ENERGY STAR® Qualified Imaging Equipment

Specification Revision

Directional Draft

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Section 1 – Introduction

1.1 – General Introduction

This paper is a Directional Draft for the revision of the ENERGY STAR energy-efficiency criteria for imaging equipment. In an effort to make the specification-revision process as transparent as possible, EPA is releasing this document prior to a First Draft so that interested stakeholders have a chance to comment on the direction EPA proposes to take. Much of the information in this Directional Draft has been aggregated from concerns shared through meetings and correspondence with current partners, international authorities, and other industry stakeholders. This Directional Draft will be submitted to all industry stakeholders who have indicated their interest in this process to EPA, and can be considered a response to the Information Technology Industry (ITI) Council's proposal submitted to EPA in 2003. EPA welcomes the wider distribution of this document to others who may be interested in contributing to the revision of the ENERGY STAR specification for imaging equipment. In addition, EPA is grateful for all of the input and feedback that stakeholders have provided over the past several months, which has helped to shape this document. Continued feedback and support is valuable to EPA; a list of specific questions and action-items that stakeholders may want to consider providing input on is included in Section 4 of this Directional Draft.

1.2 – Objectives of the Directional Draft

This Directional Draft precedes a First Draft specification, and outlines an approach EPA may engage to determine and recognize the energy-efficiency of imaging equipment products. Since the revised ENERGY STAR specification for imaging equipment may diverge from the energy-efficiency criteria and testing methods found in the existing Memoranda of Understanding (MOUs), this Directional Draft explains the framework and rationale for a possible new approach. It will provide stakeholders with an introduction and understanding of EPA's proposed new method before initial specification limits are set in a First Draft.

Another objective of this document is to provide an opportunity for manufacturers and other interested parties to comment on the intended method. This document does not definitively set all variables at this time. In many instances, there are placeholders for data and methods that will need to be further developed and possibly changed in future drafts. However, in cases where substantial test data is available, and the similar method in which some products are addressed, some preliminary specification levels are provided here for consideration. EPA had not originally intended to provide power levels in this Directional Draft, but has done so here, in part, to respond to the criteria proposed by ITI. The levels proposed in this document are based on partner-submitted product data for ENERGY STAR qualified products available on the market during the past two years.

With this Directional Draft, EPA hopes to respond to stakeholder input received to date, including the draft proposal submitted by ITI. It should be noted, however, that some stakeholders' comments and preferences have conflicted. This Directional Draft does not claim to represent the concerns or opinions of all parties. EPA will need to continue to engage stakeholders throughout this process to ensure that all issues are vetted.

1.3 – Objectives of the Specification Revision Process

As with the revision or creation of any ENERGY STAR specification, the open participation of industry and other energy-efficiency authorities is crucial to the success of this endeavor. EPA encourages stakeholders to offer comments and assist with the revision of this specification. EPA will strive to make all appropriate data and rationale for its decisions available for stakeholders, to ensure this process is transparent and collaborative. All materials and updates pertinent to the imaging equipment specification development process will be available on the ENERGY STAR Product Development Web site at www.energystar.gov/productdevelopment, which is updated regularly for stakeholders to access and review.

Stakeholders can assist with the revision process through the submission of data on the power consumption of imaging equipment. This information will assist EPA in setting appropriate energy-efficiency criteria, especially for new models currently in development. As a test procedure is developed in conjunction with industry, manufacturers will be asked to test products to help determine the validity of the test procedure, and to collect data to assist with the establishment of criteria. Appendix F lists other areas where EPA would appreciate stakeholder input.

As feedback is shared, the sensitive nature of manufacturer information will continue to be respected as requested by stakeholders. This includes any input regarding draft specifications, as well as any test data that stakeholders may choose to provide to EPA.

1.4 - Objectives of the Revised Specification

The primary objectives that EPA intends to attain in the revised specification include the following.

Achieving Electricity Savings through Product Differentiation
The ENERGY STAR energy-efficiency criteria for imaging equipment need to be set at a level that achieves a high degree of electricity savings and pollution prevention. An important means by which EPA pursues this goal is to use the ENRGY STAR designation to differentiate between products with varying energy efficiencies. Differentiation allows consumers a viable means to express a preference for products that offer energy-efficiency benefits. It is EPA's hope that over the long term, as recognition of the ENERGY STAR label becomes more pronounced, and efficient products gain greater acceptance, manufacturers will compete to satisfy consumer demand for efficient products. This behavior should spur the market toward a long-term transformation and maximum energy savings. (Differentiation is addressed further in EPA's ENERGY STAR guiding principles, included in Appendix E).

ENERGY STAR manufacturer partners design their products to meet stringent product specifications that do not adversely impact product performance and can be attained in an economically-feasible manner, thereby enabling EPA to achieve its energy savings program goals. EPA ensures these goals are met by typically setting new specifications at levels that are challenging, yet already attained by numerous products currently available.

As new specifications are released, they should differentiate for consumers approximately the top 25% of energy-efficient products in the marketplace. Moreover, the specifications should be set at a level that allows multiple manufacturers to participate. EPA also investigates the need for individualized specifications for certain product categories if needed, to avoid a one-size-fits-all approach which, depending on the circumstances, may not be appropriate. In fulfilling these general guidelines when setting a specification, it is assumed that the specification can only cover a reasonable subset of the market that EPA has defined as approximately the top 25%.

Relevance and Longevity
The revised ENERGY STAR imaging equipment specification should have relevance by virtue of the differentiation it brings to the marketplace and the reasonably attainable goal it provides for

manufacturers to pursue in the long term. New specifications should also retain their relevance over the long term by providing a general framework that does not impede technical innovation.

International Harmonization
The definitions, measurement methods, and criteria levels should be harmonized with existing international standards and methods as much as possible.

One Umbrella Specifications Document Covering All Imaging Equipment Products
The imaging equipment products that have previously been covered in four, separate ENERGY STAR MOUs will be covered under one "umbrella" specification. The imaging equipment products addressed in this Directional Draft include the following:

- Fax Machines, Printers, and Mailing Machines;
- Copiers;
- Multifunction Devices and Upgradeable Digital Copiers; and
- Scanners.

As product technology continues to converge, EPA has determined it is appropriate to attempt to group these individual products into a single ENERGY STAR umbrella specifications document for imaging equipment. This should result in a clearer, more consistent set of specifications. It should be noted that many stakeholders agree with this proposed approach.

Appropriate Grouping of Marking Technologies
The revised specification will need to group marking technology appropriately. More information on EPA's rationale for product groupings in this Directional Draft can be found in Section 3.

Use of Efficiency Formulas Rather than a Step Approach
Where possible, and per ITI's suggestion, linear formulas may be used for energy efficiency that consider speed as the determining factor, rather than step criteria for broad speed band categories. Figure 1 below shows how efficiency criteria have been outlined in a step approach in previous specifications.

Figure 1. An Example of Criteria Using the "Step" Approach, Categorized by Product Speed Band

Product Speed In Pages Per Minute (ppm)	Sleep Mode (Watts)	Default Time To Sleep Mode
$0 < ppm \leq 10$	≤ 10	≤ 5 minutes
$10 < ppm \leq 20$	≤ 20	≤ 15 minutes
$20 < ppm \leq 30$	≤ 30	≤ 30 minutes
$30 < ppm \leq 44$	≤ 40	≤ 60 minutes
$44 < ppm$	≤ 75	≤ 60 minutes

In this Directional Draft, the lack of reported data for some products or speed bands has prevented EPA from creating linear formulas for all products. Industry feedback is welcomed to carry this approach to its conclusion. However, it should be noted that employing an energy-efficiency formula might not necessarily be appropriate for all products, such as scanners.

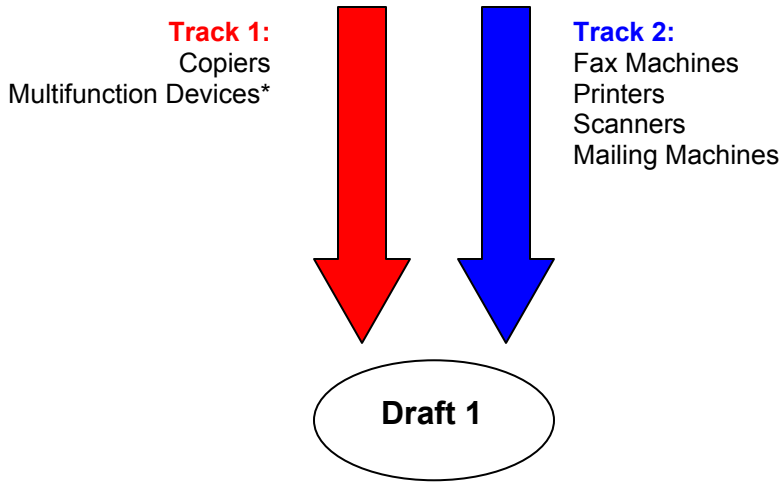
Consideration of "On" Mode Power Consumption
The new specification may address product energy consumption beyond what is used in low-power modes. Other operational modes for each product type may be covered, such as "on" modes, possibly including energy consumed when the product is producing an image or waiting in its ready mode.

More rationale for EPA's decisions with respect to each product type is included in the following sections.

1.5 – Format of the Directional Draft

Following this introductory section, this Directional Draft outlines a new proposed approach to the specification, which uses two "tracks" operating in tandem as a means to specify the energy-efficiency of imaging equipment products. Figure 2 below illustrates how this dual-tracked approach will address different products.

Figure 2. Format of the Directional Draft



**A definition of an MFD can be found in Appendix A*

Track 1 considers the Typical Electricity Consumption (TEC) of copiers and multifunction devices. Track 2 addresses printers, fax machines, scanners, and mailing machines with the traditional operational mode approach (i.e., Sleep, low-power) found in the current MOUs for these products. These two tracks are detailed in Sections 2 and 3 of this Directional Draft. Section 4 outlines elements that require continued investigation in order to develop this Directional Draft into a First Draft specification.

