4.2.5 Tankless Water Heater

**Description**

This measure covers the installation of on-demand or instantaneous tankless water heaters. Tankless water heaters function similar to standard hot water heaters except they do not have a storage tank. When there is a call for hot water, the water is heated instantaneously as it passes through the heating element and then proceeds to the user or appliance calling for hot water. Tankless water heaters achieve savings by eliminating the standby losses that occur in stand-alone or tank-type water heaters and by being more efficient than the baseline storage hot water heater.

This measure was developed to be applicable to the following program types: TOS, RF, ER.

If applied to other program types, the measure savings should be verified.

**Definition of Efficient Equipment**

|  |  |
| --- | --- |
| **Electric** | **Gas** |
| To qualify for this measure, the tankless water heater shall be a new electric powered tankless hot water heater with an energy factor greater than or equal to 0.98 with an output greater than or equal to 5 GPM output at 70° F temperature rise. | To qualify for this measure, the tankless water heater shall meet or exceed the efficiency requirements for tankless hot water heaters mandated by the International Energy Conservation Code (IECC) 2012/2015, Table C404.2. |

**Definition of Baseline Equipment**

|  |  |
| --- | --- |
| **Electric** | **Gas** |
| The baseline condition is assumed to be an electric commercial-grade tanked water heater 50 or more gallon storage capacity with an energy factor less than or equal to 0.9 or the water heater is five or more years old. | The baseline condition is assumed to be a gas-fired tank-type water heater meeting the efficiency requirements mandated by the International Energy conservation Code (IECC) 2012/2015, Table C404.2. |

**Deemed Lifetime of Efficient Equipment**

|  |  |
| --- | --- |
| **Electric** | **Gas** |
| The expected measure life is assumed to be 5 years[[1]](#footnote-1). | The expected measure life is assumed to be 20 years[[2]](#footnote-2) |

**Deemed Measure Cost**

The incremental capital cost for an electric tankless heater this measure is assumed to be[[3]](#footnote-3)

| **Output (gpm) at delta T 70** | **Incremental Cost** |
| --- | --- |
| 5 | $1050 |
| 10 | $1050 |
| 15 | $1950 |

The incremental capital cost for a gas fired tankless heater is as follows:

|  |  |
| --- | --- |
| **Program** | **Capital Cost, $ per unit** |
| Retrofit | $3,255[[4]](#footnote-4) |
| Time of Sale or New Construction | $2,526[[5]](#footnote-5) |

**Deemed O&M Cost Adjustments**

$100[[6]](#footnote-6)

**Loadshape**

Loadshape C02 - Commercial Electric DHW

**Coincidence Factor**

The measure has deemed kW savings therefor a coincidence factor is not applied

**Algorithm**

**Calculation of Energy Savings**

**Electric Energy Savings [[7]](#footnote-7)**

The annual electric savings from an electric tankless heater is a deemed value and assumed to be:

|  |  |
| --- | --- |
| **Output (gpm) at delta T 70** | **Savings (kWh)** |
| 5.0 | 2,992 |
| 10.0 | 7,905 |
| 15.0 | 12,879 |

**Summer Coincident Peak Demand Savings[[8]](#footnote-8)**

The annual kW savings from an electric tankless heater is a deemed value and assumed to be:

|  |  |
| --- | --- |
| **Output (gpm) at delta T 70** | **Savings (kW)** |
| 5.0 | 0.34 |
| 10.0 | 0.90 |
| 15.0 | 1.47 |

**Natural Gas Savings**

ΔTherms =[[Wgal x 8.33 x 1 x (Tout - Tin) x [(1/Eff base) - (1/Eff ee)]]/100,000] +[[(SL x 8,766)/Eff base]] / 100,000 Btu/Therms]

Where:

Wgal = Annual water use for equipment in gallons

= custom, otherwise assume 21,915 gallons [[9]](#footnote-9)

8.33 lbm/gal = weight in pounds of one gallon of water

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

8,766 hr/yr = hours a year

Tout = Unmixed Outlet Water Temperature

= custom, otherwise assume 130 °F[[10]](#footnote-10)

Tin = Inlet Water Temperature

= custom, otherwise assume 54.1 °F[[11]](#footnote-11)

Eff base = Rated efficiency of baseline water heater expressed as Energy Factor (EF) or Thermal Efficiency (Et); see table below[[12]](#footnote-12)

|  |  |  |
| --- | --- | --- |
| **Input Btu/hr of existing, tanked water heater** | **Eff base** | **Units** |
| Size: ≤ 75,000 Btu/hr | 0.67 -0.0019\*Tank Volume | Energy Factor |
| Size: >75,000 Btu/hr and ≤ 155,000 Btu/hr | 80% | Thermal Efficiency |
| Size: >155,000 Btu/hr | 80% | Thermal Efficiency |

Where:

Tank Volume = custom input, if unknown assume 60 gallons for Size: ≤ 75,000 Btu/hr

Please note: Units in base case must match units in efficient case. If Energy Factor used in base case, Energy Factor to be used in efficient case. If Themal Efficiency is used in base case, Thermal Efficiency must be used in efficient case.

