**Workpaper WPSDGENRWH0012**

**Revision 0**

**San Diego Gas & Electric**

**Customer Programs Department**

**Low-Flow Pre-Rinse Spray Valves Direct Install**

Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| Revision No. | Date | **Description** | **Author** |
| 0 | April 3, 2013 | Adopted from Southern California Gas Company Work Paper WPSCGNRWH121113A Rev1 Dated January 11, 2013 without changes | Charles Harmstead |

# 

Measure Summary Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Measure Name | CZ | Building Type | EUL or RUL | NTG | Unit Definition | Program Type (NEW, ROB, RET) | Incremental Measure Cost ($/unit) | Gas  Savings (Therms) | Gross Unit Annual Electricity Savings (kWh/unit) | User Entered kW Savings per unit (kW/unit) | % Eligible for TOU AC  Adjustment | Gross  Realization Rate (GRR) |
| Low Flow Pre-Rinse Spray Valve, 1.07 GPM | All | RFF/RSD | 5 | 0.85 | Valve | RET | 75.99 | 52.4 | 0 | 0 | 0 | 1.0 |
| Low Flow Pre-Rinse Spray Valve, 1.15 GPM | All | RFF/RSD | 5 | 0.85 | Valve | RET | 75.99 | 43.9 | 0 | 0 | 0 | 1.0 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |

# Table of Contents

[Revision History i](#_Toc343841129)

[Measure Summary Table ii](#_Toc343841130)

[List of Tables iv](#_Toc343841131)

[SECTION 1 - General Measure & Baseline Data 1](#_Toc343841132)

[1.01 Measure & Delivery Description 1](#_Toc343841133)

[1.02 DEER Differences Analysis 2](#_Toc343841134)

[1.03 Code Analysis 2](#_Toc343841135)

[1.04 Measure Effective Useful Life 2](#_Toc343841136)

[1.05 Net-to-Gross Ratios for Different Program Strategies 2](#_Toc343841137)

[1.06 Gross Realization Rate 2](#_Toc343841138)

[SECTION 2 - Energy Savings & Demand Reduction Calculations 2](#_Toc343841139)

[2.01 Load Shapes 2](#_Toc343841140)

[2.02 Energy Savings 2](#_Toc343841141)

[SECTION 3 - Base Case & Measure Costs 5](#_Toc343841142)

[3.01 Base Case Cost 5](#_Toc343841143)

[3.02 Gross Measure Cost 5](#_Toc343841144)

[3.03 Incremental Measure Cost 5](#_Toc343841145)

[Attachments 7](#_Toc343841146)

[References 8](#_Toc343841147)

List of Tables

[Table 1 - Base and Qualifying Measure Operating Conditions 3](#_Toc343841379)

[Table 2 - Calculations of Annual Energy Savings for Replacing 1.6 GPM Pre-Rinse Spray Valves in Restaurant Facilities 4](#_Toc343841380)

[Table 3 - Calculations of Annual Water Savings for Replacing 1.6 GPM Pre-Rinse Spray Valves in Restaurant Facilities 5](#_Toc343841381)

1. General Measure & Baseline Data

Measure & Delivery Description

Measure Description

* + - 1. Pre-rinse spray valves (PRSV), also referred to as spray nozzles or spray heads are used in various food service applications, such as restaurants and cafeterias to remove loose food and debris from plates and other dishes prior to loading them in the dishwasher. The low flow pre-rinse spray valves utilize a knife-edge spray rather than a shower type spray to better focus the available energy and remove food debris more efficiently. The Food Service Technology Center[1] currently lists (24) pre-rinse spray valves that meet the federally required [2] flow rate of 1.6 gallons per minute (GPM) or less, and have a clean ability performance of 26 seconds per plate or less, which is based on the ASTM Standard Test Method for Performance of Pre-Rinse Spray Valves.
      2. Pre-rinse spray valves are defined in the Energy Policy Act of 2005, requiring a maximum flow rate of 1.6 GPM.
      3. A previous Southern California Gas PRSV workpapaer in the 2004/2005 program cycle, H101 and H102, estimated savings for replacing a PRSV of at least 2.6 GPM with a 1.6 GPM PRSV.
      4. Because hot water is dispensed at PRSV to rinse the plates more effectively, the reduction in the flow rate results in the energy savings.
    1. Baseline and Measure Flow Rates
       1. The baseline flow rate is 1.6 GPM which is the maximum allowed by the federal code.
       2. The flow rates of qualifying PRSVs are 1.07 GPM and 1.15 GPM.
    2. Measure Application Type
       1. This measure is applied as an early retirement by replacing the existing baseline equipment with the qualifying equipment.
    3. Workpaper Type
       1. Deemed.