1.6 – Rationale for Employing a Dual-Tracked Approach

In researching the strategy for revising the existing ENERGY STAR specifications for imaging equipment, EPA has carefully considered how best to address the current trends in product-use patterns. Data obtained in the field by Lawrence Berkeley National Laboratories (LBNL) demonstrates low power-management enabling rates and/or very long default times in many office equipment areas, particularly in copiers and MFDs. To continue capturing the energy savings that the ENERGY STAR program has been able to achieve, EPA suggests that it may be necessary to pursue a new direction for copiers and MFDs apart from the conventional approach of setting energy-efficiency criteria solely for a product's power management modes. Rather, in these two product areas, EPA sees the need to measure energy efficiency through a product's total duty cycle, by considering the energy consumed by a product throughout the day. A product's total duty cycle encompasses all relevant power states of that product, and may include a range of activities, such as production (i.e., printing, copying, scanning), power management, wake events (i.e., maintenance), and idle periods.

Information received from some partners as well as international stakeholders continues to assert the importance of addressing the Active- and Ready-mode consumptions of certain products. EPA hopes that specifying limits for the TEC of these products is a way to respond to these concerns, while encouraging manufacturers to employ innovation in their designs. Addressing TEC of a product places emphasis on energy-efficiency in the product's total duty cycle and allows manufacturers the flexibility to design for reduced energy consumption in any or all modes. This will continue to provide an incentive to partners who have been successful reducing the energy consumption of their products in low-power modes.

While all imaging equipment products may eventually migrate to a TEC specification, EPA has determined that, at this time, there is still potential for some products to provide significant environmental benefits from the conventional operational mode structure found in the current MOUs. Printers, fax machines, scanners, and mailing machines are products that may follow this traditional operational mode approach.

Since printers and copiers are growing more similar in terms of their main components and customers' needs, it is possible that both products would ultimately be best addressed by a TEC approach. However, EPA opted to consider printers under an operational mode approach at this time, due to the following:

- Printers generally have higher power management enabling rates; and
- Addressing printers with the traditional operational mode approach will allow EPA to progress more quickly on the revision of these specifications. Developing a TEC approach that will have longevity will take time, and it is important to reduce energy consumption in areas where reductions are possible today, while the development of this new TEC approach begins to take shape for copiers and MFDs.

EPA is willing to consider adopting a TEC approach for printers during this revision process if strong stakeholder interest exists in doing so. Stakeholders who want EPA to pursue this path are welcome to share their views.

1.7 – A Possible Alternative to the Dual-Tracked Approach

One alternative to the dual-tracked approach that has been suggested to EPA involves categorizing print engines (i.e., EP, Ink Jet, Thermal Transfer, etc.) rather than individual product types (i.e., printers, fax machines, copiers, etc.). An approach like this could be used with either the traditional specification structure (operational mode) or TEC specification structure.

Under this scenario, print engines would be grouped by type and speed, and a certain amount of power (for the traditional approach) or energy (for the duty cycle approach) would be added for each additional component: scanner, network connection, phone connection, digital front-end, paper supply, or finishing accessory. A single specification utilizing this approach may be more flexible and simpler (since there would be no separate criteria for each product), and may more easily cover the full range of imaging products. This approach would not require defining what an MFD is or is not, and could be more adaptable to new technologies and changes in the market, considering that the definition of an MFD is evolving every day in the field.

This document does not attempt to delve into the "print engine" approach in detail; however, EPA has presented it here for stakeholder consideration and feedback as an alternative to the dual-tracked approach upon which this Directional Draft is based.

Section 2 – Track 1: A Typical Electricity Consumption Approach for Copiers and MFDs

Following are several general components that are initially considered integral to this approach.

2.1 – Introduction to a TEC Energy-Efficiency Specification

EPA proposes to develop a formula that defines energy efficiency in terms of watt-hours over time (Wh/h) and allows energy (Wh/h) to increase with image speed (ipm). With input from industry, EPA will determine if separate formulas are warranted to address varying product attributes (i.e., color, marking technology, or additional features). Figure 3 presents a sample table to illustrate this concept:

Figure 3. How the Energy-Efficiency Specification for Copiers and MFDs May be Categorized

Product	Image Speed (ipm)	Energy
Monochrome Copier	0 < ipm ≤ X	Y Wh/h
Color Copier	0 < ipm ≤ X	Y Wh/h
Monochrome MFD	0 < ipm ≤ X	Y Wh/h
Color MFD	0 < ipm ≤ X	Y Wh/h

2.2 – Japan's Energy Saving Law

Following EPA's goal to harmonize with international methods as appropriate, EPA has investigated Japan's Energy Saving Law. This law includes a method of energy-efficiency measurement supported by the Energy Conservation Center, Japan (ECCJ). According to Japan's Ministry of Trade, Economy, and Industry (METI), this method of energy efficiency measurement has been successful in achieving energy consumption efficiency in monochrome copiers in Japan. EPA is considering ways in which this method may be used as the basis of the ENERGY STAR specification. This method, and EPA's proposed modifications to it are explained in Sections 2.3 and 2.4 below.

2.3 – EPA's Proposed Modifications to the Law

Within Japan's Energy Saving law the energy efficiency method presumes an eight-hour use pattern, where a monochrome copier is turned off at the end of each day. To address networked copiers that are left on all day, and non-networked products that are shipped internationally where use patterns may vary, EPA proposes to amend the formula to presume a 24-hour cycle. The following formula is presented for consideration:

Energy Efficiency = [(8A + 16B)/24] Wh/h, where

A = watts used during one hour of a typical working day, which may include warm up; and
B = watts used during a second hour when the product is off, or if network compatible, in a low-power state.

EPA considers quick recovery time to be an important component to encouraging energy efficiency in imaging products. In addition to an energy efficiency equation that addresses a product's energy consumption, the TEC track would likely set a criterion for recovery time (e.g., 10 seconds or less).

As stated at the April 2003 stakeholder meeting in Washington, DC, EPA aims to harmonize ENERGY STAR with the U.S. Federal Energy Management Board (FEMP)'s requirements for imaging equipment in Plug-in Off/Standby mode. FEMP's current level for copiers and MFDs is one watt or less. This criterion may also be included in the TEC track.

2.4 – TEC Test Procedure

Base Methodology Creation
The TEC test procedure may incorporate elements from more than one existing test procedure. A few choices for consideration are listed below:

- Japan's Energy Saving Law – Described in Section 2.1.
- ASTM's "Standard Test Method for Determining Energy Consumption of Copier and Copier-Duplicating Equipment" – A test methodology developed by ASTM International that provides a procedure by which copiers, copier-duplicators, accessories, and similar office imaging equipment may be rated for energy consumption.
- IEA-DSM Copier of the Future Initiative – A test procedure that evolved from the Copier of the Future Technology Procurement Project, developed by IEA, which provides an estimation of copier energy consumption.

In creating a test procedure, EPA could consider additional procedures not included above if they merit inclusion, with industry's cooperation. EPA welcomes industry input in developing and determining the validity and usability of a future TEC test procedure.

Product Usage Patterns
In order to provide information that can be used when creating a first draft specification, EPA will research common usage patterns of copiers and MFDs. This will help to validate the hourly usage assumptions inherent in the formula proposed in Section 2.3, as well as provide information on the average image-volume for products in representative speed bands. At this time, EPA is working with vendors who track the office-utilization of copiers and MFDs to obtain general usage patterns in different U.S. office environments. EPA intends to work with its international partners to obtain similar data for non-U.S. office environments. By integrating this collected consumer-usage pattern data, the results should yield a baseline that can be used when assessing products' energy efficiency. It is understood that typical and actual use patterns will vary by machine, user, and market; however, it is believed that energy-efficiency numbers arrived at by referring to the proposed formula will provide an accurate basis for a relative comparison of like products, provided all manufacturers follow the same test procedure.

Copy Volume and Testing Environment
The test procedure in Japan's Energy Saving Law directs manufacturers to consider the speed of each product when determining the copy volume to reference for testing. Following, in Figure 4, is the chart for the Law. These numbers would need to be analyzed for appropriateness given the alterations EPA is considering to the energy-efficiency formula to account for a 24-hour use pattern. They are presented below to reference when considering the following suggested test procedure.

Figure 4. Required Copy Volume for Product Testing According to Japan's Energy Saving Law

Imaging speed of copying machine (pages/minute)	Number of pages copied
~10	2
11~20	10
21~30	30
31~40	50
41~60	100
61~85	300

Energy Efficiency = [(8**A** + 16**B**)/24] Wh/h,

The formula proposed in Section 2.3 is reproduced again above for reference. Following is an example of how copy volume would need to be incorporated in the test procedure.

The energy consumed in timeframe A would be measured by taking the following steps:

- Turn the product on if it had previously been turned off (or in a network low-power state).
- Reproduce the number of pages listed in the right column above (corresponding to the imaging speed listed in the left column of the same table).
- Following the copies, leave the machine with the power on.
- Upon leaving the machine as is, if the machine has a power management function, such as an Auto-off mode, etc., carry out the measurement in that mode.

The energy consumed in timeframe B would be measured by taking the following steps:

- Immediately after taking measurement A, leave the machine as it is after the copying is complete.
- Upon leaving the machine as it is, if the copying machine has a power management function, such as an Auto-off mode, etc., take the measurement in that mode.

Measurements A and B would be carried out under the following conditions:

- Ambient temperature: 20 ± 2°C;
- Ambient humidity: 65 ± 10%;
- Fluctuation in input voltage: within ± 3% of the rated voltage;
- Image magnification: set at 100%;
- Exposure: automatic or at the appropriate level; and
- Other settings: default as upon shipment from the factory.

Measurement A would be conducted using a test chart, which would be pre-determined.

While image quality would not be considered as part of the TEC test procedure, it might be appropriate to specify a certain level of image quality as a constant to ensure that testing is consistent across industry (e.g., equal to or better than "draft quality").

There are several additional areas in both tracks of this Directional Draft that EPA would like to expand upon or improve, including determining variables such as default time, number of copy jobs performed per hour, etc. Section 4 details elements that would benefit from stakeholder feedback, and includes a specific list of areas and/or questions on which EPA would appreciate input.

