



Answers to Frequent Questions: Electronics Environmental Benefits Calculator (EEBC)

Updated: 03/04/2009

PURPOSE

This resource provides answers to frequently asked questions about the Electronics Environmental Benefits Calculator (EEBC), and in particular, questions about version 2.0.

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GENERAL

What products are included in the EEBC?

The EEBC estimates the environmental benefits of improving the purchasing, use, and disposal of computer products, specifically computer desktops, liquid crystal display (LCD) and cathode ray tube (CRT) monitors, and computer notebooks/laptops. The EEBC also calculates the benefits of mobile phone reuse and recycling, and of recycling mixed loads of electronic equipment.

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 Standard 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.

What was changed in the EEBC between version 1.1 and 2.0?

Generally, the following updates were made for version 2.0. Please see Sheet 9 in the EEBC for more details.

Revision	Reasoning
Default values for EPEAT-registered products have been updated to reflect the electronic products in the registry as of May 2008.	The required and optional criteria generally met by products in the EPEAT registry have changed since this data was included in version 1.1.
The “Initial cost per unit” data entry fields on tabs 3a and 3c have been hidden, as well as associated calculations and results on tabs 4 and 5a. This data entry point was hidden, and not deleted, so that it may be restored in later versions, if needed.	There is currently no cost premium for EPEAT-registered products. Inclusion of this data entry point may have resulted in monetary costs or savings which were not the result of a product’s environmental performance. For instance, cost savings that are the result of bulk purchasing agreements are not related to the EPEAT registration of a product.
The user can now enter an ENERGY STAR® power management enabling rate for purchased products in Sheets 3a/3c. If no enabling rate is provided, the default is used.	Version 1.1 assumed the default power management rate for all purchased products. The revision for version 2.0 allows users to account for the enabling of power management features above the default rate for their EPEAT-registered product purchases entered in Sheet 3a.



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Revision	Reasoning
<p>Calculation of ENERGY STAR benefits have been altered for purchased products. The baseline is now an ENERGY STAR 3.0 product, and the purchased product (for all three EPEAT tiers) is an ENERGY STAR 4.0/4.1 product. Benefits are calculated using either default enabling rates or user-defined enabling rates. In either case, the enabling rates are kept the same for the baseline and purchased product.</p>	<p>This change was implemented to ensure that the energy savings attributable to purchasing an EPEAT-registered product are the result of the energy efficiency gains over the baseline, not from a change in behavior (e.g., enabling power management at a greater rate).</p>
<p>The number of in-use computer desktops, notebooks, CRT monitors, and LCD monitors can now be entered independently of each other (the total number of monitors does not have to equal the number of computer desktops) on Sheet 3b.</p>	<p>Version 1.1 assumed that all computers in service had one associated monitor or were notebooks. The revision for version 2.0 allows users to account for all products in use, including special computer configurations, such as a notebook with a monitor or a desktop with multiple monitors.</p>
<p>The lifespan for in-use computer desktops, notebooks, CRT monitors and LCD monitors can now be entered separately on Sheet 3b.</p> <p>The baseline for average computer system lifetime now takes into account the user-entered distribution of products.</p>	<p>Version 1.1 assumed the same lifespan for a single "computer system" (e.g., desktop computer and monitor). The revision for version 2.0 allows users to account for different lifespans for different products.</p>
<p>The user can input the number of each product type that are ENERGY STAR 3.0 and 4.0/4.1, as well as the enabling rate, on Sheet 3b.</p>	<p>The energy savings between ENERGY STAR 3.0 and 4.0/4.1 vary significantly. Since it is likely that a user has a mix of ENERGY STAR 3.0 and 4.0/4.1 equipment in their inventory, the EEBC allows these products to be separately designated.</p> <p>Version 1.1 applied the same power management rate to all products in use. Power management rates may differ significantly for different products. The revision for version 2.0 allows these rates to be entered separately for each product.</p>
<p>ENERGY STAR-related assumptions have been updated to reflect the most recent specifications for computers and monitors.</p>	<p>The ENERGY STAR specifications have changed since this data was included in version 1.1.</p>



