4.2.11 High Efficiency Pre-Rinse Spray Valve

**Description**

Pre-rise valves use a spray of water to remove food waste from dishes prior to cleaning in a dishwasher. More efficient spray valves use less water thereby reducing water consumption, water heating cost, and waste water (sewer) charges. Pre-rinse spray valves include a nozzle, squeeze lever, and dish guard bumper. The primary impacts of this measure are water savings. Reduced hot water consumption saves either natural gas or electricity, depending on the type of energy the hot water heater uses.

This measure was developed to be applicable to the following program types: TOS, RF, and DI. If applied to other program types, the measure savings should be verified.

**Definition of Efficient Equipment**

To qualify for this measure, the new or replacement pre-rinse spray nozzle must use less than 1.6 gallons per minute with a cleanability performance of 26 seconds per plate or less.

**Definition of Baseline Equipment**

The baseline equipment will vary based on the delivery method and is defined below:

|  |  |
| --- | --- |
| **Time of Sale** | **Retrofit, Direct Install** |
| The baseline equipment is assumed to be 1.6 gallons per minute. The Energy Policy Act (EPAct) of 2005 sets the maximum flow rate for pre-rinse spray valves at 1.6 gallons per minute at 60 pounds per square inch of water pressure when tested in accordance with ASTM F2324-03. This performance standard went into effect January 1, 2006. | The baseline equipment is assumed to be an existing pre-rinse spray valve with a flow rate of 1.9 gallons per minute.[[1]](#footnote-1) If existing pre-rinse spray valve flow rate is unknown, then existing pre-rinse spray valve must have been installed prior to 2006. The Energy Policy Act (EPAct) of 2005 sets the maximum flow rate for pre-rinse spray valves at 1.6 gallons per minute at 60 pounds per square inch of water pressure when tested in accordance with ASTM F2324-03. This performance standard went into effect January 1, 2006. However, field data shows that not all nozzles in use have been replaced with the newer flow rate nozzle. Products predating this standard can use up to five gallons per minute |

**Deemed Lifetime of Efficient Equipment**

The expected measure life is assumed to be 5 years[[2]](#footnote-2)

**Deemed Measure Cost**

The cost of this measure is assumed to be $100[[3]](#footnote-3)

**Loadshape**

Loadshape C01 - Commercial Electric Cooking

**Coincidence Factor**

N/A

**Algorithm**

**Calculation of Energy Savings**

**Electric Energy Savings (note water savings must first be calculated)**

ΔkWH = ΔGallons x 8.33 x 1 x (Tout - Tin) x (1/EFF electric) /3,413 x FLAG

Where:

ΔGallons = amount of water saved as calculated below

8.33 lbm/gal = specific mass in pounds of one gallon of water

1 Btu/lbm°F = Specific heat of water: 1 Btu/lbm/°F

Tout = Water Heater Outlet Water Temperature

= custom, otherwise assume Tin + 70°F temperature rise from Tin[[4]](#footnote-4)

Tin = Inlet Water Temperature

= custom, otherwise assume 54.1 °F[[5]](#footnote-5)

EFF = Efficiency of electric water heater supplying hot water to pre-rinse spray valve

=custom, otherwise assume 97%[[6]](#footnote-6)

Flag = 1 if electric or 0 if gas

EXAMPLE

Time of Sale: For example, a new spray nozzle with 1.06 gal/min flow replacing a nozzle with 1.6 gal/min flow at a large institutional establishments with a cafeteria with 70 degree temperature rise of water used by the pre-rinse spray valve that is heated by electric hot water saves annually :

ΔkWH = 30,326x 8.33 x 1 x ((70+54.1) - 54.1) x (1/.97) /3,413 x 1

= 5,341kWh

Retrofit: For example, a new spray nozzle with 1.06 gal/min flow replacing a nozzle with 1.9 gal/min flow at a large institutional establishments with a cafeteria with 70 degree temperature rise of water used by the pre-rinse spray valve that is heated by electric hot water equals:

ΔkWH = 47,175 x 8.33 x 1 x ((70+ 54.1) - 54.1) x (1/.97) /3,413 x 1

=8309 kWh

**Summer Coincident Peak Demand Savings**

N/A

**Natural Gas Energy Savings**

ΔTherms = ΔGallons x 8.33 x 1 x (Tout - Tin) x (1/EFF) /100,000 Btu

Where (new variables only):

EFF = Efficiency of gas water heater supplying hot water to pre-rinse spray valve

= custom, otherwise assume 80%[[7]](#footnote-7)

EXAMPLE

Time of Sale: For example, a new spray nozzle with 1.06 gal/min flow replacing a nozzle with 1.6 gal/min flow at a large institutional establishments with a cafeteria with 70 degree temperature of water used by the pre-rinse spray valve that is heated by fossil fuel hot water saves annually:

ΔTherms = 30,326 x 8.33 x 1 x ((70+54.1) - 54.1) x (1/.80)/100,000 x 1.0

= 219 Therms

Retrofit: For example, a new spray nozzle with 1.06 gal/min flow replacing a nozzle with 1.9 gal/min flow at a busy large institutional establishments with a cafeteria with 70 degree temperature rise of water used by the pre-rinse spray valve that is heated by fossil fuel hot water saves annually:

ΔTherms = 47,175 x 8.33 x 1 x ((70+54.1) - 54.1) x (1/.80)/100,000 x (1-0)

=341 Therms

**Water Impact Calculation[[8]](#footnote-8)**

ΔGallons = (FLObase - FLOeff)gal/min x 60 min/hr x HOURSday x DAYSyear

Where:

