**Work Paper PGECODHW125**

**Showerheads, Thermostatic Control Valves and Aerators**

**Revision # 6**

**Pacific Gas & Electric Company**

**Customer Energy Solutions**

**Low Flow Showerheads and Aerators**

**Measure Codes:**

***Faucet Aerators 3P Measure Codes: S530, S531, S235, S236,***

***Moderate Income Direct Install (MIDI) Measure Codes: 0S00, 0S01, BW001, BW002, (GP and some 3P programs)***

***Core Measure codes AP005, AP006, AP007, AP008***

***Low Flow Showerheads 3P Measure Codes: G8, G11, G13, G14***

***MIDI Measure Codes: 0S02, 0S03, BW005, BW006,***

***Core Measure Codes: AP009 and AP010***

# At-a-Glance Summary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Applicable Measure Codes:** | **S530**  **0S01**  **AP006** | **S531**  **0S00**  **AP005** | **S235**  **BW001**  **AP008** | **S236**  **BW002**  **AP007** |
| **Measure Description:** | Faucet Aerator 0.5GPM (Electric WH) | Faucet Aerator 0.5GPM (Gas WH) | Faucet Aerator 1.0GPM (Electric WH) | Faucet Aerator 1.0GPM (Gas WH) |
| **Energy Impact Common Units:** | Each | | | |
| **Base Case Description:** | Varies | | | |
| **Base Case Energy Consumption:** | Varies | | | |
| **Measure Energy Consumption:** | Source: DEER2015, ED Disposition for 13-14 | | | |
| **Energy Savings**  **(Base Case – Measure):** | Varies | | | |
| **Costs Common Units:** | $ / aerator | | | |
| **Base Case Equipment Cost ($/unit):** | Source: DEER; $3.74 | | | |
| **Measure Equipment Cost ($/unit):** | Source DEER; $6.54 | | | |
| **Gross Measure Cost ($/unit)** | Source: DEER; $2.80 | | | |
| **Measure Incremental Cost ($/unit):** | Source: DEER; $2.80 | | | |
| **Effective Useful Life (yr):** | Source: DEER; 10 years | | | |
| **Measure Application Type:** | ROB | | | |
| **Net-to-Gross Ratios:** | Source: DEER2014  Direct Install: NTG = 0.59, Res-mDHWaerator  Upstream: NTG = 0.55, Res-Default>2 | | | |
| **Applicable Measure Codes:** | **G8**  **BW006** | **G13**  **BW005** | **G11 / 0S02**  **AP009** | **G14 / 0S03**  **AP010** |
| **Measure Description:** | Low Flow Showerhead (1.6 GPM Gas WH) | Low Flow Showerhead (1.6 GPM Electric WH) | Low Flow Showerhead Thermostatic Control Valve(1.6 GPM Gas WH) | Low Flow Showerhead Thermostatic Control Valve (1.6 GPM Electric WH) |
| **Energy Impact Common Units:** | Each | | | |
| **Base Case Description:** | Source: DEER, 2.25 GPM | | | |
| **Base Case Energy Consumption:** | Source: DEER, 2.25 GPM | | | |
| **Measure Energy Consumption:** | Varies | | | |
| **Energy Savings**  **(Base Case – Measure):** | Varies | | | |
| **Costs Common Units:** | $ / showerhead | | | |
| **Base Case Equipment Cost ($/unit):** | Source: DEER, $14.32 | | | |
| **Measure Equipment Cost ($/unit):** | Source DEER $29.22 | Source DEER $29.22 | Source DEER $39.95 | Source DEER $39.95 |
| **Gross Measure Cost ($/unit)** | Source: DEER $14.90 | Source: DEER $14.90 | Source: DEER $25.63 | Source: DEER $25.63 |
| **Measure Incremental Cost ($/unit):** | Source: DEER $14.90 | Source: DEER $14.90 | Source: DEER $25.63 | Source: DEER $25.63 |
| **Effective Useful Life (years):** | Source: DEER 10 years | | | |
| **Measure Application Type:** | ROB | | | |
| **Net-to-Gross Ratios:** | Source: DEER2014  Direct Install: NTG = 0.7, Res-sAll-mDHWshwr  Upstream: NTG = 0.55, Res-Default>2 | | | |

# Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision #** | **Revision Date** | **Section-by-Section Description of Revisions** | **Author (Company)** |
| **Revision 0** | **05/15/2014** | **Showerhead, TXV, Aerators**  **Combined PGECODHW113 with PGE3PDHW117 and PGE3PDHW116** | **Charlene Spoor (PG&E)** |
| **Revision 1** | **01/12/2015** | **Updated MIDI Codes for all offerings** | **Charlene Spoor (PG&E)** |
| **Revision 2** | **08/14/2015** | **Added new measure codes for DEEMED offering** | **Charlene Spoor (PG&E)** |
| **Revision 3** | **08/30/2016** | **Revised template to be consistent with DEER measure tables. Updated energy savings estimates due to Title 20 code update effective 1/1/2016 for faucet aerators.** | **Jia Huang (PG&E)** |
| **Revision 4** | **08/30/2016** | **Update energy savings estimates due to Title 20 code update effective 7/1/2016 for showerheads.** | **Jia Huang (PG&E)** |
| **Revision 5** | **01/25/2017** | **Sunset measure codes BW003 and BW004** | **Jia Huang (PG&E)** |
| **Revision 6** | **03/20/2017** | **Sunset measure codes BW007, BW008, S237, S238, H803, and H804. Corrected NTG for upstream measures. Corrected GSIA for low flow showerheads with flow restrictor valves.** | **Jia Huang (PG&E)** |
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**Section 1. General Measure & Baseline Data**

## 1.1 Product Measure Description & Background

***Catalog Description –***

***Faucet Aerators:*** Measures S530, 0S01, AP006, S531, 0S00, AP005, S235, BW001, AP008, S236, BW002, and AP007 -- faucet aerators must have a flow rate of 0.5 gallons per minute (gpm) and must be installed on a faucet with a flow rate of 2.2 gpm or higher. The faucet aerator heating source must be electric for measures S530, 0S01, AP006, S235, BW001, and AP008; and gas for measures S531, 0S00, Ap005, S236, BW002, and AP007.

***Low Flow Showerheads:*** Measures G8, BW006, G13, BW005, G11, 0S02, AP009, G14, 0S03, and AP010: Low flow showerheads must have a flow rate of 1.6 gallons per minute (gpm) and must replace an existing showerhead that has a flow rate of 2.5 gpm or greater. The shower water heating source must be gas for measure G8, BW006, G11, 0S02, and AP009 and electric for measures G13, BW005, G14, 0S03, and AP010.

***Program Restrictions and Guidelines***

***Faucet Aerators 3P Measure Codes: S530, S531, S235, S236***

***Moderate Income Direct Install (MIDI) Measure Codes: 0S00, 0S01, BW001, and BW002 (GP and some 3P programs)***

***Core Deemed: AP005, AP006, AP007, AP008***

***Terms and Conditions***

Customer must have electricity/gas distributed by PG&E to the installation address. The customer must meet all the terms and conditions as described on the rebate application form.

***Market Applicability***

This measure is applicable to all residential households who have faucets with a flow of 2.2 gpm or higher. This workpaper may also be utilized by comparable building types with faucets (e.g. hotel guest rooms and mobile homes) targeted by third party and government partnership programs where DEER provides best available data. Applicable building types are as follows:

|  |  |
| --- | --- |
| Multi Family | MFm |
| Single Family/ Domestic Mobile Home | SFm/DFo |

***Technical Description***

Faucet aerators are inexpensive and easy to install. They lower flow by introducing air to the spray. The user may experience what feels like additional flow, but this is due to the air-water mixture under pressure producing a high speed spray.

Measures S530, S531, S235, S236, 0S00, 0S01, BW001, and BW002 are intended for third party and government partnership programs; incentive is provided to the contractor at the time of installation upon receipt of sales data and installation. This is a Direct-Install program as defined in DEER.

Measures AP005, AP006, AP007, and AP008 are intended for Core upstream programs.

***Program Restrictions and Guidelines***

***Low Flow Showerheads 3P Measure Codes: G8, G11, G13, G14***

***MIDI Measure Codes: 0S02, 0S03, BW005, BW006; Core Deemed AP009, AP010***

***Terms and Conditions***

* Make and model number must be included with a copy of your receipt
* Must have water heating source using natural gas or electricity distributed by PG&E
* Low flow showerhead must pass test procedure ANSI/ASME A112.18.1-2000, Section 5.5

***Market Applicability***

The low flow showerhead (measures G8 and G13) and combination low flow showerhead and thermostatic valve (measures AP009, AP010, G11 and G14) apply to all residential households, single family or multi family, who have showerheads with a flow of 2.5 GPM or greater.