Section 3 – Track 2: An Operational Mode Approach for Printers, Fax Machines, Scanners, and Mailing Machines

3.1 – Introduction to Operational Mode Approach

Many stakeholders are familiar with the current ENERGY STAR approach for specifying energy-efficiency criteria for a product's low-power modes. As mentioned in Section 1, several imaging equipment products, including printers, fax machines, scanners, and mailing machines, will continue to be addressed by this approach. However, despite methodological similarities, several aspects of Track 2 are different than in previous specifications, as briefly bulleted below:

- As stated at the April stakeholder meeting in Washington, DC, EPA aims to harmonize ENERGY STAR with the U.S. Federal Energy Management Board (FEMP)'s requirements for imaging equipment in Plug-in Off/Standby mode. FEMP's current levels for this mode have been included in this Directional Draft for each product.
- Product groupings have been structured differently in this Directional Draft. The product and marking technology groupings have been formed based on information collected in the field, manufacturer-reported product data, and input from key stakeholders. One example is that Ink

Jet printers are now addressed by separate criteria. Additional rationale for each of the groupings can be found under each table of criteria in Section 3.2.

- As noted in Section 1, EPA has sought to very clearly define the various applicable operating modes in imaging equipment to ensure that these terms are consistent across all product categories. In the past, manufacturers have expressed concern about the apparent variation among the terminology in different MOUs. Since ITI proposed new terms that EPA largely agrees with, many of the terms used in this Directional Draft have been drawn from ITI's proposal, and are located in Appendix A.
- Where possible, EPA has developed energy-efficiency criteria formulas for several product categories outlined in Section 3.2, instead of using "step approach" criteria as in previous specifications (see Figure 1). EPA has decided to pursue formulas in response to ITI's 2003 proposal, which suggested this format. More information about how the formulas were derived, and why, is provided in Section 3.2.
- EPA aims to categorize products according to how they are most commonly marketed, and as such, printer/fax combination units are considered MFDs in this Directional Draft. These combination units are not covered by the proposed Track 2 approach, where stand-alone printers and fax machines are addressed.
- As EPA revises product specifications, the energy savings potential of the product is analyzed, as well as its key components, including the power supply. Section 4.8 provides detailed information on how power supplies may be included in the specification.

3.2 – Proposed Energy-Efficiency Criteria: Operational Mode Approach

Methodology

The criteria tables presented in this section were determined after thorough analysis of current product energy consumption patterns, market trends in product sales and usage patterns, and product capabilities, obtained through activities such as field-testing, analysis of recent ENERGY STAR qualified product data, and communication with various stakeholders. EPA carefully studied the 2003 proposal submitted by ITI; as well as input from LBNL; the Australian Green House Office; the European Commission ENERGY STAR Board (ECESB); Japan's Ministry of Economy, Trade, and Industry (METI); and other key ENERGY STAR stakeholders.

The power specifications listed below for each imaging equipment product area have been based upon ENERGY STAR qualified product data submitted by ENERGY STAR manufacturing partners for products available on the market in 2002 and 2003. Approximately 25% of models meet the power levels proposed in this section. In response to concerns from industry stakeholders regarding the traditional "step" approach that EPA has used in the past (see Figure 1), where product energy-efficiency was categorized by designated speed bands, EPA has created this Directional Draft specification using formulas wherever possible. The following three steps provide a brief description of the process EPA followed to create these formulas:

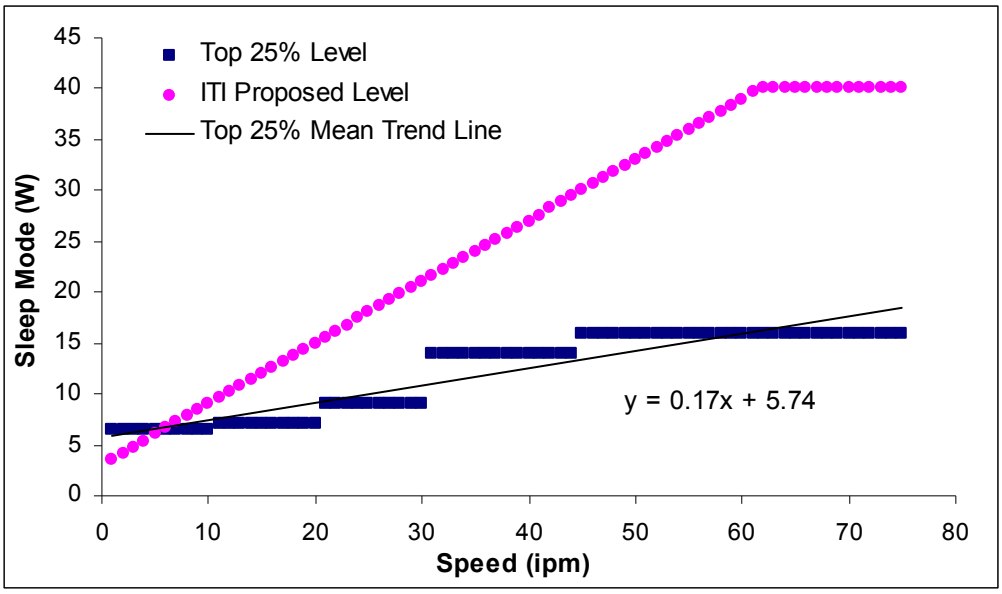
1.) EPA first determined the lowest exhibited Sleep-mode power in each MOU-specified speed band, which was met by approximately 25% of qualified models available in 2002 and 2003. For example, EPA determined that 25% of already qualified monochrome printers (excluding Ink Jet) in the 20-30 ipm speed band consumed 9 watts or less (see Appendix D, Table 3).
2.) Once calculated, the top 25% power levels for each product area were plotted against the corresponding product speed bands. Figure 5 below illustrates how monochrome printers (excluding Ink Jet) were plotted (e.g., 9 W for the 20-30 ipm speed band).
3.) Once the top 25% power levels were plotted, the data's overall behavior or "trend line" was calculated, across all speed bands. This trend line's mathematical formula represents the power level that the 25% of products should be able to meet as a function of product speed.

Continuing the example from Step 1, Figure 5 below shows that the level for 20-30 ipm products is 9 watts. This means that approximately 25% of the ENERGY STAR qualified products available in this speed band during the last two years could meet a specification set at 9 watts. It is important to note

that the data plotted in Figure 5 does not represent individual models, but rather, the power **levels** that were met by the most efficient qualified models (top 25%) by speed band.

Additionally, Figure 5 illustrates how the formula proposed by EPA for monochrome printers (excluding Ink Jet) compares with the formula suggested by ITI in its April 2003 proposal (depicted in pink). The linear trend line based on the data points in blue depicts EPA's proposed formula. Data used in this example and in the creation of the proposed criteria for other products listed in this section, are available for review in Appendix D.

Figure 5. How EPA Derived its Proposed Energy Efficiency Formula for Monochrome Printers (Excluding Ink Jet)



Proposed Power Levels

Table 1. Stand-alone Fax Machines
Applicable Size(s): Standard*
Applicable Marking Technologies: All

Product Speed (ipm)	Sleep (W)	Default Time to Sleep (min.)	Recovery Time from Sleep (sec.)	Plug-in Off/Standby (W)
0 < ipm ≤ 10	≤ 0.36x + 1.48	≤ 5	TBD	≤ 2
10 < ipm ≤ 20	≤ 0.36x + 1.48	≤ 15	TBD	≤ 2
20 < ipm	≤ 0.36x + 1.48	≤ 30	TBD	≤ 2

**Media sizes and marking technologies are defined in Appendix A.*

Rationale: The equation used above is based upon the top 25% of energy-performing products reported to EPA over the past two years, as well as extrapolated data based on consumption patterns proposed to EPA. Since product data was limited at product speeds greater than 10 ipm, EPA formulated target power levels using the growth trend ITI used in its proposal for fax machines. The wattages used to create the formula are provided in Appendix D. EPA recognizes that there are additional functionalities associated with fax machines today domestically and in various international markets, including L-mode, Caller ID, Call Waiting, etc., which may affect energy performance. These additional features are not covered in this initial draft specification, but continue to be investigated. Additionally, EPA is continuing to

consider how to address stakeholder concerns regarding fax capability to enter a Plug-in Off/Standby mode, or similarly consuming low-power state. Plug-in Off/Standby power levels listed above reflect the current FEMP requirement in this mode; however, it should be noted that this level might change in the near future.

Table 2. Monochrome and Color Ink Jet Printers
Applicable Size(s): Standard
Applicable Marking Technologies: Ink Jet

Product Speed (ipm)	Sleep (W)	Default Time to Sleep (min.)	Recovery Time from Sleep (sec.)	Plug-in Off/Standby (W)
0 < ipm ≤ 10	≤ 3	≤ 5	TBD	≤ 1
10 < ipm ≤ 20	≤ 3	≤ 15	TBD	≤ 1
20 < ipm ≤ 30	≤ 3	≤ 30	TBD	≤ 1
30 < ipm ≤ 44	≤ 3	≤ 60	TBD	≤ 1
44 < ipm	≤ 3	≤ 60	TBD	≤ 1

Rationale: Ink Jet printers have separate criteria in this Directional Draft due to very prominent differences in energy consumption between Ink Jet technology and other technologies, such as EP and Thermal Transfer. LBNL has collected data in the field that shows if EPA continues to group Ink Jet products with more energy-intensive technologies, the ENERGY STAR program will not yield carbon savings in this product area. EPA sees the following reasons as justification to treat this group of products separately from the other marking technologies: 1.) As observed in the field, Ink Jet printers consume energy very differently than other marking technologies; 2.) Ink Jet technology primarily serves a different market base than other technologies, such as EP, as a result of differences in inherent characteristics such as speed, print job quality, and color vs. monochrome capability differences; and 3.) Ink Jet is not due to be phased out of the market any time in the near future.

Based on manufacturer-reported data collected in 2002 and 2003, EPA has found that the top 25% of ENERGY STAR qualified Ink Jet printers on the market today would meet a 3-watt specification, regardless of product speed.

