controllable peripherals in a home office. From Table 9 the total average savings per smart power strip in a home office is 28.05 kWh/yr.

According to the 2008 Home Electronics Survey [B], approximately 14.2% of computers are plugged into power strips that are turned off when the computer is not in use. To account for this fraction of people that would not save energy by using a smart power strip for a home office, a discount factor of 85.8% was applied final kWh number. See the “Savings and cost derivations 2.xlsx”[[[6]](#endnote-6)] spreadsheet for more information.

Final adjusted Home Office Energy Savings = 28.05 kWh/yr × 85.8%

Final adjusted Home Office Energy Savings = **24.08 kWh/yr**

The control device for a home entertainment center is a television. Table 11 is a summary of the average savings per smart power strip used in a home entertainment center for each controlled peripheral. Devices that are associated with home entertainment centers, such as DVRs, whose functions would be compromised by being turned off are not included as peripherals.

Table 11 Home Entertainment Center Electrical Energy Savings Summary

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Peripheral** | **HOFF** | **STB** | **KWSTB** | **OFF** | **KWOFF** | **PCD** | **PPH** | **EES** |
|  | (h/yr) | (%) | (W) | (%) | (W) | (%) | (%) | (kWh/yr) |
| DVD player | 7274 | 5% | 7.00 [D] | 95% | 3.00 [D] | 97% | 47% | 10.61 |
| Stereo or home theatre | 7274 | 6% | 6.50 [D] | 94% | 4.30 [D] | 87% | 23% | 6.45 |
| VCR player | 7274 | 10% | 6.00 [D] | 90% | 3.00 [D] | 99% | 20% | 4.75 |
| Video game console | 7274 | 8% | 56.81 [D] | 92% | 1.59 [D] | 99% | 5% | 2.16 |
| Speakers or subwoofer | 7274 | 5% | 10.99 [E] | 95% | 11.07 [E] | 99% | 2% | 1.59 |
| Computer (for video or music) | 7274 | 0% | 11.60 [D] | 100% | 3.30 [D] | 99% | 1% | 0.24 |
| Total |  |  |  |  |  |  |  | 25.81 |

The total savings potential from using a smart power strip in a home entertainment center is the sum of the savings potential of the individual peripherals. Table 11 shows that the total average savings per smart power strip in a home entertainment center is 25.81 kWh/yr.

According to the 2008 Home Electronics Survey [B], approximately 5.0% of TVs are plugged into power strips that are turned off when the television is not in use. To account for this fraction of people that would not save energy by using a smart power strip for a home entertainment center, a discount factor of 95.0% was applied final kWh number. See the “Savings and cost derivation.xls” [F] spreadsheet for more information.

Final adjusted Home Entertainment Center Energy Savings = 25.81 kWh/yr × 95.0%

Final adjusted Home Entertainment Center Energy Savings = **24.52 kWh/yr**

The actual energy savings will be affected by the interactive effects for a specific climate zone, but the base energy savings for the four residential solution codes are shown in Table 12 below. For CE-56301, the savings is the average of the home office and home entertainment center values.

Table 12 Energy Savings excluding Interactive Effects by Solution Code

|  |  |  |
| --- | --- | --- |
| Solution Code | Description | Energy Savings\* (kWh/yr) |
| CE-43621 | Home Office Smart Power Strip | 24.08 |
| CE-56301 | Home Office or Entertainment Center Smart Power Strip | 24.30 |
| CE-57213 | Home Office Occupancy Sensor Power Strip | 24.08 |
| CE-69507 | Home Entertainment Center Smart Power Strip | 24.52 |

\* Energy savings excluding interactive effects

## Demand Reduction Estimation Methodologies

Smart power strips and occupancy sensor power strips produce savings during the time that controlling devices are not in use. This includes the peak demand period of summer weekdays from 2:00 PM to 5:00 PM. The on-peak demand reduction is estimated as the annual energy savings divided by the hours the control device is off per year. The demand reduction for a particular climate zone is also influenced by interactive effects, but the general demand reduction for each solution code is shown in Table 13 below. For CE-56301, the savings is the average of the home office and home entertainment center values.

