Workpaper WPSCGCCWH180504A

**Revision 00**

**SoCalGas**

**Commercial/Residential Flow Control Valves for Faucets and Showerheads**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | TBD (See EAD tables for the measure codes) |
| **Measure Description** | Flow control valves reduce the flowrate at both hot and cold-water lines in faucets and at the fixture in showerheads. |
| **Base Case Description** | Faucets and showerhead without any flow restriction devices. |
| **Units** | Fixture |
| **Energy Savings** | Refer to Excel Calculation Attachment (Attachment H) |
| **Full Measure Cost ($/unit)** | FCV showerheads: $41.74  FCV faucets: $58.48 |
| **Incremental Measure Cost ($/unit)** | FCV showerheads: $41.74  FCV faucets: $58.48 |
| **Effective Useful Life** | FCVs applied to showerheads-EUL ID: WtrHt-WH-Shrhd  FCVs applied to faucets – EUL ID: WtrHt-WH-Faucet |
| **Measure Installation Type** | Retrofit Add-on (REA) |
| **Net-to-Gross Ratio** | FCVs in Residential faucets: Res-mDHWaerator  FCVs in commercial faucets: All-Default<=2yrs  FCVs in residential showerhead: Res-LowF-SH-All  FCVs in commercial Showerhead: 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 | 5/4/2018 | Carlos Pineda(SCG) | * Initial Release |
|  |  |  |  |

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# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

This workpaper measure allows for energy to be saved from the installation of Flow Control Valves(FCV) at faucets or showerheads. These control valves act as a converging-diverging section with a throat in which the flow area is reduced to impede full flow while retaining pressure. The reduction in flow rate offsets the amount of hot water used, in effect the energy demand by the water heating source is reduced. This workpaper will use the energy savings values used in other SocalGas workpapers (See sections 2) as these flow control valves operate and conserve energy in the same manner as the referenced measure technology, but applied upstream from fixture point.

Table : Base, Standard, and Measure Cases

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | Fixtures with a flow control valve for a reduce flow rate. |
| Existing Condition | Fixture without any type of flow rate reducer. |
| Code/Standard | 1. Showerhead: 1.8 GPM at 80 PSI 2. Lavatory Faucet: 1.2 GPM at 60 PSI 3. Kitchen: 2.2 GPM at 60 PSI 4. Public lavatory faucet: 0.5 GPM at 60 PSI |
| Industry Standard Practice | N/A |

Table : Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
| TBD |  |  |  | Lavatory Faucet FCV: 1.00 GPM |
| TBD |  |  |  | Res showerhead FCV: 1.00 GPM |
| TBD |  |  |  | Public Lavatory Faucet FCV Commercial Buildings: 1.0 GPM |
| TBD |  |  |  | Private Lavatory Faucet FCV Commercial Buildings: 1.0 GPM |
| TBD |  |  |  | Res Showerhead FCV: 1.25 GPM |
| TBD |  |  |  | Res Showerhead FCV: 1.50 GPM |
| TBD |  |  |  | Com Showerhead FCV: 1.50 GPM |
| TBD |  |  |  | Kitchen Faucet FCV: 1.5 GPM |

Measures are available for both the residential and commercial sectors; the application will be identical to current SoCalGas workpapers for residential and commercial faucet aerators and low flow showerheads.

* **Eligibility requirements:**

Residential Faucets and Showerhead Flow Control Valves:

1. This workpaper addresses the savings associated with the installation of flow control valves on bathroom or kitchen sinks for single, multi-family and mobile homes.
2. Mobile home faucet FCV savings are the same as single family home savings. Mobile homes will not have separate defined measures.
3. Measures in this workpaper include a combined/mix water flow rate at the faucet of 1.0 GPM for bathroom sinks and a mix/combine water flow rate of 1.5 GPM at the faucet for kitchen sinks, each measure has single and multifamily option.
4. Flow control valves for faucet water line inlets must be installed in pairs, one in the cold and one in the hot line.
5. Flow control valves for showerhead measures presented in this workpaper for residential applications apply to single-family and multi-family residential households.
6. Residential showerhead flow control valve measure will include (1.0, 1.25, 1.5) GPM.
7. FCV make, model number and flow rate must be included with a copy of the invoice.
8. Flow control valves are applicable to existing faucets without an aerator and a flow rate of 2.2 GPM or greater.