Table 3. Monochrome Printers (Excluding Ink Jet)
Applicable Size(s): Standard
Applicable Marking Technologies: EP, LED, LCD, Thermal Transfer, Dye Sublimation, and Impact

Product Speed (ipm)	Sleep (W)	Default Time to Sleep (min.)	Recovery Time from Sleep (sec.)	Plug-in Off/Standby (W)
0 < ipm ≤ 10	≤ 0.17x + 5.74	≤ 5	TBD	≤ 1
10 < ipm ≤ 20	≤ 0.17x + 5.74	≤ 15	TBD	≤ 1
20 < ipm ≤ 30	≤ 0.17x + 5.74	≤ 30	TBD	≤ 1
30 < ipm ≤ 44	≤ 0.17x + 5.74	≤ 60	TBD	≤ 1
44 < ipm	≤ 0.17x + 5.74	≤ 60	TBD	≤ 1

Rationale: The wattage data used to derive the formula for monochrome printers, excluding Ink Jet models, reflect the top 25% of qualified products in energy performance, as reported to EPA over the past two years. The individual wattages found in each speed band from which this formula is derived are listed in Appendix D. Because Impact products are not as prominent on the market today as they were when the existing MOU was developed, and because they perform similarly to other marking technologies in energy consumption, EPA has decided to include these products under Table 3. Figure 5 depicts a visual representation of the formula listed here.

Table 4. Color Printers (Excluding Ink Jet)
Applicable Size(s): Standard

Applicable Marking Technologies: Serial Color EP, Color LED, Color Thermal Transfer, and Color Dye Sublimation

Product Speed (ipm)	Sleep (W)	Default Time to Sleep (min.)	Recovery Time from Sleep (sec.)	Plug-in Off/Standby (W)
0 < ipm ≤ 10	≤ 0.15x + 17.19	≤ 30	TBD	≤ 1
10 < ipm ≤ 20	≤ 0.15x + 17.19	≤ 30	TBD	≤ 1
20 < ipm ≤ 30	≤ 0.15x + 17.19	≤ 30	TBD	≤ 1
30 < ipm ≤ 44	≤ 0.15x + 17.19	≤ 30	TBD	≤ 1
44 < ipm	≤ 0.15x + 17.19	≤ 60	TBD	≤ 1

Rationale: Similarly to Table 3, the power data used to derive the formula for color printers, excluding Ink Jet models, reflects the top 25% of qualified products in energy performance, as reported to EPA over the past two years. Data used to arrive at this formula is listed in Appendix D. In response to stakeholder concerns, serial EP technology has been separated from parallel EP technology, as further described in the rationale for Table 5.

Table 5. Parallel Color EP Printers
Applicable Size(s): Standard
Applicable Marking Technologies: Parallel Color EP

Product Speed (ipm)	Sleep (W)	Default Time to Sleep (min.)	Recovery Time from Sleep (sec.)	Plug-in Off/Standby (W)
0 < ipm ≤ 10	≤ 0.15x + 17.19	≤ 15	TBD	≤ 1
10 < ipm ≤ 20	≤ 0.15x + 17.19	≤ 30	TBD	≤ 1
20 < ipm ≤ 30	≤ 0.15x + 17.19	≤ 60	TBD	≤ 1
30 < ipm ≤ 44	≤ 0.15x + 17.19	≤ 60	TBD	≤ 1
44 < ipm	≤ 0.15x + 17.19	≤ 60	TBD	≤ 1

Rationale: As noted in the rationale for Table 4, EPA has established separate criteria for parallel color EP. EPA recognizes that product speed is an important factor for consumers when purchasing products, and that industry regards parallel color EP technology as a response to consumer preference. Additionally, serial color machines and parallel color machines are different products that respond to different markets, and therefore need to be held to different requirements. Table 5 has been constructed based on product data used for Table 4, in part due to scarcity of data on parallel machines. EPA understands that these criteria will need to be modified to adequately reflect the differences between parallel and serial machines. Default time values reflect ITI's proposed levels for all speed bands except the highest, where ITI suggested 90 minutes. EPA considers 60 minutes as ample time for a machine to enter its power management state, but stakeholders are welcome to demonstrate why 90 minutes may be necessary.

Table 6. Large Format Printers
Applicable Size(s): Large Format
Applicable Marking Technologies: Color and Monochrome Ink Jet, EP, LED, Dye Sublimation, Thermal Transfer, and Impact

Product Speed (ipm)	Sleep (W)	Default Time to Sleep (min.)	Recovery Time from Sleep (sec.)	Plug-in Off/Standby (W)
0 < ipm ≤ 10	≤ 17	≤ 15	TBD	≤ 1
10 < ipm ≤ 20	≤ 17	≤ 30	TBD	≤ 1
20 < ipm ≤ 30	≤ 17	≤ 60	TBD	≤ 1
30 < ipm ≤ 40	≤ 17	≤ 60	TBD	≤ 1
40 < ipm	≤ 17	≤ 60	TBD	≤ 1

Rationale: The Sleep power criteria listed for large format printers reflect the top 25% of qualified products in energy performance in the 0-to-40-ipm speed band, as reported to EPA over the past two years. Due to a scarcity of product data, EPA was not able to arrive at criteria for product speeds above 40 ipm. However, the 6 models reported to EPA consumed fewer than 17 watts. EPA would like to include a formula to address the energy efficiency of large format printers, but the limited sample set did not afford this opportunity. EPA welcomes manufacturer input moving forward. Default time values reflect ITI's proposed levels for all speed bands except the highest, where ITI suggested 90 minutes. EPA considers 60 minutes as ample time for a machine to enter its power management state, but stakeholders are welcome to demonstrate why 90 minutes may be necessary.

Table 7: Scanners
Applicable Size(s): Standard, Large Format
Applicable Marking Technologies: Not Applicable

Product Speed (ipm)	Sleep (W)	Default Time to Sleep (min.)	Recovery Time from Sleep (sec.)	Plug-in Off/Standby (W)
0 < ipm	≤ 6	≤ 15	TBD	≤ 1

Rationale: The Sleep power criteria listed for scanners reflect the top 25% of qualified products in energy performance, as reported to EPA over the past two years. EPA is investigating how machine differences, such as type of power source (USB versus AC) or network capability, may affect energy performance, and is conducting product testing at this time.

Table 8: Mailing Machines
Applicable Size(s): Standard, Large Format
Applicable Marking Technologies: All

Product Speed (mppm)	Sleep (W)	Default Time to Sleep (min.)	Recovery Time from Sleep (sec.)	Plug-in Off/Standby (W)
0< mppm ≤ 50	≤ 0.16x + 1.32	≤ 20	TBD	≤ 1
50< mppm ≤ 100	≤ 0.16x + 1.32	≤ 30	TBD	≤ 1
100< mppm ≤ 150	≤ 0.16x + 1.32	≤ 40	TBD	≤ 1
150< mppm	≤ 0.16x + 1.32	≤ 60	TBD	≤ 1

Rationale: The Sleep power formula listed for mailing machines reflects the top 25% to 33% of these products in energy performance, as reported to EPA over the past two years. It is important to note that the data set for mailing machines is limited, so while these wattages are an accurate representation of qualifying product data EPA has received, it may not represent new types of mailing machines on the market. The formula has been derived from the top-performing models' trend line, and the Plug-in Off/Standby power level is taken from the level FEMP has designated for printers, which is consistent with the levels proposed by ITI. EPA welcomes feedback from stakeholders to ensure that the breadth of this market will be adequately addressed in the future specification.

3.3 – Considerations When Developing the Operational Mode Approach

Recovery Time
Due to the fact that previous MOUs did not include criteria for recovery time, EPA has not collected information on recovery time in the past for fax machines, printers, scanners, and mailing machines. For this reason, specific recovery time criteria have not been defined in this Directional Draft for these products. However, EPA recognizes that aspects such as recovery time can have an impact on how power management is used by the consumer, and can affect the overall energy efficiency of a product. Determining the power consumption criteria in the products' power management mode(s) is a key step in determining related aspects such as recovery time and default time. EPA values stakeholder feedback on these proposed power criteria, and would like to further discuss how these power limits might affect the way the products can recover from power management.

Throughput Measurement
The energy efficiency criteria outlined in this Directional Draft specification are provided in "images per minute" (ipm) and are based on manufacturer-advertised speed. Products only capable of monochrome printing are represented by the speed at which the machine prints in monochrome, and products capable of printing in color (or both color and monochrome) are represented by the speed at which the machine prints in color. Per ITI's proposal to EPA, a single sheet printed/scanned on one side in a minute is equal to 1 ipm. A single sheet printed/scanned on both sides in a minute is equal to 2 ipm. Products capable of image capture and/or image output at varying and/or multiple speeds based upon resolution, image quality, printing modes, or the like should use the maximum speed claimed in the product specifications, following the above guidelines for color and monochrome speed. It should be noted that EPA assumed a 1:1 relationship between pages-per-minute (ppm) and ipm when analyzing product data submitted by manufacturers and constructing the criteria presented in Section 3.2.

Media Type
EPA is exploring the best way to address and define the variety in media type and size used with imaging equipment today. For this initial Directional Draft specification, EPA has drawn from existing MOUs as well as ITI's proposal to best categorize media sizes. It is recognized that smaller media, such as microfilm and specialized photography media, will need to be incorporated in a way where they can be compared with other products on an image-reproduction-speed basis. An alternate approach that has been suggested to EPA proposes that media size be categorized by *width* of the paper path, rather than by specific media sizes. EPA welcomes stakeholder feedback on how defining media size and addressing smaller media would be best accomplished. For the purposes of this initial Directional Draft specification, media such as Letter/A4, Legal, Ledger/A3, and smaller (i.e., 4" x 6", microfilm) are considered Standard size, while media such as A2, and larger are considered Large Format. Mailing machine criteria are based upon the conventional unit of measurement "mail pieces per minute" (mppm). These media distinctions also are defined in Appendix A.

There are several additional areas in both tracks of this Directional Draft that EPA would like to expand upon or improve. Section 4 below details elements that would benefit greatly from stakeholder feedback.

Section 4 – Opportunities for Expansion and Improvement of Directional Draft

4.1 Introduction

Following are specific items to be resolved so that this Directional Draft may better inform the process of creating a First Draft specification. EPA hopes that industry will welcome the opportunity to collaborate on any of these elements. Specific questions to industry are in bold text.

4.2 – The Breadth of Products Addressed in Directional Draft

The imaging equipment industry is large and varied. As such, EPA recognizes that ENERGY STAR will not be able to encompass all imaging equipment products or technologies available today. However, EPA strives to reach as many areas of the consumer market as possible where ENERGY STAR can make an impact, and where energy savings can be realized through differentiating more energy-efficient products. The product areas covered in this Directional Draft are areas that ENERGY STAR has successfully implemented in the past, and where EPA continues to see meaning for the ENERGY STAR mark. This Directional Draft is an attempt to submit preliminary thoughts for industry feedback, and is not prohibited from expansion to include additional products or technologies. If industry requests consideration of additional products or technologies, specific proposals for addressing such products would be welcomed. Some products and technologies that have been brought to EPA's attention for possible incorporation in a revised specification include the following:

- Digital duplicators;

- Medical imagers;
- Inkjet photo printers; and
- Products employing new marking technologies (i.e., Solid Ink).