Measures H803, H804, G8, G11, G13, G14, 0S02, 0S03, BW005, and BW006 are intended for third party and government partnership programs; incentive is provided to the contractor at the time of installation upon receipt of sales data and installation. This is a Direct-Install program as defined in DEER.

Measures AP009 and AP010 are intended for Core upstream programs.

Applicable building types area as follows:

|  |  |
| --- | --- |
| Multi Family | MFm |
| Single Family/ Domestic Mobile Home | SFm/DFo |

## 1.2 Product Technical Description

## Faucet aerators are inexpensive and easy to install. They lower flow by introducing air to the spray. The user may experience what feels like additional flow, but this is due to the air-water mixture under pressure producing a high speed spray.

Low flow showerheads are inexpensive and easy to install. They lower flow by introducing air to the spray in two ways: drawn or forced (using compressed air). It may seem like more water is flowing than it really is due to the air-water mixture under pressure produces a high speed spray. Since about 73% of water used in a typical shower is hot water, reducing the amount of water used will save energy because there is less water needed to be heated. As a result, the water heater will use less energy, creating an opportunity for savings[[1]](#endnote-1).

Thermostatically initiated shower restriction valves (measures AP009, AP010, G11 and G14) are installed at the showerhead. The valve is initially open and allows cold water that has been sitting in the pipes to flow through the showerhead at full flow. When the water temperature reaches approximately 95 ºF, the valve closes and restricts the water flow to a trickle until the user enters the shower and switches the valve open again to restore full flow. The intention of this device is to prevent hot water from running down the drain during the ‘pre-useful shower’ warm-up period, i.e. the time the user lets the shower water run down the drain before the ‘useful’ shower event. This pre-useful shower period typically involves the user engaging in an activity instead of standing at the shower head, after which the user returns to the shower to find the hot water running (and the water has been hot for an unknown period of time). By preventing hot water from unnecessarily running down the drain before the useful shower event, this device reduces water heater energy consumption because the hot water demand on the water heater has temporarily been halted.

## 1.3 Measure Application Type

The DEER 2014 Ex Ante Database Format defines the terms as follows:

Table  Measure Application Type[[2]](#endnote-2)

*Identifies the measure application type in the Measure Implemenation table in DEER2014.*

|  |  |  |
| --- | --- | --- |
| **Code** | **Description** | **Comment** |
| ER | Early retirement | *Measure is more efficient than code/std; Dual baseline, full measure costs required* |
| ROB | Replace on Burnout | *Single baseline (above code), incremental or full costs* |
| NC | New Construction | *Single baseline (above code), incremental or full costs* |
| REA | Retrofit Add On | *Single baseline (above pre-existing), full measure costs required* |

*These measures are considered ROB.*

## 1.4 Product Base Case and Measure Case Data

## 1.4.1 DEER Base Case and Measure Case Information

The DEER 2014 database does not include faucet aerators or showerheads, however the ex-ante team, as part of their disposition for Water Fixtures, dated February 22, 2013, recommended statewide savings values based on review the IOU workpapers for the 2013-2014 program cycle . DEER 2014 data includes Net to Gross and EUL data. Cost data is also referenced in DEER 2014. All other savings data is taken directly from the ED disposition recommendations for statewide savings values.

Faucet aerator and low flow shower head savings are included in READI tool; however existing values in the READI Tool have expired due to a code update for Title 20.

Additionally some implementers requested additional measures for faucet aerators of 1.0 gpm and 1.5 gpm to accommodate customer preference. For these measures, this workpaper assumed a linear relationship of flow rate and energy impacts. Please see Section 2 for more details.

**Table 2. DEER Use and Technology Table Faucet Aerators and Showerheads**





**Delta Wattage Assumption (ΔW):**

**EUL Electric Savings** **(ΔW): DEER Version and Impact IDs**

The EUL electric savings were downloaded from DEER 2012 disposition directly, (based on DEER2011 values) they match the intended measures. EUL is based on DEER 2014 data.

