**Workpaper WPSCGREWH120919A**

**Revision 2**

**Southern California Gas Company**

**Customer Programs Department**

**Tankless Water Heaters for Single Family and Multifamily Applications**

Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| Revision No. | Date | **Description** | **Author** |
| 0 | Oct. 09, 2012 | Original release | Stu Knoke (ICF) |
| 1 | May 20, 2014 | Revision due to Title 24 | Julianna Colwell (SCG) |
| 2 | Dec 08, 2014 | * Update with regards to DEER 2015 and Federal Code Standard * Update Workpaper Template * Updated Cost Information * Incorporated SF Tankless WP WPSCGREWH140122a * Added Tier 1 measure * Added Measure ID * Revised Terms and Conditions to exclude tankless water heater attached to storage tank. | Miguel Urrea (SCG) |

# 

Measure Summary Table A

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Measure ID | Measure  Description | Pre-Existing  Description | Code/Standard  Description | Sector | App Type(s) | Delivery Method(s) | EUL ID | NTG ID(s) | GSIA ID |
| RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p82EF-40g | Tankless Water Heater ≤200 MBtu/hr (Small / Medium), Tier 1 (≥0.82 EF) | N/A | Storage Water Heater 40 Gal ≤75 MBTUh EF 0.615 | Res | ROB | PreRebDown, PreReb, PreRebup | WtrHt-Instant-Res | Res-Default >2yrs | Def-GSIA |
| RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p92EF-40g | Tankless Water Heater ≤200 MBtu/hr (Small / Medium), Tier 2 (≥0.92 EF) | N/A | Storage Water Heater 40 Gal ≤75 MBTUh EF 0.615 | Res | ROB | PreRebDown, PreReb, PreRebup | WtrHt-Instant-Res | Res-Default >2yrs | Def-GSIA |

Measure Summary Table B

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Measure ID | Descriptors | | | | | Above Preexisting/  Customer-Average Savings | | | Above Code/  Standard Savings | | | Cost | | |
| Bldg Type | Bldg Vint | Bldg Loc | Bldg HVAC | Norm Unit | kWh/ unit | kW/ unit | therm | kWh/ unit | kW/unit | therm | Code/ Standard ($/unit) | Measure ($/unit) | Incremental  Measure ($/unit) |
| RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p82EF-40g | SFm | Ex | SCG | Any | Each | 0 | 0 | 0 | 0 | 0 | 33.6 | $788.58 | $1,246.28 | $457.70 |
| RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p82EF-40g | MFm | Ex | SCG | Any | Each | 0 | 0 | 0 | 0 | 0 | 25.4 | $788.58 | $1,246.28 | $457.70 |
| RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p92EF-40g | SFm | Ex | SCG | Any | Each | 0 | 0 | 0 | -3.52 | -0.00036 | 46.5 | $788.58 | $1,736.19 | $947.61 |
| RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p92EF-40g | MFm | Ex | SCG | Any | Each | 0 | 0 | 0 | -2.91 | -0.0003 | 36. | $788.58 | $1,736.19 | $947.61 |

**Note: For the complete list of Measures, refer to the accompanying calculation spreadsheet found in Attachment A**

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1. General Measure & Baseline Data

Measure & Delivery Description

Measure Description

Tankless water heaters have become available in recent years for a variety of applications. Relative to a storage water heater, a tankless unit has a relatively large burner that rapidly heats water to the desired temperature. Due to the rapid “instantaneous” heating, a tankless water heater does not require a storage tank.

Due to the relatively larger burner size, these water heating devices are capable of providing hot water on a continuous basis. They have relatively high energy efficiency levels because standby losses from storage tanks are essentially eliminated.

The California Titles 20 and 24 standards define an instantaneous water heater to mean “a water heater that has an input rating of at least 4,000 Btu per hour per gallon of stored water”[[1]](#endnote-1),[[2]](#endnote-2). All “tankless” water heaters are “instantaneous” water heaters and tankless water heaters generally have rated inputs less than 200 MBtu/hr.