4.3 – Treatment of Products with Varying Functionality

1.) How should MFDs be addressed? The additional functionality offered by MFDs will need to be addressed in the TEC energy-efficiency specification. Following are two different approaches for stakeholder consideration and comment:

- Borrow from the proposed copier specification and test procedure to create a similar, but separate, MFD specification and test procedure. This method may allow for a more accurate representation of how MFDs operate in the field, but requires time since it would be a complex process. Or,
- Use the proposed copier specification as a base for an MFD specification and then allow increases in the specification for additional functionality (e.g., 5 Wh/h for fax; 7Wh/h for scanner; 20Wh/h for large format, etc.). While this method may be a simpler method than creating a separate MFD TEC specification, it also may unfairly limit improvements in MFD design, where different components share common parts of the base machine and hence, use less energy.

2.) How should Digital Front Ends (DFEs) be addressed? Manufacturers have encouraged EPA to include an additional power allowance for products that contain a functionally integrated DFE. It has been requested that EPA address DFEs that are not functionally integrated in the ENERGY STAR computer specification, rather than with imaging equipment. EPA understands the additional functionality and performance that can be realized from some imaging products that employ DFEs, and will continue to work with manufacturers to fully understand the implications of treating or disregarding DFEs in an imaging specification.

3.) How should networked products (i.e., scanners) be addressed? ITI has suggested, in its proposal to EPA, that EPA create separate energy-efficiency criteria for networked and non-networked scanners. EPA will continue to investigate this request as well as the applicability of this distinction for other products.

4.) How should USB-powered scanners be addressed? EPA is currently in the process of testing top-selling scanners on the market today to better understand how USB-powered machines consume energy compared to conventional machines, as well as to provide additional data from which to base a specification. EPA will be using this data to possibly expand upon the criteria outlined in this Directional Draft.

5.) How should fax-machine options be addressed? Fax machine functionality is expanding over time, and features such as L-mode, Caller ID, cordless handset-capability, etc., may have an effect on how these machines consume power. Since functionality varies across both the U.S. market, as well as international markets, EPA is investigating how these features affect energy efficiency, and how to address them.

6.) How should photo printers be addressed? With the proliferation of digital cameras, there may be a need or advantage to specifying a separate category of small-format Ink Jet photo printers. A key question to be answered is whether these products operate very differently from standard Ink Jet printers.

4.4 – Refinement of Definitions

7.) How should recovery time be defined? Some manufacturers have stated that recovery time and warm-up time can be interpreted differently within industry. To reduce possible measurement inconsistency across industry, the ENERGY STAR specification will need to clearly define the starting and

ending events for these periods. For example, should the ending event be at the time when the machine is ready to produce an output, or when the machine is actually producing an output?

8.) How should each product's "base" unit be defined? For example, is the product assumed to be networked and contain color capability? Following this, energy-efficiency specifications and test methodologies can be amended as necessary to address units that have added or reduced functionality. How a copier is defined, whether analog, digital, or digital upgradeable, to meet criteria requirements, will need to be addressed.

4.5 – Refinement of Test Procedure

9.) How can the TEC test procedure be compressed? The TEC test procedure proposed in Section 2.2 requires products to be metered for two hours. When refining this test procedure, EPA will attempt to simplify the process so that the duration of the test is shorter. EPA welcomes stakeholder feedback on a compressed time frame for the completion of this test.

10.) How can test variables be defined so that they reflect the needs of and realities faced by international stakeholders? For the TEC method, it will be important to address key testing variables that can differ by product speed and/or country/region. This is especially important, given that the specification will ultimately apply to an international audience. One example presented in Section 2.2 is the need to determine an average image volume, or number of sheets per job. This image volume will vary by product speed. Rather than referring to a table that specifies volume by speed band category, a formula could be employed. The following formula is proposed for monochrome copiers: $0.04*(ipm)^2$. Using this formula, a product that produces images at a speed of 20ipm would copy or print 16 sheets per job during testing.

$$0.04*(20)^2 = .04*400 = 16$$

The TEC energy efficiency specification will need to establish use patterns, i.e., the number of hours the product is in use per day and the time it spends turned off. Japan's Energy Saving Law presumes monochrome units are in use for eight hours per day. EPA will need to verify the applicability of this assumption in other markets.

11.) Is there a need for the creation of a standard "test page" for testing imaging equipment (i.e., printers, copiers)? The creation of a test page for the TEC method will be investigated for the purpose of ensuring that partners are testing their products uniformly across industry.

12.) How can recovery time be minimized while still saving energy in low-power? This factor should be considered for both the TEC method and operational mode approach. Recovery time can have an impact on how power management is utilized by the consumer; quickening recovery time can be an effective approach to minimizing the energy consumption of products. As an example, ENERGY STAR qualified copiers could be required to have a recovery time of 10 seconds or less.

4.6 – Access to Test Data

As was previously mentioned, access to current and complete test data assists EPA in making the best decisions about energy-efficiency criteria. Since longevity is one intent of the specification, manufacturers are encouraged to help EPA understand how new products and products in development use power. Test data for copiers, MFDs, large format printers, mailing machines, network scanners, and USB scanners would be particularly helpful.

4.7 - Indirect Energy Savings

13.) Paper conservation issues will be considered during the preparation of the First Draft specification, but have not been the primary focus of the ENERGY STAR program to date. Manufacturers and other

interested parties have indicated preliminary support for this idea, and have suggested that the ENERGY STAR specification address the following.

- Duplex imaging capability **– Should duplexing be a requirement for certain products and/or speed bands?**
- Duplex imaging speed **– How does the speed of a product's duplexing abilities affect consumer enabling of this capability?**
- Combine imaging (printing multiple pages in a single sheet) **– How commonly available is combine-imaging, and should it be a requirement for certain products and/or speed bands?**
- The embodied energy in the manufacturing process **– How far should EPA go in recognizing the indirect savings of disposables within the ENERGY STAR specification, such as toner, paper, ink, etc.?**

EPA welcomes stakeholder opinions on how EPA should approach the recognition of indirect energy-conservation measures within the new specification.

14.) Several stakeholders have discussed remanufactured products and the impact of this process on indirect energy savings and prevention of unnecessary items entering the waste stream. **If EPA were to consider remanufactured products separately from new products, how should a remanufactured product be defined? For example should the definition incorporate the length of time a product has been in the market and/or its percent of reused parts or materials by weight?** More information on EPA's thoughts on remanufactured products can be found in Appendix C.

4.8 – EPA's Power Supply Strategy

When developing new or revising existing product specifications, EPA analyzes the energy savings potential of the overall product or system as well as its key components, including the power supply. Based on research completed to date, EPA has decided to pursue an energy-efficiency specification for single voltage AC/DC external power supplies, which will address both active and standby mode efficiency. Through ENERGY STAR, EPA plans to provide incentives for power supply manufacturers to produce and ship greater numbers of energy-efficient power supplies to their customers—who in turn will incorporate them into their new end use product designs. In 2004, EPA plans to issue a Partnership Agreement, Partner Commitments, and Eligibility Criteria (e.g., technical specification) to power supply manufacturers for their voluntary participation. The specification will apply to external power supplies utilized in existing ENERGY STAR product categories. As these existing ENERGY STAR specifications (such as imaging equipment) are opened up for revision, the external power supply specification will be incorporated as a requirement, where appropriate.

EPA also believes that internal power supplies offer significant energy savings potential across their various loads or operational modes. At this time, EPA is exploring two possible options for addressing internal power supplies:

1) Set a unique power supply specification for discrete product categories. This option would incorporate a product-specific internal power supply specification into the traditional system- or product-based specification. Specifications would then be provided at both the component and system level. This option is similar to the external power supply strategy explained above, except that it permits EPA to set internal power supply specification levels as appropriate for specific product categories.
2) Encourage, but not require, the explicit use of an efficient power supply through a traditional performance specification addressing typical product electricity use, such as the new Version 4.0 computer monitor specification that includes performance levels for On/Active, Sleep/Low Power, and Off/Standby.

At this time, EPA is exploring the possibility of addressing the efficiency of internal power supplies for imaging equipment through both the TEC approach and the operational mode approach.

15.) Does your company purchase its external and internal power supplies from a vendor, or does it manufacture in-house?

16.) What percentage of your products use internal power supplies, and what percentage use external?

4.9 – Streamlining Product User Interface

Manufacturers are strongly recommended to design products in accordance with the user interface standards being developed by the Power Management Controls project to make power controls more consistent and intuitive across all electronic devices. For details on this project, see http://eetd.LBL.gov/Controls.

Appendix A: Terminology and Definitions

Products

A. Copier – A commercially available imaging product whose sole function is the production of hard copy duplicates from graphic hard copy originals. The unit must be capable of being powered from a wall outlet. This definition is intended to cover products that are marketed and sold as copiers.

B. Digital Duplicator – A commercially available imaging product, which functions as a high-speed, multifunctional digital duplicating system. It combines four functions: digital scanner, PC connectivity, digital master making, and high-speed duplication. The unit must be capable of being powered from a wall outlet. This definition is intended to cover products that are marketed and sold as digital duplicators.

C. Facsimile Machine (Fax) – A commercially available imaging product that serves as a hard copy output device whose primary function is sending and receiving information. The unit must be capable of being powered from a wall outlet. This definition is intended to cover products that are marketed and sold as fax machines.

D. Mailing Machine – A commercially available imaging product that serves to print postage onto mail pieces. The unit must be capable of being powered from a wall outlet. This definition is intended to cover products that are marketed and sold as mailing machines.

E. Multifunction Device (MFD) – A commercially available imaging product, which is a physically-integrated device or a combination of functionally-integrated components that produces hard copy duplicates from graphical hard copy originals. This is considered to be distinct from single sheet convenience copying offered by fax machines. An MFD combines two or more of the core functions of printing, scanning, and copying, and may include fax capability as well. The unit must be capable of being powered from a wall outlet. This definition is intended to cover products that are marketed and sold as MFDs, including printer/fax combination units.

