

Comments on the Energy Star Residential Water Heaters Draft Criteria Analysis

First, I want to thank you for developing Energy Star criteria for water heaters. Although this is a difficult product to develop criteria for, I strongly support the concept of Energy Star for water heaters.

Having said that, there are a number of issues I have with the draft criteria for water heaters. I'll start with the general issues.

The largest issue, and it's not limited to Energy Star, is the Energy Factor (EF) test procedure for water heaters.¹ Ideally test procedures should predict annual energy consumption that is consistent with the annual energy consumption that products will use in the field. This is not the case with the water heater EF test. I was very disappointed that you made your energy savings calculations were based directly on the rated EF.

I am very familiar with the EF test. I was the chair of ASHRAE standards project committee 118.2, when ASHRAE's version of the test procedure was last revised. I tested electric resistance storage water heaters using the EF test procedure in support of DOE's last update of the NAECA minimum energy efficiency standards for water heaters.

The EF test is good in the sense that it defines efficiency as energy out (as heated water) divided by energy in for a 24 hour simulated use period. Unfortunately the hot water use patterns in the test procedure have only a very distant connection with how hot water is used in the field.

An example of the consequence of this disconnect is the rating of tankless water heaters. Hot water use in the test procedure consists of 6 equal draws an hour apart of 10.7 gallons each. Typically a household will have 40 to 50 much shorter hot water draws per day. This difference in draws impacts tankless and tank type water heaters differently. Because of the larger number of short draws in the field, the rating a tankless water heater gets in the lab is overstated by as much as 9 percent.² I would guess that very few gas tankless water heaters on the market have a field EF over 80.

Similarly, for storage water heaters, the test procedure EF exceeds field efficiency whenever daily hot water use is less than 64.3 gallons per day.³

Another issue with the test procedure is the tolerances. For electric resistance storage water heaters, the difference between the minimum allowed efficiency and the maximum

¹ U.S. Department Of Energy, 10 CFR 430 subpart B, Appendix E, "Uniform Test Method For Measuring The Energy Consumption Of Water Heaters"

² Davis Energy Group, Inc., "Field and Laboratory Testing of Tankless Gas Water Heater Performance", sponsored by the California Energy Commission, April 14, 2006.

³ J. D. Lutz, C. D. Whitehead, A. B. Lekov, G. J. Rosenquist, and D. W. Winiarski, "WHAM: Simplified Tool for Calculating Water Heater Energy Use," ASHRAE Transactions, vol. 105, pp. 1005-1015, 1999 CH-99-16-1,

available is about the same as the tolerance on the test results.⁴ This means that realistically, it is hard to determine which water heaters are better. For this reason, I'm glad you're not proposing an Energy Star criteria for electric resistance storage water heaters.

The other general concern I have of the draft criteria is about warranties. Here is a table summarizing the warranty periods in the draft criteria.

Water Heating Technology	Proposed Warranty (years)
Whole-House Gas Tankless Water Heaters	10
Whole-House Electric Tankless Water Heaters	
Heat Pump Water Heaters	6
Solar Water Heaters	15
Gas Condensing Water Heaters	8
Advanced Non-Condensing Gas Storage	8

Warranties “to ensure models earning the label are reliable and perform properly” is a very good idea. It is not clear to me why different water heating technologies should have different warranty periods. Warranties on water heaters are rarely simple things. There are often exclusions if the water heater is used in unusual ways or if proper maintenance isn't done. To ensure consistent quality, Energy Star water heaters should have a consistent warranty across technologies. Since water heaters rarely get serviced, the warranties should be valid whether maintenance is done or not.

Another large concern I have is that the proposed Condensing Gas Storage water heater criteria are not consistent with the proposed SEGWHAI tier 2 level. The Super Efficient Gas Water Heating Appliance Initiative (SEGWHAI) is an effort to promote the development, manufacture, sale and installation of affordable, cost effective, high efficiency storage gas water heaters for the retrofit residential market.⁵ The proposed SEGWHAI EF rating for condensing water heaters, based on extensive research, is .82. The proposed criteria for Energy Star is an EF level of .80. No reason for this EF level is given in the draft criteria. For maximal impact the Energy Star criteria for condensing gas storage water heaters should be consistent with the specifications of all other incentive initiatives being considered, including SEGWHAI.

Another problem with the proposed Energy Star criteria for gas-fired water heaters is the lack of any NOx emissions criteria. Given Energy Star's association with the Office of Air and Radiation at the EPA, this oversight is very puzzling. Because of the importance

⁴ W. Healy, J. D. Lutz, and A. Lekov, "Variability in Energy Factor Test Results for Residential Electric Water Heaters," HVAC&R Research Journal, vol. 9, 2003

⁵ Valley Energy Efficiency Corporation, “Super Efficient Gas Water Heating Appliance Initiative (SEGWHAI) PIER Final Project Report”, prepared for California Energy Commission, Public Interest Energy Research Program, April 2007, CEC-500-05-010

of air quality issues in California, SEGWHAI has proposed that South Coast Air Quality Management District NOx emissions criteria for residential type gas fired water heaters be required.⁶ The criteria for Energy Star water heaters should allow those water heaters to be sold in the Los Angeles air basin. For consistency across products, gas-fired tankless Energy Star water heaters should meet the emissions requirements of Rule 1121, not the less stringent Rule 1146.2.⁷ It would be inappropriate for Energy Star to be supporting the use of water heaters that increase air pollution in the Los Angeles air basin.

In conclusion, although I've pointed to several shortcomings in the proposed Energy Star criteria for water heaters, it is important that Energy Star criteria for water heaters be developed. Energy Star can assist in the deployment of advanced water heating technologies to the residential market. The proposed criteria should be corrected and the final criteria should be issued as soon as possible. After that, Energy Star should collaborate with its partners to develop consumer demand, contractor expertise, consumer education, and encourage product availability for advanced water heaters.

Sincerely,

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May 29, 2007

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⁶ South Coast Air Quality Management District, "Rule 1121, Control of Nitrogen Oxides From Residential Type, Natural Gas-Fired Water Heaters", adopted December 1, 1978, amended March 10, 1995, December 10, 1999, and September 3, 2004, <http://www.aqmd.gov/rules/reg/reg11/r1121.pdf>

⁷ South Coast Air Quality Management District, "Rule 1146.2. Emissions of Oxides of Nitrogen From Large Water Heaters and Small Boilers and Process Heaters", adopted January 9, 1998, amended January 7, 2005 and May 5, 2006, <http://www.aqmd.gov/rules/reg/reg11/r1146-2.pdf>