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Revision	Reasoning
The tool now uses ENERGY STAR 3.0 as a baseline for all energy savings calculations.	The ENERGY STAR program confirmed that market saturation of the ENERGY STAR 3.0 specification was over 90%. The default product available in the marketplace today is likely to be equivalent to what would have been an ENERGY STAR 3.0 product.
The tool can now calculate the benefits of recycling mixed office electronics. Benefits are based on the percent composition of materials in mixed office electronics.	Many users do not have unit data for electronics recycling activities. Inclusion of this data entry allows for accounting of a greater number of environmental benefits.
The method for calculating the environmental benefits of cell phones was revised.	The revised method was developed in response to concerns from U.S. Environmental Protection Agency (EPA) and now more accurately reflects the benefits of recycling cell phones.
Both lifetime and first year benefits are now calculated.	For the purposes of reporting, many users need to separate out immediate results (from the first year) from lifecycle results. This division makes that process easier.
Equivalency factors were updated for Annual Household Energy Use, Annual Passenger Car Emissions, and Annual Municipal Solid Waste (MSW) Generation per U.S. Household. The conversion factor for calculating GHG emissions from electricity generation was increased. The default U.S. electricity cost was increased.	Updated assumptions were available. Please see references in the EEBC for details.
Minor corrections were made to address problems discovered during the use of version 1.1.	See Sheet 9 for a complete list.
Explanatory text was revised, as needed, to reflect the changes made to the tool.	

Where is the online version of the EEBC?

The U.S. EPA is currently working on a web-based version of the EEBC, with an anticipated release date of summer of 2009. All of the revisions noted above needed to be completed before work on the web-based version was started.

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

Version 1.0 of the EEBC Tool (released December 2006) was co-developed by Abt Associates, Inc. and Dillon Environmental Associates, in coordination with the University of Tennessee (UT) Center for Clean Products and Clean Technologies. Abt Associates and Dillon Environmental Associates were subcontracted by UT who was funded through a grant from the U.S. EPA Region 10 to develop the tool. Version 1.1 (released April 2007) was developed through a contract between U.S. EPA and the Eastern Research Group (ERG), with subcontracts to Abt Associates, Inc. and Dillon Environmental Associates. Version 2.0 was developed under a contract between U.S. EPA and Abt Associates, Inc., with subcontracts to Dillon Environmental Associates and UT.

An Advisory Group guided the UT team in the development of the first version 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 of version 1.0, 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 web site: <http://eerc.ra.utk.edu/ccpct/eebc/eebc.html>. Subsequent versions have been reviewed and beta tested by a variety of users prior to final release.

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 products 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. To calculate the benefits of recycling mixed loads of electronics, the weight of the mixed load is needed.

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 (CRT and LCD), notebooks/laptops, and mobile phones;
- recycling computer desktops, monitors (CRT and LCD), notebooks/laptops, and mobile phones; and
- recycling mixed loads of electronic equipment.

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

- Open the Excel Spreadsheet, enabling the macros. See the [question 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 product), enter data in Sheet 3a to enter data for up to three types of computer products.
- Additional data entry for EPEAT-registered products may be specified in Sheet 3c. Completion of data entry in Sheet 3c is optional, and requires detailed information about the EPEAT product's registration. If data is not entered in Sheet 3c, the EEBC assumes that the entered EPEAT registered products meet the default values for required and optional criteria.
- Enter data in Sheet 3b if you're interested in calculating the environmental benefits of computer, monitor, and mobile phone reuse and/or recycling, as well as computer and monitor power management. Data can be entered into either or both Sheet 3a and Sheet 3b. See [question below about potential double-counting](#).
- To view the results, view 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); and subtotal results by first year and lifetime accrual. 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.
- Equivalent measures, such as number of cars off the road or the amount of electricity to power households, are provided in Sheet 7.

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.

Please note that if your macro security was originally set to "High" or "Very High," you may want to reset to these values after you use and close the EEBC file.



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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 by the user 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).

The calculations for energy savings are handled differently for data entered on Sheet 3a (EPEAT-registered purchases) and Sheet 3b (power management).

Sheet 3a - Purchasing

EPEAT-registered products are required to meet the technical requirements of the applicable ENERGY STAR specification. As a result, EPEAT-registered products are more energy efficient than a baseline product, and may be power managed to save more energy.

The EEBC uses a baseline that is equivalent to what would have been an ENERGY STAR 3.0 qualified product, and compares this baseline to the user entered product. The user entered product (for all three EPEAT tiers) is assumed to be an ENERGY STAR 4.0/4.1 qualified product. Benefits are calculated using either default enabling rates or user-defined enabling rates (which can be entered in Sheet 3c). In either case, the enabling rates are kept the same for the baseline and purchased product. For example, if the purchased product has a user-entered enabling rate of 50%, then the baseline will also have a user-entered enabling rate of 50%. Similarly, if the user does not enter an enabling rate, then the purchased product and baseline will use the same default enabling rate. This method ensures that the energy savings attributable to purchasing an EPEAT-registered product are the result of the energy efficiency gains over the baseline, not from a change in behavior (e.g., enabling power management).

