

**DRAFT**  
**EPEAT Standards Development Roadmap**  
**(EPEAT SDR)**

**June 4, 2007**



*Zero Waste  
Alliance*

**Prepared by Zero Waste Alliance**  
**with support from the**  
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## **Executive Summary**

This document provides a recommended Roadmap for the development of environmental leadership standards for new electronic products comparable to the IEEE 1680 standard for computers and monitors – EPEAT. The recommendations were developed based on extensive input from stakeholders.

**Recommendation 1. Sequence of standard development:** Four product categories are of highest interest, and standard development is recommended to occur in the following sequence:

1. **Imaging Devices (printers, copiers and MFDs) and Televisions and Television Monitors** (two separate standards) – Development of standards for these two product categories are proposed to be conducted first. Depending on resource availability and stakeholder interest, these standards development processes could begin simultaneously or on a staggered timeline.
2. **Servers** – Development of a standard for servers is proposed to begin following the completion of the ENERGY STAR standard for servers, which is likely to occur in 1 to 2 years.
3. **Mobile Devices (mobile phones, PDAs and SmartPhones)** – Development of a standard for mobile devices is proposed to begin following the completion of the standards development process for imaging devices and/or televisions.

**Recommendation 2. Implementation timeline:** The following timeline assumes 12-18 months development cycle for each product set.

<b>Standards Development Initiation Date</b>	<b>Product Category</b>	<b>Comments</b>
Fall 2007	Imaging Devices	
Fall 2007	Televisions/Television Monitors	
Spring or Summer 2008	Servers	Begin after completion of the ENERGY STAR standard
Winter or Spring 2009	Mobile Devices	Begin after completion of imaging devices and/or televisions/television monitors
Summer 2009	Revision of IEEE 1680	3 years after launch of IEEE 1680

This recommended timeline will likely be substantially impacted by the availability of funding for each standard development process.

**Recommendation 3. Method of standard development:** The future environmental standards should be developed through an ANSI accredited, voluntary consensus standard process using the IEEE as the Standard Development Organization. This will preserve continuity with EPEAT / IEEE 1680 and build on the successes to date.

**Recommendation 4. Launching the standard development process:** Following completion of the Roadmap, EPA will:

- Convene a workgroup meeting to discuss roadmap implementation with potential funders and workgroup leaders (August/September).
- Work to assemble the teams of stakeholders and support personnel needed to carry out the processes.
- Oversee the first steps of the convening process for standards development.

EPA has limited funding available to support the development of the first standard(s). EPA will be seeking additional funds, but those can not be guaranteed at this time.

## **1.0 Project Overview**

The purpose of the EPEAT Standard Development Roadmap (SDR) project is to provide recommendations for development of environmental leadership standards for electronic products that are parallel and compatible with IEEE 1680 – EPEAT. This is being conducted by gathering input from interested stakeholders on:

- 1) Which electronics products are the highest priority for the development of new leadership environmental standards
- 2) Groupings of products for environmental performance standards development
- 3) Sequence and method of environmental performance standard development
- 4) Issues that need to be considered both in the prioritization and the actual standards development.

The recommendations of this Roadmap are expected to build the basis for launching the process to develop new electronic product standards for EPEAT. This Roadmap, however, does not imply a commitment by any of the stakeholders or potential funders.

The EPEAT SDR Project is being managed by Zero Waste Alliance (ZWA) ([www.zerowaste.org](http://www.zerowaste.org)). Initial information to aid in framing the project was collected through a convening assessment<sup>1</sup>. This assessment informed development of a draft Background and Discussion Document, which was open for public comment in April 2007. The detailed background information presented in the draft Background and Discussion Document, including the product energy and environmental profile sections, has been updated in response to stakeholder comments<sup>2</sup>. The Background Document contains information that supported this SDR process and will provide starting information for the workgroups developing standards in the years to come.

Stakeholder viewpoints have been synthesized into this draft Roadmap. Stakeholders will have opportunities to give input in this Roadmap via two public comment periods and two conference calls (see Section 4 for a detailed schedule). More project information is available at <http://www.zerowaste.org/epeat/roadmap.htm>.

A chart detailing the information gleaned from research and stakeholder input which informed the product recommendations below is located in Attachment 1<sup>3</sup>.

## **2.0 Product Recommendations**

### ***2.1 Products of Interest and Grouping***

**Grouping.** Input from stakeholders indicated that imaging devices (printers, copiers and multi-function devices) as well as mobile devices (mobile phones, PDAs and SmartPhones) should be grouped into single categories for environmental standards development. It was noted however, that the standards will need to address different technologies and functionalities of the products within these categories.

**Products of highest interest.** Stakeholder input confirmed that the following four categories are of highest interest for development of environmental performance standards (in alphabetical order):

- Imaging devices (printers, copiers and multi-function devices)

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<sup>1</sup> [http://zerowaste.org/epeat\\_collab/files/Convening\\_Assessment\\_Findings\\_070408.pdf](http://zerowaste.org/epeat_collab/files/Convening_Assessment_Findings_070408.pdf)

<sup>2</sup> EPEAT SDR Background Document, June 4, 2007.

