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I N C O R P O R A T E D



Endless Hot Water

Establishment of Energy Star Program

We agree with the establishment of an
Energy Star Program for water heaters.

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Conventional Technology

1. Electric Storage Water Heaters

- ❑ We disagree with proposal for no criteria.
- ❑ Should specify criteria at top of range of current EFs
- ❑ Represents 5% energy savings

2. Gas Storage Water Heaters

- ❑ **Disagree with proposal.**
- ❑ Should specify criteria at top of range of current EFs

Advanced Technology

“Advanced water heating technologies vary in the technological characteristics they employ to heat water. Electric, gas and solar water heaters are each categorically unique in relation to the efficiency they can achieve heating water. Since each advanced technology is inherently different than another, each technology will have its criteria based on its own merits. Certain technologies will have criteria that are exclusive.”

□ We Agree

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Advanced Technology

❑ Gas fired tankless water heaters

We disagree that gas fired tankless water heaters should be considered at this time under the Energy Star program. The DOE has been aware of the concern regarding the suitability of the test protocol from which the Energy Factors for gas tankless have been derived since 1998.

1. *The Federal Register* 5/11/1998 pg. 25999

“EPRI commented that for large, whole house, fossil fueled instantaneous water heaters, the losses due to warm up and cool down after each water draw become significant because of the thermal mass of the water and the heater exchanger---.”

DOE: “Additionally the DOE needs data to substantiate any change to the number of draws during the 24 hour simulated use test for tankless water heaters because changing the number of draws is likely to reduce the energy factor for existing units thereby requiring a modification to the energy conservation standard for those products.”

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1. *ENERGY USE*

2. **DOE RULEMAKING FRAMEWORK 9/2006**

“The purpose of the energy use analysis is to assess the energy-savings potential of different product efficiencies. The energy use analysis may require certain engineering assumptions regarding product application, including how the product is operated and under what conditions.”

“For residential instantaneous water heaters, direct heating equipment, and pool heaters, DOE plans to rely on the assumptions in the test procedure to establish the typical annual energy consumption of the product. For residential instantaneous water heaters, DOE will also consider any other available energy use calculation methodologies that better reflect the energy use under actual field operation conditions”.

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3. *NAHB Research Center Study to NREL in 2003 “Performance Comparison Report For Residential Water Heating Technologies”*

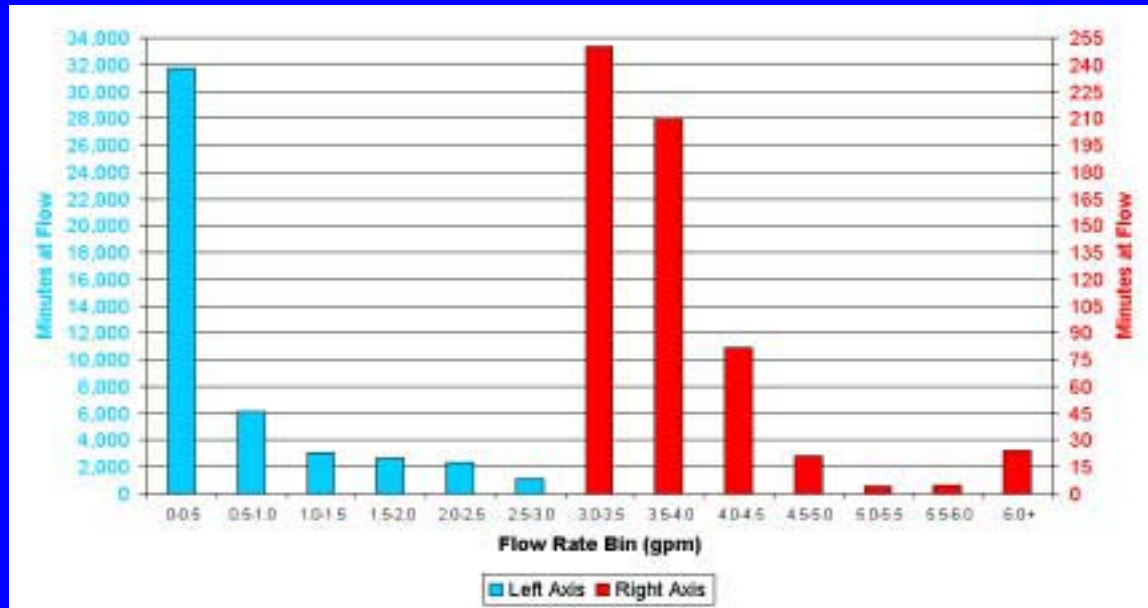
Actual use patterns monitored in this study demonstrated a very high percentage of hot water is used in very short, low flow draws.

This report is based on a full years monitoring of 2 homes in Ohio, referred to as a High Use and a Low Use Home (referring to volume of hot water used).

For the High Use home there were approximately 46,585 minutes of hot water use of which only 585 minutes of use (1.3%) were at flow rates above 3 gpm. In contrast over 38,000 minutes of use (82%) were at 1 gpm or less.

