

New Product Development: The Pipeline For Future ENERGY STAR® Growth

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ABSTRACT

The Product Development (PD) team in the U.S. Environmental Protection Agency's ENERGY STAR Labeling Branch serves as the pipeline to fuel the long-term market transformation process by delivering new programs. PD's goal is to expand the reach and visibility of ENERGY STAR as well as the market for new energy-efficient products. In 2000, PD plans to launch six new programs.

To evaluate the ENERGY STAR potential for a diverse group of products, PD prepared a framework and process for developing new and updating existing programs that rationalizes new product opportunities and draws upon the expertise and resources of other stakeholders, including manufacturers, utilities, environmental groups, and other government agencies. By systematically reviewing the potential of proposed product areas, PD makes informed decisions as to whether or not to proceed with a program. In support of this strategic vision, PD ensures that new product specifications are consistent with the ENERGY STAR philosophy and that this philosophy is effectively communicated to stakeholders, particularly in new target markets.

To date, EPA has applied this framework to four product categories targeted for program launch in 2000 (i.e., water coolers, set-top boxes, traffic lights, and ventilation fans). To date, the framework has provided PD with the rationale for making sound decisions to move forward with justifiable specifications. Through the application of this framework, PD increasingly recognizes that each industry has unique market and product characteristics that can require reconciliation with the program philosophy.

Introduction

ENERGY STAR is a voluntary partnership between the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and Industry. The primary objective of the ENERGY STAR Program is to prevent air pollution by expanding the market for energy-efficient products. EPA and DOE use the ENERGY STAR label to recognize and promote the most energy-efficient sub-set of the market. The label is a simple mechanism that allows consumers to easily identify environmental and money saving products in the marketplace. By removing information barriers that affect purchase decisions and by raising environmental awareness, the ENERGY STAR Program stimulates demand for high-efficiency products to transform the market over time.

The focus of this paper is on EPA's Product Development (PD) efforts although similar work is pursued by DOE. It is the task of EPA's PD Team to identify products where large gains in energy efficiency can be realized cost-effectively, and where the ENERGY STAR label can play a solid role in transforming the market. It is also PD's responsibility to ensure that all new

Programs are consistent with the ENERGY STAR philosophy. In addition to developing new programs, PD evaluates existing programs to determine where additional savings can be garnered through specification revisions or changes to the program scope.

EPA's PD team is in a strong position to increase the visibility of the ENERGY STAR Brand and achieve additional carbon reductions by developing new Programs. With these new opportunities for growth, come several challenges. Under pressure to launch six new programs in one year, EPA has less time to develop relationships with manufacturers and secure a thorough, detailed understanding of the industry. Continuing to broaden the portfolio of ENERGY STAR Programs also leads to diminishing returns in terms of realized carbon reductions. Because projected carbon savings from new programs are considerably less than veteran programs such as office equipment, determining what "carbon to chase" becomes an increasingly important decision.

EPA's previous methodology for developing new programs was not robust enough to both meet the demand to launch new products and to utilize a consistent decision methodology. As a result, EPA created a PD team and instituted a new product development framework that relies on rigorous market, engineering, and carbon savings analyses, as well as input from major stakeholders. At a time when ENERGY STAR is gaining momentum and market stature, this specialized approach identifies and reconciles product issues that are inconsistent with the Brand and/or objectives of other EPA programs. The remainder of this paper summarizes EPA's PD framework and presents two case studies that illustrate the application of the new product development process.

ENERGY STAR Philosophy

Each new ENERGY STAR Program must be consistent with the overall ENERGY STAR Philosophy while also recognizing any energy efficiency or marketing issues that are unique to that product or industry. As EPA designs and implements ENERGY STAR Programs, it adheres to the following five tenets.

Expand markets for energy-efficient products through voluntary partnerships with industry. EPA's message to industry is simple: Environmental challenges, including global climate change, can be turned into profitable opportunities for their businesses. By collaborating, EPA and manufacturers are able to offer consumers ENERGY STAR products that deliver high-performance features and energy and monetary savings. While most manufacturers choose to be involved, participation in the ENERGY STAR Programs is completely voluntary. Relationships with industry often begin during the program development phase as both parties work together to find innovative ways to decrease power consumption.

