CHAPTER 4. SCREENING ANALYSIS

TABLE OF CONTENTS

LIST OF TABLES

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4.1 INTRODUCTION

This chapter details the screening analysis conducted by the U.S. Department of Energy (DOE) of the technology options identified in the market and technology assessment for residential microwave ovens (chapter 3 of this technical support document (TSD)). In the market and technology assessment, DOE presented an initial list of technologies that can be used to reduce the standby power consumption of microwave ovens. The goal of the screening analysis is to identify any technology options that will be eliminated from further consideration in the rulemaking analyses.

The candidate technology options are assessed based on DOE's analysis as well as inputs from stakeholders including manufacturers, trade organizations, and energy efficiency advocates. Technology options that are judged to be viable approaches for improving standby consumption are retained as inputs to the subsequent engineering analysis, and are designated as design options. Technology options that are not incorporated in commercial products or in working prototypes, or that fail to meet certain criteria, as to practicability to manufacture, install and service, as to impacts on product utility or availability, or as to health or safety will be eliminated from consideration in accordance with *Energy Conservation Program for Consumer Products: Procedures for Consideration of New or Revised Energy Conservation Standards for Consumer Products*. 61 FR at 36974 (July 15, 1996). The rationale for either screening out or retaining each technology option is detailed in the following sections.

4.2 SCREENED-OUT TECHNOLOGY OPTIONS

The following section details the specific technology options that were screened out prior to the engineering analysis, along with the rationale for elimination.

The technologies identified in the market and technology assessment were evaluated pursuant to the criteria set out in the Energy Policy and Conservation Act (EPCA). (42 United States Code (U.S.C.) 6291-6309) EPCA establishes criteria for prescribing new or amended standards designed to achieve the maximum improvement in energy efficiency. Furthermore, EPCA directs the Secretary of Energy to determine whether a standard is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)(B)) In view of the EPCA requirements for determining whether a standard is technologically feasible and economically justified, appendix A to subpart C of Title 10 Code of Federal Regulations part 430 (10 CFR part 430), *Procedures, Interpretations and Policies for Consideration of New or Revised Energy Conservation Standards for Consumer Products* (the Process Rule), sets forth procedures to guide DOE in the consideration and promulgation of new or revised product energy conservation standards under EPCA. These procedures elaborate on the statutory criteria provided in 42 U.S.C. 6295 and in part eliminate problematic technologies early in the process of revising an energy conservation

standard. Under the guidelines, DOE eliminates from consideration technologies that present unacceptable problems with respect to the following four factors:

(1) Technological feasibility. If it is determined that a technology has not been incorporated in commercial products or in working prototypes, then that technology will not be considered further.

(2) Practicability to manufacture, install, and service. If it is determined that mass production of a technology in commercial products and reliable installation and servicing of the technology could not be achieved on the scale necessary to serve the relevant market at the time of the effective date of the standard, then that technology will not be considered further.

(3) Impacts on product utility to consumers. If a technology is determined to have significant adverse impact on the utility of the product to significant subgroups of consumers, or results in the unavailability of any covered product type with performance characteristics (including reliability), features, size, capacities, and volumes that are substantially the same as products generally available in the United States at the time, it will not be considered further.

(4) Safety of technologies. If it is determined that a technology will have significant adverse impacts on health or safety, it will not be considered further.

After reviewing the technology options to reduce standby power consumption of microwave against the screening criteria, DOE did not eliminate any technology options from consideration in its standby power rule making analysis for microwave ovens.

For lower-power display technologies, DOE understands that the consumer utility of a microwave oven display is associated with its brightness, viewing angle, and ability to display complex characters. Interviews DOE conducted with display manufacturers revealed that vacuum fluorescent displays (VFDs) can achieve higher brightness levels, wider viewing angles, and higher contrast than backlit liquid crystal displays (LCDs). Display manufacturers also stated that light-emitting diode (LED) displays have largely comparable performance to VFDs in terms of brightness and viewing angle. A VFD manufacturer mentioned that, while VFD technologies with efficiencies comparable to backlit LCDs do exist, such displays are substantially more expensive than the ones commonly found in microwave ovens today.

Multiple manufacturers of cooking products stated in interviews the need to differentiate their cooking appliance lines from those of their competitors with (among other features) coordinated displays and user interfaces. Manufacturers noted that LCD displays (backlit or not) do not work well in appliances that get very hot, such as ovens, due to thermal limitations in the technology. Manufacturers also opposed switching entirely to LED-based displays since it could make it harder for them to differentiate their products, particularly in a market as commoditized as microwave ovens. Lastly, manufacturers noted that larger, more complex, and more colorful displays are usually associated with premium appliances, which will thus have a harder time

achieving the same standby power consumption as units with smaller, dimmer, and simpler displays.

DOE notes that the current rulemaking does not seek to regulate the standby power consumption of conventional cooking appliances, and microwave ovens do not feature high surface temperatures which could preclude certain display options, as noted in the DOE sample. DOE also notes that not all high-end appliance manufacturers use the same display technology across all cooking appliances that they manufacture. For example, at least one manufacturer uses a backlit LCD in its microwave oven, with the backlighting LEDs color-coordinated with the VFDs found in its ovens. For these reasons, DOE believes that lower-power display technologies which maintain consumer utility can be incorporated in microwave ovens, and meet all of the screening criteria.

Similarly, the number of different sensor technologies available on the market that do not require standby power suggests that the utility of a cooking sensor can be maintained with zero standby power. Since improved power supplies and control board options also have no consumer utility impacts and have been incorporated in products currently available on the market, both of these technology options meet the screening criteria.

For automatic power-down, DOE interviewed the Japanese Electrical Manufacturers' Association (JEMA). These discussions revealed that there are a large number of microwave ovens in the Japanese market that implement this feature. For a power-down function, DOE believes that the entire microwave oven can be switched off, with a dedicated, low power controller waiting for a controls input, door opening, etc. before re-animating the rest of the microwave. This controller then subsequently detects a period of inactivity before switching the rest of the microwave oven off again. Power consumption could be reduced to well below 1 W, though at a reduction in consumer utility since displays, night lights, etc. would remain off until a consumer interacts with the microwave oven. DOE has determined, however, that control strategies are available to allow manufacturers to make design tradeoffs between incorporating standby-power-consuming features such as displays or cooking sensors and including a function to turn power off to these components during standby. Therefore, this technology option was retained for further analysis.

4.3 REMAINING DESIGN OPTIONS

The following sections list the technology options for each product covered by this rulemaking that were retained by DOE and subsequently designated as design options. Each of these technologies will be evaluated further in the subsequent engineering analysis.

Table 4.3.1 Retained Design Options for Microwave Ovens–Standby Power

1. Lower-power display technologies
2. Cooking sensors with no standby power requirement
3. Improved power supply and control board options
4. Automatic power-down