Tankless water heaters are most useful in point-of-use applications, i.e., at the faucet and with no circulation loop. They are very inefficient in applications with a circulation loop due to the temperature loss in the circulation system which causes the tankless water heater to run without water demand. They are problematic in central systems with circulation loops which have long pipe runs from the water heater to the faucet.

The two measures are as followed:

* + - * 1. RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p82EF-40g - Tankless Water Heater, ≤200 MBtu/hr (Small / Medium), Tier 1 (≥0.82 EF)
        2. RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p92EF-40g - Tankless Water Heater, ≤200 MBtu/hr (Small / Medium), Tier 2 (≥0.92 EF)

The 2006 Instantaneous Water Heater Workpaper includes a more detailed technology description in its Appendix A[[3]](#endnote-3).

Code/Standard Description

Storage water heater means a water heater that heats and stores water within the appliance at a thermostatically-controlled temperature for delivery on demand, and that has an input less than 4,000 Btu per hour per gallon of stored water. The baseline for this measure is as followed:

Small (≤75 MBtu/hr) 40 gallon storage water heater with an energy factor of 0.615.

* + 1. Preexisting Description – NA
    2. Measure Descriptors

1. Measure Descriptors

| **MeasureID** | **Use-Category** | **UseSubCategory** | **Tech Group** | **Tech**  **Type** | **PreTech Group** | **PreTech Type** | **StdTech Group** | **StdTech Type** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p82EF-40g | SHW | Heating | WaterHtg\_eq | Instant\_EF | NA | NA | WaterHtg\_eq | Stor\_EF |
| RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p92EF-40g | SHW | Heating | WaterHtg\_eq | Instant\_EF | NA | NA | WaterHtg\_eq | Stor \_EF |

Delivery Method

The preferred delivery method is a downstream prescriptive rebate offered to the gas customer purchasing the new tankless water heater .

However, a midstream point-of-sale prescriptive rebate or an upstream manufacturer prescriptive rebate strategy may also be implemented.

Table 2 - display the DEER approved delivery methods

1. Delivery Methods

|  |  |
| --- | --- |
| ***Code*** | ***Description*** |
| PreRebDown | Downstream Prescriptive Rebate |
| PreReb | Prescriptive Rebate |
| PreRebUp | Upstream Prescriptive Rebate |

Measure Application Type

1. Measure Application Type

|  |  |  |
| --- | --- | --- |
| ***Code*** | ***Description*** | ***Comment*** |
| ROB | Replace on Burnout | measure applied when existing equipment fails or maintenance requires replacement |

Eligibility Requirements

Test methods for measuring water heater efficiencies are referenced in the California Titles 20 and 24 standards1,2.

Minimum qualifying energy factor (EF) for small (<200 MBtu/hr) tankless water heaters replacing storage water heaters:

0.82 for Tier 1 (non-condensing)

0.92 for Tier 2 (condensing)

Tier 2 hot water heaters are condensing and often require flue modifications to handle the condensate. These modifications increase installation costs and may be eligible for a higher rebate amount.

Implementation Requirements

The rebate applies to one natural gas tankless water heater replacing one natural gas storage water heater on burnout or to new installations in existing buildings.

The rebate does not apply to new construction (NC).

This measure is applicable only to single family and multifamily residential domestic (or “service”) hot water applications with a water heater in(single family only), or attached to, each dwelling unit or in adjacent units(multifamily only). Table 4 - displays approved sectors and subsectors.

This measure is limited to single family residences with a central water heater in each dwelling unit and multifamily residences with a water heater in each dwelling unit or with a water heater serving adjacent units.

This measure includes replacing a storage water heater with a tankless water heater.

This Workpaper does not cover water heaters or hot water boilers used for commercial domestic hot water, space conditioning, industrial (process) end-use, pool, or spa applications.

1. Sector and Subsector

|  |  |  |
| --- | --- | --- |
| ***Sector*** | ***Subsector*** | ***Comment*** |
| Res | SFm | Residential Single Family |
| Res | MFm | Residential Multi-family |

Documentation Requirements

The manufacturer’s name and equipment model number must be provided.

