Market Impact Analysis of Potential Changes to the ENERGY STAR® Criteria for Refrigerators

Background

The ENERGY STAR criteria for residential refrigerators last changed on January 1, 2004. At that time, very few models were available with energy consumption ratings below the minimum ENERGY STAR criteria. In the past three years, the refrigerator market has changed substantially. More than half of all available refrigerator models are ENERGY STAR qualified and the market share for ENERGY STAR qualified refrigerators grew to 30% of residential refrigerator sales in 2006. Models using 20% less energy than the Federal standard are available in most sizes and configurations. Additionally, with annual sales of more than 11 million units, even small incremental improvements in efficiency will have major national impacts on energy consumption and consumer utility bills. The analysis below outlines the current state of the refrigerator market and proposes a revision in the criteria for standard refrigerators of 20% more efficient than the Federal standard. The proposed date for the new criteria is April 1, 2008.

Market Overview

The refrigerator market has changed in the last three years with more than one hundred models now available that are at least 20% more efficient than the Federal standard. The Energy Policy Act of 2005 approved manufacturer tax credits for refrigerators at three tiers. Manufacturers receive a $75 tax credit for each domestically produced refrigerator that is 15% better than the Federal standard. The tax credit increases to $125 for each unit 20% better than the Federal standard and to $175 for each unit 25% better than the Federal standard. Only models above a rolling baseline of 110% of each manufacturer's average production for the last three years are eligible. The tax credits run through 2007 although an extension has been proposed. Higher tax credits for the production of models at or above the ENERGY STAR criteria will help drive production of efficient products.

Due to the high market penetration, there are limited program sponsor promotions for ENERGY STAR qualified refrigerators. Most activities focus on removing old models from the market and recycling them. One of the benefits of new ENERGY STAR criteria may be an expansion of other promotional activities for refrigerators as utilities will be able to promote products with a lower market share and higher per unit savings. The Oregon Department of Energy tax credits for refrigerators already have been changed to only cover products that are at least 20% better than the Federal standard.

Table One shows the number and percentage of total available standard refrigerator models at each efficiency range.

Table One: Available Standard Refrigerator Models

Efficiency Level	*Number of Available Models*	*Percentage of Available Models*
Current Federal Standard	2,524	100%
Current ENERGY STAR Criteria (15% better than Federal Standard)	1,441	57.1%
20% better than Federal Standard	121	4.8%
25% better than Federal Standard	14	0.6%

The table above only includes standard refrigerator models. On January 1, 2003, the ENERGY STAR criteria were expanded to include freezers and compact refrigerators and freezers, as well as models with manual or partial automatic defrost. The market for compacts and freezers has not changed at the same level as the market for standard refrigerators.

Compacts

Currently there are 415 compact refrigerator models available on the market. Of these, only 22% or 92 models meet the current ENERGY STAR criteria of 20% better than the Federal standard. If the criteria were changed to, say, 25% better than the Federal standard, only 15 models would qualify and only three of these are automatic defrost. The market share for ENERGY STAR qualified compacts was only 5.8% in 2004. Recent market share figures are not available, but the market penetration for ENERGY STAR qualified compacts is estimated at well below 10%. With the already limited market share and limited energy consumption of compacts, any change in the ENERGY STAR criteria would have a minimal effect on either individual consumer savings or aggregate national savings.

Freezers

When the ENERGY STAR criteria were expanded to include freezers in 2003, there were no qualified models available. Since then, a large number of qualified products have been introduced. However, the market is still not as mature for efficient freezers as it is for refrigerators with only 114 ENERGY STAR qualified models of the 453 available models (25%). The market share for ENERGY STAR qualified freezers was 3.2% in 2004. More recent data is not available, but the market share is still very low. With the small market share, any change in the ENERGY STAR criteria would have little effect on either individual consumer savings or aggregate national savings.

For these reasons, the proposed revision will focus solely on standard refrigerator models and the feasibility of changing the ENERGY STAR criteria for those seven product classes.

Potential ENERGY STAR Criteria Performance Levels

There are three options for the ENERGY STAR criteria for standard refrigerators. The first option is to leave the ENERGY STAR criteria at 15% more efficient than the Federal standard for each product class. Although the proportion of available products is above 50%, the actual market share as of the third quarter of 2006 is just under 30%.

The second option is to raise the minimum ENERGY STAR criteria a nominal but meaningful amount and we suggest increasing it to 20% more efficient than the Federal standard. As stated above, there are already more than 120 models available in a wide range of sizes and configurations. This incremental change would provide the individual consumer an average of $150 in utility bill savings over the average life (14 years) of the product. Additionally, the aggregate national savings are significant due to the large number of refrigerators sold each year.

