



ENERGY STAR® Computer Program Discussion Guide: Version 4.0 Tier 2 November 9, 2007

Document Overview

EPA and the EC (European Commission) are sharing this ENERGY STAR Computer Program Discussion Guide: Version 4.0 Tier 2 to invite your input on the proposed specification development process, possible approaches for the covered products, as well as key questions regarding the forthcoming Tier 2 for computers. EPA will host a web-based stakeholder meeting in early December where interested parties can offer their thoughts on this document and other issues related to Tier 2.

This discussion guide will be posted to the ENERGY STAR Computer Specification Revision page at https://www.energystar.gov/index.cfm?c=revisions.computer_spec. Future materials pertaining to the revision of the ENERGY STAR Computer Specification will also be made available on this site.

Planned Tier 2 Specification Development Process

EPA will kick off the Tier 2 specification development process with a web meeting. To give stakeholders adequate time to review this document, this web meeting is planned for **December 6, 2007, tentatively scheduled from 12 PM to 2 PM, Eastern Standard Time**. EPA will distribute further information on this event in the coming weeks. Stakeholders are encouraged to contact Evan Haines, ICF International, at ehaines@icfi.com, with initial questions about this meeting or to be added to the email distribution list.

As indicated in an email update on November 8, 2007, EPA and the EC have agreed to a six-month extension to the Tier 2 Computer Specification effective date. The new Tier 2 effective date is July 1, 2009. As noted in the update, this revised effective date allows for:

- 1) Ecma to complete the development of its efficiency benchmark standard;
- 2) BAPCo to release the EEcoMark software based on the Ecma standard; and
- 3) EPA to ensure that the approach meets the goals of Tier 2.

Further information on Ecma, BAPCo, and how portions of their work are important to the goals of the Tier 2 Computer Specification are included for reference at the end of this document, page 7.

EPA envisions that the Agency will work with stakeholders between November 2007 and June 2008 to develop and refine the Tier 2 approach, covered products, definitions, and other aspects of the Specification. In late June, when the Ecma standard and EEcoMark software are available, EPA will immediately begin collecting data to inform Tier 2 levels. EPA and the EC will need to finalize the Tier 2 Computer Specification in October 2008 in order to allow manufacturers nine months before the Tier 2 Specification goes into effect in July 2009. As always, EPA and the EC will strive to ensure that this specification development process is fair, transparent, and inclusive, and we invite all stakeholders to contribute to the process.

Background

The ENERGY STAR Version 4.0 Computer Specification, effective on July 20, 2007, included placeholders for Tier 2 performance levels. In addition to subjects carrying over from Tier 1 development, the Version 4.0 Specification proposed the use of an overall “Energy Efficiency Performance Metric” approach to evaluate the energy use and performance of computing equipment for Tier 2. It is believed that this approach, now designated as an **Energy Efficiency Performance Assessment (EEPA)**, would provide a number of benefits to the ENERGY STAR Computer Specification.

In an EEPA approach, a software tool is used to run a computer through a consensus workload, or set of tasks, and collect data on how the computer performs in addressing this workload. This data can then be used in conjunction with data on the power required to achieve this performance, and certain system characteristics, to assess how effectively a computer is “translating” energy into desired performance. The EEPA would allow the Specification to more effectively scale its efficiency metrics to the performance and functionality of a given product, simplify testing, and provide greater longevity and stability to ENERGY STAR specifications, while driving consumers and enterprises toward energy efficiency as another element of desired capability and function.

The Tier 1 Specification also contained provisional Tier 2 Idle State requirements as an interim or alternative measure should EPA, the EC, and industry not be able to set in place a specification based on a completed EEPA tool. However, as EPA and the EC expect to be able to make use of the Ecma standard and EEcoMark software tool, this Discussion Guide and the upcoming stakeholder meeting will focus on a Tier 2 built around an EEPA approach.

Key Topics for the Tier 2 Specification Development

In this section, EPA and the EC have included a number of topics for consideration during Tier 2 Specification development. EPA asks that those who intend to participate in the December 6 meeting review this document in advance and come to the meeting prepared to contribute to the discussion on the following subjects. EPA invites those unable to participate in the December meeting to contact Katharine Kaplan, EPA, at kaplan.katharine@epa.gov or Evan Haines, ICF International, at ehaines@icfi.com, to offer responses to the following questions and thoughts on the following topics. If after reviewing this document stakeholders have suggestions for other high-priority topics for discussion not currently referenced, these may be forwarded to via email, as well.

