Work Paper SCE13CS009

**Revision 2**

**Southern California Edison**

**Energy Star Blu-Ray/DVD Players**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | CE-97456 Energy Star 3.0 plus 35% Blu-Ray player  CE-22951 Energy Star 3.0 plus 35% DVD player  CE-52533 Energy Star 3.0 plus 25% Blu-Ray player  CE-38563 Energy Star 3.0 plus 25% DVD player |
| **Measure Description** | Energy Star 3.0 qualified Blu-Ray/DVD players that that consume either 25% or 35% less energy than the baseline energy usage |
| **Base Case Description** | Energy Star 3.0 qualified Blu-ray/DVD players |
| **Units** | Per unit |
| **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** | 3 years |
| **Measure Installation Type** | Replace on Burnout (ROB) |
| **Net-to-Gross Ratio** | 0.70 (All-Default<=2yrs) |
| **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 | 04/25/2012 | Akane Karasawa/AESC | Original work paper for 2013 PC |
| 1 | 02/25/2014 | Akane Karasawa/AESC | -IE and Energy Star requirements update.  -kW and kWh Savings updated with new requirements |
| 3/17/2014 | Cassie Cuaresma/SCE | - Work paper updated for reporting period, effective 7/1/2014 – 12/31/2014. |
| 2 | 01/28/2016 | Ajay Wadhera/Solaris | -New template update for 2016 program year  -WP effective from 1/1/2016 thru 12/31/2016  -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

## Measure Description & Background

The measures in this work paper are for the purchase of Blu-Ray/DVD players that that consume either 25% or 35% less energy than the baseline energy usage, which was calculated based on the maximum allowable power levels stated in the Energy Star version 3.0 requirements for audio/video equipment. The eligible Base case units are Blu-Ray/DVD players that are compliant with Energy Star version 3.0 requirements, which include stand-alone DVD and Blu-Ray players. Home Theater Systems, which include a Blu-Ray or a DVD player, do not qualify for this measure. Energy Star requirements are detailed below in Section 1.2. Table below shows the measures included in this work paper.

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | Energy Star 3.0 qualified Blu-Ray/DVD players that that consume either 25% or 35% less energy than the baseline energy usage |
| Existing Condition | Energy Star 3.0 qualified Blu-ray/DVD players |
| 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-97456 | N/A | Energy Star 3.0 + 25% DVD player |
| N/A | N/A | CE-22951 | N/A | Energy Star 3.0 + 35% DVD player |
| N/A | N/A | CE-52533 | N/A | Energy Star 3.0 + 25% Blu-Ray player |
| N/A | N/A | CE-38563 | N/A | Energy Star 3.0 + 35% Blu-Ray player |

This measure only applies to Residential building types, which are Residential Mobile Home - Double-Wide, Residential Multi-family, and Residential Single-family. For the Residential Multi-Family building type, only DVD and Blu-ray players in the dwelling area were considered, as the units in the common area may have different operating hours.

## Technical Description

In order to be eligible for these measures, a Blu-Ray/DVD player must be an Energy Star version 3.0 qualified product and consume at least 25% or at least 35% less energy than the baseline energy usage calculated based on the maximum allowed power levels stated in the Energy Star version 3.0 requirements [376]. Compliance with Energy Star Version 2.0 is also required for base case products. The maximum energy usage levels for Energy Star, Energy Star + 25%, and Energy Star +35% used to determine the eligibility of the product is listed below in table below. A detailed description of the power consumption limit used to derive the energy usage for each case can be found in Section 2.

Qualifying Base and Measure Case Annual Usage Levels for Blu-Ray and DVD players

|  |  |  |  |
| --- | --- | --- | --- |
| **Product** | **Qualifying Annual Usage Level [kWh/yr]** | | |
| **Baseline** | **Energy Star + 25%** | **Energy Star + 35%** |
| DVD player | ≤ 13.71 | ≤ 10.28 | ≤ 8.91 |
| Blu-Ray player | ≤ 22.81 | ≤ 17.11 | ≤ 14.83 |

In addition to meeting the annual energy usage requirements, Blu-Ray and DVD players must offer Auto Power Down (APD) functionality and must meet the power consumption limit at each mode of operation (On, Idle, and Sleep) as shown in the following tables. The limits specified in the tables below are additive. Therefore, the maximum power consumption for a device at each operating mode is the sum of the limits for all applicable product functions of the device.