The final option is to raise the minimum ENERGY STAR criteria substantially to, say, 25% more efficient than the Federal standard. Although there are only 14 available models, the expectation is that raising the criteria would spur manufacturers to produce more products at the 25% level. ENERGY STAR products would generate more savings per unit and the aggregate savings would be significant. However, there are serious concerns over the ability of manufacturers to produce cost-effective models at higher efficiency levels. Additionally, the very small total of available models, even with a $175 manufacturer tax credit per unit, implies that producing models at this level is challenging.

Engineering Considerations

At the request of several efficiency groups, the U.S. Department of Energy (DOE) completed a Technical Support Document (TSD) for refrigerators in October 2005. At that time, the efficiency community was pushing for a change in the Federal standard to the current ENERGY STAR level of 15% better than the current Federal standard. The Technical Support Document considered 15% more efficient and 25% more efficient levels for both top-mount and side-by-side refrigerators. It can be concluded that the 20% level is technologically feasible due to the widespread availability of current products already meeting this efficiency level. However, DOE concluded that a model 25% better than the Federal standard cannot be achieved just by switching to more efficient components. Models of this efficiency would require a reduction in heat load transmitted through the refrigerator walls and doors. This change would require either the increasing of wall thickness to accommodate more insulation or the use of vacuum panels, both of which would require new product platforms and new capital investments. In the 2005 TSD, DOE noted that all manufacturers indicated that one or more of their refrigerator models could not be altered to be cost-effectively produced to be 25% more efficient than the Federal standard.

Potential Energy Savings

Based on available products and the engineering considerations, the Department is proposing to revise the criteria to a minimum of 20% more efficient than the Federal standard for the seven product classes for standard refrigerator models. Table Three shows the number of products that meet the proposed criteria by size and configuration. As shown in the table, there are units already available for most major categories where products are currently sold. Bottom-freezer models are available in all size categories. For top-freezers, there are no models below 18 cubic feet currently manufactured, but there are no indications that producing a model of that size and configuration would not be feasible. The lack of top-freezers above 22 cubic feet is to be expected, since 98% of currently available top-freezer models are less than 22 cubic feet. Side-by-side models are available in the two largest size categories and the lack of models under 18 cubic feet should not be surprising, since, with the exception of two non-qualified small specialty models, every side-by-side currently in production is over 18 cubic feet. There are no products that would meet the proposed criteria that are more than 26 cubic feet in size even though there is a substantial current market, especially for side-by-sides, at this size.

Table Three: Available Standard Refrigerator Models by Size and Configuration

Configuration	Less than 18 cubic feet	18-22 cubic feet	22-26 cubic feet
Bottom-Mount Freezer	2	39	15
Top-Mount Freezer	0	13	0
Side-by-Side Freezer	0	10	33
Single Door – Refrigerator Only	4	0	0

Table Four shows the energy savings for ENERGY STAR criteria of 20% more efficient than the Federal standard. The savings assume 20% market share based on the 2006 annual shipments of nearly 11.1 million units (Appliance Magazine, March 2007). The average model meeting the Federal standard is based on a weighted average of available products, correcting for the known percentage of each category that are sold (55% top-freezers, 35% side-by-sides, and 10% bottom-freezers). The average ENERGY STAR unit savings assume a product exactly 20% more efficient than the Federal standard. The overall savings are quite substantial, with a savings of more than 100 kWh per year for each consumer and more than 230 MWh saved nationally per year. With the average lifetime of 14 years, the average consumer will save $150 using current electric rates over a standard model and the national aggregate savings for the sales in just one year will be 3.2 GWh or 11 trillion Btu. Models that would meet the new criteria are already available with little to no price premium so consumers will recover the price premium fairly quickly.

Table Four: Energy Savings at a 20% Market Share

ENERGY STAR Shipments (20% Penetration)	Average Federal Minimum (kWh/year)	Average ENERGY STAR (kWh/year)	Savings per Unit	National Aggregate Savings (MWh/year)
2,215,520	521	417	104	230,414

Summary

Based on the current refrigerator market, the increase in ENERGY STAR market share, and the technological feasibility of efficient refrigerators, the Department proposes raising the ENERGY STAR criteria for standard refrigerators from a minimum of 15% better than the Federal standard to a minimum of 20% more efficient than the Federal standard with an effective data of April 1, 2008. This criteria change will serve to differentiate the most efficient products and provide more than $23.5 million in consumer utility savings per year. The technology to institute this change is market ready. The Department seeks the input of all partners and stakeholders regarding this criteria-setting process. If partners or stakeholders would like to submit comments or suggestions, please submit them to Richard Karney at Richard.Karney@EE.DOE.GOV by May 25, 2007. The Department will be hosting a Stakeholder Meeting on the afternoon of Monday, June 4, 2007, in Washington, DC.