

**Electronics Environmental Benefits Calculator**  
**Frequently Asked Questions**  
**July 2, 2007**

**GENERAL**

**What products are included in the Electronics Environmental Benefits Calculator (EEBC)?**

The EEBC estimates the environmental benefits of purchasing, use, and disposal of computer products, specifically computer desktops, monitors (CRTs, LCDs), and notebooks. The EEBC also calculates the benefits of mobile phone reuse and recycling. The current EEBC version (1.1) calculates benefits on a per unit basis. Future upgrades to the EEBC may allow the user to estimate the benefits of electronics recycling on a per ton basis.

**Why does the EEBC only include the benefits of purchasing environmentally preferable computer products?**

In order to measure environmental benefits, clearly defined and measurable “green” performance criteria are needed. The Electronic Product Environmental Assessment Tool (EPEAT) and IEEE Standard 1680 for *Environmental Assessment of Personal Computer Products*, provides such a set of measurable criteria for computer desktops, monitors, and notebook computers. Additional electronic products may be added to the EEBC when environmental performance standards are available.

**Who developed the EEBC and was it subject to peer review?**

The University of Tennessee Center for Clean Products and Clean Technologies, with support from Abt Associates and Dillon Environmental Associates, developed the EEBC under a cooperative agreement with the U.S. Environmental Protection Agency (EPA). An Advisory Group guided the University of Tennessee team in the development of the tool. The Advisory Group, comprised of representatives from the U.S. EPA, state government, industry, and not-for-profits, provided essential feedback on issues such as the scope of the tool, functionality, user interface, and presentation of results. Upon completion, the EEBC was also subject to an extensive Peer Review Process, which focused on the baseline data inputs, assumptions, and benefits calculations. The Peer Review Group included representatives from industry, the U.S. EPA, and other federal agencies. A list of Advisory and Peer Review Group members is provided on the University of Tennessee website (<http://eerc.ra.utk.edu/ccpct/eebc/eebc.html>.)

**USING THE EEBC**

**What data do I need to run the EEBC?**

The minimum data input needed to run the calculator is the number of electronic units of interest; for example, the number of computer desktops, CRT monitors, LCD monitors,

notebook computers, and/or mobile telephones. To calculate the benefits of purchasing EPEAT-registered products, the EEBC user also needs to indicate the EPEAT-registration level (that is, bronze, silver, or gold) for the products of interest.

### **What if I only have data on EPEAT purchases? Can I still use the EEBC?**

Yes, the EEBC is modular. A user can choose to calculate the benefits of one or more of the following:

- purchasing EPEAT-registered computer products;
- improving computer power management;
- reusing computer desktops, monitors, and laptops (EPEAT or non-EPEAT);
- recycling computer desktops, monitors, and laptops (EPEAT or non-EPEAT);
- reusing mobile phones; and
- recycling mobile phones.

### **How do I calculate environmental benefits using the EEBC in the Excel Spreadsheet format?**

- Open the Excel Spreadsheet, enabling the macros. See the FAQ below if you have trouble opening the spreadsheet.
- To calculate the environmental benefits of purchasing EPEAT-registered products (compared to a pre-EPEAT or baseline products), use Sheet 3a to enter data for up to 3 types of computer products. Use Sheet 3b if you're interested in calculating the environmental benefits of computer and mobile phone reuse and/or recycling, as well as computer power management. Data can be entered into either or both Sheet 3a and Sheet 3b.\*
- To view the results, open Sheet 5a. The aggregate result ("Grand Total") is in the first table, highlighted in yellow. This table also presents subtotal results by purchasing, equipment use, and end of life management (i.e., reuse and recycling). The data entered into the EEBC is displayed at the top in red. To see additional breakdowns of the results, scroll down the screen.
- An explanation of the calculations for each criterion can be found in Sheet 5b.
- If you're interested in graphs of the results, see Sheet 6.
- If you're interested in equivalents, such as number of cars off the road for greenhouse gas emission reductions or the amount of electricity to power households for energy savings, see Sheet 7.

