Work Paper SCE13CS002

**Revision 3**

**Southern California Edison**

**Smart Power Strips**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **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. |
| **Units** | Per power strip |
| **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** | EUL = 8 |
| **Measure Installation Type** | Retrofit Add-On (REA) |
| **Net-to-Gross Ratio** | 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** | 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 | 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 |
| 1 | 6/19/2014 | 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  -Added a note to section 1.4.2 Codes & Standards Analysis per CA Title 24 2013 ( effective July 1 2014) |
| 2 | 8/28/2014 | Jason Wang/SCE | - Fixed kW savings to a per-strip value. |
| 3 | 01/25/16 | Ajay Wadhera/Solaris | -New template update for 2016 program year  -WP effective from 1/1/2016 thru 12/31/2016  -Removed SCE building types (Agr, FSt, Cli, Ind, MiC, TCU)  -No value modifications |

# 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 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.

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | The replacement of standard power strips with smart and occupancy sensor power strips in home offices and home entertainment centers. |
| Existing Condition | No power strips or standard power strips where all the outlets are controlled with one manual switch. |
| Code/Standard | N/A |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
| N/A | N/A | CE-43621 | N/A | Home Office Smart Power Strip |
| N/A | N/A | CE-56301 | N/A | Home Office or Entertainment Center Smart Power Strip |
| N/A | N/A | CE-57213 | N/A | Home Office Occupancy Sensor Power Strip |
| N/A | N/A | CE-69507 | N/A | Home Entertainment Center Smart Power Strip |
| N/A | N/A | OE-49876 | N/A | 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 Installation Types and Delivery Mechanisms

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).

**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** |
| 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. |
| 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.* |
| Partnership | The program implements projects through a partnership between the utility and an institutional, government, or community-based organization. |

**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. |
| Giveaway | The program provides customers with energy efficiency equipment or services for free. |
| Mid-Stream Incentive  Mid-Stream Buy Down | The program gives a financial incentive to a midstream market actor (distributor, vendor, or retailer) to encourage the promotion of efficient measures. Buy Down means that the incentive is required to be passed down to the end-use 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 | No |
| DEER Operating Hours | No |
| DEER eQUEST Prototypes | No |
| DEER Version | N/A |
| Reason for 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 work paper. |
| 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** |
| 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 |

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 ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| Plug-OccSens | Non-Residential | Plug Loads | Occupancy Sensors | 8 | 2.7 |

### 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.

Code Summary

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

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

### 1.5.1 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.

## 1.6 Data Quality and Future Data Needs

N/A

# Section 2. Calculation Methodology

## 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 below:

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 work paper. This is shown in table below:

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 below 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.

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 below 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.

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 above 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 below. For CE-56301, the savings is the average of the home office and home entertainment center values.

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 below. For CE-56301, the savings is the average of the home office and home entertainment center values.

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 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 |
| Health/Medical - Hospital | Occupancy Sensor | Misc.\_Commercial |
| Health/Medical - Nursing Home | Occupancy Sensor | Misc.\_Commercial |
| Health/Medical - Clinic | Occupancy Sensor | Small\_Office |
| Lodging - Hotel | Occupancy Sensor | Hotel\_Motel |
| Lodging - Motel | Occupancy Sensor | Hotel\_Motel |
| Manufacturing - Bio/Tech | Occupancy Sensor | Industrial |
| Manufacturing - Light Industrial | Occupancy Sensor | Industrial |
| 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 |
| Education - Community College | DEER:RefgFrzr\_HighEff | RES |
| Education - University | DEER:RefgFrzr\_HighEff | RES |
| Lodging - Hotel | DEER:RefgFrzr\_HighEff | RES |
| Lodging - Guest Rooms | DEER:RefgFrzr\_HighEff | RES |
| Lodging - Motel | DEER:RefgFrzr\_HighEff | RES |
| Residential Single Family | DEER:RefgFrzr\_HighEff | RES |
| Residential Multi-family | DEER:RefgFrzr\_HighEff | RES |
| Residential Mobile Home - Double-Wide | DEER:RefgFrzr\_HighEff | RES |

# Section 4. 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 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].

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 below:

Measure Case Cost by Solution Code

|  |  |  |
| --- | --- | --- |
| **Solution Code** | **Description** | **Full 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 Full and Incremental Measure Cost

As this is an REA measure, the incremental measure cost is equal to the full measure cost. These costs are shown in section 4.2.

**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** |
| Home Office Smart Power Strip | REA | 39.07 | 39.07 | N/A |
| Home Office or Entertainment Center Smart Power Strip | REA | 39.07 | 39.07 | N/A |
| Home Office Occupancy Sensor Power Strip | REA | 86.20 | 86.20 | N/A |
| Home Entertainment Center Smart Power Strip | REA | 39.07 | 39.07 | N/A |
| Plug Load Occupancy Sensor Controls | REA | 86.20 | 86.20 | N/A |

# Attachments

1. 
2. 
3. 

# References



[215]

[355]

1. California Energy Commission’s Public Interest Energy Research Program Technical Brief. Energy Use of Household Electronics: Taming the Wild Growth. September 2008. http://www.energy.ca.gov/2008publications/CEC-500-2008-064/CEC-500-2008-064-FS.PDF (site accessed 10/21/10). [↑](#endnote-ref-1)
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)