**Therms Savings Assumption (ΔTh) DEER Version and Impact IDs**

The EUL electric savings were downloaded from READI v.2.4.3, but modified to account for the Title 20 code update.

**Hours of Operation**: There are no DEER hours of operation listed for this measure.

**Base Case Costs and Measure Case Costs**

The Base Case and Measure case costs were downloaded from DEER 2014 directly.

See Section 4 for base and measure costs.

**Net-to-Gross Assumption:** *DEER 2014 NTG assumptions were used and downloaded directly from the READI database.*

The rebate provided to the contractor or customer at the time of installation upon receipt of sales data and installation. This is a Direct- install and an incentive based program.

Table 5 below summarizes all applicable DEER based Net-to-Gross ratios for programs that may be used by this measure.

Table 3 DEER Net-to-Gross Ratios

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **DEER Spreadsheet** | |
| Program Approach | NTG | Bldg type | Install Type |
| Res-sAll-mDHWshwr | 0.70 | Any | DI |
| Res-mDHWaerator | 0.59 | Any | DI |
| Res-Default>2 | 0.55 | Any | Upstream |

**Effective Useful Life / Remaining Useful Life:**

**Table 4 Effective Useful Life**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Building type** | **Bldg Vintage** | **Climate Zone** | **Electric Savings Watts** | **Deer units** | **DEER Version** | **EUL** | **Measure** | **DEER ID** |
| **MFM/SFM** | **Any** | **Any** | **Any** | **Each** | **2014** | **10 yrs** | **Aerators** | WtrHt-WH-Aertr |
| **MFM/SFM** | **Any** | **Any** | **Any** | **Each** | **2014** | **10 yrs** | **Showerheads** | WtrHt-WH-Shrhd |

**In-service rate: DEER Version and Impact IDs**

* In-Service Rate (ISR) for aerators:  0.665 per DEER2014
* ISR for Showerheads: 0.737, 0.59 for Shower heads with thermostatic controls per DEER2014.

**Table 5 In Service Rate or GSIA**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Building type/vin/CZ** | **measure** | **implementation** | **In-service rate** | **DEER Version** | **GSIA Ids** |
| **ANY** | **Faucet aerator** | **DI, Upstream** | **0.665** | **DEER 2011** | Res-LowF-FA-All |
| **ANY** | **Showerhead** | **DI, Upstream** | **0.737** | **DEER 2011** | Res-LowF-SH-All |
| **ANY** | **Showerhead with restrictor** | **DI, Upstream** | **0.59** | **DEER 2013** | Res-LowF-wRest-SH-All |

## 1.4.2 Codes & Standards Requirements Base Case and Measure Information

**Title 20:** Showerheads and faucets fall under Title 20 of the California Energy Regulations, Section 1605.3. Effective January 1st, 2016, new regulations for faucets and aerators are as follows:



The CEC added amendments to its 2015 Appliance Efficiency Regulations to apply more stringent efficiency requirements for certain water appliance measures. Showerheads manufactured on or after July 1, 2016 are required to have a maximum flow rate of no greater than 2.0 gpm.



**Title 24:** These measures do not fall under Title 24 of the California Energy Regulations.

**Federal Standards:** These measures fall under Federal DOE or EPA Energy Regulations. The Federal Energy Policy Act of 1992 requires that all faucet fixtures manufactured in the United States restrict maximum water flow at or below 2.5 gallons per minute (gpm) at 80 pounds per square inch (psi) of water pressure or 2.2 gpm at 60 psi. This ensures that most faucet products available will offer at least minimal water efficiency benefits.[[3]](#endnote-3) The Federal Energy Policy Act of 1992 requires that “showerheads must use no more than 2.5 gpm”[[4]](#endnote-4). This work paper addresses above code showerheads with a flow of 1.6 and 2.0 gpm.

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

## 1.4.4 Assumptions and Calculations from other sources—Base and Measure Cases

There are no further data or calculations provided for the support of the measures in this workpaper.

***1.4.5 Time-of-Use Adjustment Factor***

We are required by CPUC decision 06-06-063 dated June 29, 2006 to apply time-of-use (TOU) adjustment factors on residential A/C and commercial A/C (packaged and split-system direct-expansion cooling) measures only. Since this is not an A/C measure, the TOU adjustment factor is 0.