If necessary, customer must provide proof of unit efficiency (e.g., manufacturer’s equipment specification sheet).

Terms & Conditions

* + - 1. Only tankless water heaters as defined by the California Energy Commission qualify, and they must:

Be used primarily for domestic hot water

Be installed at the point of use

Never be used to supply hot water to a circulation loop

DEER Differences Analysis

1. DEER Difference Summary

|  |  |
| --- | --- |
| DEER Difference Summary Table | |
| Modified DEER Methodolgy | Yes |
| Scaled DEER Measure | No |
| DEER Building Prototypes Used | Yes |
| Deviation from DEER | * Change measure baseline for from 75 gallon storage water heater to 40 gallon storage water heater * Updated energy factor to reflect new baseline storage water heater volume size federal code requirements. * DEER does not contain cost data for measure efficiency * DEER has adopted this measure into READI per IOU request |
| DEER Version | DEER2015 |
| DEER Run ID and Measure Name | * Tankless Water Heater ≤200 MBtu/hr (Small / Medium), Tier 1 (≥0.82 EF)   + RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p82EF-40g * Tankless Water Heater ≤200 MBtu/hr (Small / Medium), Tier 2 (≥0.92 EF)   + RG-WtrHt-SmlInst-Gas-150kBtuh-lt2G-0p92EF-40g |

Measure Efficiency

The minimum qualifying measure efficiencies are based on the 2015 Database for Energy-Efficient Resources (DEER)[[4]](#endnote-4) which take into consideration the California Titles 20 and 24 standards, and Code of Federal Regulation[[5]](#endnote-5) standards. The measure efficiency practicality were reviewed with respect to the high-efficiency tankless water heaters listed in the California Energy Commission Energy Efficiency Appliance Database[[6]](#endnote-6):

DEER 2015 update incorporates two tiers for small tankless water heaters which are used here.

Small (150 MBtu/hr) Tier 1 tankless water heater – the small (150 MBtu/hr) DEER 2015 value of 0.82 EF for non-condensing tankless water heaters is used in this Workpaper.

Small (150 MBtu/hr) Tier 2 tankless water heater – the medium (150 MBtu/hr) DEER 2015 value of 0.92 EF for condensing tankless water heaters is used in this Workpaper.

Baseline Efficiency

The minimum baseline efficiencies have changed from the 2015 Database for Energy-Efficient Resources (DEER). The following measure efficiencies are adopted after consideration of the California Titles 20 and 24 standards, DEER 2014, and ASHRAE[[7]](#endnote-7):

Small (150 MBtu/hr) tankless water heater – the Federal Regulations Standard equation for small (≤75 MBtu/hr) storage water heaters energy factor is equal to {0.675-(0.0015\*V)} for a volume size ≥ 20 and ≤ 50 and {0.8012-(0.00078\*V)} for a volume size > 50 and ≤ 100 is used in this Workpaper, where Volume (V) is the rated storage volume. To meet the hot water demand, tankless water heaters with rated inputs in the range of 75 to 200 MBtu/hr are used to replace small storage water heaters with rated inputs in the range of 30 to 75 MBtu/hr and storage volumes in the range of 28 to 100 gallons. The corresponding range of Titles 20 and 24 minimum energy factors for this selection of storage water heaters is 0.60 to 0.754. A typical storage water being replaced is a 40-gallon storage water heater with a rated input of 40 MBtu/hr, for which the Titles 20 and 24 energy factor is 0.615. DEER 2014 specifies that the baseline for the Tier 1 measure similar to the measure in the Workpaper is a small gas storage water heater with energy factor of 0.59, storage volume of 40 gallons, and a recovery efficiency of 0.76 while the DEER 2015 specifies that the baseline for the Tier 1 and Tier 2 measures listed in this Workpaper is a small gas storage water heater with energy factor 0.74, storage volume of 75 gallons, and a recovery efficiency of 0.88. Upon review of the DEER 2015 code update and ASHRAE7 SCG has decided to continue to define the baseline as a 40 gallon storage water heater as contained in DEER 2014, with the exception of increasing the energy factor to 0.615 to comply with new federal regulations. DEER now includes this measure with a baseline of 40 gallon storage tank per IOU request.