F. Printer – A commercially available imaging product that serves as a hard copy output device, and is capable of receiving information from single-user or networked computers. The unit must be capable of being powered from a wall outlet. This definition is intended to cover products that are marketed and sold as printers including printers that can be upgraded into an MFD.

G. Printer/Fax Combination Unit – A commercially available imaging product that serves as both a fully functional printer and fax machine, as defined in this document. The unit must be capable of being powered from a wall outlet. This definition is intended to cover products that are marketed and sold as combination printer/fax devices. Printer/fax combination units are addressed as MFDs in this Directional Draft.

H. Scanner – A commercially available imaging product that functions as an electro-optical device for converting information into electronic images that can be stored, edited, converted, or transmitted, primarily in a personal computing environment. This definition is intended to cover products that are marketed and sold as Scanners.

Marking Technologies

A. Ink Jet (Bubble Jet) – A marking technology where images are formed by depositing colorant in small drops directly to the print media in a matrix manner. Color Ink Jet is distinguished from monochrome Ink Jet in that more than one colorant is available in a product at any one time. Several forms of Ink Jet are defined below.

a. PE Ink Jet – PE (Piezo-electric) Ink Jet technology is a marking technology where an ink droplet is forced out of the head of the pen by the mechanical flexing of the crystal due to current flowing in the crystal. The ink in PE Ink Jet technology does not have to be heated and cooled, which affords greater flexibility in ink composition.

b. Ink Jet Sublimation – In the Ink Jet sublimation process, a digital image is printed with special sublimation inks onto paper. Once the image is on the paper, it is placed under a heat transfer press on top of a substrate, and the paper is heated until the inks turns into a gas, transferring the image onto another substrate.

B. Electrophotography (EP, Laser, or Laser Jet) –

a. Monochrome EP – A marking technology characterized by illumination of a photoconductor in a pattern representing the desired hard copy image via a light source, development of the image using particles of toner using the latent image on the photoconductor to define the presence or absence of toner at a given location, transfer of the toner to the final hard copy medium, and fusing to cause the desired hard copy to become durable. Monochrome EP is distinguished from color EP in that toner with a single color is available in a product at any one time.

b. Serial Color EP – A marking technology similar to monochrome EP, except that toners of at least two different colors are available in a given product at one time. Serial color EP is distinguished from parallel color EP in that a single light source and photoconductor are used in a serial fashion to achieve the multi-color hard copy output.

c. Parallel Color EP – A marking technology similar to serial color EP, except that multiple light sources and multiple photoconductors are used to increase the maximum color printing speed.

C. LED – LED technology is not common, but can be found in printers, label printers, copiers, and MFDs. LED printer technology differs from Laser Jet only in the manner light (and possibly the light frequency) is applied to the drum for image exposure. There is a matrix of small LEDs, which individually deliver the exposure light. Since the light frequency is directly related to the amount of energy imparted per photon applied to the drum, the power level of the LED may need to increase to produce the required effect.

D. LCD – LCD technology is not common, but can be found in printers, label printers, copiers, and MFDs. The LCD theory of operation is very similar to that of the LED printer; however, an LCD panel is used instead of the matrix of LEDs. This makes LCD units page printers rather than units that print line-by-line.

E. Thermal Transfer –

a. Color Thermal Transfer – A marking technology where the desired hard copy image is formed by depositing small drops of solid colorant (usually colored waxes) in a melted/fluid state directly to the print media in a matrix manner. Color Thermal Transfer is distinguished from monochrome and color Ink Jet in that the ink is solid at room temperature and is made fluid by heat.

b. Monochrome Thermal Transfer – A marking technology where the desired hard copy image is produced by means of changing the color of the hard copy media or by transferring material to the hard copy media based on selective localized heating. Thermal Ink Jet technology is not included in this definition.

F. Dye Sublimation – A marking technology where images are formed by depositing (subliming) dye onto the print media based upon the amount of energy delivered by the heating elements.

G. Impact –

   a. Dot Formed Impact – A marking technology characterized by the formation of the desired hard copy image by transferring colorant from a "ribbon" to the media via an impact process. The image is formed in a matrix arrangement by small dots that can be addressed uniformly and selectively transferred. This technology is commonly called wire matrix, dot matrix, and dot band technology.

   b. Fully-formed Impact – A marking technology characterized by the formation of the desired hard copy image by transferring colorant from a "ribbon" to the media via an impact process. The image is formed through transferring fully formed shapes (characters) to the media. This technology is commonly called Wheel, Ball, or type-bar printing.

Operational Modes and Activities

A. Warm Up Time – The amount of time it takes to reach the state where the machine is ready for operation after turning on the power switch.

B. Recovery Time from Sleep – The amount of time needed to bring a product out of power management into Ready Mode. Per the Copier of the Future initiative, which is referred to in Section 2.2, Recovery Time from Sleep should be equal to the difference between the time required to produce an image from Sleep mode and the time it takes to produce an image from Ready mode (Note: when Recovery Time from Sleep differs for copying and printing in an MFD, this period should be measured for copying). For a product capable of color operation, the recovery time must include the time required to begin performing the appropriate primary function with color support. (Note: This definition will require refinement once a test procedure is developed.)

C. Recovery Time from Off – The amount of time needed to bring a product out of Manual Off into Ready Mode.

D. Default Time – The time set by the manufacturer prior to shipping that determines when the product will enter its various power management modes.

E. Active – The power state in which the product is connected to a power source and is actively producing output, as well as performing any of its additional functions. This mode is entered when stimulated by an external input or manipulation. The power requirement in this mode is typically greater than the power requirement in all other modes.

F. Ready – The condition that exists when the product is not producing output, has reached operating conditions and is ready to produce an output with no delay, but has not yet entered into any energy saving modes. When the product is in this mode, there will be virtually no delay before it is capable of producing the next output.

G. Sleep – The reduced power state that the product automatically enters, without actually turning off, after a period of inactivity. The product returns to Active mode within a predetermined period of time in response to various external stimuli (e.g., telephone rings as a fax is polling, operator lifts the scanner cover prior to making a copy, etc.). The product must maintain full network connectivity (the ability to respond to ordinary network traffic) while in Sleep, waking up only as necessary.

H. Plug-in Off/Standby – The lowest power consumption mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when an appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions. For purposes of this specification, Plug-in Off/Standby is defined as the power state when the product is connected to a power source, produces no outputs, and is waiting to be switched to Active Mode by a direct signal from a user, e.g., user pushes power switch. When measuring power in this mode, control equipment for remote servicing may be excluded.

I. Manual Off – The condition where the product is plugged into the mains, but has been disconnected from an external power source, usually by a user turning it off via a switch.

J. Disconnect – The product has been unplugged from the mains and therefore is disconnected from all external power sources.

Additional Terms

A. Accessory – A piece of additional equipment that is not necessary for the operation of the base unit, but that may be added before or after shipment in order to enhance or change product performance. An accessory may be sold separately under its own model number, or sold with a base unit as part of a copier package or configuration.

B. Reproduction speed – Product speed, as determined and advertised by the manufacturer.

C. Duplex speed – Product speed while in duplex mode, as determined and advertised by the manufacturer.

D. Media size – Varying media sizes will need to be defined, particularly those that are smaller in dimension than standard letter-sized paper.

    a. Standard – Products categorized as Standard include the following - Letter, A3, A4, and smaller (i.e., 4" X 6", microfilm)
    b. Large Format – Products categorized as Large Format include the following - A2, Legal, and larger

Appendix B: Partner Commitments

Beyond the energy-efficiency criteria, the ENERGY STAR Partnership Agreement also contains Partner Commitments that pertain to the manufacturing of ENERGY STAR qualified imaging equipment including printers, facsimile machines, copiers, scanners, MFDs, and mailing machines. The ENERGY STAR Partner must adhere to the following proposed requirements:

- Comply with current ENERGY STAR Eligibility Criteria, defining the performance criteria that must be met for use of the ENERGY STAR certification mark on imaging equipment and specifying the testing criteria for imaging equipment. EPA may, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at EPA's request.
- Comply with current ENERGY STAR Identity Guidelines, describing how the ENERGY STAR marks and name may be used. Partner is responsible for adhering to these guidelines and for ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance.
- Qualify at least one ENERGY STAR qualified imaging equipment product within one year of activating the imaging equipment portion of the agreement. If the revised imaging equipment specifications employ a tiered approach, the product qualified by the partner must meet the specification (e.g., Tier 1 or 2) in effect at that time.
- Provide clear and consistent labeling of ENERGY STAR qualified imaging equipment products. The ENERGY STAR mark must be clearly displayed on the top/front of the product, on the product packaging, in product literature (i.e., user manuals, spec sheets, etc.), and on the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed.
- Provide to EPA, on an annual basis, an updated list of ENERGY STAR qualified imaging equipment product unit models. Once the Partner submits its first list of ENERGY STAR qualified imaging equipment, the Partner will be listed as an ENERGY STAR Partner. Partner must provide annual updates in order to remain on the list of participating product manufacturers.
- Provide to EPA, on an annual basis, unit shipment data or other market indicators to assist in determining the market penetration of ENERGY STAR. Specifically, Partner must submit the total number of ENERGY STAR qualified imaging equipment units shipped (in units by model) or an equivalent measurement as agreed to in advance by EPA and Partner. Partner is also encouraged to provide ENERGY STAR qualified unit shipment data segmented by meaningful product characteristics (e.g., capacity, size, speed, or other as relevant), total unit shipments for each model in its product line, and percent of total unit shipments that qualify as ENERGY STAR. The data for each calendar year should be submitted to EPA, preferably in electronic format, no later than the following March and may be provided directly from the Partner or through a third party. The data will be used by EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner;
- Notify EPA of a change in the designated responsible party or contacts for imaging equipment within 30 days.

Appendix C: Discussion of Elimination of Automatic Grandfathering and Remanufacturing

Under the newest version of the Partnership Agreement, EPA has made a significant change with regard to product qualification and labeling during specification transitions. ENERGY STAR qualification under a previous specification version is not automatically granted for the life of the product model. To earn the ENERGY STAR, a product model must meet the ENERGY STAR specification in effect on the date of manufacture. EPA has made this important programmatic change for two reasons:

1. To deliver on expectations about ENERGY STAR by ensuring that the products perform at levels promised by the program; and
2. To ensure that ENERGY STAR's ability to differentiate more efficient products is not undermined by high percentages of labeled products qualifying at less stringent performance levels.