Market Applicability

This measure is applicable only to non-residential restaurant facilities with natural gas storage and tankless water heaters.

* + - 1. This measure replaces a pre-rinse spray valve using 1.6 GPM or higher with a new pre-rinse spray valve using either 1.07 GPM or 1.15 GPM.

Delivery Method

* + - 1. The delivery method is no-cost direct installation of more efficient systems or specific efficiency measures.
    1. Terms and Conditions
       1. The measure (or measures) described herein is only available to California Investor-Owned Utility (IOU) Customers whom are paying the Public Goods Charge, and are Customers of the IOU for which the particular measure (or measures) described herein are being offered through the IOU’s Energy Efficiency program.
       2. The Customer attempting to participate in the program must be currently in good standing with the administering IOU.
       3. The only applicable market segments allowed to participate are within the foodservice industry.  Specifically, participants are limited to:  commercial family-style or fine-dining-style restaurants, not-for-profit food kitchens, K-12 school-site or school-district kitchens (commissaries), government commissaries (such as those on military bases), College / University commissaries and kitchens, Hospital commissaries and kitchens, Hotel or Hotel and Resort restaurant kitchens, and Amusement Park commissaries and kitchens.
       4. PRSVs used for residential uses such as in commercial facility kitchenettes are not eligible.
       5. Only commercial-grade PRSVs with a minimum flow rate less than or equal to 1.15 GPM are eligible.
       6. Customer agrees that the IOU may conduct a post measure implementation inspection.

DEER Differences Analysis

This measure is currently not included in the DEER database; therefore no differential analysis was conducted.

Code Analysis

The minimum baseline efficiency is based on the Energy Policy Act of 2005 [2] mandate of 1.6 GPM.

The minimum qualifying measure efficiency exceeds the Federal Standard.

Measure Effective Useful Life

For pre-rinse spray valves, the EUL of 5 years is taken from the 2007 impact and process evaluation of the California Urban Water Conservation Council 2004-5 Pre-Rinse Spray Valve Installation Program (Phase 2) study [3].

Net-to-Gross Ratios for Different Program Strategies

* + 1. The 2011 DEER documents recommend a net-to-gross ratio (NTGR) of 0.85 for all energy efficiency measures with no previously evaluated NTGR: direct install to hard-to-reach only [4].

Gross Realization Rate

Gross realization rate of 1.00 is applied to the measures in this document.

1. Energy Savings & Demand Reduction Calculations

Load Shapes

N/A

Energy Savings

Annual Gas Energy Savings.

* + - 1. The annual gas energy savings per unit are based on the decrease in the flow rate (GPM) between the Federal Standard minimum efficiency of 1.6 GPM and the qualifying measure flow rate of 1.07 GPM or 1.15 GPM utilized during the pre-rinse process.
      2. Pre-rinse spray valves have been included as part of energy efficiency programs in California, Washington, and Canadian cities for several years. These programs have undergone evaluation studies validating the baseline operating hours, baseline flow rates, proposed operating hours, proposed flow rates, mixed water temperature, and supply water temperature. The results of these studies are used as the basis for energy savings calculations for this measure.

Baseline and Measure Operating Conditions.