Sheet 3b – Power management

In contrast, the EEBC calculates the benefits of behavior change using the data entered in Sheet 3b.

The EEBC uses a baseline of the number of user entered ENERGY STAR qualified products, enabled at the default rate. The EEBC compares this baseline to number of user entered ENERGY STAR qualified products, enabled at the user entered rate. Since these savings vary across ENERGY STAR 3.0 and ENERGY STAR 4.0/4.1, the EEBC compares them separately, which is why the user must enter the number of ENERGY STAR 3.0 and ENERGY STAR 4.0/4.1 qualified units separately.

If the user entered rate is less than or equal to the baseline rate, then no benefit is calculated. In version 2.0 of the EEBC, the following enabling rates are used for the baseline:

- Desktop computers: 8%

- CRT monitors: 77%
- LCD monitors: 81%
- Notebooks/laptops: 8%

In some cases, inclusion of the EPEAT-registered products entered in Sheet 3a in the number of units in use in Sheet 3b may result in duplication of benefits (or “double-counting”). If the user **does not change** the default rate for EPEAT-registered purchases in Sheet 3c, then they may include the purchases entered in Sheet 3a in the units in use in Sheet 3b without duplication of results. Any change to the default enabling rate in Sheet 3c for purchases may cause duplication of results if the purchased units are also entered in Sheet 3b.

Why am I getting no results for enabling power management or extending the life of equipment?

The EEBC compares the user entered data (e.g., power management rate or life span) to the baseline data for the entered product. If the user entered data is less than or equal to the baseline, then no benefits are calculated.

In version 2.0 of the EEBC, the following enabling rates are used for the baseline:

- Desktop computers: 8%
- CRT monitors: 77%
- LCD monitors: 81%
- Notebooks/laptops: 8%

In version 2.0 of the EEBC, the following life spans are used for the baseline:

- Desktop computers: 49 months
- CRT monitors: 49 months
- LCD monitors: 49 months
- Notebooks/laptops: 38 months

The references for these assumptions are detailed in Sheet 8a.

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 user selected product type. The EEBC calculation assumes an environmental performance profile for each product type and EPEAT level, based on actual product registrations (see Sheet 8b2). 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 tiers as described above. The EEBC does not 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, were updated in version 2.0 to reflect the distribution of products in the registry in May 2008.

Criteria in EEBC	EPEAT Reference	Profile of EPEAT Silver products
RoHS compliance (Pb, Hg, Cd, Cr6+, PBB, PBDE)	4.1.1.1 Required	Yes
Hg declaration; number of lamps with Hg; maximum average Hg content per lamp	4.1.3.1 Required	Yes; 4 (LCDs), 1 (Notebooks); 0.003 grams
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 declaration; percentage	4.2.1.1 Required – Declaration Optional - % content	No; 0%
Recycled content of product resin (10%; 25%)	4.2.1.2; 4.2.1.3 Optional	No; No
Meets Energy Star® requirements	4.5.1.1 Required	Yes
Recycled content of packaging	4.8.3.1 Required – Declaration Optional - % content	Yes; 25% for corrugated/paper fiber packaging; 0% for plastic/foam/resin/other packaging

Criteria in EEBC	EPEAT Reference	Profile of EPEAT Silver products
Minimum 25% recycled content of corrugated packaging	4.8.3.2 Optional	Yes
Reusable packaging	4.8.5.1 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 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. Here, 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 ENERGY STAR features are incorporated into the EEBC in two ways. First, the EEBC calculates the benefits of ENERGY STAR 4.0/4.1 features as one of the required performance criteria of EPEAT. In calculating environmental benefits, the EEBC assumes that the ENERGY STAR power management features of EPEAT-registered products are enabled at the default or user entered rate over a 4-year initial life (3 years for notebook computers). The EEBC also assumes that a conventional unit is equivalent to an ENERGY STAR 3.0 qualified product, which is also power managed at the default or user entered enabling rate.