NAHB Study

38,000 minutes
at 1 gpm



585 minutes over
3gpm

“-- there are relatively few minutes when 28 KW (120 MBTU gas) demand heater cannot meet the load, less than 2% of all minutes when water is used.”

(NAHB “*PERFORMANCE COMPARISON FOR RESIDENTIAL WATER HEATING SYSTEMS*”)

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4. *Energy Savings*

The “Analysis” suggests that a gas tankless provides a 30% savings.

We do not believe it is 30% more efficient than the DOE standard for gas storage tank heaters.

Based on the aforementioned NAHB data it is fairly obvious that 6-10.7 draws at 3 gpm do not represent the typical flow or duration of hot water use in residential applications and thus the energy factors derived from the new test protocol the DOE suggests, would in all likelihood be substantially lower.

It has been demonstrated in studies performed by others including the California Energy Commission that when low flow rates and short draws are utilized, the efficiency and thus energy factor for gas tankless water heaters is significantly reduced.

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4. *Energy Savings-Continued*

The “Analysis” suggests that a gas tankless provides a 30% savings.

Furthermore this statement of 30% increase in efficiency fails to consider the electric consumption used by the gas tankless for power venting, cooling of the heat exchanger, and standby power for the electronics.

When full consideration is given to the total energy consumed, including electrical consumption, we believe it is possible that the actual annual savings will be more on the order of \$45/year.

If, as according the “analysis” a 9.5% gain in efficiency over the DOE standard for electric tankless does not justify the electric tankless retrofit (less expensive than gas), then a \$45 annual savings would certainly not justify the higher \$2,500 cost of the gas tankless installation.

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5. *Environmental Issues*

As the fuel to air ratio changes with lower flow rates there is the probability that there will be less efficient combustion of fuel resulting in higher incomplete combustion potentially making some of the gas tankless products virtual smog machines.

DOE RULEMAKING FRAMEWORK 9/2006:

DETERMINATION OF EMISSIONS RESIDENTIAL GAS APPLIANCES.

“While NEMS-BT contains provisions for estimating emissions of NO_x and SO₂ from power generation, it does not estimate household emissions from gas appliances. Therefore, DOE plans to conduct an analysis that includes separate estimates of the effect of energy conservation standards on household NO_x and SO₂ emissions based on simple emissions factors derived from the literature. DOE will report household SO₂ emissions savings, although they are small, because the SO₂ emissions caps do not apply to the residential sector.”

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6. *Maintenance, Service Life and Other Issues and Concerns*

Each of these concerns, including the waste of water, voided warranty when failure occurs as a result of hard water, uniquely resulting from the use of gas tankless are covered well on page 4 of the “Analysis.” However, we agree with the included comments.

Whole House Tankless Electric Water Heaters

- ❑ The First principle of Energy Star is to identify the most efficient products on the market, traditionally considered the upper 25%.

Electric whole house tankless water heaters in residential use, particularly those recognized by the DOE as being used, but considered as commercial because they exceed the 12kW limitation, an arbitrary definition for residential electric tankless, certainly fall into the top 25% of advanced technologies for residential water heating.

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Whole House Tankless Electric Water Heaters

JANUARY 2007 RULEMAKING FRAMEWORK RESIDENTIAL WATER HEATERS
(EXCLUSION OF ELECTRIC TANKLESS)

“DOE recognizes that electric, instantaneous water heaters with an input of less than 12 kilowatts are subject to the energy conservation standards in section 430.32(d) of 10 CFR Part 430. However, DOE is proposing to exclude electric instantaneous water heaters from consideration in this rulemaking because there is no significant energy savings potential from these products. The energy efficiency metric for water heaters is a combination of standby losses and recovery efficiency. All electric water heaters, including instantaneous water heaters, have minor losses in recovery efficiency, and electric instantaneous water heaters have negligible standby losses due to their small storage size. In addition, many of the electric instantaneous water heaters currently on the market are well above the existing minimum energy conservation standard and utilize the available technologies to reduce the standby losses of the product.”

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Whole House Tankless Electric Water Heaters

- ❑ Fuel Neutral Program

“The Department is intent on establishing a fuel neutral program that does not favor one energy source over another.”

We, therefore, disagree with proposed exclusion of electric tankless water heaters from the Energy Star rating and further disagree with the characterization that there isn't enough savings over the DOE standard electric storage tank water heaters.

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Whole House Tankless Electric Water Heaters

□ Energy Savings

1. We understood the comments of the DOE contained in the January 2007 Rulemaking Framework for proposing to exclude electric tankless from the classes covered by energy standard requirement was that the DOE believes correctly that the electric tankless at 99% efficiency is already as efficient as it can get and that there would not be sufficient energy savings gained through improved efficiency to justify being part of the RULEMAKING program.

Surely the DOE does not consider energy savings from any advanced water heating technology of 9% plus over any other high efficiency electric water heaters to be insignificant.