ENERGY STAR Version 3 Auto Power Down Requirements

|  |  |  |
| --- | --- | --- |
| **Product Function** | **Requirement** | |
| Default Auto Power Down | Default Timing <= 2 Hours |
| Available Auto Power Down Settings | If APD timing is set by default to no more than 30 minutes and APD cannot be disabled or increased to greater than 30 minutes, product does not have to meet Idle state power consumption requirements. |

ENERGY STAR Version 3 Sleep Mode Power Consumption Limits

|  |  |
| --- | --- |
| **Product Function** | **Power Limit (W)** |
| Base (All Products) | 1.0 |
| In-use Networking / Control Protocol (Wake / Sleep Capability Only) | 1.0 |
| In-use Wi-Fi or Gigabit Ethernet Protocols with Wake Capability (Applied to Either Wi-Fi or Gigabit Ethernet, but Not Both Simultaneously) | 2.0 |

ENERGY STAR Version 3 On Mode Power Base Allowances Consumption Limits

|  |  |
| --- | --- |
| **Product Function** | **Playback Power Limit (W)** |
| Standard Definition (SD) or Audio Source Optical Disc Player | 6.0 |
| SD Source to HD Output "Upconversion" Optical Disc Player | 10.0 |
| High Definition (HD) Source Optical Disc Player | 10.5 |

ENERGY STAR Version 3 On Mode Power Function Allowances Consumption Limits

|  |  |  |
| --- | --- | --- |
| **Product Function** | **Power Limit (W)** | |
| High Resolution Display | *PON = 6\*(R) + 0.05\*(A) + 3*  Where:  *R* = Display resolution *(x \* y)*  in megapixels  *A* = Viewable screen area  in square inches | |
| In-use Networking/Control Protocols | 1.0 | |
| In-use Wi-Fi or Gigabit Ethernet Protocols (Applied to Either Wi-Fi or Gigabit Ethernet, but Not Both Simultaneously) | 2.0 | |
| Audio Amplification  *Where:*  *POUT is the output power at 1/8 MUP with 1kHz sinusoidal input* | *POUT* <= 50 watts | 5.0 |
| *POUT* > 50 watts | 0.1 x *POUT* |

ENERGY STAR Version 3 Idle State Power Consumption Limits

|  |  |  |
| --- | --- | --- |
| **Product Function** | **Power Limit (W)** | |
| Base (All Products) | 5.0 | |
| In-use Networking/Control Protocols | 1.0 | |
| In-use Wi-Fi or Gigabit Ethernet Protocols (Applied to Either Wi-Fi or Gigabit Ethernet, but Not Both Simultaneously) | 2.0 | |
| Audio Amplification  *Where:*  *POUT is the output power at 1/8 MUP with 1kHz sinusoidal input* | *POUT* <= 50 watts | 5.0 |
| *POUT* > 50 watts | 0.1 x *POUT* |

Amplifier efficiency requirements are added in Energy Star version 3.0, which are summarized in table below.

ENERGY STAR Version 3 Amplifier Efficiency Requirements

|  |  |
| --- | --- |
| **Amplifier Input Power at 1/8 MUP with 1kHz Sinusoidal Input, *PIN*** | **Minimum Amplifier Efficiency, *η*** |
| *PIN* < 20 | N/A |
| 20 ≤ *PIN* < 100 | 0.44 |
| *PIN ≥ 100* | 0.55 |

## Installation Types and Delivery Mechanisms

The program/install type for the above measures is:

* Replace on Burn-out (ROB)

The delivery method that is available for the measures is:

* Midstream Programs / Mid-Stream Incentive

**Installation Type Descriptions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Installation Type** | **Savings** | | **Life** | |
| 1st Baseline (BL) | 2nd BL | 1st BL | 2nd BL |
| Replace on Burnout (ROB) | Above Code or Standard | N/A | EUL | N/A |

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** |
| Mid-Stream Programs | *See Mid-Stream Incentive in the Incentive Method Descriptions table.* |

**Incentive Method Descriptions**

|  |  |
| --- | --- |
| **Incentive Method** | **Description** |
| 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

This specific measure is not included in the Database for Energy Efficient Resources (DEER) 2014 version 4.0 [49], either non-residential or residential. Furthermore, DEER does not include any measures that describe savings for Blu-Ray/DVD payers.

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 this type of measure. |
| 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** |
| All-Default<=2yrs | All other EEM with no evaluated NTGR; new technology in program for 2 or fewer years | All | Any | All | 0.70 |

**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.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| AppPlug-AllEquip-BRDVD | Energy Star Blu-Ray/DVD Equipment | Res | AppPlug | 3 | 1 |

### 1.4.2 Codes and Standards Analysis

This measure is governed by Title-20 “Appliance Efficiency Regulations” [51], which mandates Digital Versatile Disc Players and Digital Versatile Disc Recorders to have a power usage not greater than 3 watts in video standby-passive mode.

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 20 (2012) | Section 1605.3(v)(1) Table V-1 | January 1,2006 |

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

### 1.5.1 Non-DEER Study Review

The 2007 TIAX report, commissioned by the Consumer Electronics Association [380] was referenced to obtain the estimated hours of operation for Blu-ray and DVD players.

## 1.6 Data Quality and Future Data Needs

N/A

# Section 2. Calculation Methodology

The baseline energy consumptions were derived from the Energy Star version 3.0 Product Specification for Audio/Video equipment [376]. The baseline power limits were chosen so that the most conservative savings estimate will result. This was accomplished by determining the most common product functions for DVD and Blu-Ray players. The Energy Star product list includes DVD and Blu-Ray products from several manufacturers. The most common product functions among all listed DVD and Blu-Ray products determined the baseline product functions. Table below summarizes the most common product functions and their corresponding power limits. It was assumed that the On/Active Mode power draw was based on the video playback. This yields a conservative estimate because the power draw for video playback is greater than audio playback.

Baseline Power Draws

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Mode** | **Function** | **Power Limit [W]** | **Power Limit per Mode [W]** | **Assumptions** |
| DVD player | **On** | Standard Definition (SD) Source | 6 | **6** | No High Resolution Display, Network/Control Protocol Device, or Audio Amplification |
| **Idle** | Base | 5 | **5** | No Network/Control Protocol Device, Wi-Fi/Gigabit Ethernet Protocols, or Audio Amplification |
| **Sleep** | Base | 1 | **1** | No Network/Control Protocol or Wi-Fi/Gigabit Ethernet Protocols |
| Blu-Ray player | **On** | High Definition (HD) Source  In-use Wi-Fi or Gigabit Ethernet Protocols | 10.5  2 | **12.5** | No High Resolution Display, Network/Control Protocol Device, or Audio Amplification |
| **Idle** | Base | 5 | **5** | No Network/Control Protocol Device, Wi-Fi/Gigabit Ethernet Protocols, or Audio Amplification |
| **Sleep** | Base | 1 | **1** | No Network/Control Protocol or Wi-Fi/Gigabit Ethernet Protocols |

The measure case power consumptions were derived from the Energy Star 3.0 Qualified Products List [378]. Blu-Ray and DVD players were categorized into base case and core measures by their estimated annual power consumptions. The average was taken within those categories to determine the measure case power draw at each mode. Home Theater Systems, which include a Blue-Ray or a DVD player, do not qualify for this measure and were excluded from the average. The table below summarizes the difference in the calculated baseline and measure case power draws.