([http://zerowaste.org/epeat\\_collab/files/SDR\\_Background\\_Document\\_070604.pdf](http://zerowaste.org/epeat_collab/files/SDR_Background_Document_070604.pdf))

<sup>3</sup> Attachment 1 contains information gathered by The Center for Clean Products and Materials Policy at the University of Tennessee from existing research and reports on environmental and energy profiles for products of highest interest.

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- Televisions and television monitors
- Servers
- Mobile devices (mobile phones, PDAs and SmartPhones)

This Roadmap focuses on these four product categories of highest interest. Proposed definitions for these product categories are provided in the SDR Background Document ([http://zerowaste.org/epeat\\_collab/files/SDR\\_Background\\_Document\\_070604.pdf](http://zerowaste.org/epeat_collab/files/SDR_Background_Document_070604.pdf)).

**Products of some interest.** Stakeholders expressed some interest in digital television adapters (DTAs) and set top boxes. It is recommended that these products be incorporated into standards such as a standard for televisions or an updated standard for computers. The workgroups assembled to develop these standards will consider the scope of products for each standard during the standard setting process and it is recommended that they consider if DTAs and set top boxes should be incorporated.

In response to the interest in DTAs (also known as Digital Converter Boxes), ZWA researched this product and found that ENERGY STAR worked with the National Telecommunications and Information Administration (NTIA), manufacturers and broadcasters and created a base required energy efficiency level for all boxes eligible for the NTIA coupon. ENERGY STAR has also developed a more aggressive specification for DTAs that is in effect currently (for more information see [http://www.energystar.gov/index.cfm?c=new\\_specs.digital\\_tv\\_adapters](http://www.energystar.gov/index.cfm?c=new_specs.digital_tv_adapters)).

**Products of low interest.** Facsimile machines and scanners were of low interest as stand-alone products because they are being incorporated into multi-function devices. Consequently they are not specifically included as stand-alone devices in the imaging devices list of products. However, the actual scope of products in a standard will be determined in the standard development process. A complete list of products considered during this process is provided in Attachment 2.

## ***2.2 Consumer Electronic Products***

The current EPEAT standard is explicitly designed for computers and monitors sold to institutional purchasers. Though initially open to all types of electronic products, the EPEAT Development Team for IEEE 1680 decided to focus initially on products sold to institutional purchasers. In this SDR project, there was clear interest among stakeholders to develop environmental performance standard(s) for consumer electronics (CE) products. Given that interest, this process and the Roadmap incorporate products for both the institutional market as well as the consumer market.

Due to the focus on institutional purchasers in the initial implementation of EPEAT, following completion of this Roadmap, EPEAT Inc. and its Board of Advisors will evaluate the role that EPEAT Inc. should play in implementation of the recommendations for CE products in the context of the current EPEAT mission<sup>4</sup>.

## ***2.3 Product Priority and Sequencing***

Information collected and stakeholder feedback were synthesized and the recommended priority/sequence of development of environmental performance standards for the four product categories of highest interest is presented below. The information and input used to develop these recommendations is described briefly in the following subsections and presented in more detail in Attachment 1.

### **Sequence of Standards Development**

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<sup>4</sup> EPEAT Inc. manages the EPEAT standard (IEEE 1680) and maintains the list of registered products and other information on [www.EPEAT.net](http://www.EPEAT.net).

- **Imaging Devices (printers, copiers and MFDs) and Televisions and Television Monitors** (two separate standards) – Development of standards for these two product categories are proposed to be conducted first. Depending on resource availability and stakeholder interest, these standards development processes could begin simultaneously or on a staggered timeline.
- **Servers** – Development of a standard for servers is proposed to begin following the completion of the ENERGY STAR standard for servers, which is likely to occur in 1 to 2 years. We heard from stakeholders the importance of having an ENERGY STAR standard for servers in place prior to development of a broader environmental standard.
- **Mobile Devices (mobile phones, PDAs and SmartPhones)** – Development of a standard for mobile devices is proposed to begin following the completion of the standards development process for imaging devices and/or televisions.

These recommendations will likely be substantially impacted by the availability of funding for each standard development process. A proposed timeline is presented in Section 3.2.

### **Considerations in Selecting Products**

The information used to develop the recommendations is provided in Attachment 1 and includes:

- Existence of single or multi-attribute environmental performance standards that could serve as the basis of a comprehensive U.S. standard.
- Extent of overall environmental impact of product and opportunity for influencing design change through a new standard – this includes a qualitative review of the products’ average energy consumption, overall mass, likely inclusion of constituents of concern, and how the products are managed at the end of life.
- The relative size of the current and future markets for the products, focusing specifically on projected market size in the next 3 – 5 years. Other market factors that could influence the success of a future standard were also reviewed, such as the relative proportions of institutional vs. consumer markets, distribution channels, turnover rates, etc.
- Stakeholder interest in developing environmental performance standards for the products.
- Ease of standard development and implementation.

