

Market Impact Analysis on the Potential Revision of the ENERGY STAR[®] Criteria for Dishwashers

Background:

The ENERGY STAR criteria for residential dishwashers were last revised on January 1, 2001. The Department of Energy (the Department) considered revisions to the ENERGY STAR criteria for dishwashers, but waited for the manufacturers' energy consumption submittals to the Federal Trade Commission (FTC), required by the new Federal test procedure in order to determine if large changes in consumption were realized due to the new testing protocols. However, since the improved Federal test procedure took effect on February 25, 2004 and the market share of ENERGY STAR qualified dishwashers has increased beyond 80 percent, it is an appropriate time to institute a criteria revision.

Revising ENERGY STAR criteria is often critical to protecting the value of the ENERGY STAR brand and ensuring its continued relevance in the marketplace. ENERGY STAR criteria are designed to consider and balance a varied set of objectives, including ensuring that the established criteria:

- Provide meaningful differentiation between ENERGY STAR qualified products and those that just meet the Federal standard.
- Will result in significant energy savings, both for consumers and the nation as a whole.
- Are cost-effective for manufacturers as well as consumers.
- Provide ample consumer choice, both in terms of number of models and a wide range of manufacturers.
- Do not compromise functionality or performance of the qualified product.
- Do not rely on proprietary technologies of one or a small set of manufacturers.

History of Dishwasher Federal Standard and Federal Test Procedures

The current Federal efficiency standard for dishwashers went into effect on May 14, 1994 and establishes a minimum Energy Factor¹ (EF) no less than 0.46. In 2003, the Department lowered the number of dishwasher cycles per year assumed for the average user to 215. As a result, the current maximum energy consumption per the standard is 467 kWh/year. The Department also has made significant changes to the dishwasher test procedures. The original Federal dishwasher test procedure used only clean dishes to perform all energy tests. In the mid-1990s, dishwasher manufacturers began to improve efficiency by using "soil sensor" controls, which detected the cleanliness of the dishes and planned the wash cycle accordingly. Some observers expressed concern that using a clean dish test procedure with soil sensing models would yield unrealistic energy consumption numbers, i.e., under actual conditions dishes are typically soiled. As a result, all models are now tested using a mix of a ratio of heavily, moderately, and lightly soiled dishes as specified in the test procedure.

Changes to the ENERGY STAR criteria for dishwashers were delayed during the development and implementation of this new test procedure since time was needed to see if the new procedure radically changed the energy ratings of dishwasher models. However, based on a comparison of models tested under both the old and new test procedures, the effects of the new test procedure were minimal, according to product submissions to the FTC. Of the 83 models tested using both the old and new test procedures, only 11 models had a higher energy use, only two products had a decrease in EF of more than 0.01, with the greatest change being one model that moved from an EF of 0.62 to 0.59.

¹ Energy factor (EF) is the number of cycles per kilowatt-hour per year.

Another change to the test procedure was the inclusion of standby power.² However, the energy use for standby power is only included in the EnergyGuide label kWh/year total, but not in the Energy Factor (EF). Therefore, standby power can be determined by calculating the difference of the stated kWh/year of a specific model and the kWh/year as a function of the per cycle use of a model with the same EF that uses no standby power.

Current ENERGY STAR Criteria for Dishwashers

The current ENERGY STAR criteria for dishwashers of a minimum EF of 0.58 (26 percent above the Federal standard) took effect on January 1, 2001. At an EF level of 0.58, an ENERGY STAR qualified model uses 371 kWh/year (assuming electric water heating), which provides a net savings of 96 kWh/year over models just meeting the Federal standard.

Key Market Indicators

A crucial element to the ENERGY STAR criteria revision process is to identify all key market indicators that may influence the guiding criteria principles or objectives. The Department examines the current retail market and technology trends to identify all supporting evidence or potential limitations to increasing the ENERGY STAR criteria.

Dishwasher Market Share:

The existing dishwasher market includes 17 different manufacturers that produce a total of 565 dishwasher models under a total of 47 brands. Of these 565 models, 486 or 86.0% of the available models are ENERGY STAR qualified. Ten manufacturers' entire dishwasher product lines are ENERGY STAR qualified.

The fourth quarter of 2004 shows that 85.9% of dishwashers sold were ENERGY STAR qualified, so the ratio of ENERGY STAR qualified sales is the same as the proportion of ENERGY STAR qualified models available.