Energy Star Version 3.0 Qualified Products Average Power Draws

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Description** | **Power Draw [W]** | | |
| **On** | **Idle** | **Sleep** |
| DVD player | Energy Star 3.0 | 6 | 5 | 1 |
| Energy Star 3.0 + 25% | 5.24 | 4.16 | 0.59 |
| Energy Star 3.0 + 35% | 4.03 | 3.00 | 0.38 |
| Blu-Ray player | Energy Star 3.0 | 12.5 | 5 | 1 |
| Energy Star 3.0 + 25% | 8.71 | 6.79 | 0.29 |
| Energy Star 3.0 + 35% | 5.95 | 3.47 | 0.20 |

The estimated hours of operation for each usage mode were derived from a 2007 TIAX report, commissioned by the Consumer Electronics Association [380]. It was assumed that Blu-Ray players have approximately the same usage hours as DVD/VCR combination units because Blu-Ray players can also play DVDs and often come with additional features (i.e. networking and streaming capabilities). The estimated hours of usage were used to calculate both base and measure Blu-Ray/DVD players’ annual energy usage. The table below summarizes the usage estimates that were established from the aforementioned reference.

Blu-Ray and DVD Players Usage Estimates

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Usage  [hours/year] | Type | Usage Mode | | | Total |
| **On** | **Idle** | **Sleep** |
| DVD players | 270 | 900 | 7,590 | 8,760 |
| Blu-Ray players\* | 425 | 900 | 7,435 | 8,760 |

\*Estimated from the DVD/VCR combination unit’s operating hours from the TIAX report [380].

**Energy Savings**

Annual energy savings for consumer electronic equipment is typically calculated by comparing the annual electricity consumption (AEC) of the base equipment and the measure equipment. In order to calculate the total AEC for Blu-Ray/DVD players, the average power draw in three modes (On, Idle, and Sleep) is multiplied by the corresponding hours of usage. Total energy use in each mode is then summed to calculate total energy consumption:

*AEC (kWh/yr) = (PActive \* TActive) + (PIdle\* TIdle)* + *(PSleep \* TSleep)*

*Where P = Power draw (W) and T = operating hours (hours per year)*

The energy savings were calculated by subtracting the measure energy use from base case energy use. Sample calculations are shown below.

An example calculation for Energy Star 3.0 DVD player replacing Energy Star 3.0 + 25% DVD player is as follows:

* 1. Base case = (0.006 kW \*270 hours/yr + 0.005 kW\*900 hour/yr + 0.001 kW \* 7590 hours/year) = 13.71 kWh / year.
  2. Measure case = (0.00524 kW \*270 hours/yr + 0.00416 kW\*900 hour/yr + 0.00059 kW \* 7590 hours/year) = 9.60 kWh / year.
  3. Energy Savings (Base – Measure) = 13.71 kWh/yr – 9.60 kWh/yr = 4.11 kWh/yr

**Demand Reduction**

The load reduction that the electrical utility grid will experience is determined by the coincident diversity factor the demand interactive effects. The coincident diversity factor is an estimate of the percent of the total load of a certain technology that is operating during the peak period. This can vary greatly based on usage patterns and differs by building type and market sector.

The demand interactive effects are an estimate of the additional demand reduction resulting from avoided air conditioning load because of reduced internal gains from decreased equipment load. The demand difference is multiplied by the coincident diversity factor and the demand interactive effects to determine the load reduction that the utility grid will experience during peak periods.

The residential coincident diversity factor varies based on climate zone, and the values used in the attached calculations represent the most recent numbers available for DEER 2014. This may be conservative, as DVD and Blu-Ray players may be on and idle more during the peak daytime period than lights.

The non-coincident average annual demand was determined by dividing the annual energy usage by 8760 hours per year. Coincident Demand Reduction is estimated using the following equation:

*Coincident Demand Savings (kW) = Coincident Diversity Factor \* Non-coincident Demand Savings (w/ Interactive effects)*

Table below shows both the non-coincident average annual demand for each measure in climate zone 9 along with the coincident demand savings.