Small (150 MBtu/hr) tankless water heater – the Titles 20 and 24 standard for small (150 MBtu/hr) tankless water heaters is an energy factor equal to {082 – (0.0019\*V)}, where Volume (V) is the rated storage volume. For V < 2 gallons, EF = 0.82

Incremental Measure Cost

Since the efficiencies used here do not contain cost information in DEER, the incremental measure costs was developed.

Data were collected through a survey of vendors that sell tankless water heaters in California and SCG customers who participated in single family rebate program. The incremental measure costs used in this Workpaper are the arithmetic average of the survey cost data for the tankless water heaters covered by this Workpaper.

Code Analysis

1. Code Summary

|  |  |  |
| --- | --- | --- |
| Code | Applicable Code Reference | Effective Dates |
| Title 24 (2013) | Section 110.3 | 11/26/2013 |
| Title 20 (2012) | Section 1605.3(f) | 1/20/2004 |
| Code of Federal Regulations | 10 CFR 430.32(d) | 04/16/2015 |

The minimum baseline efficiencies are consistent with the Code of Federal Regulations standards which are to take into effect April 15, 2015.

The minimum qualifying measure efficiency for Tier 2 exceeds the California Titles 20 and 24 and the Code of Federal Regulations standards. Since it is considered standard practice to purchase storage water heaters for residential applications we are offering a Tier 1 measure of a tankless water heater listed at the Code of Federal Regulations standards of energy factor 0.82.

1. California Title 20 Gas Appliance Standards And Code Of Federal Regulations

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Equipment Type** | **Rated Input (MBtu/hr)** | **Rated Volume (gal)** | **Efficiency Units** | **Minimum**  **Efficiency** | **Maximum Standby Loss (Btu/hr)** |
| **Storage Water Heaters** | | | | | |
| Small federally-regulated | ≤ 75 | ≥ 20 and ≤ 50 | EF | 0.675-(0.0015\*V) | --- |
| Small federally-regulated | ≤ 75 | > 50 and ≤ 100 | EF | 0.8012-(0.00078\*V) | --- |
| Small non-federal regulated | ≤ 75 | < 20 | EF | 0.62-(0.0019\*V) | --- |
| Small non-federal regulated | ≤ 75 | > 100 | EF | 0.62-(0.0019\*V) | --- |
| **Tankless Water Heaters** | | | | | |
| Small federally-regulated | ≤ 200 | < 2 | EF | 0.82-(0.0019\*V) | --- |
| Small non-federal regulated | ≤ 50 | Unspecified | EF | 0.62-(0.0019\*V) | --- |
| Small non-federal regulated | ≤ 200 | ≥ 2 | EF | 0.62-(0.0019\*V) | --- |

\*V is the rated volume in gallons; Q is the rated input is Btu/hr

Measure Effective Useful Life

For tankless water heaters, the EUL for WtrHt-Instant-Res of 20 years is taken from the DEER 2014 EUL Table[[8]](#endnote-8).

Net-to-Gross Ratios for Different Program Strategies

The 2014 DEER documents recommend a net-to-gross ratio (NTGR) of 0.55 for all other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years listed as Res-Default>2[[9]](#endnote-9).

Gross Realization Rate

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

Time-of-Use Adjustment Factor

N/A

Gross Savings and Installation Adjustment (GSIA)

1. GSIA Table

|  |  |  |  |
| --- | --- | --- | --- |
| ***GSIA ID*** | ***GSIA Type*** | ***GSIA Value*** | ***Description*** |
| Def-GSIA | Annual Installation Rate | 1 | Default GSIA Value |

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

N/A

1. Energy Savings & Demand Reduction Calculations

Load Shapes

N/A

Energy Savings

Annual Gas Energy Savings.