Since the last criteria revision in 2001, the market share of ENERGY STAR qualified dishwashers has steadily grown. Market share was below 40% until the fourth quarter of 2002 and it surpassed 50% in the first quarter of 2003, 60% in the fourth quarter of 2003, and 70% in the first quarter of 2004.

State and Efficiency Group Activities:

States have taken upon themselves to establish higher dishwasher efficiency requirements for their rebate and incentive programs to bolster this product category. For example, on August 2, 2004, the Oregon Residential Energy Tax Credit program changed its criteria from the current ENERGY STAR level of 0.58 to a minimum EF of 0.61 cycles/kWh and also added a maximum water consumption level of 6.5 gallons per cycle. In April 2005, the Consortium for Energy Efficiency (CEE) released its draft specification with a Tier 1 level of a minimum EF of 0.62 and a maximum energy use of 355 kWh/year. This allows for 8 kWh/year in standby power (approximately one watt per hour) for a model at 0.62.

² Standby power is the power used by the dishwasher when it is in the off mode and provides the power for touchpad controls and such features as a timed or delayed start.

Retail Price Trends:

The price premium for ENERGY STAR qualified dishwashers as compared to non-qualified dishwashers has historically been estimated at \$30-\$50. However, in recent years, as a result of the increasing market share of ENERGY STAR qualified dishwashers, there is little to no premium for ENERGY STAR qualified models compared to non-qualified products. In today's market, price premium is driven by the number of features the product can offer along with the product finishes – a stainless steel finish demands on average \$120 more. To demonstrate this point, below are three qualified dishwashers within the same price range but having different efficiency levels:

Model 1:	EF of 0.62 is \$219
Model 2:	EF of 0.64 is \$259
Model 3:	EF of 0.67 is \$299

This price-point sample is just a representation of the current available products and does not try to calculate the actual price premium of the efficient technology. But, this analysis does show that even with current technology, very efficient ENERGY STAR qualified dishwashers are available for under \$300, therefore, increasing the dishwasher criteria efficiency requirement should not adversely affect the retail marketplace or product offerings.

Water:

Water consumption has never been included in the ENERGY STAR criteria for dishwashers as it is not included in the DOE test procedure. On average, the most inefficient non-qualified dishwashers use 10 gallons per cycle. Using the Oregon water requirement as an example, it would save 3.5 gallons per cycle or 753 gallons per year. Additionally, unlike clothes washers, where models can meet the ENERGY STAR criteria without any water use reduction, the more energy efficient the dishwasher, the less water the machine will use as approximately 56% of all dishwasher energy use is for water heating. Therefore, any energy efficiency requirement will automatically result in more water efficiency as well as more energy conserved.

Standby Power:

DOE incorporated a standby power requirement into the Federal dishwasher test procedure to comprehensively address annual energy use for the EnergyGuide label since EF only addresses per cycle consumption. This new requirement was initiated to provide consumers with a more realistic operating cost estimate.

In order to determine standby power usage, the energy use of each dishwasher in the ENERGY STAR products database was calculated. Since EF is simply calculated by the average number of cycles per year (215) divided by kWh/year, the standby power can be calculated by finding any models where the kWh/year is above the range for each EF. For example, a dishwasher with an EF of 0.60 will have an average energy use of 358 kWh/year, but since EF is rounded to the hundredth, the model can have actual energy usages from 355 kWh/year to 361 kWh/year. Any energy use above 361 kWh/year must be standby power or the machine would have a lower EF.

Of the 565 models in the ENERGY STAR product database:

- 339 have some standby power usage.
- 148 models show standby power usage of less than 1 kWh/year.

- 98 active models use more than one dollar per year in standby power (11.6 kWh/year assuming an electric rate of 8.6 cents per kWh).
- The highest standby power use is 25 kWh/year.

Since 60% of current qualified products use standby power and the trend for new products is to offer more features that will draw power in the standby mode, the Department seeks comment on the value of incorporating a standby power requirement into the ENERGY STAR criteria for dishwashers. In addition, the Department seeks to determine whether (a) setting a maximum amount of standby power in terms of watts or kWh/year or (b) setting the maximum total allowable ENERGY STAR qualified product usage in terms of kWh/year instead of Energy Factor is preferred.

Market Effects of Potential ENERGY STAR Dishwasher Criteria Levels

The Department analyzed the market effects of potential changes to the ENERGY STAR criteria for dishwashers in terms of models available and the cumulative market share of manufacturers that could offer at least one qualified model at each level.