\* Note: ENERGY STAR® compliance is a required criteria for EPEAT-registered products. Energy savings resulting from ENERGY STAR® specifications are included in the environmental benefits calculations for all EPEAT-registered products entered into the EEBC. The separate data entry fields for power management in Sheet 3b should only be used for product unit data that is NOT entered into Sheet 3a. Entering data for individual units on both Sheet 3a and the power management fields in Sheet 3b will result in "double counting" energy savings and other benefits related to energy (such as greenhouse gas emissions). Since product reuse and recycling are not required by EPEAT, and therefore not included in the benefits calculations for EPEAT purchases,

EEBC users can enter data on both Sheet 3a and 3b for the same units, either in the current year or subsequent years.

### **Why can't I open the Excel Spreadsheet version of the EEBC?**

The EEBC utilizes macros, short software instructions, to aid navigation and perform certain calculations. To ensure that the EEBC functions properly, please follow these instructions:

- Before opening the spreadsheet, open Microsoft Excel.
- Click on the "Tools" menu.
- Scroll down to "Macro" and select "Security" from the side menu.
- Set the "Security Level" to "Medium".
- Open the spreadsheet.
- Select "Enable Macros" when the Security Warning appears.

### **If I use the EEBC to calculate environmental benefits of purchasing EPEAT registered products, can I also use the EEBC to calculate power management, product reuse, and recycling benefits? Wouldn't this be "double counting"?**

The EEBC can be used to calculate the environmental benefits of product reuse and recycling, but it does not calculate these activities for data entered on EPEAT purchases since product reuse and recycling are not specific EPEAT criteria. To calculate the benefits of reuse and recycling, an EEBC user must enter data in separate data entry fields (Sheet 3b in the Excel spreadsheet.)

In contrast, the EEBC assumes that ENERGY STAR<sup>®</sup> power management features are enabled over the life of the product for EPEAT purchases. Therefore, the EEBC user should not enter data into designated fields for power management (Sheet 3b in Excel spreadsheet) for products that have been entered into the EEBC under EPEAT purchases (Sheet 3a).

### **EEBC CALCULATIONS**

#### **How does the EEBC calculate the benefits of EPEAT-registered products when products can meet different performance criteria (e.g., recycled content or mercury-free lighting)?**

An EEBC user can specify the EPEAT-registration level (i.e., bronze, silver, gold) for each data input or product type. The EEBC calculation then assumes a default environmental performance profile for each product type and EPEAT level, based on actual product registrations. Using the Excel Spreadsheet version of the tool, an EEBC user can also choose to customize the profile of its product using a separate worksheet (Sheet 3c) that overrides the EEBC default assumptions.

**Does the EEBC calculate the environmental benefits resulting from all EPEAT criteria, both required and optional?**

The EEBC calculates environmental benefits for both EPEAT required and optional criteria, using default profile assumptions for EPEAT level as described above. The EEBC does not, however, calculate benefits for all EPEAT criteria. In developing the EEBC, only EPEAT criteria that were considered measurable and are established at the time of product purchase were included in the EEBC. For example, the EEBC does not calculate the benefits of product recyclability and life extension criteria, nor does it calculate the “provision of a take back service.”

The Table below shows the EPEAT criteria that are included in the EEBC calculations. As an example, the default profile of an EPEAT Silver product is shown. These criteria are the ones incorporated into the environmental benefit calculations for EPEAT Silver product purchases. The EPEAT default profiles, which are based on the current EPEAT product registry, will be updated periodically to reflect the distribution of products in the registry.