Reduce air pollution through energy-efficient technologies. Compared to conventional models, energy-efficient technologies waste less energy and generate less air pollution. Through the ENERGY STAR Programs, EPA capitalizes on the United States' technological creativity of industry to deliver long-term environmental benefits.

Recognize the most energy-efficient models on the market by using the ENERGY STAR label. The lack of clear, accurate information about energy-efficient products has long been a barrier to the successful implementation of these products in the marketplace. As the symbol for energy efficiency, the ENERGY STAR label makes it easy for consumers to choose products that

will reduce their utility bills and reduce air pollution. The label appears directly on product models as well as marketing materials that explain the benefits of energy efficiency.

Maintain customer satisfaction by increasing energy efficiency without sacrificing performance. When faced with a trade off between energy efficiency and high-performance features, most consumers not surprisingly would choose the product with the features they desire. To maintain the integrity of the ENERGY STAR label and energy-efficient products in general, EPA works closely with industry to ensure that ENERGY STAR-labeled products provide the same or better performance, features, and reliability as conventional models.

Encourage innovation and competition by developing energy-efficiency guidelines that are non-proprietary and technology neutral. ENERGY STAR specifications are carefully developed to avoid favoring one manufacturer or one technology. By encouraging participation by all interested manufacturers rather than a select few, the ENERGY STAR Programs are able to realize more dramatic reductions in energy use and air pollution.

All five tenets of the ENERGY STAR Philosophy are equally important and critical to the success of the ENERGY STAR Programs. EPA's philosophy is shared with manufacturers and other interested parties during the program development phase.

The PD Framework and Process

The purpose of the PD framework is to provide EPA with a means of systematically evaluating the technical potential for new ENERGY STAR products. The framework consists of four primary areas of product analysis:

- Developing the initial list of potential ENERGY STAR products
- Prioritizing the product list
- Analyzing technical potential of high-priority products
- Working with industry and other major stakeholders

Each area is described in more detail below.

Developing Initial List of Potential ENERGY STAR Products

The first stage in PD's process is to develop an initial list of potential ENERGY STAR products (**Table 1**). PD utilizes four information channels to identify future product areas: the Federal Energy Management Program (FEMP), input from industry and other stakeholders, ENERGY STAR Program evaluations, and industry/literature research.

FEMP product recommendations. DOE's FEMP Program helps federal agencies purchase energy efficient products. To simplify federal purchasing of energy-efficient products, FEMP identifies and recommends products in the top quartile of the market (in terms of energy performance). Table 1 shows many areas of coordination between ENERGY STAR and FEMP.

Table 1. List of Potential ENERGY STAR Products Grouped by Projected Launch Date

Category 1 - Summer 2000	Category 2 - Fall 2000	Category 3 - 2001 & Beyond
Set-top boxes	Ceiling fans	Ice machines*
Traffic signals*	Reach-in refrigerators and freezers*	Vending machines*
Ventilation fans	Dehumidifiers	Visi-coolers*
Water coolers*	Telephony	Humidifiers
	Industrial motors*	Air purifiers
	Commercial unitary AC*	

* indicates products currently covered by FEMP or proposed as future product areas

Input from industry and other stakeholders. The ENERGY STAR Brand has now achieved a level of market influence such that manufacturers and other stakeholders are contacting EPA and seeking the ENERGY STAR label to promote their energy-efficient products or programs. For example, the ENERGY STAR Scanner Program was developed because manufacturers wanted their full suite of office products to be eligible for the label.

Program evaluation outputs. PD evaluates existing programs to identify where additional carbon savings can be realized. To assess the un-tapped product potential, PD currently relies on a carbon savings model, developed by Lawrence Berkeley National Laboratory (LBNL), which tracks ENERGY STAR product achievements to date and projects future savings through 2010 (Webber, C and R. Brown. "Savings Potential of ENERGY STAR Voluntary Labeling Programs". Proceedings of the ACEEE 1998 Summer Study on Energy Efficiency in Buildings: Washington DC, 1998).¹

PD uses the model to analyze:

- Shipment data to assess the effect of broadening a program scope to encompass excluded product classes
- Savings scenarios to determine if cost-effective technology applications are available to further improve ENERGY STAR product efficiencies
- Market penetration information to determine if additional EPA resources can increase annual ENERGY STAR product sales

¹The carbon savings models project savings from a program's inception through 2010. The model relies on key inputs including annual product shipments, unit energy savings (kWh/yr), and the penetration of products that meet the ENERGY STAR specification and utilize ENERGY STAR features.