Energy Efficiency Performance Assessment (EEPA) Approach

Under an EEPA Tier 2 approach, EPA envisions developing specification levels based on results for desktops/notebooks running EEPA software and a consensus usage scenario that represents tasks that most users will commonly perform. Systems will be evaluated based on a balance of performance running a predefined set of tasks and the energy required to complete the tasks.

The Ecma/BAPCo process is presently exploring two sets of workloads: office productivity and rich media. ENERGY STAR will need to set forth the rules for what workloads apply to what types of machines covered under the Specification. EPA and the EC look forward to working with stakeholders, Ecma, and BAPCo in determining the proper mix and application of the Ecma/BAPCo workloads and the role system characteristics play in determining this mix.

While this approach allows for scaling of power use by capability of systems, EPA and the EC are aware of the challenges presented by a software evaluation approach. For example, the effect of new operating system releases could impact the effectiveness of EEPA tool versions in evaluating cross generation products. Additionally, care regarding the comparison of performance and energy use between different operating system platforms may be necessary.

EPA and the EC understand that the Ecma effort applies to some of the primary operating systems used today, but that it will also allow for expansion in the future. If EEPA tool update schedules prove to be more frequent than ENERGY STAR's development process, clarification memorandums could be released to formalize EEPA tool versions in effect. EPA has released several specification clarifications for other ENERGY STAR products that faced similar test procedure updates. EPA and the EC believe the EEPA approach is the best way to compare desktops and notebooks across a range of capabilities.

Discussion Questions:

- A. *What challenges does platform dependence introduce to the ENERGY STAR Computer program?*
- B. *How can performance under different EEPA workloads best be integrated into ENERGY STAR?*
- C. *Do stakeholders believe that when paired with a calculated annual energy use value, an EEPA tool like EEcoMark will be a reasonable means of comparing the energy use of desktops? Notebooks?*
- D. *Should the EEPA take into account different usage patterns for businesses compared to home users in arriving at a consensus usage scenario?*
- E. *Should the EEPA reflect typical usage patterns of computer users in all ENERGY STAR countries in arriving at a consensus usage scenario?*
- F. *How does the proposed EEPA approach mesh with the Climate Savers Computing Initiative, which bases qualification largely on the efficiency of internal power supplies and motherboards?*

Product Categories

As introduced above, the EEPA approach focuses on desktop and notebook computers. The software would likely be applicable for associated sub groups of these categories as well (integrated computers and tablet PCs). Other product categories may require separate provisions to be addressed under the Tier 2 Specification:

- **Desktop-Derived Servers:** EPA expects to retain this product in the Computer Specification at this time and, as such, seeks comment on how to evaluate these products under this Tier 2 Computer Specification. EPA has received suggestions to address this product in a forthcoming ENERGY STAR Server specification as these products handle a workload similar to that of Servers. However, this Server specification is in the early stages of development and preliminary feedback from that sector implies that these products should remain in the Computer Specification. It is expected that in time the Server specification may be based on a metric that considers performance and energy under various Server workloads. If the Server specification makes use of such a metric in the near future, and the accompanying workloads are also appropriate for Desktop-Derived Servers, EPA expects to consider then covering these products under the specification specific to Servers. Information on ENERGY STAR's Server specification development process can be found at: https://www.energystar.gov/index.cfm?c=new_specs.enterprise_servers.
- **Workstations:** EPA encourages stakeholder comment on methods to address workstations under this Tier 2 Specification, including keeping the current Tier 1 TEC approach.

- Game Consoles: EPA has received requests to address game consoles in Tier 2 either (1) as a separate product category with different requirements under the existing Computer Specification or (2) as an entirely separate specification all together. EPA is considering developing requirements specific to game consoles and keeping this category in the computer specification. EPA proposes developing these requirements through a parallel process and timeline to that of the computer Tier 2 requirements.
- Thin Clients: EPA and the EC have received numerous questions about thin clients and if they could become eligible for ENERGY STAR qualification through the Computers program in the future. Thin clients may take a larger role in the future both for businesses and home users; it is therefore relevant to consider including them in Tier 2. Thin clients typically consume less electricity than desktops and some notebooks. However, data center electricity consumption will often be increased as workload is shifted from the computer itself to centralized servers. ENERGY STAR is interested in further data and information on the effects on datacenter energy consumption related to thin client implementation and on how thin clients could be included in the Specification, including which test standard to use. Information on future market development and current prevalence of thin client setups in enterprises is also welcome.