**EPEAT Criteria in the EEBC**

<b>Criteria in EEBC</b>	<b>EPEAT Reference</b>	<b>Profile of EPEAT Silver products</b>
RoHS compliance (Pb, Hg, Cd, Cr6+, PBB, PBDE)	4.1.1.1 Required	Yes
Hg in light source; maximum average of 3 mg Hg/lamp	4.1.3.2 Optional	Yes
Hg-free lamps	4.1.3.3 Optional	No
Recycled content of product resin (10%, 25%)	4.2.1.2 & 4.2.1.3 Optional	No
Energy Star® Compliant	4.5.1.1 Required	Yes
Recycled content of packaging	4.8.3.1 Required – Declaration only Optional - % content	No
Minimum 25% recycled content of corrugated packaging	4.8.3.2 Optional	No
Packaging avoided per unit by packaging reuse	5.8.5.1 Optional	No

**Does the EEBC calculate the total life cycle environmental impacts of computer products, that is, from mining to production, use, and disposition?**

The EEBC is not a complete product life cycle analysis. The EEBC calculates environmental benefits (savings or reductions) of an EPEAT registered product, compared to a conventional product. The EEBC only calculates environmental benefits

for performance criteria covered by EPEAT. Depending on the EPEAT criteria and metric, the EEBC may use life cycle data to calculate benefits. For example, energy consumption and recycled material content criteria include savings from upstream processes associated with material production, while the upstream benefits of removing RoHS restricted metals are not included in EEBC benefits calculations. In the latter case, the EEBC only tallies the amount of material directly in the product. The use of life cycle data in EEBC calculations was largely influenced by the availability of data. Additional life cycle data may be incorporated into future upgrades of the EEBC.

### **Does the EEBC calculate the environmental benefits of purchasing ENERGY STAR® products?**

Yes, the environmental benefits of computer and monitor power management are incorporated into the EEBC in two ways. First, the EEBC calculates the benefits of ENERGY STAR® power management features as one of the required performance criteria of EPEAT. In calculating environmental benefits, the EEBC assumes that the ENERGY STAR® features of EPEAT-registered products are 100% enabled over a 4-year initial life (3 years for notebook computers). The EEBC also assumes that a conventional unit does not meet ENERGY STAR® specifications.

Second, the EEBC can also estimate the environmental benefits of computer power management, independent of EPEAT purchases. This is because an EEBC user can separately calculate the benefits of enabling (or not) the ENERGY STAR® power management features of its computer inventory.\* These calculations assume that a percentage of computer desktops (7%) and monitors (59% and 77% for CRTs and LCDs, respectively) have the ENERGY STAR® features enabled, based on published computer usage patterns.\*\* Increasing the power management rate results in environmental benefits. The EEBC Excel Spreadsheet also allows the user to modify the power management assumptions, if desired, to more accurately reflect the office equipment profile before the implementation of power management strategies (see Sheets 8d – f for different product types.)

\* To avoid double counting of environmental benefits, the EEBC should not be used to calculate BOTH the benefits of EPEAT purchases and power management for the same computer units.

\*\* Note: a negative value will result if the EEBC user enters a power management rate below the default values, which are based on published usage patterns. The EEBC user, however, can modify the default assumptions to reflect actual usage patterns.

### **What assumptions does the EEBC use in making the environmental benefits calculation?**

The EEBC makes assumptions about the material composition and energy use of EPEAT and conventional products, the profile of EPEAT registered products, and the life cycle impacts resulting from material and energy inputs as well as reuse and recycling. The various assumptions and default values used in the EEBC, along with reference sources, are explicitly outlined in the Excel Spreadsheet version of the EEBC (see Sheets 8a - c), and were subject to the Peer Review Process. As additional data

becomes available, any of the underlying assumptions in the EEBC can be updated. In the meantime, the EEBC user can customize EPEAT product profiles (using Sheet 3c) and power management assumptions (using Sheets 8 d-f.)