Commercial Faucets and Showerhead Flow Control Valves:

1. The FCV measure for faucets is applicable to existing faucets in commercial buildings that have a flow rate of 2.2 GPM or greater.
2. Measures in this workpaper include a combined/mix water flow rate at the faucet of 1.0 GPM.
3. This workpaper includes only a Direct Install delivery method for flow control valves applied to commercial showerheads. All implementers of this measure will market and identify commercial facilities utilizing higher flow showerheads (>2.5 GPM) and offer to install the retrofit add on FCV (<1.8 GPM).
4. FCV make, model number and flow rate must be included with a copy of the invoice.
5. The commercial showerhead FCV will only be available in 1.5 GPM.

* **Implementation and installation requirements**:

Residential Faucets and Showerhead Flow Control Valves:

1. Flow control valves must have a rated GPM of
   1. 0.50 GPM for bathroom sinks for a combined/mix flow rate of 1.0 GPM.
   2. 0.75 GPM for kitchen sinks for a combined/mix flow rate of 1.5 GPM.

Commercial Faucets and Showerhead Flow Control Valves:

1. The FCV showerhead measures defined in this workpaper are applicable to existing buildings only. Newly constructed buildings, additions to existing buildings, and alterations to existing buildings are excluded.
2. Gas savings from showerhead FCVs will apply to both lodging building types(Hotel/Motel), as well as all other commercial building types. The COM building type designation will include, but is not limited to, educational facilities (University, Public/Private Schools), healthcare facilities, small/large office buildings, fitness centers, and municipal facilities (Recreation centers, parks).
3. Faucet FCVs shall be implemented at private or public lavatory faucets in commercial buildings as a Retrofit Add-on (REA). These building types include, but are not limited to, restaurants, hotels/motels, schools, universities, university campus housing, retail and offices.
4. Private lavatory faucets are defined as those that are found in individual dwelling units such as a hotel/motel guest room, dorm room, or nursing home room. Public lavatory faucets are defined as those found in bathrooms shared by a communal area such as a school, restaurant, hotel lobby, or office building.
5. Faucets at health care facilities that are subject to the Office of Statewide Health Planning and Development (OSHPD) code and regulation (e.g. hospitals, clinics, skilled nursing facilities) are not applicable for this measure.
6. FCVs installed in commercial faucets must be rated at 0.5 GPM for a mix/combined flow rate of 1.00 GPM.

* **Other program restrictions and guidelines**
  1. This measure is applicable to all California climate zones.
  2. Measures in this workpaper only apply to customers who have natural gas service from a California IOU.

## 1.2 Technical Description

Flow Control Valves(FCVs) reduce the incoming flow rate to the units specified GPM. This is accomplished by reducing the water flow while maintaining pressure through its converging-diverging structure in which the area is reduced at the throat to lower the flow rate. In showerhead applications the FCV is installed between the showerhead arm and the showerhead. In faucets, two FCVs shall be used, one at the hot and cold line stop angles.

## 1.3 Installation Types and Delivery Mechanisms

Table : 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 |

The FCV measures will be of the Retrofit Add-on installation type.

Table : Delivery 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. |

The incentive method for the application sectors for these measures are summarized below.

1. FCVs applied in commercial showerheads: Direct install prescriptive rebate(PreRebDI).
2. FCVs applied in residential showerheads: Direct Install(DirInstall), Prescriptive Rebate(PreReb).
3. FCVs applied in commercial faucets: Direct Install(DirInstall).
4. FCVs applied in residential faucets: Direct Install(DirInstall).

## 1.4 Measure Parameters

### 1.4.1 DEER Data

DEER does not have this type of measure.

Table : 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 | No |
| 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. Measures will be separated by application and building, sector type.