* + - 1. Table 1 lists the flow rate and operating hours for pre-rinse spray valves.
      2. The minimum baseline flow rate for pre-rinse spray valves matches the Energy Policy Act of 2005 standard [2].
         1. The baseline operating hours were determined using the results of existing evaluation studies for restaurant facilities that included baseline operating hours of 0.79 hours/day for a 2.92 GPM [5] unit and the proposed operating hours of 1.02 hours/day for a 1.18 GPM unit [5]. The linear relationship between these two parameters yielded the following equation, Hours/day = -0.1322 x Flow Rate +1.176, which was utilized to calculate operating hours for the baseline unit at 1.6 GPM.
      3. The qualifying measure flow rate is assumed to be the rated flow of 1.07 GPM or 1.15 GPM for the two qualifying PRSVs. The qualifying measure flow rates are consistent with the results of evaluation studies for previously implemented pre-rinse spray valve programs [3]
         1. The qualifying measure operating hours were determined using the results of existing evaluation studies for restaurant facilities that included baseline operating hours of 0.79 hours/day for a 2.92 GPM [5] unit and the proposed operating hours of 1.02 hours/day for a 1.18 GPM unit [5]. The linear relationship between these two parameters yielded the following equation, Hours/day = -0.1322 x Flow Rate +1.176, which was utilized to calculate operating hours for the qualifying units at 1.07 GPM and 1.15 GPM.
      4. For the baseline and qualifying measure, the mixed water temperature is 114.1 °F [5] for evaluated PRSV units in California programs, the supply water temperature is 68 °F [3,5] for Southern California Gas Company’s service territory, and the hot water temperature is 130.9 °F [5].

1. Base and Qualifying Measure Operating Conditions

|  |  |  |
| --- | --- | --- |
| **Equipment Type** | **Rated Flow (GPM)** | **Operating Hours (Hr/Day)** |
| Base, Pre-Rinse Spray Valve | 1.6 | 0.964 |
| Qualifying Measure 1 | 1.07 | 1.035 |
| Qualifying Measure 2 | 1.15 | 1.024 |

Energy Savings Calculation

* + - 1. The annual energy use was calculated using the following equation:

*Eq-1*

Where

* + - * 1. Q – Energy Used (therms/yr)
        2. F – flow rate (gallons/minute)
        3. density of water is 8.33 (lbm/gal)
        4. specific heat of water is 1.0 (btu/lbm-°F)
        5. temperature of mixed water (°F)
        6. temperature of supply water (°F)
        7. - daily operating hours (hours/day)
        8. - yearly days of operating (days/year)
        9. − thermal efficiency of natural gas water heating unit

For calculating energy savings, the following assumptions are used:

The average efficiency for the water heating unit equal to those from several evaluation studies, and is 70% [3,6]

The number of annual operating days is equal to the results from previous evaluation studies of installed PRSV units in California, and is 365 days per year [3]

With the above assumptions, the energy saved by installing a qualified pre-rinse spray valve is calculated as follows:

*Eqn-2*

1. Calculations of Annual Energy Savings for Replacing 1.6 GPM Pre-Rinse Spray Valves in Restaurant Facilities

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | GPM | Hours/Day | Days/yr | Mix H2O °F | Supply H20 °F | eff | Therms/yr | Savings Therms/yr |
| Baseline | 1.6 | 0.964 | 365 | 114.1 | 68 | 0.7 | 185.4 | N/A |
| Qualifying Measure 1 | 1.07 | 1.035 | 365 | 114.1 | 68 | 0.7 | 133.0 | **52.4** |
| Qualifying Measure 2 | 1.15 | 1.024 | 365 | 114.1 | 68 | 0.7 | 141.5 | **43.9** |

Water Savings Calculation

* + - 1. The annual water use was calculated using for hot, cold and mixed water temperatures, using the following equation:

*Eqn-3*

Where

* + - * 1. F – flow rate (gallons/minute) for hot, cold, or mixed water temperatures
        2. - daily operating hours (hours/day)
        3. - yearly days of operating (days/year)
        4. - annual water use (gallons/year)

For calculating water savings, the following assumptions are used:

The hot water flow rate in the baseline case is 1.17 GPM. The hot water flow rate in the proposed case is 0.78 GPM for the 1.07 GPM PRSV and 0.84 GPM for the 1.15 GPM PRSV as calculated on the attached spreadsheet.