Table 13 Demand Reduction excluding Interactive Effects by Solution Code

|  |  |  |  |
| --- | --- | --- | --- |
| Solution Code | Description | HOFF | Demand Reduction\* (kW) |
| CE-43621 | Home Office Smart Power Strip | 7573 | 0.00318 |
| CE-56301 | Home Office or Entertainment Center Smart Power Strip | N/A | 0.00328 |
| CE-57213 | Home Office Occupancy Sensor Power Strip | 7573 | 0.00318 |
| CE-69507 | Home Entertainment Center Smart Power Strip | 7274 | 0.00337 |

\* Demand reduction excluding interactive effects

# Section 3. Load Shapes

The difference between the base case load shape and the measure load shape would be the most appropriate load shape; however, only end-use profiles are available. Therefore, the closest load shape chosen for the home office and home entertainment center measures is the DEER:RefgFrzr\_HighEff load shape. The closest load shape chosen shape for the office measure (OE-49876) and Home Office Occupancy Sensor (CE-57213) is the Occupancy Sensor load shape. See Table 14 for a list of all Building Types and Load Shapes. See the KEMA report [31] for a more thorough discussion regarding the load shapes for this measure.

Table 14 Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| Building Type | E3 Alt. Building Type | Load Shape |
| Assembly | Misc.\_Commercial | Occupancy Sensor |
| Education - Primary School | K\_thru\_12\_School | Occupancy Sensor |
| Education - Secondary School | K\_thru\_12\_School | Occupancy Sensor |
| Education - Relocatable Classroom | K\_thru\_12\_School | Occupancy Sensor |
| Education - Community College | K\_thru\_12\_School | Occupancy Sensor |
| Education - University | K\_thru\_12\_School | Occupancy Sensor |
| Grocery | Misc.\_Commercial | Occupancy Sensor |
| Food Store | Misc.\_Commercial | Occupancy Sensor |
| Health/Medical - Hospital | Misc.\_Commercial | Occupancy Sensor |
| Health/Medical - Nursing Home | Misc.\_Commercial | Occupancy Sensor |
| Health/Medical - Clinic | Small\_Office | Occupancy Sensor |
| Lodging - Hotel | Hotel\_Motel | Occupancy Sensor |
| Lodging - Motel | Hotel\_Motel | Occupancy Sensor |
| Manufacturing - Bio/Tech | Industrial | Occupancy Sensor |
| Manufacturing - Light Industrial | Industrial | Occupancy Sensor |
| Industrial | Industrial | Occupancy Sensor |
| Misc - Commercial | Misc.\_Commercial | Occupancy Sensor |
| Office - Large | Large\_Office | Occupancy Sensor |
| Office - Small | Small\_Office | Occupancy Sensor |
| Restaurant - Fast-Food | Misc.\_Commercial | Occupancy Sensor |
| Restaurant - Sit-Down | Misc.\_Commercial | Occupancy Sensor |
| Retail - Multistory Large | Large\_Retail\_Store | Occupancy Sensor |
| Retail - Single-Story Large | Large\_Retail\_Store | Occupancy Sensor |
| Retail - Small | Small\_Retail\_Store | Occupancy Sensor |
| Storage - Conditioned | Misc.\_Commercial | Occupancy Sensor |
| Storage - Unconditioned | Misc.\_Commercial | Occupancy Sensor |
| Transportation - Communication - Utilities | Trans\_Comm\_Util | Occupancy Sensor |
| Warehouse - Refrigerated | Misc.\_Commercial | Occupancy Sensor |
| Education - Community College | RES | DEER:RefgFrzr\_HighEff |
| Education - University | RES | DEER:RefgFrzr\_HighEff |
| Lodging - Hotel | RES | DEER:RefgFrzr\_HighEff |
| Lodging - Guest Rooms | RES | DEER:RefgFrzr\_HighEff |
| Lodging - Motel | RES | DEER:RefgFrzr\_HighEff |
| Residential Single Family | RES | DEER:RefgFrzr\_HighEff |
| Residential Multi-family | RES | DEER:RefgFrzr\_HighEff |
| Residential Mobile Home - Double-Wide | RES | DEER:RefgFrzr\_HighEff |

# Section 4. Base Case & Measure Costs

## 4.1 Base Case Cost

The assumed base case is no smart power strip. Therefore, the base case cost is zero, or not applicable, as reported in the DEER08 Revised Measure Cost Summary [215].