***1.5 Summary of Inputs for Savings Calculations***

The following table provides references to sections that document the inputs for calculation:

**Table 6 Summary of Inputs for Savings Calculations**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Input Variable** | **Variations** | **Base Case 1 Average Value** | **Base Case 2 Average Value** | **Measure Case Average Value** | **Reference Section** |
| **Electric Savings** | Res | Varies |  | Varies | *Section 2.1* |
| **Gas Savings** | Res | Varies |  | Varies | Section 2.3 |
| **Hours of operation** | N/A |  |  |  | N/A |
| **Full Cost** | Varies | N/A |  | Varies | Section 4.2 |
| **Incremental Cost** | Varies | N/A |  | Varies | Section 4.2 |
| **EUL /RUL** | ROB | 10 yrs |  | 10 yrs | Section 1.4.1 |
| **NTG** | many | Varies |  | Varies | Section 1.4.1 |
| **ISR** | Yes | Varies |  | Varies | Section 1.4.1 |
| **TOU Factor** | *A/C projects only* |  |  |  | *Section 1.4.5* |

# Section 2. Calculation Methods

Table 7 Baseline by Measure Application Type

|  |  |  |  |
| --- | --- | --- | --- |
| ****Measure Application Type**** | ****Measure Life Basis**** | ****First Baseline Period: Energy Savings Baseline**** | ****Second Baseline Period: Energy Savings Baseline**** |
| ***ER* (early retirement)** | **EUL** | Customer Average Baseline | Code Baseline |
| ***ROB* (replace-on-burnout)** | **EUL** | Code Baseline | N/A |
| ***NC* (new construction)** | **RUL/EUL-RUL** | Code Baseline | N/A |
| ***REA (retrofit add on)*** | **EUL** | Code Baseline | N/A |

Notes:

* For ROB and REA measures, First Baseline is the baseline for the full EUL. There is no second baseline.
* For ER measures, First Baseline Period is the period for the RUL(remaining useful life),defined by the CPUC as RUL=1/3 EUL. Second baseline period for ER is Code baseline for the period EUL-RUL.

## 2.1 Electric Energy Savings Estimation Methodologies

The READI Tool contains impacts for measures in this workpaper. DEER impacts were derived from the CPUC’s Workpaper Disposition for Water Fixtures, dated February 22, 2013. Since the California Energy Commission adopted more stringent requirements for faucets and aerators for products sold on or after January 1, 2016 and showerheads for products manufactured on or after July 1, 2016, existing savings estimates in the READI Tool were scaled to reflect the new code. The spreadsheet “WP template-PGECODHW125 R4.xlsx” includes detailed calculations for the revised values. The highlighted cells in tab “Revised DEER Measure Impacts” show the proposed revisions to be added to the READI Tool to reflect the new Title 20 requirements. Lavatory faucet aerator measures requiring a flow rate of 1.5 GPM and showerheads measures requiring a flow rate of 2.0 GPM have been revised to zero savings due to now being at or below code.

## 2.2. Demand Reduction Estimation Methodologies

## 2.3. Gas Energy Savings Estimation Methodologies

# *Section 3. Load Shapes*

Load Shapes are an important part of the life-cycle cost analysis of any energy efficiency program portfolio. The net benefits associated with a measure are based on the amount of energy saved and the avoided cost per unit of energy saved. For electricity, the avoided cost varies hourly over an entire year. Thus, the net benefits calculation for a measure requires both the total annual energy savings (kWh) of the measure and the distribution of that savings over the year. The distribution of savings over the year is represented by the measure’s load shape. The measure’s load shape indicates what fraction of annual energy savings occurs in each time period of the year. An hourly load shape indicates what fraction of annual savings occurs for each hour of the year. A Time-of-Use (TOU) load shape indicates what fraction occurs within five or six broad time-of-use periods, typically defined by a specific utility rate tariff. Formally, a load shape is a set of fractions summing to unity, one fraction for each hour or for each TOU period. Multiplying the measure load shape with the hourly avoided cost stream determines the average avoided cost per kWh for use in the life cycle cost analysis that determines a measure’s Total Resource Cost (TRC) benefit.

## 3.1 Base Case Load Shapes

The base case load shape would be expected to follow a typical multifamily residential hot water end use load shape.