## **ENVIRONMENTAL BENEFITS**

### **What environmental benefits does the EEBC calculate?**

The EEBC calculates eight environmental benefits: energy savings, greenhouse gas reductions, air emission reduction, water emission reduction, hazardous waste reduction, toxic material reduction, primary material savings, and cost savings. With the exception of greenhouse gas emissions, these benefits are considered “inventory” metrics that measure the mass or quantity of the metric that is reduced (e.g., amount of hazardous waste), and NOT the “impact” of the metric in the environment (e.g., toxic health effects). Greenhouse gas (GHG) reduction is the one exception. The GHG metric takes the GHG emissions from the total air emissions and applies the global warming potential to the mass, to calculate GHG equivalents (as carbon or CO<sub>2</sub>-equivalents). Attachment A provides more details on benefits calculations.

### **Are greenhouse gases also included in the total air emissions metric?**

Yes, the total air emissions metric includes the mass of all air emissions, including gases that contribute to global warming. The greenhouse gas (GHG) metric takes only the greenhouse gases from the total air emissions and applies global warming potential factors to the mass of each gas to calculate GHG equivalents as carbon or CO<sub>2</sub>-equivalents.

### **What’s the difference between toxic material savings and hazardous waste savings?**

Toxic material savings are a direct measure of the sum of the toxic materials (by weight) found in conventional products that are restricted in EPEAT products, either as required or optional criteria. Hazardous waste savings are the sum of the components (by weight) that are rendered hazardous by toxic constituents, and therefore, their disposal is restricted or monitored. For example, the toxic material metric includes the reduction in the use of mercury in backlights and lead solder on circuit boards. The hazardous material metric, in contrast, includes the entire weight of the mercury backlights, circuit boards and leaded CRT glass.

### **Does water emissions savings include water pollutants and the volume of water?**

Water emission savings are pollutants only. The EEBC does not capture the volume of wastewater saved.

## **What factors are included in the EEBC cost savings estimates?**

In the current version of the EEBC, cost savings are only calculated for energy savings. The energy cost savings are life cycle based. That is, the cost savings do not benefit just the equipment user, but may accrue throughout the product life cycle (for example, reducing material consumption reduces the energy needed to produce materials). The cost savings are offset by any price premiums for EPEAT-registered products. Only EPEAT Gold products are currently assumed to carry a price premium.

## Attachment A

### Description of EEBC Calculations by EPEAT Criteria

*Source: EEBC, Version 1.1, Excel Spreadsheet 5b*

EPEAT Criteria	Metrics
<b>Reduced Toxicity</b>	All reduced toxicity calculations compare the user-inputted purchase data for a unit to a pre-EPEAT baseline (conventional) unit.
E 4.1.1.1 RoHS compliance - Pb, Hg, Cd, Cr6+, PBB, PBDE	<p><b>Toxic material savings:</b> direct reduction in the amount of toxic material (e.g., lead) in purchased product compared to baseline unit.</p> <p><b>Haz waste savings:</b> the addition of toxic materials to a component (e.g., lead in a printed circuit board, wire and cable or CRT glass) can render the entire component hazardous if landfilled. This metric takes into account the reduction in hazardous components (by weight) at the EOL resulting from the avoidance of toxic material in the purchased product. Note the Hg RoHS criterion excludes lamps and cathode ray tubes.</p>
E.1.3.1-2 Hg in light source; max avg of 3 mgHg/lamp	<p><b>Toxic material savings:</b> gives credit if product has max level of 3 mg of Hg in lamp, based on direct reduction in the amount of toxic material in purchased product compared to baseline unit.</p> <p><b>Haz waste savings:</b> not calculated here since it would be repetitive of savings calculated under the RoHS-Hg criterion.</p>
E 4.1.3.3 Hg-free lamps	<p><b>Toxic material savings:</b> direct reduction in amount of toxic material in purchased product compared to baseline unit. If Hg-free lamps selected, benefits from this criterion override the previous one for max of 3 mg.</p> <p><b>Haz waste savings:</b> not calculated here since it would be repetitive of savings calculated under the RoHS-Hg criterion.</p>
<b>Material Use</b>	Savings are based on the amount of virgin resins not produced due to the replacement of virgin resin with recycled content in the products as compared to a pre-EPEAT baseline, which is currently assumed to have zero recycled content in the product resins. These calculations use data from the average of three typical resins in computers: ABS (acrylonitrile-butadiene-styrene), HIPS (high impact polystyrene), and PC (polycarbonate).
E 4.2.1.1-3 Recycled content (RC) of product resin	<p><b>Energy, primary material, total air emissions, and water emissions savings:</b> based on all energy used, materials used, air releases and water releases, respectively, from producing the virgin resins (including materials extraction and processing associated with resin production; this life-cycle data are from European sources: BUWAL and APME, see Sheet 8c, Table 7).</p> <p><b>GHG emissions savings:</b> based on GHG emissions (i.e., a subset of air emissions that have global warming potential); as above, based on the materials extraction and processing of the three resins; data also based on BUWAL and APME.</p> <p><b>MSW savings:</b> assumes the average amount of recycled content in the product resins is the amount of solid waste saved. Note, this does not include all solid waste from materials extraction, as other metrics above, as these data were not readily available for Version 1.0. Note, <b>Haz waste savings are not included</b> since the resins themselves are not hazardous wastes and all hazardous waste from materials extraction and processing data were not readily available for version 1.0.</p> <p><b>Cost savings:</b> cost of electricity of energy savings calculated above. For cost estimation purposes, this simply assumes that all production energy to produce the resins is electric energy.</p>