These considerations were reviewed for each of the four product categories of highest interest. The approach taken was qualitative, with assignments of “high”, “medium” and “low” based on an evaluation of importance and/or opportunity for incentivizing design improvement in the product category (see Attachment 1).

### **2.3.1 Imaging Devices (Printers, Copiers and MFDs)**

It is recommended that imaging devices (printers, copiers and multi-function devices) be one of the first two environmental standards to be developed. As this category includes multiple products, the standard will need to address different technologies and functionalities of the products within these categories.

Facsimile machines and scanners were of low interest among stakeholders, and consequently are not specifically included in the imaging devices list of products. However, the actual scope of products in a standard will be determined in the standard development process.

This recommendation is based on the following:

- There are many existing standards including an ENERGY STAR standard and a European Union EuP standard is under development.
- Environmental criteria for imaging devices is likely to be similar to computers in IEEE 1680, which may simplify development of a new environmental performance standard for this product.

- There is a large institutional purchasing component for imaging devices, including the federal government, making it relatively easy to reach purchasers. However, much of the purchasing/leasing of imaging devices may be decentralized.
- The federal government is creating government-wide acquisition contracts (GWACs) for printers and copiers.
- Based on data of units sold in the U.S. in 2007 and rough estimates of average product units weights (see Attachment 1), the total annual weight of the imaging devices (printers, copiers and MFDs) sold currently in the U.S. appears to be among the highest of the product categories assessed in this Roadmap.
- Based on data of units sold in the U.S. in 2007 and energy usage estimates (see Attachment 1), the total annual energy usage of the imaging devices (printers, copiers and MFDs) sold currently in the U.S. appears to be in the mid-range of the four product categories assessed in this Roadmap.
- There appears to be a high level of interest among both purchasers and manufacturers in development of an environmental performance standard for these products.

### **2.3.2 Televisions and Television Monitors**

It is recommended that televisions and television monitors be one of the first two environmental standards to be developed. This recommendation is based on the following:

- There are three existing environmental performance standards, including an ENERGY STAR standard, for this product category.
- The upcoming switch from analog to digital TV in February 2009 will likely trigger a substantial increase in television sales.
- Environmental criteria for televisions and television monitors is likely to be similar to monitors in IEEE 1680, which may simplify development of a new environmental performance standard for this product.
- Based on data of units sold in the U.S. in 2007 and rough estimates of average product units weights (see Attachment 1), the total annual weight of televisions sold currently in the U.S. appears to be among the highest of the product categories assessed in this Roadmap.
- Based on data of units sold in the U.S. in 2007 and energy usage estimates (see Attachment 1), the total annual energy usage of televisions sold currently in the U.S. appears to among the highest of the four product categories assessed in this Roadmap.
- This product category appears to have two notable features impacting end of life – the use of mercury lamps (in some products) and the use of liquid crystals (in some products). Liquid crystals cannot yet be economically reclaimed at end of life.
- There is a smaller institutional purchasing component (on the order of 10%), therefore, either the focus of the standard is on only on products bought most commonly by that 10% of the market (institutional purchasers), or potentially requiring additional resources for outreach to retailers of televisions. Reaching consumers would likely require a significant shift in both resources and approach for EPEAT.
- There appears to be a high level of interest among manufacturers. Interest among purchasers appears to be mid-range.

### **2.3.3 Servers**

It is recommended that an environmental standard be developed for servers following the completion of the ENERGY STAR standard development process based the following:

- An ENERGY STAR standard is being developed and there are currently no other known environmental performance standards for this product. Stakeholders indicated that while there was

considerable support for a server standard, the ENERGY STAR standard process needed to be completed first.

- Based on a recent study by Koomey (2007; see Attachment 1) the total annual energy usage of servers sold currently in the U.S. appears to be among the highest of the four product categories (second to televisions) assessed in this Roadmap.
- Although actual data was not obtained, it is highly likely that there is a large institutional purchasing component for servers making it relatively easy to reach purchasers and thus harness demand for greener versions of these products.
- Market data (see Attachment 1) indicates that this product category has the least number of units sold annually. However, servers appear to be a growing market (projected increase of 69% from 2005 to 2009).
- There is a broad range of product types, configurations and applications for servers, storage and networking devices which will require careful consideration and definition.
- Although there appears to be a high level of interest from those manufacturers that provided feedback, the government purchasers that gave input ranked servers as a lower priority than other three product categories.

### **2.3.4 Mobile Devices (Mobile Phones, PDAs and SmartPhones)**

It is recommended that an environmental performance standard be developed for mobile devices (mobile phones, PDAs and SmartPhones) following the completion of the standards development process for imaging devices and/or televisions.