This model allows PD to direct future efforts and quantify the additional savings due to program modifications.

Industry/literature research. PD reviews a wide variety of literature to identify industry trends, and new products and services with energy intensive or energy savings implications. PD also attends major trade shows to gather product information and establish industry contacts.

Selecting High Priority Products and Analyzing Technical Potentials

Once the initial product list is developed, PD proceeds to prioritize the product categories. PD's initial prioritization tool is the carbon savings model, which was developed by LBNL for each proposed product identified prior to Summer 1999. **Figure 1** shows projected savings for a host of new products. Set-top boxes has the highest potential for carbon reductions and is discussed in more detail in Section 4. The projected carbon potential for traffic lights assumes a 2010 penetration of only 5%; however, if the ENERGY STAR Program achieves higher penetrations, the savings magnitude will be much greater.

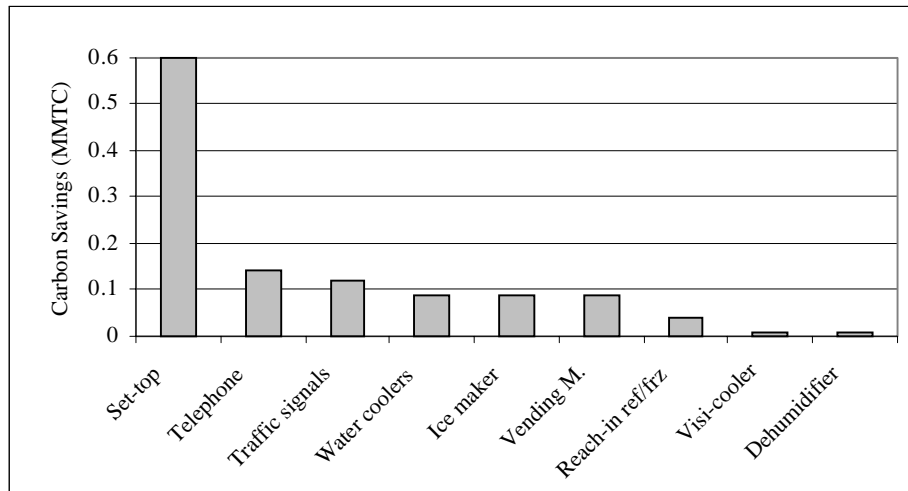


Figure 1. Projected Annual Carbon Savings in 2010

In addition to projected savings, industry feedback has the ability to assign high-priority status to a product or in some cases demote a product to the low-priority category. For example, PD was initially interested in ice machines due to its moderate carbon potential and the possibility of coordinating ENERGY STAR and FEMP efforts (Figure 1).² After initial discussions with manufacturers, it was apparent that industry had strong reservations about an ENERGY STAR Ice Machine Program and was not willing to work with EPA in the near-term. At that time, PD decided to discontinue its pursuit of this product and classified ice machines as a low-priority product.

² Summer 1999, FEMP was developing product recommendations for ice machines. EPA was hoping to coordinate efforts by establishing an ENERGY STAR level, which would enable FEMP to simply recommend purchasing ENERGY STAR ice machines.

Unique market/product characteristics also play an integral role in developing priorities. Areas considered by PD include brand visibility, difficulty and time required to transform the market, and the suitability of the ENERGY STAR label as a market transformation tool. Water coolers provides a good example. With only three major manufacturers and a stream-lined product line, this product offers the potential for a relatively quick market transformation. Because these products are used daily and placed prominently in offices and kitchens, labeling water coolers can increase logo visibility and Brand recognition.