FLObase = Base case flow in gallons per minute, or custom

|  |  |
| --- | --- |
| **Time of Sale** | **Retrofit, Direct Install** |
| 1.6 gal/min[[9]](#footnote-9) | 1.9 gal/min[[10]](#footnote-10) |

FLOeff = Efficient case flow in gallons per minute or custom

|  |  |
| --- | --- |
| **Time of Sale** | **Retrofit, Direct Install** |
| 1.06 gal/min[[11]](#footnote-11) | 1.06 gal/min[[12]](#footnote-12) |

HOURSday = Hours per day that the pre-rinse spray valve is used at the site, custom, otherwise[[13]](#footnote-13):

|  |  |
| --- | --- |
| **Application** | **Hours/day** |
| Small, quick- service restaurants | 1/2 |
| Medium-sized casual dining restaurants | 1.5 |
| Large institutional establishments with cafeteria | 3 |

DAYSyear = Days per year pre-rinse spray valve is used at the site, custom, otherwise 312 days/yr based on assumed 6 days/wk x 52 wk/yr = 312 day/yr.

EXAMPLE

Time of Sale: For example, a new spray nozzle with 1.06 gal/min flow replacing a nozzle with 1.6 gal/min flow at a large institutional establishment with a cafeteria equals

= (1.6 – 1.06) \* 60 \* 3 \* 312

= 30,326 gal/yr

Retrofit: For example, a new spray nozzle with 106 gal/min flow replacing a nozzle with 1.9 gal/min flow at a large institutional establishments with a cafeteria equals

= (1.9 – 1.06) \* 60 \* 3 \* 312

= 47,175 gal/yr

**Deemed O&M Cost Adjustment Calculation**

N/A

**Measure Code: CI-FSE-SPRY-V03-160601**

1. Verification measurements taken at 195 installations showed average pre and post flowrates of 2.23 and 1.12 gallon per minute, respectively.” from IMPACT AND PROCESS EVALUATION FINAL REPORT for CALIFORNIA URBAN WATER CONSERVATION COUNCIL 2004-5 PRE-RINSE SPRAY VALVE INSTALLATION PROGRAM (PHASE 2) (PG&E Program # 1198-04; SoCalGas Program 1200-04) (“CUWCC Report”, Feb 2007) [↑](#footnote-ref-1)
2. Reference 2010 Ohio Technical Reference Manual, Act on Energy Business Program Technical Reference Manual Rev05, and Federal Energy Management Program (2004), "How to Buy a Low-Flow Pre-Rinse Spray Valve." [↑](#footnote-ref-2)
3. Costs range from $60 Chicagoland (Integrys for North Shore & People's Gas) to $150 referenced by Nicor's CLEAResultWorkpaper WPRSGCCODHW102 "Pre-Rinse Spray Valve." Act on Energy references $100. [↑](#footnote-ref-3)
4. If unknown, assume a 70 degree temperature rise from Tin per Food Service Technology Center calculator assumptions to account for variations in mixing and water heater efficiencies [↑](#footnote-ref-4)
5. August 31, 2011 Memo of Savings for Hot Water Savings Measures to Nicor Gas from Navigant states that 54.1°F was calculated from the weighted average of monthly water mains temperatures reported in the 2010 Building America Benchmark Study for Chicago-Waukegan, Illinois. [↑](#footnote-ref-5)
6. This efficiency value is based on IECC 2012/2015 performance requirement for electric resistant water heaters rounded without the slight adjustment allowing for reduction based on size of storage tank. [↑](#footnote-ref-6)
7. IECC 2012/2015, Table C404.2, Minimum Performance of Water-Heating Equipment [↑](#footnote-ref-7)
8. In order to calculate energy savings, water savings must first be calculated [↑](#footnote-ref-8)
9. The baseline equipment is assumed to be 1.6 gallons per minute. The Energy Policy Act (EPAct) of 2005 sets the maximum flow rate for pre-rinse spray valves at 1.6 gallons per minute at 60 pounds per square inch of water pressure when tested in accordance with ASTM F2324-03. This performance standard went into effect January 1, 2006. www1.eere.energy.gov/femp/pdfs/spec\_prerinsesprayvavles.pdf. [↑](#footnote-ref-9)
10. Verification measurements taken at 195 installations showed average pre and post flowrates of 2.23 and 1.12 gallon per minute, respectively.” from IMPACT AND PROCESS EVALUATION FINAL REPORT for CALIFORNIA URBAN WATER CONSERVATION COUNCIL 2004-5 PRE-RINSE SPRAY VALVE INSTALLATION PROGRAM (PHASE 2) (PG&E Program # 1198-04; SoCalGas Program 1200-04) (“CUWCC Report”, Feb 2007) [↑](#footnote-ref-10)
11. 1.6 gallons per minute used to be the high efficiency flow, but more efficient spray valves are available ranging down to 0.64 gallons per minute per Federal Energy Management Program which references the Food Services Technology Center web site with the added note that even more efficient models may be available since publishing the data. The average of the nozzles listed on the FSTC website is 1.06. [↑](#footnote-ref-11)
12. 1.6 gallons per minute used to be the high efficiency flow, but more efficient spray valves are available ranging down to 0.64 gallons per minute per Federal Energy Management Program which references the Food Services Technology Center web site with the added note that even more efficient models may be available since publishing the data. The average of the nozzles listed on the FSTC website is 1.06. [↑](#footnote-ref-12)
13. Hours primarily based on PG& E savings estimates, algorithms, sources (2005), Food Service Pre-Rinse Spray Valves with review of 2010 Ohio Technical Reference Manual and Act on Energy Business Program Technical Resource Manual Rev05. [↑](#footnote-ref-13)