This recommendation is based the following:

- There are currently two existing environmental performance standards for mobile phones and no ENERGY STAR standard.
- Environmental criteria for these products may be substantially different than those for computers and monitors in IEEE 1680.
- The average lifespan of mobile phones is shorter (1.5 years) than for products in the other three product categories assessed in this Roadmap.
- Based on data of units sold in the U.S. in 2007 and rough estimates of average product units weights (see Attachment 1), the total annual weight of mobile devices sold currently in the U.S. appears to be lower than the other product categories assessed in this Roadmap.
- Based on data of units sold in the U.S. in 2007 and energy usage estimates (see Attachment 1), the total annual energy usage of mobile devices sold currently in the U.S. appears to be substantially less than the other three product categories assessed in this Roadmap.
- Although federal government purchasers ranked mobile devices as a very high priority, based on the feedback received to date, there appears to be a lower level of interest among manufacturers at the present time.

## **3.0 Implementation Recommendations**

### ***3.1 Selection of a Standard Development Organization (SDO)***

The future environmental standards should be developed through an ANSI accredited, voluntary consensus standard process using the Institute of Electrical and Electronic Engineers (IEEE) as the SDO for the following reasons:

- Preserve continuity with EPEAT / IEEE 1680 and build on the successes to date.

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- The standard development process with IEEE was satisfactory. There was no suggestion by stakeholders to change the SDO.
- The IEEE 1680 standard includes sections that define the method of standard implementation, which could be incorporated by direct reference in a new standard. It may be possible to create a “family” of standards that would incorporate common elements. This would streamline development of future standards to focus on product-specific issues rather than the implementation and/or verification system.
- Maintaining consistency and continuity with the existing IEEE 1680 standard provides the greatest ease of reference and use for purchasers.

### ***3.2 Standards Development Process and Timeline***

Under IEEE, the development of a new product environmental performance standard occurs in several steps. Following is a simplified description of the process.

1. Interested stakeholders are convened in a study group to outline the intended purpose and scope of the standard and to draft a Project Authorization Request (PAR). This may also include developing a draft “straw man”.
2. A sponsoring body within IEEE is identified and engaged, for example, the IEEE Computer Society’s Technical Committee on Electronics and the Environment.
3. The PAR is submitted and approved by IEEE.
4. An IEEE working group is formally convened to develop a ballot-able draft standard. Membership in the working group is open to anyone and IEEE membership is not required. Final scope of the draft standard will be determined. This is the main work of developing the standard, including reviewing all available data and reaching consensus on a draft.
5. Public notice is issued of the intent to ballot the standard. A balloting group (consensus body) is formed through an open process – everyone who has “a direct and material interest” has a right to participate. The balloting group consists of a balance of interests, avoiding a dominance by any single interest group. IEEE membership is required, with possible exceptions, to serve on a balloting group.
6. The draft standard is issued to the balloting group for balloting.
7. The working group considers all comments received, makes edits accordingly, reiterates the balloting with the new draft standard, and responds to all comments. Attempts are made to resolve all negative comments.
8. The formal ballot is taken and it is determined if consensus is achieved. “Consensus” is defined by IEEE.
9. The final standard is submitted to the SDO for approval. Any party may appeal to the SDO.
10. The SDO approves and publishes the standard.

The composition of the stakeholder groups – the original study group and the working group – should be balanced and it should involve individuals who are committed to putting in the time to work together toward a consensus standard. Membership will be open as long as it maintains a balance between the different interest groups. A chairperson, or co-chairpersons, will be selected for each working group to lead the process and assure that all stakeholders have an opportunity to be heard.

Based on experience with the 1680 process, it will be important to have staff support provided throughout the standard development process. This work will include:

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- Coordinating meetings of the working group and drafting documents according to group consensus.
- Assuring that the standard document is in the proper IEEE standard form.
- Reviewing balloter comments and drafting standard edits and responses.
- Developing the standard into its final form for submission to the SDO.

This process can be expected to take 12 – 18 months for each new standard from the start to the publication of the standard. For this reason it is recommended that the standards development processes of the first two product sets (imaging devices and televisions/television monitors) be run concurrently (possibly with a staggered initiation dependent on resources available and stakeholder interest). That is, totally separate processes within IEEE shall be run in parallel.

**Implementation Timeline.** The following timeline assumes 12-18 months development cycle for each product set.

<b>Standards Development Initiation Date</b>	<b>Product Category</b>	<b>Comments</b>
Fall 2007	Imaging Devices	
Fall 2007	Televisions/Television Monitors	
Spring or Summer 2008	Servers	Begin after completion of the ENERGY STAR standard
Winter or Spring 2009	Mobile Devices	Begin after completion of imaging devices and/or televisions/television monitors
Summer 2009	Revision of IEEE 1680	3 years after launch of IEEE 1680

This proposed timeline is dependent on securing resources and funding to run these processes.

### **3.3 Undecided Questions**

The following are outstanding questions and information on how they will be resolved:

**1. How will the standard development processes be funded?**

EPA will be organizing a roadmap implementation workgroup meeting for late August or early September. One of the primary topics of the meeting will be to explore funding opportunities. EPA has also committed to financially supporting (in part) the development of one of the first standards. The availability of funding could substantially impact the actual sequence of environmental performance standards developed.

**2. Is the timing right for EPEAT Inc. – that is, the existing organization including the EPEAT Registry – to expand into consumer electronic products?**

The EPEAT Board of Advisors will consider this following completion of Roadmap recommendations, and prior to the workgroup meeting to discuss roadmap implementation with potential funders and workgroup leaders.