Because product development is an evolving process, priorities are rarely peremptory and re-prioritization frequently occurs as PD becomes more educated about target industries.

Analyzing Technical Potential of New Products

Once priorities are established, PD begins its rigorous assessment of each product's technical potential in order to ensure Brand consistency and reconcile any product issues that conflict with other EPA Programs. **Figure 2** illustrates the process for assessing technical potentials, which ultimately leads to PD's decision of whether or not to proceed with a given product.

PD begins this three-stage process with a product briefing and market assessment. (**Figure 3** illustrates the specific research areas.) The product briefing is designed to provide an overview of the technology and design of the product, allowing for enough familiarity so that EPA is able to effectively communicate with industry. Given the limited time available for PD to familiarize itself with the industry, this is a necessary and time compressed first-step in educating the EPA Program Manager about a product.

After learning the technical basics of a product, PD conducts a market assessment of the industry. The focus of the market research effort is to 1) better understand the marketplace and market actors (e.g., prominent manufacturers and distributors, key customers, and promotional mechanisms), 2) identify any market barriers (e.g., extremely complex distribution chains, poor attitudes about energy efficiency, or proprietary technologies) and options for addressing them, if appropriate, 3) assess where the market is going over the next 5-10 years and how this may or may not impact ENERGY STAR, 4) review any relevant regulations or voluntary guidelines, and 5) estimate the market potential by analyzing expected market growth rates, product lifetimes, product usage patterns, and similar information. Also during the market assessment, PD makes the initial contact with major manufacturers. By bringing industry into discussions during this stage, PD identifies major program challenges early in the process and has time to build relationships with industry, which are necessary for a successful program.

Next, PD uses the engineering design analysis to assess energy efficiency options for a given industry. The focus of this effort is on understanding energy efficiency design options, incremental costs associated with technology options, and ramifications for the industry. True to the ENERGY STAR philosophy, the engineering analysis attempts to highlight highly efficient products currently on the market as well as readily available, cost-effective, and underutilized components or technologies that can be incorporated during product redesigns.

Finally, product testing and analysis is becoming a larger part of PD's process. (Where possible, product testing and analysis is conducted concurrently with the market and engineering

assessments.) The objective of product testing is to collect “real world” data that PD can then bring into industry negotiations. Product testing also includes re-designing actual product models to include energy efficiency options, and then metering the energy savings. By providing re-design data, PD is able to justify and support its specification with an actual example(s).

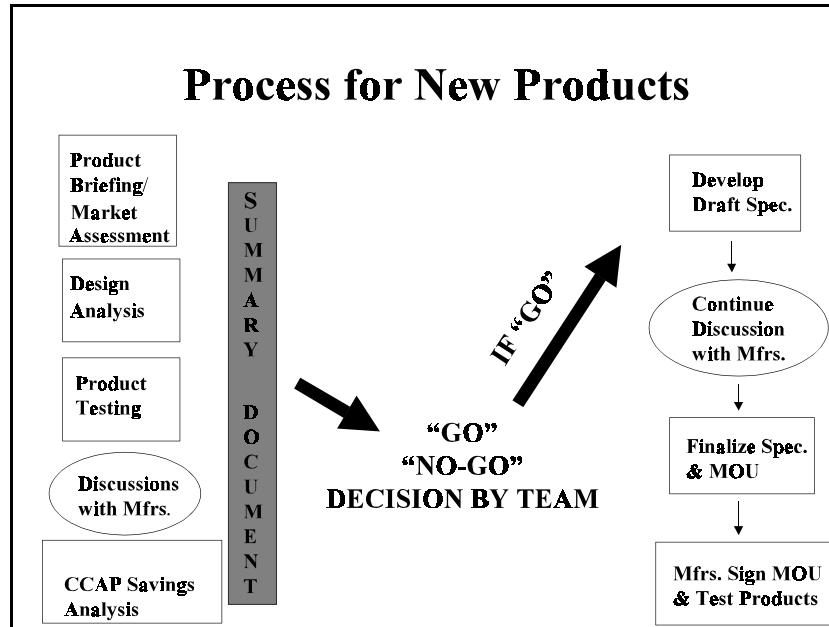


Figure 2. Process for Developing New Products

Once these analyses are complete, the carbon savings model is updated with new information gathered from the assessments and a summary document is often created. The summary document highlights key market and engineering information and is used by PD to make its “Go, No-Go” decision. In general, if no serious market barriers exist that can’t be overcome with the label, if there are no irreconcilable contradictions with the ENERGY STAR philosophy, and if there is industry interest and moderate carbon savings to be gained, PD will move forward with a product.

