

Workpaper WPRSGCODHW104
Gas Storage Water Heater 88% TE

Resource Solutions Group

Gas Storage Water Heater
88% TE

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At-A-Glance Measure List

Measure Description	Building Type	Building Vintage	Peak Electric Demand Reduction (kW/ Unit)	Electric Savings (kWh/ Unit)	Gas Savings (therms)	Base Case Cost (\$/unit)	Measure Cost (\$/unit)	Incremental Measure Cost (\$/unit)	Effective Useful Life (years)
Gas Storage Water Heater 88% TE	ASM	ALL	0	0	5	\$3,492	\$4,209	\$716	15
Gas Storage Water Heater 88% TE	ESE	ALL	0	0	207	\$5,094	\$6,134	\$1,044	15
Gas Storage Water Heater 88% TE	EUN	ALL	0	0	207	\$5,094	\$6,134	\$1,044	15
Gas Storage Water Heater 88% TE	GRO	ALL	0	0	31	\$1,746	\$2,104	\$358	15
Gas Storage Water Heater 88% TE	HSP	ALL	0	0	741	\$8,731	\$10,522	\$1,791	15
Gas Storage Water Heater 88% TE	HTL	ALL	0	0	543	\$2,095	\$2,525	\$430	15
Gas Storage Water Heater 88% TE	MLI	ALL	0	0	14	\$1,746	\$2,104	\$358	15
Gas Storage Water Heater 88% TE	OFL	ALL	0	0	80	\$1,746	\$2,104	\$358	15
Gas Storage Water Heater 88% TE	OFS	ALL	0	0	5	\$873	\$1,052	\$179	15
Gas Storage Water Heater 88% TE	RFF	ALL	0	0	323	\$1,048	\$1,263	\$215	15
Gas Storage Water Heater 88% TE	RSD	ALL	0	0	959	\$1,048	\$1,263	\$215	15
Gas Storage Water Heater 88% TE	RTL	ALL	0	0	76	\$1,048	\$1,263	\$215	15
Gas Storage Water Heater 88% TE	SCN	ALL	0	0	97	\$873	\$1,052	\$179	15

Measure Description	Building Type	Building Vintage	Peak Electric Demand Reduction (kW/ Unit)	Electric Savings (kWh/ Unit)	Gas Savings (therms)	Base Case Cost (\$/unit)	Measure Cost (\$/unit)	Incremental Measure Cost (\$/unit)	Effective Useful Life (years)
Gas Storage Water Heater 88% TE	MFM	ALL	0	0	543	\$2,095	\$2,525	\$430	15
Gas Storage Water Heater 88% TE	OTR	ALL	0	0	243	\$2,598	\$3,131	\$533	15

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Gas Storage Water Heater 88% TE

1.1 Measure Description & Background

Measure Description

This work paper documents the cost and savings information regarding gas storage water heaters larger than 75,000 Btuh heating capacity and a Thermal Efficiency (TE) of 88% or greater and applies to non-residential and commercial multi-family natural gas customers. Gas storage water heaters must meet minimum efficiency requirements based on size.

Technical Description

This measure is for upgrading from minimum code to higher efficiency gas storage-type water heaters. Gas storage water heaters are used to supply hot water for a variety of commercial building types. Storage capacities vary greatly depending on the application. Large consumers of hot water include (but not limited to) industries, hotels/motels and restaurants.

1.2 Base Cases for Savings Estimates: Existing & Above Code

Savings are calculated using the federal standard minimum efficiency regulations of 80% TE.⁽³⁾ Small water heaters are defined as units of 75 MBtuh or less, while large water heaters are defined as units greater than 75 Mbtuh. All large gas water heaters must have a minimum thermal efficiency of 88%.

1.3 Measure Effective Useful Lives

The measure effective useful life is 15 years as stated in DEER 08 EUL Update.⁽⁴⁾

1.4 Net-to-Gross Ratio

The Net-to-Gross ratio for the Gas Storage Water Heater 88% TE is 0.80.

Table 1.0: Net-to-Gross Ratio

Measure	NTG
Gas Storage Water Heat 88% TE	0.80

1.5 Energy Savings

Energy use data comes from the Technology Data Characterizing Water Heating In Commercial Buildings: Application To End-Use Forecasting which supplied a value of BTU/sq.ft. of annual hot water usage. This was converted to therms used by the following formula

$$\text{Therms Use} = (\text{Hot Water Load (BTU/sq.ft.)} \times \text{Nominal Area} / 100,000) / \text{efficiency}$$

The Nominal Area was taken from DEER data where several of the customer types were reduced to reflect an area appropriate for a storage water heating unit. Very large facilities are typically served with a boiler and an insulated circulation tank. See table below for reduced area facilities.