**3. Who will staff and coordinate the standards development processes?**

EPA plans to issue an RFP to select a facilitator to help manage the environmental performance standard development process for one or more of the standards. EPA also will convene a meeting

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of other possible funders to contribute to those efforts. EPA anticipates including interested stakeholders in the selection of the organizing entity.

## **4.0 Next Steps and Funding**

Following completion of the Roadmap, EPA will:

- Convene a workgroup meeting to discuss roadmap implementation with potential funders and workgroup leaders (late August/early September).
- Work to assemble the teams of stakeholders and support personnel needed to carry out the processes.
- Oversee the first steps of the convening process for standards development.

EPA has limited funding available to support the development of the first standard(s). EPA will be seeking additional funds, but those can not be guaranteed at this time.

### **SDR Timeline**

- **June 4 to June 19** – Public comment period for this Draft Roadmap document
- **June 20 to July 9** - Incorporate comments and post revised Roadmap document on web site for review
- **July 9 to July 21** – Public comment period for revised Roadmap document
- **July 24 & July 25** - Final national open-to-all conference calls to ask, “Did we get it right?”
- **Mid August** - Post final Roadmap document
- **Late August/Early September** - EPA will convene roadmap implementation meeting potential funders and workgroup leaders

<b>Attachment 1 - SDR Evaluation Considerations Table</b>				
Evaluation of importance/opportunity for incentivizing design improvement (H = high, M = medium and L = low) More detailed information is provided in the EPEAT SDR Background Document				
<b>Consideration</b>	<b>Mobile Phones, Smartphones and PDAs</b>	<b>Imaging Devices (Printers, Copiers and MFDs)</b>	<b>Servers</b>	<b>Televisions and Television Monitors</b>
<b>Existing Standards</b>	<u>Mobile phones:</u> TCO and Blue Angel  <u>PDAs:</u> None identified	<u>Printers:</u> ENERGY STAR, TCO, Nordic Swan, Japanese Eco-Mark. Environmental Choice EcoLogo and Blue Angel <u>Copiers:</u> ENERGY STAR, Blue Angel, Nordic Swan, Environmental Choice EcoLogo and Japan Eco-Mark <u>MFDs:</u> ENERGY STAR, Blue Angel, Nordic Swan, TCO, Environmental Choice EcoLogo and Japan Eco-Mark  EuP developing standards by end of 2007	None identified  ENERGY STAR preparing a standard	ENERGY STAR, TCO and Nordic Swan
<b>Evaluation</b>	<b>L</b> Two existing standards and no ENERGY STAR	<b>H</b> Many existing standards including ENERGY STAR	<b>M</b> No existing standards, but ENERGY STAR in development	<b>H</b> Three existing standards including ENERGY STAR
<b>Market Split (Institutional vs.</b>	<u>SmartPhones</u> <ul style="list-style-type: none"> <li>In the U.S. in 2006 54% institutional purchaser and</li> </ul>	<u>Printers:</u> U.S. 2007 - 52% institutional U.S. 2010 -57% institutional	<ul style="list-style-type: none"> <li>Actual data was not found, however it is likely that the vast</li> </ul>	<ul style="list-style-type: none"> <li>Possible split of 10% institutional purchases and 90% consumer</li> </ul>

<p><b>Consumer)</b></p>	<p>46% consumer</p> <ul style="list-style-type: none"> <li>In 2010 projected to drop to 40% institutional purchaser and 60% consumer</li> </ul> <p>Source: IDC, 2006a</p> <p><u>Mobile phones and PDAs</u></p> <ul style="list-style-type: none"> <li>No data obtained</li> </ul>	<p><u>Copiers:</u> U.S. 2007 - 100% institutional U.S. 2010 –87% institutional</p> <p><u>MFDs:</u> U.S. 2007 - 87% institutional U.S. 2010 –87% institutional</p> <p><b>Total U.S. 2007 - 74% institutional and 26% consumer</b></p> <p>Source: IDC 2006b</p>	<p>majority servers are purchased/leased by institutions</p>	
<p><b>Units Sold Annually – U.S.</b></p> <ul style="list-style-type: none"> <li><b>Current (2006 or 2007)</b></li> <li><b>Projected (2009 or 2010)</b></li> <li><b>% Increase</b></li> </ul>	<p><u>Cell phones and PDAs:</u></p> <ul style="list-style-type: none"> <li>Estimated U.S. sales in 2007 is 130M units (CEA, 2007)</li> <li>U.S. sales of have doubled 2002 to 2007 (CEA, 2007)</li> </ul> <p><u>SmartPhones</u></p> <ul style="list-style-type: none"> <li>In 2006 - 8.3M units</li> <li>In 2010 projected to be 33.9M units</li> <li>2006 to 2010 projected increase of 308% (based on numbers above)</li> </ul> <p>Source: IDC 2006a</p>	<p><u>Printers:</u> U.S. 2007 -12.7M units U.S. 2010 – 11.2M units 2007 to 2010 projected decrease of 15% (based on numbers above)</p> <p><u>Copiers:</u> U.S. 2007 -1.33M units U.S. 2010 – 1.26M units 2007 to 2010 projected decrease of 5% (based on numbers above)</p> <p><u>MFDs:</u> U.S. 2007 - 19.8M units U.S. 2010 – 21M units 2007 to 2010 projected increase of 6% (based on numbers above)</p> <p>Total units U.S. 2007 – 25.5M</p>	<ul style="list-style-type: none"> <li>3.3M units in 2006</li> <li>3.9M units in 2007</li> <li>4.4M units in 2008</li> <li>4.9M units in 2009</li> </ul> <ul style="list-style-type: none"> <li>2005 to 2009 projected increase of 69% (based on numbers above)</li> </ul> <p>Source: Turner, 2006</p>	<ul style="list-style-type: none"> <li>2007 projected total 35.2M units <ul style="list-style-type: none"> <li>- CRTs = 10.4M units</li> <li>- Plasma = 13.7M units</li> <li>- LCDs = 17.6 units</li> </ul> </li> <li>2010 projected total 44.7M units <ul style="list-style-type: none"> <li>- CRTs = 2.1M units</li> <li>- Plasma = 6.0M units</li> <li>- LCD = 32.7 M units</li> </ul> </li> <li>2007 to 2010 projected increase of 27% (based on numbers above)</li> </ul> <p>Source: iSuppli, 2006</p>