Although EPA has decided to eliminate grandfathering, it is recognized that the growing industry practice of remanufacturing imaging equipment products might lead EPA to further evaluate and possibly adjust this decision in appropriate product areas. Stakeholders have explained to EPA how remanufactured products contribute to indirect energy savings and prevent equipment from unnecessarily entering the waste stream. EPA understands that it is not cost-effective for manufacturers to redesign remanufactured products so that they meet new ENERGY STAR energy-efficiency criteria in effect at the time of sale.

EPA has not reached a final determination on the most appropriate way to address remanufactured products, but will continue to give this matter the utmost attention. It is likely that EPA, with help from industry, will create a specification that defines a remanufactured product as one which contains X% of reused materials, and which has spent Y years in the field. Theoretically, a product that was qualified under Version 3.0 and has met the remanufactured definition would then be permitted to retain its ENERGY STAR qualification, post-remanufacture. In addition, EPA will carefully consider appropriate effective dates for the transition to revised product specifications. The treatment of remanufactured products will weigh heavily on this decision.

EPA expects that the track 2 operational mode approach will be finalized by fall 2004. It is anticipated that the track 1 TEC method will be completed in the first quarter of 2005. Manufacturers are encouraged to suggest alternatives for treating remanufactured products in the revised ENERGY STAR imaging equipment specification, and feedback on appropriate transition time.

Appendix D: Support Data Used in Deriving Operational Mode Approach Energy-Efficiency Formulas

The following data outlines wattages that the top 25% of ENERGY STAR qualified products have met in 2002 and 2003. It was used in determining the formulas, where provided, for product areas in Section 3. Note that not all speed bands in all product areas are represented due to a scarcity of manufacturer-reported data in certain ranges.

Table 1. Stand-alone Fax Machines

Product Speed (ipm)	Sleep (W)
0 < ipm ≤ 10	≤ 3
10 < ipm ≤ 20	≤ 7
20 < ipm	≤ 11

Table 2. Monochrome and Color Ink Jet Printers

Product Speed (ipm)	Sleep (W)
0 < ipm ≤ 10	≤ 3
10 < ipm ≤ 20	≤ 3
20 < ipm ≤ 30	≤ 3
30 < ipm ≤ 44	≤ 3
44 < ipm	≤ 3

Table 3. Monochrome Printers (Excluding Ink Jet)

Product Speed (ipm)	Sleep (W)
0 < ipm ≤ 10	≤ 6.5
10 < ipm ≤ 20	≤ 7.0
20 < ipm ≤ 30	≤ 9
30 < ipm ≤ 44	≤ 14
44 < ipm	≤ 16

Table 4. Color Printers (Excluding Ink Jet)

Product Speed (ipm)	Sleep (W)
0 < ipm ≤ 10	≤ 12
10 < ipm ≤ 20	≤ 21
20 < ipm	≤ 25

Table 5. Parallel Color EP Printers

Product Speed (ipm)	Sleep (W)
0 < ipm ≤ 10	≤ 12
10 < ipm ≤ 20	≤ 21
20 < ipm	≤ 25

Table 6. Large Format Printers

Product Speed (ipm)	Sleep (W)
0 < ipm ≤ 10	≤ 17
10 < ipm ≤ 40	≤ 17
40 < ipm	≤ 17

Table 7: Scanners

Product Speed (ipm)	Sleep (W)
0 < ipm	≤ 6

Table 8: Mailing Machines

Product Speed (mppm)	Sleep (W)
0 < mppm ≤ 50	≤ 3.5
50 < mppm ≤ 100	≤ 12.5
100 < mppm ≤ 150	≤ 27.0
150 < mppm	≤ 27.0

Appendix E: The ENERGY STAR Label: A Summary of Product Labeling Objectives and Guiding Principles

This summary document provides an overview of the key principles that guide the US Environmental Protection Agency (EPA) and the US Department of Energy (DOE) when first determining which product categories will be covered by the ENERGY STAR label and then developing and revising the corresponding performance specifications. It begins with a brief introduction followed by a discussion of program objectives and six guiding principles.

Introduction
Introduced by the EPA in 1992 for energy-efficient computers, the ENERGY STAR program has grown to encompass more than 35 product categories in addition to new homes and commercial buildings. For each product category, a unique specification describes the energy performance requirements that a product must meet to qualify for the label. Product manufacturers may use the label to identify those models that meet the energy performance requirements.

Objectives
The ENERGY STAR label was established to achieve the following two objectives:

- To prevent air pollution, including emissions of greenhouse gases, caused by the inefficient use of energy.
- To make it easy for businesses and consumers to identify and purchase products, homes, and buildings with enhanced efficiency that offer savings on utility bills while maintaining, if not enhancing, performance, features, and comfort.

The EPA and DOE use a systematic framework (1) to assess the feasibility for applying the label to a product category; (2) to develop performance specifications that must be met in order to earn the label; and (3) to reassess performance specifications as market conditions change. This process relies on rigorous market, engineering, and pollution savings analyses as well as input from industry and other stakeholders. To ensure that the ENERGY STAR label remains an effective consumer tool, EPA and DOE strive to ensure that the resulting performance-based specifications identify energy-efficient products whose use results in reasonable financial return without sacrificing product performance or features.

Guiding Principles
To determine the feasibility for any new ENERGY STAR product category and the corresponding performance-based specifications, EPA and DOE follow a set of six key principles. It is important to note that these principles are not applied as a strict checklist per se. However, they are used as guidance during an iterative process to achieve the desired balance among the principles. The ultimate viability of an ENERGY STAR specification in the marketplace depends upon many factors. However, the success of a specification can be more reasonably assured through the application of these principles.

1. Significant energy savings can be realized on a national basis.
EPA and DOE seek to identify product categories that can contribute significant energy savings nationwide. An ENERGY STAR specification can achieve sizable energy savings from a product category where there are significant savings on a unit basis and relatively small annual unit sales or, where there are relatively small energy savings on a unit basis, but very large annual unit sales (see Examples 1 and 2). To determine energy savings potential, EPA and DOE collect and analyze a variety of factors, including, but not limited to the following:

- Number of products sold nationwide and widespread availability
- Market growth rates
- Amount of energy used by product in various power modes as appropriate (e.g., active, sleep, and standby/off power modes)

- The product's typical usage pattern (i.e., amount of time spent in each of the various modes of operation)
- Amount of energy that may be saved through the application of different technologies, operating procedures, or design practices
- Product lifetimes
- Applicable standards and legislation that may affect a product's energy consumption and availability
- Extent to which potential energy savings may be impacted by installation practices or system interactions

It is EPA and DOE's goal to create ENERGY STAR specifications for only those product categories where it is clear that the energy savings potential of a product will translate into tangible energy savings when the product is placed in a home or building. That is, installation or system integration issues have little or no impact on a consumer's ability to realize the product's energy efficiency. This is essential to building and maintaining consumer confidence in the ENERGY STAR label. As a result, the Agencies are very cautious about labeling products that are components of larger building or industrial systems (see Example 3).

EXAMPLE 1: An ENERGY STAR qualified air-source heat pump saves a substantial amount of energy – close to 2,300 kWh per year compared to a conventional new model. In 2002 year, ENERGY STAR qualified units save enough energy to light 160,000 homes for an entire year. This is a significant energy savings, considering the fact that fewer than 1.4 million air source heat pumps are sold annually.

EXAMPLE 2: Among the many reasons TVs were identified as an attractive product for a national program, one of the most important was their large annual unit sales. The per unit energy saved in off/standby mode by a typical ENERGY STAR qualified television does not appear significant when compared to a non-qualified model. On average, up to 4 watts are saved. However, millions of TVs are sold nationwide each year and installed in homes where they spend the majority of the day in off/standby mode. Thus, if models that have earned the ENERGY STAR replaced half of all household TVs, this change would eliminate the air pollution produced by one entire power plant.

Starting in 2005, in order for TVs to qualify for ENERGY STAR, a model must use one watt or less in off/standby mode. Once this specification is in place, it is unlikely that the specification would be further reduced during future revisions. The amount of energy savings possible from further reducing the wattage requirements may not be significant enough to warrant the change, unless there is a major technology advancement or a technologically feasible way to address the energy consumption of TVs in other power modes.

EXAMPLE 3: Due to interest from various stakeholders, EPA evaluated the feasibility of an ENERGY STAR specification for integral electric motors. After extensive research and discussion, EPA concluded that systems integration issues made it not possible at this time to guarantee that the installation of an energy-efficient motor would also yield an energy-efficient system.

2. Product performance can be maintained or enhanced with increased energy efficiency.
EPA and DOE seek to maintain the ENERGY STAR label as an attractive purchasing tool for a broad array of consumers. This is accomplished by ensuring that the label is not only a credible symbol for energy efficiency, but that it is also found on products with the features and performance that consumers demand. The Agencies would expect few consumers to choose more efficient products if it required sacrificing performance, non-energy-related features, or functionality. The Agencies will continue to

examine the following factors when determining the feasibility of new ENERGY STAR product categories and performance-based specifications, to ensure that product quality, features, and functionality are not compromised.

- Safety
- Performance
- Warranty
- Size/capacity/fuel source
- Speeds (e.g., print speed)
- Product sub-categories (e.g., component TV unit)
- Other features that consumers consider in making purchasing decisions

For example, when appropriate, EPA and DOE create specifications that address different fuel types, so that consumers may find the right products for the fuel type in their home, as most make product replacements without switching fuel types. Although one fuel type may be inherently more efficient for certain product categories, when considering the cost of switching to that other fuel type, the purchase may no longer be cost-effective to the consumer.