Facility Type	Original Area	Proposed Area
Jr. High/High School	150,000	75,000
Health	60,000	5,000
Hotel	180,800	60,000

Some facilities types were not represented in the usage data and the following values were used to represent missing facility types.

Facility Type	Area
Assembly	34,000
University	75,000
Multi Family	60,000
Other	30,000

The usage was calculated at a base case efficiency of 80% and a measure case of 88%, with the savings being the difference of the two cases.

The building type definitions used in the At-A-Glance Table can be found in Appendix A.

For customer types where data was not available, the weighting was used to develop an average value to represent the “other” case strategy or used where building type results were considered to be outliers. The weighting used in the analysis is based on expected customer building type program penetration rates.

Table 1.1 – Table of Customer Types Weights

Building type	% Therm Usage
ASM	2%
ESE	6%
EUN	6%
GRO	2%
HSP	9%
HTL	2%
MLI	38%
OFS	2%
OFL	2%
RFF	2%
RSD	10%
RTL	6%
SCN	10%
MFM	3%
Totals	100%

1.6 Base Case Costs

DEER 2008 provides per unit costs for a standard 80% TE water heater with an average input capacity of 233.24 Mbtuh.⁽¹⁾ The cost is converted to a per Mbtuh basis. Table 1.2 gives the based base cost for gas storage water heaters.

Table 1.2: Gas Storage Water Heater 88% TE Base Case Cost per Mbtuh

Measure	Equipment Cost per Mbtuh
Gas Storage Water Heater 88% TE (75,000 Mbtuh)	\$17.46

1.7 Measure Costs

DEER 2008 provides the unit costs for an 82% TE water heater with an average input capacity of 233.24 Mbtuh. This cost and the standard efficiency water heat cost (above) are used to extrapolate the cost for an 88% TE water heater. The cost is then converted to a per Mbtuh basis. The costs are summarized in the following table.

Table 1.3: Gas Storage Water Heater 88% TE Measure Cost per Mbtuh

Measure	Equipment Cost per Mbtuh
Gas Storage Water Heater 88% TE (75,000 Mbtuh)	\$21.04

1.8 Incremental Measure Costs

The incremental cost is the difference between the measure cost and the base cost. The incremental costs are summarized in the following table.

Table 1.4: Gas Storage Water Heater 88% TE Incremental Measure Cost

Measure	Incremental Cost per Mbtuh
Gas Storage Water Heater 88% TE (75,000 Mbtuh)	\$3.58

The cost data was applied to the DEER input capacity data to yield the following results

Code	Typical Storage (gallons)	Modeled Input (MBtuh)	Base Case Cost (\$/unit)	Measure Cost (\$/unit)	Incremental Measure Cost (\$/unit)
ASM	200	232.00	\$3,492	\$4,209	\$716
ESE	500	1082	\$5,094	\$6,134	\$1,044
EUN	500	1082	\$5,094	\$6,134	\$1,044
GRO	100	117	\$1,746	\$2,104	\$358
HSP	500	1013	\$8,731	\$10,522	\$1,791
HTL	120	140	\$2,095	\$2,525	\$430
MLI	100	117	\$1,746	\$2,104	\$358
OFL	100	117	\$1,746	\$2,104	\$358
OFS	50	75	\$873	\$1,052	\$179
RFF	60	70	\$1,048	\$1,263	\$215
RSD	60	70	\$1,048	\$1,263	\$215
RTL	60	70	\$1,048	\$1,263	\$215
SCN	50	75	\$873	\$1,052	\$179
MFM	120	140	\$2,095	\$2,525	\$430
OTR	90	109.13	\$1,572	\$1,894	\$322

Appendix A:

Building Type Code Definitions

BLDG_TYPE_CODE	DESCRIPTION
ASM	Assembly
ESE	Schools- Primary/Secondary
EUN	Schools- Post Secondary
GRO	Grocery
HSP	Health/Medical - Hospital
HTL	Hotel/Hospitality
MLI	Manufacturing - Light Industrial
MFM	Multi-Family
OFL	Office - > 60,000 sq-ft
OFS	Office - < 60,000 sq-ft
RFF	Restaurant – Fast Food
RSD	Restaurant- Sit Down
RTL	Retail
SCN	Storage
OTR	No Building Type Available

References

1. **Database for Enetrgy Efficient Resources.** [Online] 2008.
http://www.deeresources.com/deer0911planning/downloads/DEER2008_Costs_ValueAndDocumentation_080530Rev1.zip.
3. **Energy Policy Act.** 2005.
4. **Pacific Gas and Electric Company.** *Gas Storage WAter Heater NRes- Gas PGECODHW103 R1.*