Table : NTGR

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Measure** | **NTGR ID** | **Description** | **Sector** | **BldgType** | **Measure Delivery** | **NTGR** |
| FCV: Com Showerhead, Com Faucet | All-Default<=2yrs | All other EEM with no evaluated NTGR; new technology in program for 2 or fewer years | Any | Any | Any | 0.70 |
| FCV: Res Showerhead | Res-sAll mDHWshwr | Low flow showerheads | Res | Any | DirInstall | 0.70 |
| FCV: Res Showerhead | Res-Default>2 | All other EEM with no evaluated NTGR; existing EEM with same delivery mechanism for more than 2 years | Res | Any | Any | 0.55 |
| FCV: Res Faucets | Res-mDHWaerator | Faucet aerators | Res | Any | DirInstall | 0.59 |

**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.

Table : GSIA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Measure** | **GSIA ID** | **Description** | **Sector** | **BldgType** | **ProgDelivID** | **GSIAValue** |
| FCV: Com Showerhead, Com Faucet | Def-GSIA | Default GSIA values | Any | Any | Any | 1 |
| FCV: Res Showerhead | Res-LowF-SH-All | Residential low-flow Showerhead; Annual Installation Rate | Res | Any | NonUpStrm | 0.737 |
| FCV: Res Faucets | Res-LowF-FA-All | Residential low-flow Faucet Aerator; Annual Installation Rate | Res | Any | NonUpStrm | 0.665 |

**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 values for FCV’s applied to showerheads will assume the same EUL as a showerhead. FCV’s apply to incoming hot water and cold lines will assume the aerators EUL. It is expected that the flow control valves will have a life of 10 or more years therefore the assigned values are appropriate.

Table : EUL ID

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Measure** | **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| FCV: Showerhead | WtrHt-WH-Shrhd | Low-Flow Showerhead | Com /Res | SHW | 10 | 3.3 |
| FCV: Faucets | WtrHt-WH-Faucet | Faucet Effective Useful Life | Com/Res | SHW | 20 | 6.67 |

### 1.4.2 Codes and Standards Analysis

Standards for plumbing fittings and fixtures are outlined in California’s Title 20 Appliance Efficiency Program Codes. Applicable codes for this measure are stipulated in Title 20 of the California Code of Regulations Table H-3, H-4 and H-5 displayed below.

Figure : Lavatory faucets and aerator Title 20 requirements

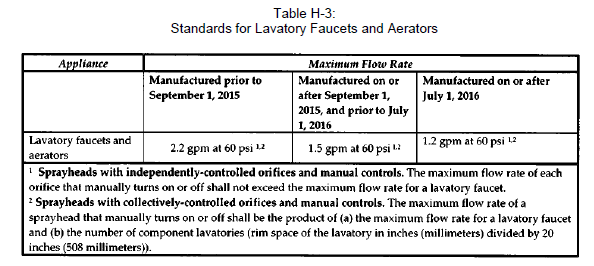


Figure : Kitchen faucets and aerator Title 20 requirements

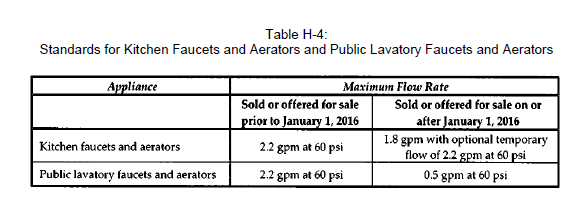


Figure : Showerheads Title 20 requirements

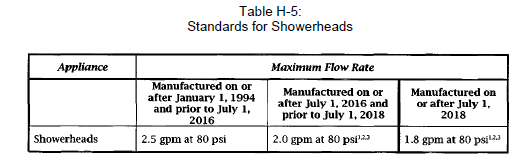


Table : Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 20 (2017) | Section 1605.1(h). Plumbing Fittings | 1. Lavatory faucet and aerators: July 1, 2016 2. Kitchen faucets and aerators: January 1, 2016 3. Showerheads: July 1, 2018 |

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

This workpaper will adopt all savings values from currently in use SoCalGas workpapers. The studies below can also be found in their respective workpapers.