## 4.2 Measure Case Cost

As the occupancy sensor measures are of the REA type, the measure case cost is the sum of the measure material cost and the installation labor cost. As the installation of a power strip is simple and can easily be performed by the homeowner, the installation labor cost is assumed to be zero. Material costs were found for 8-10 outlet smart and occupancy power strips as shown in Table 15 below. The cost of the power strips were found on internet commerce sites. The sources are listed in the spreadsheet “Savings and cost derivation.xls” [F].

Table 15 Advanced Power Strip Costs

|  |  |  |  |
| --- | --- | --- | --- |
| **Supplier** | **Manufacturer** | **Type** | **Cost/Strip** |
| Walmart | Bits Limited Model #LCG3 | Smart – 10 outlets | $46.99 |
| Home Depot | Belkin Item #F7C007 | Smart – 8 outlets | $32.97 |
| Amazon | Belkin Item #F7C007 | Smart – 8 outlets | $37.24 |
| Platt Electric Supply | Watt Stopper | Occupancy – 8 outlets | $92.81 |
| 1000Bulbs | Watt Stopper | Occupancy – 8 outlets | $79.59 |

Therefore, the average measure cost for both the smart power strip and the occupancy sensor strip is shown below in Table 16:

Table 16 Measure Case Cost by Solution Code

|  |  |  |
| --- | --- | --- |
| Solution Code | Description | Gross Measure Cost ($) |
| CE-43621 | Home Office Smart Power Strip | 39.07 |
| CE-56301 | Home Office or Entertainment Center Smart Power Strip | 39.07 |
| CE-57213 | Home Office Occupancy Sensor Power Strip | 86.20 |
| CE-69507 | Home Entertainment Center Smart Power Strip | 39.07 |
| OE-49876 | Plug Load Occupancy Sensor Controls | 86.20 |

## 4.3 Gross and Incremental Measure Cost

### 4.3.1 Gross Measure Cost

As this is an REA measure, the gross measure cost (GMC) is equal to:

*GMC = Measure Equipment Cost + Measure Labor Cost*

These measure costs are presented in Table 15 and discussed in Section 4.2 above.

### 4.3.2 Incremental Measure Cost

As this is an REA measure, the incremental measure cost is equal to the gross measure cost. These costs are shown in Table 16 above.

# References

31,213, 215, 351

# Appendix A – SCE/ED Application Types

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SCE Program Type | ED Application Type | 1st Baseline Savings | 2nd Baseline Savings | 1st Baseline Cost | 2nd Baseline Cost | 1st Baseline Life | 2nd Baseline Life |
| New | New Construction (Nc) | Above Code/Standard | N/A | Incremental Cost | N/A | EUL | 0 |
| Replace on Burnout (ROB) | Replace on Burnout (Rob)/Normal Replacement (NR) | Above Code/Standard | N/A | Incremental Cost | N/A | EUL | 0 |
| Retrofit (RET) | Early Replacement (ER) | Above Cust. Existing | Above Code/Standard | Full Cost | Incremental Cost | RUL | EUL-RUL |
| Retrofit – First Baseline Only (REF) | Early Replacement RUL (ErRul) | Above Cust. Existing | N/A | Full Cost | N/A | EUL | 0 |
| Retrofit Add-on (REA) | N/A | Above Cust. Existing | N/A | Full Cost | N/A | EUL | 0 |

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2. Hiner and Partners. Statewide Home Electronics Assessment Survey. October 2008. [↑](#endnote-ref-2)
3. Brad Acker, Carlos Duarte and Devin Van Den Wymelenberg, University of Idaho. Office Space Plug Load Profiles and Energy Savings Interventions. 2012 ACEEE Summer Study on Energy Efficiency in Buildings (see Attachment #2). [↑](#endnote-ref-3)
4. New York State Energy Research and Development Authority. Advanced Power Strip Research Report. August 2011. [↑](#endnote-ref-4)
5. Lawrence Berkeley National Laboratory. Developing and Testing Low Power Mode Measurement Methods. September 2005. <http://www.energy.ca.gov/reports/2004-10-13_500-04-057.PDF>. [↑](#endnote-ref-5)
6. Savings and cost Excel spreadsheet (see Attachment #3). [↑](#endnote-ref-6)