Table 8 Base Case Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| **Building Type** | **E3 Alt. Building Type** | **Load Shape** |
| RESIDENTIAL | Any | PGE:Residential:21 = Res. Wtr. Heating |

## 3.2 Measure Load Shapes

For purposes of the net benefits estimates in the E3 calculator, what is required is the load shape that ideally represents the *difference* between the base equipment and the installed energy efficiency measure. This *difference* load profile is what is called the Measure Load Shape and would be the preferred load shape for use in the net benefits calculations.

The measure load shape for this measure is determined by the E3 calculator based on the applicable residential market sector and hot water end-use.

# Section 4. Base Case & Measure Costs

**Table 9 DEER 2014 Base Case & Measure Case Cost Definitions**

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure Application Type** | **Measure Life Basis** | **First Baseline Period Full Measure Cost (RUL)** | **Second Baseline Period Full Measure Cost (EUL – RUL)** |
| ***NC (new construction)*** | EUL | Calculated as Incremental Measure Cost | N/A |
| ***ROB(replace on burnout)*** | EUL | Calculated as Incremental Measure Cost | N/A |
| ***ER (early retirement)*** | RUL/  EUL-RUL | Calculated as Full Gross Measure Cost | Calculated as Negative Full Gross Base Case Cost |
| ***REA (retrofit add on)*** | EUL | Calculated as Full Gross Measure Cost | N/A |

## 4.1 Base Case(s) Costs

**Table 10 Base Case Costs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Measure Code*** | **Measure Application Type** | **Baseline** | **Equipment Cost** | **Labor / Installation Cost** | **Maintenance / Other Cost** | **Total Base Case Cost** |
| S530, S531, S235, S236, 0S00, 0S01, BW001, BW002, AP005, AP006, AP007, AP008 | ROB | Existing | $3.74 | $6.70 | $N/A | $10.44 |
| G8, G13, BW005, BW006, | ROB | Existing | $14.32 | $16.74 | $N/A | $31.06 |
| G11, 0S02, AP009, G14, 0S03, AP010 | ROB | Existing | $14.32 | $16.74 | $N/A | $31.06 |

## 4.2 Measure Case Costs

Costs from the DEER 2014 database were used (although these values have not been updated since the DEER 2008 cost data update). The following Measure Application Types are appropriate to these measures. The Measure Case Costs are noted in Table 19 below:

**Table 11 Measure Case Costs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Measure Code*** | **Measure Application Type** | **Baseline** | **Equipment Cost** | **Labor / Installation Cost** | **Maintenance / Other Cost** | **Total Measure Case Cost** |
| S530, S531, S235, S236, 0S00, 0S01, BW001, BW002, AP005, AP006, AP007, AP008 | ROB | Existing | $6.54 | $6.70 | $N/A | $13.24 |
| G8, G13, BW005, BW006, | ROB | Existing | $29.22 | $16.74 | $N/A | $45.96 |
| G11, 0S02, AP009, G14, 0S03, AP010 | ROB | Existing | $39.95 | $16.74 | $N/A | $56.69 |

*All costs are noted as $ per measure unit*

## 4.3 Incremental & Full Measure Costs

**Table 12 DEER 2014 Incremental and Full Measure Case Cost Definitions**

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure Application Type** | **Full Measure Cost**  **(RUL Period/First Baseline)** | **Full Measure Cost**  **(EUL-RUL Period/ Second Baseline)** | **Incremental Measure Cost** |
| ER | Measure Equipment Cost  +Measure Labor Cost | (-1)x(Base Equipment Cost  + Base Labor Cost) | Measure Equipment Cost  – Base Case Equipment Cost |
| ROB | Measure Equipment Cost  – Base Case Equipment Cost | N/A | Measure Equipment Cost  – Base Case Equipment Cost |
| NC | Measure Equipment Cost  – Base Case Equipment Cost | N/A | Measure Equipment Cost  – Base Case Equipment Cost |
| REA | Measure Equipment Cost  – Base Case Equipment Cost | N/A | Measure Equipment Cost  – Base Case Equipment Cost |

# *4.3.1 Full Measure Cost*

Full Measure Cost is the cost to install an energy efficient measure per the CPUC calculators. This definition implies a different meaning depending on the Measure Application type.