Eff ee = Rated efficiency of efficient water heater expressed as Energy Factor (EF) or Thermal Efficiency (Eff t)

= custom input, if unknown assume 0.84[[13]](#footnote-13)

SL = Stand-by Loss in Base Case Btu/hr

= custom input based on formula in table below, if unknown assume unit size in table below[[14]](#footnote-14)

|  |  |
| --- | --- |
| **Input Btu/h of new, tankless water heater** | **Standby Loss (SL)** |
| Size: ≤ 75,000 Btu/hr | 0 |
| Size: >75,000 Btu/hr | (Input rating/800)+(110\*√Tank Volume)) |

Where:

Tank Volume = custom input, if unknown assume, 60 gallons for <75,000 Btu/hr, 75 gallons for >75,000 Btu/hr and ≤ 155,000 Btu/hr and 150 for Size >155,000 Btu/hr

Input Rating = nameplate Btu/hr rating of water heater

EXAMPLE

For example, a 75,000 Btu/hr tankless unit using 21,915 gal/yr with outlet temperature at 130.0 and inlet temperature at 54.1, replacing a baseline unit with 0.8 thermal efficiency and standby losses of 1008.3 btu/hr:

ΔTherms =[[(21,915 x 8.33x 1 x (130 – 54.1) x [(1/.8) - (1/.84)]/100,000] +[(1008.3 x 8,766)/.8]] / 100,000

=115 Therms

**Water Impact Descriptions and Calculation**

N/A

**Deemed O&M Cost Adjustment Calculation**

The deemed O&M cost adjustment for a gas fired tankless heater is $100

**Reference Tables**

Minimum Performance Water Heating Equipment[[15]](#footnote-15)



**Measure Code: CI-HW\_-TKWH-V03-160601**

1. Ohio Technical Reference Manual 8/2/2010 referencing CenterPoint Energy-Triennial CIP/DSM Plan 2010-2012 Report; Additional reference stating >20 years is at Energy Savers.Gov online at http://www.energysavers.gov/your\_home/water\_heating/index.cfm/mytopic=12820 [↑](#footnote-ref-1)
2. Ibid. [↑](#footnote-ref-2)
3. Act on Energy Technical Reference Manual, Table 9.6.2-3 [↑](#footnote-ref-3)
4. Based on AOE historical average installation data of 42 tankless gas hot water heaters [↑](#footnote-ref-4)
5. <http://www.mncee.org/getattachment/7b8982e9-4d95-4bc9-8e64-f89033617f37/>, Low contractor estimate used to reflect less labor required in new construction of venting. [↑](#footnote-ref-5)
6. Water heaters (WH) require annual maintenance. There are different levels of effort for annual maintenance depending if the unit is gas or electric, tanked or tankless. Electric and gas tank water heater manufacturers recommend an annual tank drain to clear sediments. Also recommended are “periodic” inspections by qualified service professionals of operating controls, heating element and wiring for electric WHs and thermostat, burner, relief valve internal flue-way and venting systems for gas WHs. Tankless WH require annual maintenance by licensed professionals to clean control compartments, burners, venting system and heat exchangers. This information is from WH manufacturer product brochures including GE, Rennai, Rheem, Takagi and Kenmore. References for incremental O&M costs were not found. Therefore the incremental cost of the additional annual maintenance for tankless WH is estimated at $100. [↑](#footnote-ref-6)
7. Act on Energy Technical Reference Manual, Table 9.6.2-3 [↑](#footnote-ref-7)
8. Ibid. [↑](#footnote-ref-8)
9. 21,915 gallons is an estimate of 60 gal/day for 365.25 days/yr. If building type is known, reference 2007 ASHRAE Handbook HVAC Applications p. 49.14 Table 7 Hot Water Demands and Use for Various Types of Buildings to help estimate hot water consumption. [↑](#footnote-ref-9)
10. Based on 2010 Ohio Techical Reference Manual and NAHB Research Center, (2002) Performance Comparison of Residential hot Water Systems. Prepared for National Renewable Energy Laboratory, Golden, Colorado. [↑](#footnote-ref-10)
11. 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-11)
12. International Energy Conservation Code (IECC) 2012/2015, Table C404.2, Minimum Performance of Water-Heating Equipment [↑](#footnote-ref-12)
13. Specifications of energy efficient tankless water heater. Reference Consortium for Energy Efficiency (CEE) which maintains a list of high efficiency tankless water heaters which currently have Energy Factors up to .96. Ameren currently requires minimum .82 energy factor. [↑](#footnote-ref-13)
14. Stand-by loss is provided in 2012/2015 IECC, Table C404.2, Minimum Performance of Water-Heating Equipment [↑](#footnote-ref-14)
15. International Energy Conservation Code (IECC)2012/2015 [↑](#footnote-ref-15)