Often the product performance principle is easily followed, given that many energy-efficient product models are also considered to be of the highest quality with a wide range of features that consumers typically desire (see Example 4). In some cases, EPA and DOE have determined that it is preferable to develop multiple specifications, by dividing up a product category that has a wide range of performance functionality, each requiring different amounts of energy. This approach allows consumers to find an efficient model in a product size, speed, or other sub-category without unnecessarily limiting choice (see Example 5). In other cases, EPA and DOE have included particular performance-based criteria in the ENERGY STAR specification to ensure that overall product performance is maintained relative to non-qualifying product (see Example 6 and 7). In still other cases, EPA and DOE have determined that a product category is inappropriate for the ENERGY STAR label at this time because of performance expectations (see Example 8).

> EXAMPLE 4: ENERGY STAR qualified dehumidifiers provide energy savings as well as other key features such as enhanced moisture removal, quiet operation, reliability, and durability.

> EXAMPLE 5: The ENERGY STAR specification for printers provides different energy performance requirements for basic printer types, e.g., standard size vs. large format; and color vs. black and white. This allows consumers to find an efficient model in the specific product segment they require.

> EXAMPLE 6: The ENERGY STAR specification for residential light fixtures includes requirements for lamp start time, lamp life, noise, dimming capability, and safety. This ensures that ENERGY STAR qualified residential light fixtures are high quality as well as compliant with National Fire Protection Association (NFPA) 70, and the National Electrical Code.

EXAMPLE 7: Compact fluorescent light bulbs (CFLs) had a poor quality history and lacked any product standards. To address common problems of premature failure and poor light quality of CFLs, DOE developed ENERGY STAR specifications for CFLs that include minimum energy efficiency and efficacy levels along with product lifetime, lumen maintenance, photometric qualities, warranty, and third party testing requirements. As a result, CFL customers who choose ENERGY STAR qualified units are better assured of a quality purchase.

EXAMPLE 8: In the case of automobiles, many consumers are very specific about the performance, size, and features of the cars they intend to purchase. It is also very likely that these desired qualities are not found in the most efficient cars. Therefore, at this time, an ENERGY STAR specification has not been pursued, as there is no feasible way to design a specification that would satisfy both energy efficiency and other performance aspects of cars.

3. Purchasers will recover their investment in increased energy efficiency within a reasonable period of time.

Some energy-efficient products may have a price premium while others do not. In both cases, ENERGY STAR's consumer educational materials explain that all products that use energy have *two* price tags: 1) the initial cost of the product at the time of purchase, and 2) the cost of energy to operate that product over its lifetime. In evaluating the cost effectiveness of a specification for ENERGY STAR qualified products, the following factors are examined:

- Product lifetimes
- Additional cost of energy saving technologies for the manufacturer
- Incremental cost of increased efficiency of products (versus the incremental cost of other product enhancements) as passed onto the purchaser
- Price of energy
- Additional testing that may be needed to qualify as ENERGY STAR
- The geographic distribution of sales (e.g., North vs. South)
- Prevalence of rebates or other incentives for the purchase of energy-efficient products

ENERGY STAR specifications are set so that if there is a cost differential at time of purchase, that cost is recovered through utility bill savings over a reasonable period of time for the typical consumer (see Examples 9, 10, and 11).

EXAMPLE 9: An ENERGY STAR qualified torchiere has an average cost differential of about $30 ($85 for ENERGY STAR, $55 for conventional). However, a consumer will recover this cost in less than two years, given the annual savings for a qualified torchiere are approximately $25. These savings include lower electricity costs and lower bulb replacement rates.

EXAMPLE 10: Purchasers of ENERGY STAR qualified commercial solid door refrigerators and freezers can expect to save $140 annually per refrigerator and $100 annually per freezer. These purchasers will recover their increased cost at the time of purchase within 2 years.

EXAMPLE 11: There is no incremental cost between ENERGY STAR qualified DVD players and those that do not qualify for ENERGY STAR. Therefore, this principle need not be evaluated, as there is no increased initial investment to recover.

4. Energy-efficiency can be achieved with several technology options, at least one of which is non-proprietary.

ENERGY STAR is an effective marketing tool that may convey a business advantage to manufacturers that use it. As such, EPA and DOE are careful not to favor one manufacturer over all others by designating a proprietary technology or unique design approach when developing the performance attributes of an ENERGY STAR product specification. To ensure that specifications are set so that more than one manufacturer can meet them with at least one of their product models, the following factors are considered and evaluated:

- Number of companies that manufacture a product type
- Availability, variety, and cost-competitiveness of energy-saving technologies
- Proprietary or exclusive nature of any technologies in use

EXAMPLE 12: The ENERGY STAR specification for cordless telephones was set at a level such that manufacturers could implement any of several design options to meet the required efficiency. These options included employing: more efficient power supplies; smart charging technology, which prevents battery overcharging; smart circuitry that disengages when the unit is turned off or in its standby mode; and/or low power LED lights on product displays. These options are widely available, cost-effective, and not proprietary in nature.

5. Product energy consumption and performance can be measured and verified with testing.

Product testing has two roles: 1) to yield accurate energy consumption values for products whose manufacturers are hoping to earn the label, and 2) to verify that labeled products are performing at the appropriate levels and delivering on ENERGY STAR's promise to consumers. When assessing the viability of a product category to be covered by ENERGY STAR, and when developing specific performance-based specifications, EPA and DOE make every effort to choose energy performance metrics (e.g., CFM/W, cubic feet per meter per watt; AFUE, Annual Fuel Utilization Efficiency) for which an industry accepted test procedure exists and is in use by manufacturers. It is critical that the Agencies, in concert with product manufacturers and other stakeholders, work closely to fine-tune the selected test procedure to ensure it accurately and repeatedly measures the energy consumption of a product, regardless of who is conducting the testing. The following are examples of organizations that may be sources for product test procedures and knowledge:

- The United States Federal Government Code of Regulations (CFR)
- American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)
- American Society of Testing and Materials (ASTM)
- American National Standards Institute (ANSI)

- Canadian Standards Association (CSA)
- International Electrotechnical Commission (IEC)
- Individual trade organizations: American Home Appliance Manufacturers (AHAM), Air Conditioning and Refrigeration Institute (ARI), Illuminating Engineering Society of North America (IESNA), Home Ventilating Institute (HVI).

At other times, existing industry test procedures may not be entirely appropriate for use by ENERGY STAR, or may not exist at all. In this case, the Agencies must take the lead, while working closely with manufacturers and other stakeholders, to develop an appropriate test procedure that yields accurate and precise (repeatable) energy consumption values for the units under test (see Example 13).

EXAMPLE 13: Before a specification for ENERGY STAR qualified ceiling fans was created, an accepted industry test procedure to measure the energy consumption of ceiling fans did not exist. Due to manufacturer and retailer interest in a specification and the potential opportunity for energy savings, EPA worked closely with all stakeholders to create a technically sound test procedure and implementation manual.

6. Labeling would effectively differentiate products and be visible for purchasers.
As previously described, a goal of ENERGY STAR is to provide value to purchasers by enabling them to easily identify energy-efficient products that have earned the ENERGY STAR label. To achieve this goal, EPA and DOE have set specifications that may be met by only the most efficient products. This level typically represents approximately the top quartile of products currently available in the market at the time the specification is initially set. By recognizing the top quartile, EPA and DOE distinguish these products from the others, thereby adding to their intrinsic value.

Observing variations in the energy performance of models in a product category is important for ENERGY STAR to design a specification and to serve in this differentiation role. Moreover, the more extreme the spectrum of energy performance among models, the larger the potential magnitude for energy savings that may result from a product specification. If all product models used approximately equal amounts of energy, then an ENERGY STAR specification would not be pragmatic (see Example 14).

EXAMPLE 14: An ENERGY STAR specification for stovetops has not been developed given that no significant variation in energy consumption exists among the product models. The basic technology employed by most manufacturers is similar for most conventional stovetop models.

In some cases, very few models may meet the ENERGY STAR specification when it is initially set. Through research and analysis prior to setting the specification, EPA and DOE may conclude that manufacturers could implement relatively simple design changes to modify product models to enhance their energy-efficiency. With these design changes, sufficient numbers of models will qualify and ENERGY STAR will identify the more efficient products on the market (see Example 15).

EXAMPLE 15: When the ENERGY STAR specification for water coolers was first developed, very few, if any, models were able to qualify. However, the addition of insulation and timers were considered very feasible, and likely to be the sole prerequisites needed to meet the specification. Over time, several manufacturers have altered their designs to qualify a number of water cooler models.

Once an ENERGY STAR specification is in place for some amount of time, market conditions and the available model mix may change, resulting in a majority of models meeting the specification. Thus, the label would no longer serve as a differentiator. This scenario dictates that EPA and DOE reassess the specification and potentially revise it, so that the label again serves to identify the most efficient models. In effect, the specification development cycle begins again driven by the application of ENERGY STAR's guiding principles, as outlined above.

Appendix F: Questions for Stakeholders

Following are specific items reproduced from Section 4 that need further resolution so that this Directional Draft may take shape into a First Draft specification. Please refer to Section 4 for additional clarification about the context of these questions. EPA hopes that industry and other stakeholders will welcome the opportunity to collaborate on any of these elements.

1.) How should MFDs be addressed?

2.) How should Digital Front Ends (DFEs) be addressed?

3.) How should networked products (i.e., scanners) be addressed?

4.) How should USB-powered scanners be addressed?

5.) How should fax-machine options be addressed?

6.) How should photo printers be addressed?

7.) How should recovery time be defined?

8.) How should each product type be defined?

9.) How can the TEC test procedure be compressed?

10.) How can test variables be defined so that they reflect the needs of and realities faced by international stakeholders?

11.) Is there a need for the creation of a standard “test page” for testing imaging equipment (i.e., printers, copiers)?

12.) How can recovery time be minimized while still saving energy in low-power?

13.a.) Should duplexing be a requirement for certain products and/or speed bands?

13.b.) How does the speed of a product’s duplexing abilities affect consumer enabling of this capability?

13.c.) How commonly available is combine-imaging, and should it be a requirement for certain products and/or speed bands?

13.d.) How far should EPA go in recognizing the indirect savings of disposables within the ENERGY STAR specification, such as toner, paper, ink, etc.?

14.) If EPA were to consider remanufactured products separately from new products, how should a remanufactured product be defined? For example should it incorporate the length of time a product has been in the market and/or its percent of reused parts or materials by weight?

15.) Does your company purchase its external and internal power supplies from a vendor, or does it manufacture in-house?

16.) What percentage of your products use internal power supplies, and what percentage use external?