This Measure Application Type(s) is **ROB**, so the Full Measure Cost (FMC) is represented by the equation below (choose):

FMC = (Measure Equipment Cost + Measure Labor Cost) –

(Base Case Equipment Cost + Base Case Labor Cost)

\*Note: We assume that, unless stated otherwise, the measure case labor and base case labor are assumed to be the same value reducing the equation to the following:

FMC = Measure Equipment Cost – Base Case Equipment Cost

# *4.3.2 Incremental Measure Costs*

Incremental Measure Cost is the premium cost to install an energy efficient measure over a standard efficiency measure or code baseline measure. While IMC has a straightforward definition depending on the Measure Application type, the equation does vary.

This Measure Application Types is **ROB,** so the Incremental Measure Cost (GMC) is represented by the appropriate equation below:

IMC = (Measure Equipment Cost + Measure Labor Cost) –

(Base Case Equipment Cost + Base Case Labor Cost)

\*Note: Unless stated otherwise the measure case and base case labor costs are typically the same, reducing the equation to the following:

IMC = Measure Equipment Cost – Base Case Equipment Cost

**Summary Table for Section 4**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure ID** | **Measure Application Types** | **Base Case Total Cost** | **Measure Case Total Cost[[5]](#endnote-5)** | **Full Measure Case Cost** | **Incremental Measure Cost** |
| S530, S531, S235, S236, 0S00, 0S01, BW001, BW002, AP005, AP006, AP007, AP008 | ROB | $10.44 | $13.24 | $2.80 | $2.80 |
| G8, G13, BW005, BW006, | ROB | $31.06 | $45.96 | $14.90 | $14.90 |
| G11, 0S02, AP009, G14, 0S03, AP010 | ROB | $31.06 | $56.69 | $25.63 | $25.63 |

**Section 5. Other Concerns**

Factors unrelated to energy savings were also investigated further for program effectiveness: reliability and scalding issues. Applied Technology Services (ATS), a division of Pacific Gas and Electric Company, was contracted to test these issues and develop a report on their findings[[6]](#endnote-6). Below is a summary of their conclusions.

**5.1 Reliability**

Due to a lack of government enforcement, the advertised versus actual flow rate of low flow showerheads is a concern. ATS tested two samples of ten different showerhead models (for a total of twenty) with various flow rates, most of which are less than 2 gpm. Their findings concluded nine out of ten showerhead models demonstrated flow rates consistent to the manufacturers’ advertised flow rates.

**5.2 Scalding**

Safety issues over scalding were also a concern with low flow showerheads. Scalding, or thermal shock, is the result of a rapid change in water temperature, causing sudden physical reactions in which a person may slip or fall. Scalding may also cause epidermal damage, depending on the length of exposure to hot water temperatures. After testing, ATS has concluded that showerhead design, mixing, and pressure did not greatly affect the potential for scalding. However, plumbing systems with inadequate piping may increase the risk for scalding with installation of low flow showerheads. Testing under plumbing systems with adequate piping showed minimal to no effects. Due to uncertainty of the design of a customer’s plumbing system, there is a certain degree of risk for scalding when installing low flow showerheads. Therefore, due to legal reasons, a disclaimer will be provided for participants of this program.

# Input Appendices

# References

1. Flex Your Power – Residential Product Guides – Showerheads. 2007. Retrieved

   December 14, 2007 from <http://www.fypower.org/res/tools/products_results.html?id=100160> [↑](#endnote-ref-1)
2. The DEER Measure Cost Data Users Guide found on [www.deeresources.com](http://www.deeresources.com) under DEER2011 Database Format hyperlink, DEER2011 for 13-14, spreadsheet SPTdata\_format-V0.97.xls. [↑](#endnote-ref-2)
3. Flex Your Power: <http://www.fypower.org/res/tools/products_results.html?id=100160> [↑](#endnote-ref-3)
4. Flex Your Power – Residential Product Guides – Showerheads. 2007. Retrieved

   December 14, 2007 from <http://www.fypower.org/res/tools/products_results.html?id=100160> [↑](#endnote-ref-4)
5. SCE, Measure Cost Revision 5 revised for PG&E by S.L. Blanc 2012

   [↑](#endnote-ref-5)
6. Leni-Konig, K. (2008). Low Flow Showerhead Test Report: Scalding, Flow Rates, and the Evolve Ladybug Showerhead Adapter, Pages ii, 11 and 12. Applied Technology Services. Pacific Gas and Electric Company [↑](#endnote-ref-6)