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		Total units U.S. 2010 – 26.0M Projected increase of 2%  Source: IDC 2006b		
<b>Evaluation</b>	<b>H</b> Rapidly growing market and largest number of units	<b>L</b> Flat market and mid-range number of units	<b>M</b> Growing market and smallest number of units	<b>M</b> Slightly growing market and mid-range number of units
<b>Average Unit Product Weight</b>	<u>Mobile Phone</u> = 136 g (0.30 lbs) with battery  Assume <u>PDA</u> s and <u>SmartPhones</u> are similar  Source: Socolof et al., 2007	<u>Printers</u> : avg ~15lbs  <u>Copiers</u> : avg ~145lbs  <u>MFDs</u> : Consumer: avg ~15lbs @ 13% market share Institutional: avg ~170lbs @ 87% market share MFD: average ~150lbs  Sources: Printer data - HP News Release, Geneva, June 2, 2006 Real Consumer Costs for Electronic Equipment  Copier and MFD data: Industry expert estimates	<u>Personal and Blade Servers</u> Range: 31-50 lbs  Source: University of Tennessee, 2007  <u>Other Servers</u> : No data obtained	CRT = 65 lb Plasma = 65 lbs (42") LCDs = 55 lbs (32")
<b>Total Product Category Weight (annual)</b>  (estimated using sales data and average unit weight)	Based on <b>2006/07</b> estimate: Mobile phones and PDAs = 19.5K tons SmartPhones = 1.2K tons <b>Total = 20.7K tons</b>	Based on <b>2007</b> estimate: Printers = 96.7K tons Copiers = 96.1K tons MFDs = 1,486K tons <b>Total = 1,679K tons</b>  Based on <b>2010</b> estimate: Printers = 85.6K tons Copiers = 91.2K tons MFDs = 1,580K tons	Based on <b>2007</b> estimate: Blade/personal servers = 78.9K tons Mainframe= no data  Based on <b>2009</b> estimate: Blade/personal servers = 99.2K tons Mainframe=no data	Based on <b>2007</b> estimate: CRTs = 337K tons Plasma = 447K tons LCDs = 483K tons <b>Total = 1,267K tons</b>  Based on <b>2010</b> estimate: CRTs = 68K tons Plasma = 196K tons LCDs = 898K tons

		Total = 1,758K tons		Total = 1,162K tons
Evaluation	L	H	Incomplete data	H
<b>Constituents of Concern in Products (notable differences between product categories)</b>		Use of consumables such as toner and ink	Comparatively higher percent of circuit boards by weight	Presence of mercury-containing lamps in some products
Evaluation	L	M	M	H
<b>Energy Use (per product unit)</b>	<ul style="list-style-type: none"> <li>Standby mode - 1 W (75% time)</li> <li>Charging mode - 5 W (5% time)</li> <li><b>Total avg. = 8.76 kWh/yr</b></li> </ul> <p>Source: Rosen and Meier, 2001</p>	<p><u>Printers:</u> avg – could vary widely:</p> <ul style="list-style-type: none"> <li>Standby mode- 3.6 W (49% time)</li> <li>Idle mode- 12.1W (50% time)</li> <li>Active mode- 361W (1% time)</li> <li><b>Total avg. = 100 kWh/yr</b></li> </ul> <p><u>Copiers:</u> measured for copiers during operational mode include (Rosen and Meier, 2002) (Ahmadi et al., 2003):</p> <ul style="list-style-type: none"> <li>Standby mode- 4 -360 W (0% time)</li> <li>Idle mode- 30 W- 1920 W (99% time)</li> <li>Active mode 100 W- 7440 W (1% time)</li> <li><b>Total avg. = 270 kWh/yr</b></li> </ul> <p>Source: Rosen and Meier, 2000</p> <p>Energy usage data was not found for MFDs. Data for copiers was used as an</p>	<ul style="list-style-type: none"> <li><b>Avg. per units - 250 kWh/yr</b></li> </ul> <p>Source: Koomey, 2007</p>	<p>Assume:</p> <ul style="list-style-type: none"> <li>Active mode 8 hours/day</li> <li>Standby mode 16 hours/day</li> </ul> <p><u>Average CRT:</u></p> <ul style="list-style-type: none"> <li>Active mode - 146 watts</li> <li>Standby mode – 2 watts</li> <li><b>Total avg. = 438 kWh/yr</b></li> </ul> <p><u>Average plasma:</u></p> <ul style="list-style-type: none"> <li>Active mode - 328 watts</li> <li>Standby mode – 4 watts</li> <li><b>Total avg. = 981 kWh/yr</b></li> </ul> <p><u>Average LCD:</u></p> <ul style="list-style-type: none"> <li>Active mode - 193 watts</li> <li>Standby mode – 10 watts</li> <li><b>Total avg. = 622 kWh/yr</b></li> </ul> <p>Source: Nadel and Moskovciak, 2007</p>