The annual gas energy savings are based on 2015 DEER, with changes to the baseline efficiency values based on the California Titles 20 and 24 standards, Federal Regulations standards, and ASHRAE. Table 9 - lists the baseline and qualifying efficiency measure efficiencies for tankless water heaters in the DEER 2015.

The California Titles 20 and 24 standards use energy factor to describe the efficiency of small (rated input less 200 MBtu/hr) tankless water heaters.

1. Base and Measure Tankless Water Heater Efficiencies in DEER 2015

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Equipment Type** | **Rated Input (MBtu/hr)** | **Efficiency Units** | **Base Efficiency** | **Qualifying Efficiency** |
| Small, < 2 gallons | ≤ 75 | EF | 0.743 | 0.82, 0.92 |

Water Heater Efficiencies.

Water heating products in the CEC Appliance Database intermingle tankless, storage, non-condensing, and condensing water heaters. The ratio of rated input to rated storage volume is used to sort the data. First, water heating products having a ratio less than 4,000 Btu/hr/gallon (“storage water heaters”) were removed from the database. Table 10 -shows the range of water heater efficiencies found in the CEC Appliance Database for products having a ratio ≥4,000 Btu/hr/gallon. Non-condensing and condensing water heaters are intermingled, although a water heater with energy factor or thermal efficiency above about 88% is most likely a condensing water heater. See Attachment C for complete list.

Less than 1% of the tankless water heaters on the market have rated input less than 75,000 MBtu/hr.

Figure 1 -shows the distribution of energy factors for small tankless water heaters (rated input under 200 MBtu/hr) in the CEC Appliance Database. Numerous models with EF > 0.92 are available.

1. Tankless Water Heater Efficiency Ranges from California Energy Commission Appliance Efficiency Database

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Equipment Type** | **Rated Input (MBtu/hr)** | **Efficiency Units** | **Minimum Efficiency** | **Maximum Efficiency** |
| Small | 38 – 199 | EF | 0.62 | 0.98 |

1. Energy Factor Distribution for Small Tankless Water Heaters in the CEC Appliance Efficiency Database

Standard Efficiencies.

Table 7 -lists the California Titles 20 and 24 and Federal Regulations standards for storage and tankless water heaters. Title 20 defines a "storage water heater" to be a water heater that heats and stores water within the appliance at a thermostatically-controlled temperature for delivery on demand, and that has an input less than 4,000 Btu/hr per gallon of stored water. Title 20 also defines an "instantaneous water heater" to be a water heater that has an input rating of at least 4,000 Btu/hr per gallon of stored water.

Energy factor is the standard efficiency unit for storage water heaters with rated input ≤ 75 MBtu/hr and for tankless water heaters with rated input ≤ 200 MBtu/hr. The efficiencies of all of the storage water heaters and tankless water heaters found in the CEC Appliance Database meet these standards.

Baseline and Measure Efficiencies.

Table 11 -lists the efficiency units and efficiency values recommended for tankless water heaters.

The minimum baseline efficiencies and efficiency units for tankless water heaters match the California Titles 20 and 24 and Federal Regulation standards for storage water heaters:

Small (≤75 MBtu/hr) 40-gallon storage water heaters are matched with the small (≤200 MBtu/hr) tankless water heaters.

* + - * 1. The baseline small storage water heater is a code standard 40-gallon storage water heater with an energy factor of 0.615.

The baseline efficiencies have the following changes compared to the 2015 Database for Energy-Efficient Resources (DEER):

The baseline small storage water heater is a code standard 40-gallon storage water heater with an energy factor of 0.615. As discussed above, the DEER 2015 baseline storage water heater with rated volume of 75 gallons, energy factor of 0.74, and recovery efficiency of 0.88.