1. Workpaper WPSCGNRWH120618A Revision 03: Faucet Aerators for Bathroom/Kitchen Sinks in Residential Buildings: Climate Zone Factors
   1. ([Attachment F](#_Attachments)) The savings calculations for this paper are defined in the Workpaper Disposition for Water Fixtures from the California Public Utilities Commission (CPUC), Energy Division (ED) February 22, 2013. The stated Climate zone factors in Workpaper Disposition for Water Fixtures from the California Public Utilities Commission (CPUC), Energy Division (ED) February 22, 2013 are out of date and should be replaced by the Climate Zone[[1]](#endnote-1) calculated factors.
   2. ([Attachment G](#_Attachments)) Workpaper Disposition for Water Fixtures from the California Public Utilities Commission (CPUC), Energy Division (ED) February 22, 2013.
2. Workpaper SCGWP100303A Revision 05: Low-Flow Showerheads
3. SEU Survey conducted by ASW (2009) while servicing SEU customers (February ~ May, 2009), including data from various residential water measurements and household questionnaire response.
4. Hendron, Robert and Engebrecht, Cheryn. *Building America Research Benchmark Definition*, Updated December 2009, National Renewable Energy Laboratory. Retrieved from <http://www.nrel.gov/docs/fy10osti/47246.pdf>
5. *California Statewide Residential Appliance Saturation Study* (RASS - 2004). Contract No. 400-04-009. Prepared for the California Energy Commission by KEMA-XENERGY, Itron, Roper, and ASW. PG&E Banner Subset, Pages 100 and 102. Retrieved from [www.energy.ca.gov/reports/400-04-009/2004-08-17\_400-04-009\_PG+E.PDF](http://www.energy.ca.gov/reports/400-04-009/2004-08-17_400-04-009_PG+E.PDF)
6. Work Paper WPSCGNRWH16122A Revision 0: Aerators for Faucets in Commercial Buildings
7. *(*[Attachment C](#_Attachments)*)* Savings Calculations for Commercial Faucet Aerator: Baseline Water and Gas Consumption Estimates for Commercial Hot Water Applications:

Overview:Baseline water and gas consumption for lavatory faucets were estimated for 8 commercial facilities (5 hotels, 2 schools, 1 restaurant). These estimates were prepared by CLEAResult in March 2016 and were determined by reviewing multiple studies on water consumption in commercial buildings. The purpose of this study was to establish baseline consumption values and estimate the savings that occur from the installation of low-flow faucet aerators.

1. *(*[Attachment D)](#_Attachments) Water Consumption Patterns in Hospitals

Overview: Water consumption patterns were measured and analyzed for 19 faucets at 3 hospitals over two 10-day periods by Water Saver Solutions, Inc. in 2016. The first 10-day period measured baseline water consumption patterns before the installation of flow control devices. The second 10-day period measured the post-installation consumption patterns. The purpose of this study was to investigate existing water consumption patterns (e.g. time usage per day, gallons of water consumed per day, length of average usage instance, existing faucet flow rates) at various faucet types and determine the impacts of installing faucet flow control devices.

1. *(*[Attachment E)](#_Attachments) Existing Fixtures and Water Consumption Patterns in Hotels

Overview: Surveys were conducted by Blackstone Research Solutions, Inc. in 2016 at five hotels to obtain information on the condition of the existing water fixtures at these sites. Faucets at three of the five sites were also metered to gather data on water consumption patterns for these building types.

1. Work Paper WPSCGNRWH170412A Revision 01: Low Flow Showerheads for Commercial Facilities
2. Study Title: Savings Calculations for Commercial Showerheads

A study prepared by CLEAResult in March 2016 *(*[Attachment A](#_Attachments)*)*

Multiple studies were reviewed to find data that was utilized to determine baseline consumption of water and natural gas in applications using hot water for showers in commercial buildings, Lodging and schools from the commercial sector were selected in this study.

1. Field Study: Hot Water Survey in Hotels and Motels in SoCal

An audit performed by Blackstone Research Corp., Inc. in 2016 *(*[Attachment B](#_Attachments)*)*

This study audited 5 hotels to collect data related to hot water such as water heater efficiencies and input rates, HW set points, faucet flowrates in guestrooms and public

restrooms, showerhead flowrates, hot and cold-water temperatures, monitoring of hot and cold flows, etc. The analysis of the data resulted in an average flowrate for guestroom showerheads at 2.48 GPM. This workpaper adopted the lower flowrate (2.25 GPM) as the pre-existing baseline. The same baseline estimate was used in the water and gas savings calculation for schools.