The average cold water flow rate in the baseline case is 0.43 GPM. The cold water flow rate in the proposed case is 0.29 GPM for the 1.07 GPM PRSV and 0.31 GPM for the 1.15 GMP PRSV as calculated on the attached spreadsheet.

With the above assumptions, the water saved by installing a qualified pre-rinse spray valve is calculated as follows:

*Eqn-4*

1. Calculations of Annual Water Savings for Replacing 1.6 GPM Pre-Rinse Spray Valves in Restaurant Facilities

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Water Consumption | GPM | Hour/Day | Days/yr | Gal/yr | Savings Gal/yr |
| Baseline, Hot | 1.17 | 0.964 | 365 | 24,769.0 | 0 |
| Qualifying Measure 1 (1.07 GPM), Hot | 0.78 | 1.035 | 365 | 17,767.6 | **7,001.4** |
| Qualifying Measure 2 (1.15 GPM), Hot | 0.84 | 1.024 | 365 | 18,900.8 | **5,868.2** |
|  |  |  |  |  |  |
| Baseline, cold | 0.43 | 0.964 | 365 | 9,026.4 | 0 |
| Qualifying Measure 1 (1.07 GPM), cold | 0.29 | 1.035 | 365 | 6,474.9 | **2,551.5** |
| Qualifying Measure 2 (1.15 GPM), cold | 0.31 | 1.024 | 365 | 6,887.9 | **2,138.5** |
|  |  |  |  |  |  |
| Baseline, Hot+Cold | 1.6 | 0.964 | 365 | 33,795.4 | 0 |
| Qualifying Measure 1 (1.07 GPM), Hot+Cold | 1.07 | 1.035 | 365 | 24,242.5 | **9,552.9** |
| Qualifying Measure 2 (1.15 GPM), Hot+Cold | 1.15 | 1.024 | 365 | 25,788.7 | **8,006.7** |

1. Base Case & Measure Costs

Base Case Cost

For this measure category, the base case cost is $0 because this is a direct install retrofit measure where no action is taken for the base case.

Gross Measure Cost

* + 1. For this measure category, the gross measure cost is the full cost of the measure to purchase and install.
       1. The equipment costs are estimated to be $54.30 for either the 1.07 GPM PRSV or the 1.15 GPM PRSV based information provided by Southern California Gas.
       2. The labor costs are estimated to be $21.69 for either the 1.07 GPM, or the 1.15 GPM based on the labor cost to install plumbing fixtures and the city index for Los Angeles [7].
       3. The gross measure cost for this measure type is $75.99 for the 1.07 GPM PRSV or the 1.15 GPM PRSV.

Incremental Measure Cost

The incremental measure cost for this measure is $$75.99 for the 1.07 GPM PRSV or the 1.15 GPM PRSV.

Attachments

References

* + - 1. Food Service Technology Center, [http://www.fishnick.com/equipment /sprayvalves/](http://www.fishnick.com/equipment%20/sprayvalves/)
      2. *Energy Policy Act 2005, Section 119 Stat 632, pp 40.*
      3. *“Impact and Process Evaluation Final Report for California Urban Water Conservation Council 2004-5 Pre-Rinse Spray Valve Installation Program (Phase2).” By SBW Consulting, Inc, February 21, 2007.*
      4. *DEER Database for Energy-Efficient Resources*, Version 2011 4.00, For Use in the California IOU 2013-14 Energy Efficiency Planning (Accessed Sep. 24, 2012 at <http://www.deeresources.com/>, Filename is “DEER2011\_NTGR\_2012-05-16.xls”, Row 59).
      5. *“Pre-Rinse Spray Valve Programs: How Are They Really Doing?” By SBW Consulting Inc and Koeller and Company, December 1, 2005,* downloaded from Alliance for Water Efficiency, <http://www.allianceforwaterefficiency.org/Commercial_Food_Service_Introduction.aspx>
      6. *“Evaluation of the 2005 SmartRinse Program”* By Ecology Action, April 9, 2006
      7. *RS Means Mechanical Cost Data 2013*, item 224139.10.5000, bare labor costs

THIS PAGE INTENTIONALLY LEFT BLANK