The qualifying measure efficiencies are the same as the 2015 Database for Energy-Efficient Resources (DEER):

1. Baseline and Qualifying Measure Efficiencies for Tankless Water Heaters Replacing Storage Water Heaters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Equipment Type** | **Rated Input (MBtu/hr)** | **Efficiency Units** | **Base Efficiency (Storage Water Heater)** | **Qualifying Efficiency (Tankless Water Heater)** |
| **Tankless Water Heaters** | | | | |
| Small, Tier 1 (non-condensing) | ≤ 200 | EF | 0.615 | 0.82 |
| Small, Tier 2 (condensing) | ≤ 200 | EF | 0.615 | 0.92 |

Energy Savings Calculation

The energy savings data was calculated in DEER 2015 Water Heater Calculator, DEER has incorporated these measures into READI, the savings reported in READI by use of this calculator are used as the basis for this Workpaper.

For calculating energy savings, the following assumptions are used:

The efficiency for the baseline units used with tankless water heaters is the Code of Federal Regulation efficiency standards for 40 gallon storage water heaters.

The efficiencies for tankless water heater measure units are the Code of Federal Regulation efficiency standards set at Tier 1 and the average efficiencies of commercially available Tier 2 qualifying efficiencies for tankless water heaters.

Table 12 -lists the base efficiencies, measure efficiencies, and calculated values for the two measures reported in the DEER 2015 calculations for tankless water heaters replacing storage water heaters. The data and calculations are included in an Excel file embedded as Attachment A.

* + - * 1. The energy savings calculated for 2015 DEER are a set of values separated by climate zones.
        2. The example in Table 12 -uses the IOU value for. The rest of the calculations can be found in the excel sheet as Attachment A.
        3. Only existing building vintages are used for the DEER calculations.
      1. With the above assumptions, the energy saved by a high-efficiency measure tankless water heater can be calculated using the DEER 2015 Water Heater Calculator[[10]](#endnote-10):

Table 13 -shows the adjusted energy savings calculations for tankless water heaters replacing storage water heaters. The data and calculations are included in an Excel file embedded as Attachment A.

The table shows the calculation results for annual energy savings using the 40 gallon baseline.

The annual energy savings for small tankless water heaters are significantly increased compared to 2015 DEER measure with a 75 gallon baseline.

1. DEER Calculations of Annual Energy Savings for Tankless Water Heaters Replacing Storage Water Heaters

|  |  |  |
| --- | --- | --- |
| **Equipment Type** | **Small, Tier 1** | **Small, Tier 2** |
| **Rated Input (MBtu/hr) 🡪** | **≤ 200** | **≤ 200** |
| Storage Base Volume (Gal) | 75 | 75 |
| Storage Base Recovery Efficiency | 0.88 | 0.88 |
| Base Efficiency, *E1* | 0.743 | 0.743 |
| Measure Efficiency (Tankless water heater), *E2* | 0.82 | 0.92 |
| Average Annual Energy Savings (therms/yr/MBtuh), *∆Q1-2* (SFm) | 2.01 | 14.90 |
| Average Annual Energy Savings (therms/yr/MBtuh), *∆Q1-2* (MFm) | (0.96) | 9.67 |

1. Calculations of Annual Energy Savings for Tankless Water Heaters Replacing Storage Water Heaters

|  |  |  |
| --- | --- | --- |
| **Equipment Type** | **Small, Tier 1** | **Small, Tier 2** |
| **Rated Input (MBtu/hr) 🡪** | **≤ 200** | **≤ 200** |
| **Adjusted Values** |  |  |
| Storage Base Volume (Gal) | 40 | 40 |
| Efficiency units | EF | EF |
| Base Efficiency, *E3* | 0.615 | 0.615 |
| Measure Efficiency (Tankless water heater), *E4* | 0.82 | 0.92 |
| Adjusted Annual Energy Savings (therms/yr/MBtuh), *∆Q3-4* (SFm) | **33.64** | **46.49** |
| Adjusted Annual Energy Savings (therms/yr/MBtuh), *∆Q3-4* (MFm) | **25.38** | **36.02** |

1. Base Case & Measure Costs

Base Case Cost

* + 1. When the customer is replacing equipment on burnout (ROB) or buying new equipment, the customer must buy a new water heater to continue operating, so the base case cost is that of a baseline (standard) water heater. The baseline water heater is a storage water heater.
    2. The base case costs are shown in Table 14 - below. Table 14 - is focused on tankless water heaters replacing storage water heaters for domestic hot water use.