Working with Industry

Collaborating with industry on the development of product specifications has been and continues to be a hallmark of the ENERGY STAR Program. As such, ENERGY STAR has a demonstrated track record of working closely with individual companies as well as entire industries and their representatives, such as trade associations. The PD team’s involvement comes in many forms including industry site visits by EPA staff and talks given at industry conferences. In addition, the PD team has an open-door policy with respect to discussions with industry. Individual manufacturers and trade associations alike, are encouraged to visit with and discuss issues of concern. This track record of cooperation has enabled the PD team to develop

a level of trust with manufacturers that has been useful in ensuring frank discussion with manufacturers and other stakeholders. By investing time early on in the relationships with new industries, all parties can better comprehend each others goals, convictions, and challenges in the marketplace.

Market Assessment Research and Analysis	Engineering and Design Report	Product Testing and Analysis
<ul style="list-style-type: none"> • Technology description and definitions • Available energy efficiency options • Relevant regulatory considerations • Market place and market actors • Market barriers • Unit shipments, patterns, power consumption • Industry trends • Industry contacts 	<ul style="list-style-type: none"> • Efficiency potential • Efficient design options • Low/no-cost design options • Incremental costs to industry • Performance impacts/issues • Time to introduce changes to market • Emerging technologies • Mode definitions • Test protocols • Efficient designs for reference points 	<ul style="list-style-type: none"> • Metered energy consumption • Duty cycle of product • Product energy consumption profile • Energy consumption of components in product • Energy intensive or inefficient components • Energy saved through product redesign • Range in efficiencies between product models and manufacturers

Figure 3. Research objectives of PD’s Technical Potential Analysis

The PD team deems industry input to be invaluable during the development of relevant and challenging specifications for ENERGY STAR products. In fact, the PD team relies heavily on industry experts, such as product managers for major manufacturers, for information and suggestions. Given that many of the industries the PD team is involved in are fiercely competitive, PD has found that the industries police and scrutinize themselves very closely, putting less pressure to do so on EPA. However, to ensure there is balance in the discussion and to verify industry information, the PD team utilizes its own non-industry experts as well.

Program Development Case Studies

PD currently has four products under-development for a potential launch in Summer 2000 (Table 1). This section presents case studies for two high priority products: set-top boxes and water coolers. The intent of this section is to provide product overviews and to demonstrate the application of PD’s new framework.

ENERGY STAR Set-top Boxes

Through its formal decision-making framework, the PD team assessed the set-top box market and found five compelling reasons why it should pursue set-top boxes as a high-priority ENERGY STAR Program.

Growing installed base. “Set-top box” is a general term that covers a variety of diverse products from video game consoles to cable TV set-top boxes to personal video recorders. Given that these products share many common design characteristics and it is administratively more efficient to maintain one versus several programs, the PD team decided to include more than 10 set-top products under one Set-top Box Program. Similar to other consumer electronics, these products have a reliably large and growing installed base in the United States. Approximately 70 percent of American homes, for example, have cable boxes (“Trojan horses: Paying attention to set-top boxes,” *Forbes Digital Tool*, February 23, 1999).

Significant market growth. Market researchers predict that shipments of set-top boxes will increase dramatically over the next several years. The Consumer Electronics Association (CEA) estimates growth of digital delivery devices (DBS systems, digital set-top box converters, and Internet access devices) will rise an average of 15 percent from 1999 to 2002. At the same time, analog shipments are expected to decrease by no more than two percent a year through 2002 (*Consumer Electronics Vision*, January/February 1999).