# Section 2. Calculation Methodology

The savings for these measures will be directly adopted from the workpapers mentioned in section 1.5. The adoption will occur as described below.

1. FCVs in commercial showerheads will adopt savings from WPSCGNRWH170412A Revision 01: Low Flow Showerheads for Commercial Facilities.
2. FCVs in commercial faucets will adopt savings from WPSCGNRWH16122A Revision 0: Aerators for faucets in commercial buildings.
3. FCVs in residential showerheads will adopt savings from SCGWP100303A Revision 05: Low-Flow Showerheads.
4. FCVs in residential faucets will adopt savings from WPSCGNRWH120618A Revision 03: Faucet Aerators for Bathroom/Kitchen Sinks in Residential Buildings.

The adaptation of savings from the respective workpapers is adequate due to flow control valves restricting the flow as aerators and low flow showerheads do. This measure as aerators and low flow showerheads provide savings by reducing the flow to a finite value and in effect offsetting the hot water demand. The hot water demand offset reduces the energy consumed at the heating source thus energy savings occur. Flow control valves, low flow showerheads and aerators are flow restrictors and due to this nature, the energy effects are uniform.

For flow control valves in faucets, two units will be required, one in each line, cold and hot. The addition of two controlling valves will allow for the proper mixture of hot and cold water to the temperature specified for savings purposes.

# Section 3. Load Shapes

Table : Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| **Building Type** | **Load Shape** | **E3 Alternate Building Type** |
| Commercial | Misc. Commercial | DHW HtPmp |
| Residential | Residential | HeatPump\_WtrHt-RC |

# Section 4. Costs

There are currently only a few manufacturers of flow control valves and the cost was only available for one. The cost found will be used as the material cost. Labor cost is expected to be the same as the workpapers for showerheads and aerators at each respective sector from which the savings are adopted.

## 4.1 Base Case Cost

The base case cost is zero as this will be not applying any measure.

## 4.2 Measure Case Cost

The measure cost will be the same as the IMC. For showerhead FCVs the material cost found is $25.00 per unit. Faucet FCVs are sold in pairs for a price of $25.00, this price will be used for material cost for faucet applications as the measure must be installed in pairs. The labor cost will be adopted from the workpaper from which the savings are adopted, the installation of FCVs are of the same nature as installing an aerator on faucets, or a low flow showerhead. Labor for each application is described below.

1. FCVs in commercial and residential faucets will adopt labor cost from workpaper SCGWP100303A Revision 05: Low-Flow Showerheads, at $16.74 per fixture, however the installer will have to work on the cold and hot water fixture therefore the labor cost will be multiplied by a factor of 2, for total labor cost of ($16.74 \* 2 = $33.48).
2. FCVs in commercial and residential showerheads will adopt labor cost from workpaper SCGWP100303A Revision 05: Low-Flow Showerheads, at $16.74 per fixture.

## 4.3 Full and Incremental Measure Cost

Table : Full and Incremental Measure Cost

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Application** | **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| Faucet FCVs | REA | MEC + MLC  $25.00 + $33.48 = $58.48 | MEC + MLC  $25.00 + $33.48 = $58.48 | N/A |
| Showerhead FCVs | REA | MEC + MLC  $25.00 + $16.74 = $41.74 | MEC + MLC  $25.00 + $16.74 = $41.74 | N/A |

MEC = Measure Equipment Cost; MLC = Measure Labor Cost

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

# Attachments

A: Savings Calculations for Commercial Showerhead

B: Hot Water Survey in Hotels and Motels in SoCal

C: CLEAResult Commercial Faucet Aerator Study

D: Water Consumption Patterns in Hospitals

E: Com Faucet Aerator Sample Hotel Data

F: Climate Zone Factors

G: Water Fixture Disposition 2013

H: Savings Summary

I: Cost Summary

1. [↑](#endnote-ref-1)