<p><b>Total Estimated Annual Energy Use for Product Category (estimated using sales data)</b></p>	<p><u>Based on 2006/07 estimate</u> <b>Total = 1.2B kWh/yr</b></p>	<p>approximation.</p> <p><u>Based on 2007 estimate:</u> Printers = 1.3B kWh/yr Copiers = 0.36B kWh/yr MFDs = 5.4B kWh/yr <b>Total = 7.0B kWh/yr</b></p> <p><u>Based on 2010 estimate:</u> Printers = 1.1B kWh/yr Copiers = 0.34B kWh/yr MFDs = 5.7B kWh/yr <b>Total = 7.2B kWh/yr</b></p>	<p><b>2005: Total= 23B kWh</b> (direct energy consumption), 45B kWh (including HVAC, auxillary equipment) (Note - this estimate is from Koomey, 2007 and was not estimated using sales data)</p> <p><b>Projected 2010: Could be up to 40% increase</b> over 2005, if no significant increase in efficiency</p> <p>Source: Koomey, 2007</p>	<p><u>Based on 2007 estimate:</u> CRT= 4.5B kWh/yr Plasma= 13.5B kWh/yr LCD= 10.9B kWh/yr <b>Total = 29B kWh/yr</b></p> <p><u>Based on 2010 estimate:</u> CRT= 0.9B kWh/yr Plasma= 5.9B kWh/yr LCD= 20.3B kWh <b>Total = 27B kWh</b></p>
<p><b>Evaluation</b></p>	<p><b>M</b></p>	<p><b>M</b></p>	<p><b>H</b></p>	<p><b>H</b></p>
<p><b>End of Life</b></p>	<ul style="list-style-type: none"> <li>• Very short lifespan (1.5 years) (IPMI, 2003).</li> <li>• Readily recyclable and refurbishable</li> <li>• Relatively low recycling rate. INFORM reported that less than 1 % of cell phones retired and discarded annually are recycled (INFORM, 2003) (This does not assume 99% disposed of – may be large storage component).</li> </ul>	<p><u>Printers:</u></p> <ul style="list-style-type: none"> <li>• Ink jet printers average lifetime is approximately 4 years, triggered by repair or obsolescence (EUP, 2007).</li> <li>• Canon reports ~86% of parts can be reused or remanufactured</li> </ul> <p><u>Copiers:</u></p> <ul style="list-style-type: none"> <li>• Copiers average lifetime is approximately 6 years, triggered by repair or obsolescence (EUP, 2007).</li> <li>• Robust lease market → manufacturer dismantling / reuse</li> </ul> <p><u>MFDs:</u></p> <ul style="list-style-type: none"> <li>• Ink jet MFDs average lifetime is approximately 4+</li> </ul>	<ul style="list-style-type: none"> <li>• Most components can be recycled within current recycling infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Liquid crystals cannot yet be economically reclaimed at end of life (King County, 2007)</li> <li>• Only one manufacturer to-date offers a TV that allows lamp change outs</li> <li>• Electronic circuitry, processors, and other typically computer-based TV components can be reclaimed, reused, or recycled at EOL using traditional electronic recycling processes</li> </ul>