Demand Reduction

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure Name** | **Base Case**  **Non-Coincident Annual Demand (kW/yr)** | **Measure Case Non-Coincident Annual Demand (kW/yr)** | **Non-Coincident Demand Savings (kW/yr)** | **Coincident Diversity Factor** | **Coincident Demand Savings (kW/yr)** |
| Energy Star 2.0 + 25% DVD player | 0.00157 | 0.00110 | 0.00047 | 0.045 | 0.0000211 |
| Energy Star 2.0 + 35% DVD player | 0.00157 | 0.00076 | 0.00081 | 0.045 | 0.0000364 |
| Energy Star 2.0 + 25% Blu-Ray player | 0.00197 | 0.00136 | 0.00060 | 0.045 | 0.0000272 |
| Energy Star 2.0 + 35% Blu-Ray player | 0.00197 | 0.00081 | 0.00115 | 0.045 | 0.0000519 |

**Interactive Effects**

The savings shown in Section 2 are subject to interactive effects in a residential building type. To estimate the interactive effects for both energy and demand, an analysis of the residential CFL interactive effects was done from DEER 2014. The DEER interactive effects factors were applied to all energy and demand savings. An estimation of negative therms was also made.

An example calculation of the application of interactive effects:

1. *An annual kWh savings of 4.11 kWh and Coincident demand savings of 0.0000211 kW for Energy Star 3.0 DVD player + 25% measure, with an energy interactive effects factor of 1.09, demand interactive effects factor of 1.43, and therm interactive effects factor of -0.02 for CZ 9.*
2. *Total kWh savings = 4.11 x 1.09 = 4.47 kWh*
3. *Total kW demand reduction = 0.0000211\* 1.43 = 0.0000302 kW*

*Total therm savings = 4.11 kWh \* (-0.02) = -0.145 therm*

# 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 | DEER:Indoor\_CFL\_Ltg | RES |
| Residential Multi-family | DEER:Indoor\_CFL\_Ltg | RES |
| Residential Single Family | DEER:Indoor\_CFL\_Ltg | RES |

# Section 4. Costs

## 4.1 Base Case Cost

Base case cost for this measure is the cost for Energy Star 3.0 qualified Blu-Ray and DVD players. The equipment cost may vary widely by manufacturer and model. See Section 4.2 for further information.

## 4.2 Measure Case Cost

Blu-Ray and DVD players may include additional functions, and depending on the number of features incorporated into each model, the price can vary greatly. This may include, but is not limited to, high-definition display, 3D, compatibility to new audio formats, faster processor, Wi-Fi, video streaming, etc. Since the product cost depends on the number of features incorporated into each model, rather than just the efficiency of the product, and the differentiation between the base case and the measure case equipment cost cannot be made. In fact, an Energy Star document claims that there is no incremental cost between Energy Star qualified DVD players and those that do not qualify [379]. Therefore, it is reasonable to assume that there is no cost difference among the Energy Star 2.0 qualified products, and consequently FMC is 0 for this measure.

## 4.3 Full and Incremental Measure Cost

**Full and Incremental Measure Cost Equations**

|  |  |  |  |
| --- | --- | --- | --- |
| **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| ROB | (MEC + MLC) – (BEC + BLC) | (MEC + MLC) – (BEC + BLC) | N/A |
| NEW/NC |
| RET/ER | (MEC + MLC) – (BEC + BLC) | MEC + MLC | (MEC + MLC) – (BEC + BLC) |
| REF | (MEC + MLC) – (BEC + BLC) | MEC + MLC | N/A |
| REA | MEC + MLC | MEC + MLC | N/A |

MEC = Measure Equipment Cost; MLC = Measure Labor Cost

BEC = Base Case Equipment Cost; BLC = Base Case Labor Cost

**Full and Incremental Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| Energy Star 3.0 + 25% DVD player | ROB | $0.00 | $0.00 | N/A |
| Energy Star 3.0 + 35% DVD player | ROB | $0.00 | $0.00 | N/A |
| Energy Star 3.0 + 25% Blu-Ray player | ROB | $0.00 | $0.00 | N/A |
| Energy Star 3.0 + 35% Blu-Ray player | ROB | $0.00 | $0.00 | N/A |

# Attachments



2.

3. 

4. 

5.

# References



[49]

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