Changing usage and distribution patterns for cable products. Analog cable TV boxes are being replaced by digital set-top boxes, which are smarter, faster, and more interactive than their predecessors. These boxes are able to provide cable television programming as well as Internet access, telephony, and/or interactive services such as video on demand. As the industry transitions to digital technologies, its distribution channels are changing too. Through the Telecommunications Act of 1996, the Federal Communications Commission (FCC) has ruled that all set-top boxes must be made to open specifications and available through retail channels (as opposed to leasing them from the cable provider) beginning in July 2000. As a result, consumers will be able to buy a set-top box at retail, which will likely lead to more consumer choices and create a new market for traditional consumer electronics manufacturers and retailers. (Through discussions with several manufacturers EPA has learned that the switch to traditional retail channels like Circuit City and Best Buy will not happen overnight and may take a few years to implement.) By working with the set-top box industry during this important transition stage characterized by significant investments in research and development (R&D) and increasing competition, the PD team believes that it can take the first step in creating a vibrant market for energy-efficient set-tops.

Potential for more energy-efficient designs. Most set-top boxes on the market today use almost as much energy when “OFF” as they do in their primary function. Consistent with the ENERGY STAR philosophy of maximizing energy savings without compromising performance, the PD team has chosen to focus its efforts on the standby/low-power mode or when the product appears to be “OFF” to the user. In one-on-one discussions with manufacturers, many have indicated that energy efficiency has not been a design consideration for their products to date and that reductions in energy consumption are feasible. Design changes that incorporate switching power supplies, LCD displays, flash memory or Static RAM, low-power data receivers, and/or

the integration of tuners into integrated circuits (ICs) will substantially reduce energy consumption and air pollution.

Manufacturer interest. Manufacturers from the consumer electronics, cable, satellite, and computer industries have been working with EPA on the development of the Set-top Box Program since mid 1999. Some of the companies are “champions” of the ENERGY STAR Programs, who have participated in the Home Electronics and Office Equipment Programs for many years. They are familiar with the ENERGY STAR philosophy and welcome the opportunity to further differentiate their products in the highly competitive electronics marketplace.

As development of the Set-top Box Program has moved forward, it has remained consistent with the traditional ENERGY STAR philosophy as described in Section 2. However, it has not been without its challenges. Three key challenges are described below as well as the PD team’s current approach to addressing them.

The Set-top Box Program, as proposed, covers a wide variety of product types (more than 10) that include both mature (e.g., analog cable TV boxes) and emerging (e.g., personal video recorders) technologies. As one might expect, manufacturers are not willing to make the same energy efficiency investments in their mature and emerging product lines. However, given the 7-15 year life cycle of set-top boxes, even mature products with declining sales represent potentially significant energy and pollution savings. The PD team’s approach thus far has been to propose a more liberal specification (e.g., 3 Watts instead of 1 Watt) that encourages quick, low-cost design changes. As this is a voluntary program, manufacturers are free to redesign their mature, emerging, or both technologies.

As a general rule, EPA sets energy-efficiency specifications such that 20-25 percent of the products on the market complies with the guidelines when the program is launched. The Set-top Box Program will likely be the exception to this rule. With some of the set-top box product categories, little or no consideration has been given to energy efficiency (aside from ensuring that the boxes don’t present a fire safety hazard). Thus, awarding the ENERGY STAR label to these products could jeopardize the credibility of the label and the Programs. In this instance, the PD team has proposed to industry that the specification remain at its current, challenging level and go into effect in 2001 (i.e., delay the effective date to give manufacturers additional time to redesign their products). Even with this grace period or delayed effective date, the PD team expects that compliant models for some product types will not be available on the market at the time of the program launch, but may be introduced within a year.

Satellite and cable service providers who set their own technical requirements based on the services they offer their customers have a significant influence on the design of set-top boxes. In some cases, these requirements can directly affect energy consumption of the boxes. In recognition of this fact, the PD team has invited service providers to review draft specifications and to participate in industry discussions. While the PD team believes that more energy-efficient designs are feasible within existing transmission protocols, it also sees opportunities for even greater savings through new transmission protocols or other technical requirements. On-going collaborations between manufacturers, service providers, and EPA will be necessary to bring about this change. After the launch of the Set-top Box Program, EPA envisions a key role for service providers in the implementation of the Program and the development of future specifications

Development of the ENERGY STAR Set-top Box Program is currently on track for completion by summer 2000. Draft specifications have been circulated to industry for review and comment. Over the next few months, EPA expects to finalize the specifications and incorporate set-top boxes into its marketing and communications plans and activities for late 2000/early 2001.