		years, triggered by repair or obsolescence (EUP, 2007)		
<b>Evaluation</b>	<b>H</b> End of life management is an important consideration across all categories	<b>H</b> End of life management is an important consideration across all categories	<b>H</b> End of life management is an important consideration across all categories	<b>H</b> End of life management is an important consideration across all categories
<b>Market Considerations</b>	<ul style="list-style-type: none"> <li>Relatively small number of primary purchasers in U.S. (cell service providers)</li> <li>Industry expert estimate of 80% SmartPhone sales are through service providers</li> </ul>	<ul style="list-style-type: none"> <li>Current Federal Government Printer and Copier Strategic Sourcing Initiative Workgroup creating GWACs (government-wide acquisition contracts) for federal copiers and printers</li> </ul>		<ul style="list-style-type: none"> <li>Expect significant increase in sales due to shift to digital televisions</li> </ul>
<b>Evaluation</b>	<b>M</b> Short life span	<b>M</b> Federal purchasing efforts	<b>L</b>	<b>H</b> Shift from analog to digital
<b>Ease of Standard Development</b>	<ul style="list-style-type: none"> <li>Environmental criteria for these products may be substantially different from those for computers/monitors in IEEE 1680</li> <li>There exists a very strong basis of scientific literature, about the environmental impacts of these products</li> <li>The purchaser stakeholders would be different than from EPEAT for computers/monitors due to their consumer market presence</li> </ul>	<ul style="list-style-type: none"> <li>Environmental criteria for these products likely to be similar to computers in IEEE 1680</li> <li>The possible desire of some stakeholders to address consumables, and the difficulty of addressing that issue, could complicate standard development</li> </ul>	<ul style="list-style-type: none"> <li>Defining server product category will be challenging</li> <li>No ENERGY STAR standard yet</li> <li>The broad range of product types, configurations and applications for servers, storage and networking devices will require development of meaningful server groupings and careful consideration of the full range of product attributes and use requirements.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental criteria for these products likely to be similar to monitors in IEEE 1680</li> <li>Since TVs are primarily a consumer-marketed product, this would require modification of the intent of IEEE 1680, and possibly some of the text</li> <li>The purchaser stakeholders would be different than from EPEAT for computers/monitors due to their consumer market presence</li> <li>There is considerable literature on the</li> </ul>

				environmental impacts of CRTs, but much less on flat panel displays which would be the focus of the standard
<b>Evaluation</b>	<b>M</b>	<b>M</b>	<b>L</b>	<b>M</b>
<b>Ease of Implementation</b> <ul style="list-style-type: none"> <li>• Institutional vs. retail</li> <li>• Ease/difficulty of reaching purchasers</li> <li>• Market interest</li> </ul>	<ul style="list-style-type: none"> <li>• Relatively small number of primary purchasers in U.S. (cell service providers)</li> <li>• Industry expert estimate of 80% SmartPhone sales are through service providers and 20% direct consumer sales</li> <li>• Given small number of primary purchasers, could be relatively easy to reach them</li> <li>• Market interest unknown</li> <li>• Executive Order 13423 requires federal institutional purchasers to buy EPEAT registered</li> </ul>	<ul style="list-style-type: none"> <li>• Large institutional purchasing component, including federal government</li> <li>• Relatively easy to reach purchasers, however the purchasing/leasing is primarily decentralized</li> <li>• Market interest from federal government is high</li> <li>• Executive Order 13423 requires federal institutional purchasers to buy EPEAT registered</li> </ul>	<ul style="list-style-type: none"> <li>• Primarily bought by institutional purchasers and would be relatively easy to</li> <li>• Executive Order 13423 requires federal institutional purchasers to buy EPEAT registered</li> </ul>	<ul style="list-style-type: none"> <li>• Thought to be low percentage (10%) institutional purchases</li> <li>• Could be difficult to reach retailers for consumer market, not as difficult to reach institutional purchasers (hospitals, universities, schools, hotels, military installations, etc.)</li> <li>• Executive Order 13423 requires federal institutional purchasers to buy EPEAT registered</li> </ul>
<b>Evaluation</b>	<b>L</b>	<b>H</b>	<b>H</b>	<b>L</b>
<b>Stakeholder Priority</b>	Apparent low interest from manufacturers	High level of interest from manufacturers who gave input	High level of interest from manufacturers who provided input, but concern of timing with regard to ENERGY STAR	High level of interest from manufacturers who gave input High level of interest from NGOs
<b>Evaluation</b>	<b>Manufacturers – L Gov’t purchasers – M NGOs – L Other – M</b>	<b>Manufacturers – H Gov’t purchasers – H NGOs – L Other - M</b>	<b>Manufacturers – H Gov’t purchasers – M NGOs – L Other - L</b>	<b>Manufacturers – H Gov’t purchasers – M NGOs – H Other - H</b>
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## **Attachment 2 – Full List of Electronic Products Considered in the SDR Process**

- Audio/Video equipment (receivers, VCR, DVR, speakers, etc.)
- Boomboxes
- Cameras
- Cash registers
- Cell phone network infrastructure equipment
- Mobile phones
- Computer peripherals (external hard drives, etc...)
- Copiers
- Data center equipment (large disc & tape drives, routers, switches, UPS, etc.)
- Digital converter boxes
- Fax machines
- Hand-held portable game players
- Home computer networking equipment (home WiFi, routers, cable/DSL modems, etc.)
- Internet routers, etc.
- Mainframe computers
- Multi-function devices
- PDAs
- Portable digital audio players
- Printers
- Product scanning devices
- Scanners
- Servers
- Set top boxes
- SmartPhones
- Telephone switches
- Televisions and television monitors