Second, the EEBC can also estimate the environmental benefits of computer and monitor power management, independent of EPEAT purchases. This is because an EEBC user can separately calculate the benefits of enabling the ENERGY STAR power management features of its computer inventory, above the default rate. These calculations assume that a percentage of computer desktops and notebooks (8%) and monitors (77% and 81% for CRTs and LCDs, respectively) have the ENERGY STAR features enabled, based on published computer usage patterns. Entering a percentage of enabled units above the default rate for these products results in environmental benefits; entering a number of enabled units below the default rate will not show any benefits.

Please see [question above about potential double-counting](#) between energy efficiency gains from purchasing (Sheet 3a) and power management (Sheet 3b).



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How do I estimate the number of ENERGY STAR 3.0 vs. ENERGY STAR 4.0/4.1 products in service?

The ENERGY STAR 4.0/4.1 specification for monitors went into effect on January 1, 2005/December 8, 2005. Any ENERGY STAR qualified monitors purchased after these dates are likely to be ENERGY STAR 4.0/4.1. Any ENERGY STAR monitors older than this date are likely to be ENERGY STAR 3.0. The ENERGY STAR 4.0 specification for computers went into effect on July 20, 2007. Any ENERGY STAR qualified computers purchased after this date are likely to be ENERGY STAR 4.0. Any ENERGY STAR computers older than this date are likely to be ENERGY STAR 3.0.

Example

Facility A has the following electronic equipment in use, with associated power management enabling rates:

- 100 Desktop computers
- 50 CRT monitors
- 50 LCD monitors
- 30 Laptop/notebook computers

Estimated percentage of enabled monitors: 90%
Estimated percentage of enabled computers: 60%

Facility A bought 50 of the desktop computers and all 30 laptop/notebook computers in 2008 – they are all ENERGY STAR 4.0. The other 50 desktop computers were bought in 2006 – they are ENERGY STAR 3.0. Facility A bought the 50 LCD monitors with the new desktop computers in 2008 – they are all ENERGY STAR 4.0/4.1. The CRT monitors in use have been around since 2003 – they are ENERGY STAR 3.0.

This data would be entered as follows in the EEBC:

EQUIPMENT USE AND DISPOSITION INFORMATION:					
USER INPUT		Input data			
USE:	<i>Data inputs for computers and monitors only</i>	Total number of ENERGY STAR® 3.0 units	Total number of ENERGY STAR® 4.0/4.1 units	Enabling Rate (%)	Average (l
Desktop computers (CPUs)		50	50	60%	
CRTs		50		90%	
LCDs			50	90%	
Notebook computers			30	60%	
Total number of units in service (3.0 and 4.0/4.1)		230			

What is included in the first year benefits vs. the lifetime benefits?

The EEBC separately provides information on benefits accrued in the first year of owning, using, or reusing/recycling an electronic product and the benefits accrued over the lifetime of owning and using a product. These benefits are broken out as follows:

First Year:

- All savings from reduced toxicity, recycled content material use, recycled content in packaging, and reuse of packaging from the purchase or lease of an EPEAT-registered product.
- One year of energy efficiency savings from use of an EPEAT-registered product, or from enabling power management on a product above the default rate.
- All savings from the reuse and recycling of any electronic equipment.

Lifetime:

- All the benefits listed in the first year savings.
- All savings from the reduction in hazardous waste at the end-of-life of an EPEAT-registered product.
- The remaining years of energy efficiency savings from the use of an EPEAT-registered product, or from enabling power management on a product above the default rate. The number of years in a product's lifetime is based on the average lifetime of the product.
- All savings from extending the life of electronic equipment.

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). As additional data becomes available, these underlying assumptions in the EEBC are updated. Between versions, the EEBC user can customize EPEAT product profiles (using Sheet 3c).

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., toxicity). 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



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equivalents (as carbon or CO₂-equivalents). Sheet 5b in the EEBC 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 the different 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 CO₂-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.

Do 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 water 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).

REFERENCES

The Electronics Environmental Benefits Calculator may be downloaded as a Microsoft Excel® spreadsheet from the FEC Web site:

<http://www.federalelectronicschallenge.net/resources/bencalc.htm>.

CONTACT INFORMATION

If you have questions related to this resource or need other assistance with the Federal Electronics Challenge, please contact your Regional Champion. The list of FEC Regional Champions is available at <http://www.federalelectronicschallenge.net/champions.htm>.



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Partners may also request technical assistance via email to partner@electronicschallenge.net.

FEDERAL ELECTRONICS CHALLENGE

Web site: <http://www.federaelectronicschallenge.net/>

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