<b>Packaging</b>	Savings are based on the amount of virgin packaging materials (corrugated cardboard or resins) that are not produced due to the recycled content (RC) of the packaging as compared to a pre-EPEAT baseline, which is assumed to have zero recycled content in the packaging. Zero recycled content was chosen as the baseline in order to calculate the total benefit of RC, not just the incremental benefit of increasing RC. For resin packaging, these calculations use data from the average of four typical resins in packaging LDPE (low-density polyethylene), HDPE (high-density polyethylene), PET (polyethylene terephthalate) and PS (polystyrene).
E 4.8.3.1-2 Avg. RC of packaging: 1-corrugated, 2-plastic/foam, 3-other	<b>Energy, primary materials, GHG, total air emissions, water emissions, solid waste, and cost savings:</b> Same as "Recycled content of product resin" (above under "Material Use"), but specific to the packaging type. Note, packaging type 2 and 3 are both based on average data for the four common packaging resins: LDPE, HDPE, PET, and PS.
E 4.8.3.1-2 CPG min 25% for recycled content-corrugated	<b>Energy, primary materials, GHG, total air emissions, water emissions, solid waste, and cost savings:</b> Same as RC of packaging-corrugated except this assumes 25% recycled content if this item checked in Sheet 3c, or if the EPEAT tier chosen in Sheet 3a defaults to meeting the Comprehensive Procurement Guidelines (CPG).
E 5.8.5.1 Packaging avoided per unit by packaging reuse	<b>Energy, primary materials, GHG, total air emissions, water emissions, solid waste, and cost savings:</b> Assumes a package is reused 5 times and savings are based on not producing the packaging 5 times, as compared to the baseline, where no reuse is assumed. Otherwise, these calculations are the same as for RC of packaging or product resins, except instead of savings based on RC, it is based on the amount not produced for an entire package.
<b>Energy</b>	Savings are based on the future use of a purchased product, which is compared to a pre-EPEAT (non-ENERGY STAR®) product.
E 4.5.1.1 & ENERGY STAR 3.0 or 3 4.0	<b>Energy savings:</b> based on the unit energy consumption (UEC) of a product over the life of the product. <b>Primary material savings, GHG, total air emissions, and water emissions savings:</b> use life-cycle data for materials and emissions associated with the use of electricity, based on the energy savings calculated under "energy savings" above. <b>Cost savings:</b> cost of electricity calculated under "energy savings" above.