The table lists the results of a survey of equipment vendors that sell water heaters in California. The vendor calls produced data for most of the categories of water heater type, rated input, and efficiency used in this Workpaper.

The base measure costs shown in Table 14 - represent an arithmetic average of the corresponding equipment cost/MBtuh in each category. The cost data and calculations are included in an Excel file embedded as Attachment D.

Gross Measure Cost

* + 1. The gross measure costs include the cost of the equipment, excluding installation and start-up costs. For the purposes of determining incremental measure costs, the installation and start-up costs are assumed to be the same for the base case and measure equipment.

The gross measure costs are shown in Table 14 - below.

The table lists the results of a survey of equipment vendors that sell water heaters in California. The gross measure costs shown in Table 14 - represent an arithmetic average of the equipment cost per MBtu/hr in each category. The cost data and calculations are included in an Excel file embedded as Attachment D.

Incremental Measure Cost

* + 1. The incremental measure cost (IMC) is the difference between the cost of the average baseline unit and the average measure.
    2. The incremental measure costs are shown in Table 14 - below. Table 14 - is focused on tankless water heaters replacing storage water heaters for domestic hot water use. The cost data and calculations are included in an Excel file embedded as Attachment D.

1. Gross and Incremental Measure Cost for Tankless Water Heaters Replacing Storage Water Heaters

|  |  |  |
| --- | --- | --- |
| **Equipment Type** | **Small Tier 1** | **Small Tier 2** |
| **Rated Input (MBtu/hr) 🡪** | **≤ 200** | **≤ 200** |
| **2014 Vendor Survey Data per MBtuh** |  |  |
| Average Base Cost ($/unit) | $788.58 | $788.58 |
| Average Gross Measure Cost ($/unit) | $1,246.28 | $1,736.19 |
| Average Incremental Measure Cost ($/unit) | **$457.70** | **$947.61** |

Attachments

*Attachment A – Tankless Water Heater Gas Savings*



*Attachment B –* B-REP-05-599-17A - Instantaneous (Tankless) Water Heaters



*Attachment C – CEC Database*



*Attachment D – Tankless Water Heater Vendor Cost Data*



1. # References

   (2014 Appliance Efficiency Regulations, 2014) <http://www.energy.ca.gov/2014publications/CEC-400-2014-009/CEC-400-2014-009-CMF.pdf> [↑](#endnote-ref-1)
2. (2013 Building Energy Efficiency Standards for Residential and Nonresidential Buildings - Revised, 2013) <http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF-REV2.pdf> [↑](#endnote-ref-2)
3. (B-REP-05-599-17A - Instantaneous (Tankless) Water Heaters, 2005) Attachment B [↑](#endnote-ref-3)
4. (Database for Energy Efficiency Resources, 2014) <http://www.deeresources.com/> [↑](#endnote-ref-4)
5. (Standards for Residential Water Heaters, 2013) <http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/27> [↑](#endnote-ref-5)
6. (California Energy Commission Appliance Efficiency Database, 2014) <http://www.appliances.energy.ca.gov/AdvancedSearch.aspx> [↑](#endnote-ref-6)
7. (ASHRAE, 2011) [↑](#endnote-ref-7)
8. (EUL table update, 2014), <http://deeresources.com/files/DEER2013codeUpdate/download/DEER2014-EUL-table-update_2014-02-05.xlsx> [↑](#endnote-ref-8)
9. (DEER2011 Update Net-To-Gross table, 2012), <http://deeresources.com/files/DEER2011/download/DEER2011_NTGR_2012-05-16.xls> [↑](#endnote-ref-9)
10. (DEER, DEER2015 Water Heater Calculation Tool, 2014), http://deeresources.com/files/DEER2015/download/DEER-WaterHeater-Calculator-v1.0.xlsm [↑](#endnote-ref-10)