Table 1 illustrates this analysis at various efficiency levels, including the current minimum Federal standard EF of 0.46, the current minimum ENERGY STAR EF of 0.58 and at various increments starting at 0.62 EF. According to Appliance Magazine, four manufacturers (Whirlpool, GE Appliances, Electrolux/Frigidaire, and Maytag) supply virtually 100% of all dishwashers sold in the United States. All four manufacturers produce qualified products at a minimum EF of 0.62 and two of them produce qualified products at a minimum MEF of 0.68.

Based on the potential EF levels identified in Table 1, the corresponding potential energy savings are shown in Table 2. The saving numbers are calculated by using the following assumptions:

- 1) 41% of the units are used in a house with electric water heating
- 2) 59% of the units are used in a house with gas water heating
- 3) The total dishwasher shipments are assumed to be 7,105,500³

³ Total 2004 dishwasher shipments, *Appliance Magazine*.

TABLE 1: Number of Dishwashers Available per Energy Factor

	Number of Products Available at Minimum Energy Factor (cycles/kWh)									
	Current Federal Standard	Current ENERGY STAR EF level	Potential ENERGY STAR EF level							
Energy Factor (EF)	0.46	0.58	0.62	0.63	0.64	0.68	0.72	0.76	0.80	0.84
AM: Appliance Group	16	16	16	16	16	16	16	12	10	10
BSH (Bosch)	97	97	14	0	0	0	0	0	0	0
Camco	2	2	0	0	0	0	0	0	0	0
Dacor	4	4	2	2	2	2	2	2	2	0
Danby	2	2	2	2	2	2	0	0	0	0
Electrolux	82	76	57	43	37	11	0	0	0	0
Equator	6	5	5	5	3	0	0	0	0	0
Fisher & Paykel	5	3	3	3	3	2	2	0	0	0
GE Appliances	97	60	22	2	2	2	2	0	0	0
Haier America	11	8	5	5	5	0	0	0	0	0
Indesit	6	6	6	6	6	6	6	6	6	0
Kuppersbusch USA	1	1	0	0	0	0	0	0	0	0
LG Electronics	2	2	0	0	0	0	0	0	0	0
Maytag	80	63	45	0	0	0	0	0	0	0
Miele	17	17	14	14	11	2	1	0	0	0
Smeg	4	4	4	4	4	4	0	0	0	0
Whirlpool	133	120	10	0	0	0	0	0	0	0
Total Number of Products	565	486	205	102	91	47	29	20	18	10
Percent of Available Models	100%	86%	36%	18%	16%	8%	5%	4%	3%	2%

TABLE 2: Annual Electric and Gas Savings at Various EF Levels

Total Shipments: 7,105,500											
Estimated ENERGY STAR Qualified Shipments (assumes 25% penetration): 1,776,375											
Min. EF	Units with Electric Water Heating (41%)			Units with Gas Water Heating (59%)						National Aggregate Savings	
	NAECA Annual Energy Use (kWh/year)	ENERGY STAR Annual Energy Use (kWh/year)	Savings per Unit (kWh/year)	NAECA Annual Energy Use (kWh/year)	ENERGY STAR Annual Energy Use (kWh/year)	Savings per Unit (kWh/year)	NAECA Annual Energy Use (therms/year)	ENERGY STAR Annual Energy Use (therms/year)	Savings per Unit (therms/year)	MWh/year	Therms/year
0.62	467	347	120	205	153	52	11	8.5	2.5	141,897	2.6 mill.
0.63	467	341	126	205	150	55	11	8.25	2.75	149,411	2.9 mill.
0.64	467	336	131	205	148	57	11	8	3	155,149	3.1 mill.
0.68	467	316	151	205	139	66	11	7	4	179,147	4.2 mill.

Summary

With ENERGY STAR qualified dishwasher market penetration of more than 80% and the growing trend of utilities and states setting dishwasher efficiency levels higher than ENERGY STAR, it is evident the ENERGY STAR criterion for dishwashers needs revision.

In moving forward with this revision process, the key elements are to identify the most appropriate Energy Factor (EF) level and best timeline to introduce the new levels into the marketplace so that it will assure energy savings and sufficient product selection. Issues such as water usage and standby power should also be evaluated to determine their potential impact and whether they are relevant enough to be incorporated into the revised criteria or not.

The Department will be hosting a public stakeholder meeting to discuss all issues related to the ENERGY STAR criteria for dishwashers on July 13, 2005, in Washington, DC, from 8:30 a.m. – 4:30 p.m. For more information on this meeting, please contact Josh Butzbaugh at jbutzbaugh@drintl.com. Any comments prior to this meeting can be submitted to Richard Karney at Richard.Karney@EE.DOE.GOV.