ENERGY STAR Water Coolers

Similar to the set-top box effort, the PD team assessed the water cooler market and found four compelling reasons why it should pursue water coolers as a high-priority ENERGY STAR Program.

Energy consumption of the units is substantial. PD testing data shows that hot and cold bottled water units consume an average 2.2 kWh/day or ~\$50/yr to operate. This energy consumption is comparable to that of a refrigerator. Manufacturers have indicated that these units are comprising an increasing percentage of the market, which makes this product a good target for an ENERGY STAR Program.

Potential for more energy-efficient designs. Ninety percent of the energy consumed by hot and cold bottled water units is due to standby losses. Sixty percent of the energy consumed by cold-only bottled water units is due to standby losses. The high degree of standby loss is due to poor insulation on the units and the duty cycle of the product. Most bottled coolers that are found in offices are used for drinking purposes during typical work hours. On evenings and weekends, the compressor and heater continue to work to maintain the set water temperatures even though the product is not being used. The high proportion of standby consumption to total consumption offers an excellent opportunity for energy savings.

Low cost options for energy-efficient designs. The water cooler industry is very cost-sensitive. Faced with foreign competition that offers products sometimes at two-thirds the price of a U.S. manufacturer's products, complying with the ENERGY STAR Program will not be considered if it causes wholesale product prices to increase to the point of being uncompetitive. Because efficiency gains exist in reducing standby losses, there are several low-cost options for lowering energy consumption. These options include adding insulation and/or adding a timer to shut the cooler off during periods of non-activity.

Highly visible product. Water coolers are highly visible in the work place and home environment. Labeling this product has the ability to increase Brand recognition.

As development of the Water Cooler Program has moved forward, it has remained consistent with the traditional ENERGY STAR philosophy as described in Section 2. However, it has not been without its challenges. Two key challenges are described below as well as the PD team's current approach to addressing them.

ENERGY STAR attempts to recognize the most efficient products on the market, typically setting a specification to include the top 25% of the market. However, PD determined that there was very little variation in energy consumption between manufacturers and product models. In addition, a lack of insulation on some units resulted in overall inefficient designs. Because of these factors, PD was unable to propose a draft specification to include any products currently on the market. To qualify for the label, manufacturers would need to reduce the energy

consumption of their products by approximately 35%.

ENERGY STAR is also careful to make sure that energy-efficient products have the same features and reliability as conventional models. In the case of water coolers, the addition of timers on the units has the potential to impact customer satisfaction and reliability. To address this, PD considered the following: 1) the timer must have a by-pass or 'off' switch; 2) as is the case for office equipment, disabling the timer is not "easy" to discourage negating savings by switching the timer off; and 3) there are additional means of meeting the specification without a timer, including super-insulating the unit and/or thermally separating the hot and cold systems.

Development of the ENERGY STAR Water Cooler Program is currently on track for completion by the end of Summer 2000. Draft specifications have been circulated to industry for review and comment. Over the next few months, EPA expects to finalize the specifications and incorporate water coolers into its marketing and communications plans and activities for early 2001.

Conclusions

The Product Development (PD) team in the US Environmental Protection Agency's ENERGY STAR Labeling Branch serves as the pipeline to fuel the long-term market transformation process by delivering new programs. PD's goal is to expand the reach and visibility of ENERGY STAR by launching at least six new programs in 2000. To evaluate the ENERGY STAR potential for a diverse group of products, PD developed a framework and process for developing new and updating existing programs that rationalizes new product opportunities and draws upon the expertise and resources of other stakeholders. To date, EPA has applied this framework to four product categories targeted for program launch in 2000 (water coolers, set-top boxes, traffic lights, and ventilation fans). Through the application of this framework, PD increasingly recognizes that each industry has unique market and product characteristics that can require reconciliation with the program philosophy.