Furthermore the very same NAHB Report to the NREL found the electric tankless to provide significantly higher energy savings over the DOE standard electric water heater than that represented in the “Analysis”

Whole House Tankless Electric Water Heaters

❑ Benefits Unique to Tankless Electric Water Heaters

1. Water Savings Through Closer Proximity to Fixtures
2. Better Suited For Pre-Heated Water in Solar Storage Systems, Etc.
3. Virtually No Standby Heat Loss
4. Easier to Maintain Than Tankless Gas Water Heaters
5. Enable Better Load Shifting Algorithms in Off-Peak Applications
6. Greatly Facilitate The Use of Renewable Energy Water Heating Systems
Temperature Based Flow Sensing, etc
7. Special Versions Provide Hot Water and Off-Peak Space Heating in One Appliance

Whole House Tankless Electric Water Heaters

❑ Issues and Concerns

1. “Electric tankless water heaters are impractical for most homes given the immense electrical requirements and retrofit costs for whole home service.”

These comments in the “Analysis” indicating the electric tankless will not work in normal residential applications because of the electrical requirements is not only inaccurate, but ignores the corresponding cost for the requirement of additional gas service and very stringent venting requirements for gas tankless.

The standard for electric residential service has for many years ranged from 150 to 200 amps. The electric whole house water heater is and has been evaluated each year since 2000 in many normal homes under the PATH and “Zero Energy Home” programs. Homes with these nominal 150-200 amp services can without retrofit accommodate a whole house electric tankless water heater.

Whole House Tankless Electric Water Heaters

❑ Issues and Concerns-Cont.

“The definition of electric tankless has for many years been limited to an electric tankless version having an input maximum of 12kW. We agree that a 12kW electric tankless cannot meet the test requirements and in fact is not a whole house alternative for a storage tank water heater. At the same time we reject the allowance of a gas tankless rated at 199,000 BTU as residential water heater while not providing the very same consideration to the larger and suitable electric tankless water heater.

The fact that the two types of advanced technologies are not being treated with the same considerations represents a basic failure to meet the DOE objectives for establishing “---a fuel neutral program that does not favor one energy source over another.”

Whole House Tankless Electric Water Heaters

❑ Market Share

1. It is not a correct statement to characterize the sales of electric tankless as small in number. The volumes of the electric whole house water heaters are estimated at over 30,000 units a year and growing rapidly. Typically the split in market share has been practically even between gas and electric storage tanks. The difference in the current levels of achieved market share are more the result of the introduction of gas tankless by foreign manufactures (Japan) who do not have suitable whole house electric tankless models.

Electric whole house tankless water heaters are manufactured in many power ranges. Typically a range from 18kW to 36kW providing selections of the most suitable product for the area and size of home. The electric models can easily provide such a range of product since all that is typically required is a change in the wattage of the heating elements while the rest of the structure remains the same.

It is not as cost effective to manufacture and market gas tankless in such ranges of models as it takes a great deal more than just changing heating elements to be provide this same range of gas products.

Whole House Tankless Electric Water Heaters

- ❑ Test Procedures For All Tankless Water Heaters Should Change
 1. The testing should be inclusive and not exclusive. Minimum flow rates for testing should be adjusted to meet the reasonable minimal requirements for residential applications. The NAHB study and actual experience clearly demonstrates that a large share of the residential market in warmer markets can be adequately accommodated with heaters having an input of 18kW or the gas equivalent, assuming .80 EF, of 77,000 BTU. This is based on an assumption of 70F inlet water raised to 120F. The maximum flow rate would be approximately 2.5gpm.
 2. Testing must be based on actual use patterns to obtain meaningful energy ratings. There is no reason to wait, the NAHB study certainly provides good baselines that may be further improved upon by additional studies.
 3. Definitions, particularly for advanced technologies, must be conforming with respect to fuel sources.

Energy Star Program Definitions

While we agree with the establishment of an Energy Star program, we believe that the definitions of technologies used by the Department of Energy for residential water heater categories are inadequate, represent a double standard, and do not include all water heaters currently used for residential water heating.

For example, fully condensing high input tank type gas water heaters have been available for residential use for many years and are currently 95+% efficient.

Allowing the definition of tankless gas at 199,000 BTUs but excluding tankless electric above 40,956 BTUs (12KW) is a double standard.

Heat Pump Water Heaters

- ❑ Lower the minimum Energy Factor to a value that indicates the model operates as a heat pump; something on the order of 1.2. Any heat pump water heater should qualify.

Solar Water Heater

- ❑ Any solar water heater should qualify. Lower the minimum solar fraction criteria.

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Gas Condensing Water Heaters

- This criteria should be expanded to include small commercial condensing gas water heaters (i.e. input \leq 130,000 Btu/h) that cannot be rated for EF but which are sometimes used in residential applications. This criteria would be a minimum thermal efficiency of 85%.
 1. The minimum first hour rating is unnecessary.

Advanced Non-Condensing Gas Water Heaters

- ❑ We agree with this as a Tier II criteria.
- ❑ Should be EF table by gallon capacity.

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