Discussion Questions:

- What Sleep levels are appropriate for Desktop-Derived Servers covered in the Computers Specification?*
- Should EPA use the same approach used in Tier 1 for Workstations or should they be handled differently?*
- Should Game Consoles be covered under the Tier 2 Computer Specification or treated in a separate specification altogether? What test methods are applicable/available for this product category?*
- Should Thin Clients be evaluated alongside other computer categories in the ENERGY STAR Computer Specification? What research is available on energy consumption of thin clients and their impact on overall data center energy use?*
- Are there additional products that should be considered for inclusion in this Tier 2 Specification?*

Program Scope and Requirement Categories

The Tier 1 Specification includes hardware-based Idle State requirement classifications for notebook and desktop related product categories. These categories were intended to scale power use by capability of the system, an intention that the EEPA approach is likely to address. EPA and the EC believe that a properly executed EEPA should more accurately scale power requirements to the capability of the individual systems, and therefore the need for Tier 1 type categorizations should be hopefully eliminated. ENERGY STAR is open to comments regarding this approach and welcomes feedback on possible classifications that may still be needed when using such an approach.

Discussion Question:

- Will an EEPA approach lessen the dependence on categorization of systems, as was done for Idle State requirements in Tier 1?*

Power Supplies and Components

Though the EEPA approach aims to provide a more holistic representation of energy consumption required to deliver desired functionality, some component level considerations may remain

necessary in Tier 2. Stakeholders have contacted EPA regarding a number of technologies that could save energy at the component level, including hard drive spin down, solid state hard drive technology, >85% efficient internal power supplies, and integrated/shared-memory graphics processing.

Stakeholders are encouraged to provide examples, and supporting data, for emerging technologies that were not included in Tier 1 that provide further energy saving opportunities at the component level, including other peripherals commonly shipped with PCs such as external speakers or cameras, and the technologies listed above.

Discussion Questions:

- M. *Are the Tier 1 component-level requirements for internal/external power supplies appropriate when used in conjunction with an EEPA tool such as EEcoMark? Alternatively, if they are appropriate, should component level requirements for internal/external power supplies be made more stringent?*
- N. *ENERGY STAR's existing Tier 1 framework requires measurement of desktop computers and workstations with keyboard and mouse attached. Consistent with these measures to create a realistic testing situation, should any commonly used peripherals be included in Tier 2 test procedures to accurately reflect real-world usage (i.e. keyboards, mice, USB peripherals, docking stations)?*
- O. *What new energy-saving technologies becoming prevalent on the market are worth special consideration in Tier 2?*

Power Management and Network Requirements

Recognizing that computer power management represents a significant energy saving opportunity, the ENERGY STAR Computer program remains committed to encouraging use of power management in qualified computers. Consistent with the Version 4.0 Tier 1 Specification, ENERGY STAR is interested in supporting new technologies which will help promote power management, even if these technologies use some additional power. EPA will consider giving additional power allowances (chiefly for low power modes) if manufacturers can show that these technologies will save energy in the long run by allowing computers to be shut down, or enter sleep when not in use (e.g., when left inactive for a period of time, or when an employee leaves the office for the night).

EPA intends to retain network requirements under Tier 2, both to encourage power management enablement and promote energy saving networking technologies being developed in the industry. Furthermore, EPA intends to maintain Wake On LAN requirements in Tier 2 along with requirements to reduce Ethernet network link speeds when transitioning to Sleep or Standby/Off.

The Tier 1 Specification requires for Tier 2 that "All computers shall reduce their network link speeds during times of low data traffic levels in accordance with any industry standards that provide for quick transitions among link rates. " This standard is presently in development by the IEEE 802.3az Task Force on "Energy Efficient Ethernet" (see <http://www.ieee802.org/3/az/public/index.html>).

The Tier 1 Specification also requires for Tier 2 that "...ENERGY STAR qualified computers must maintain full network connectivity while in Sleep mode, according to a platform-independent industry standard." ENERGY STAR understands that providing additional functionality in Sleep may require extra power so that sufficient extra allowances would be provided in any Sleep mode requirements. For an EEPA as is envisioned for Tier 2, the extra Sleep energy will be far lower than the avoided Idle energy so that systems that meet the standard will be credited with the savings in the calculation developed for the specification.

Discussion Questions:

- P. *Are any allowances for additional management tools that aid in the adoption of computer power management (such as service processors in Sleep and Standby) worth consideration?*
- Q. *How should the Tier 1 network provisions (reduction of the speed of active Ethernet network links when transitioning to Sleep or Standby/Off, maintaining full network presence in Sleep, and Wake-On-LAN) be evaluated under the EEPA approach?*

Testing Procedure and Reporting Requirements

Once the EEPA tool is completed, ENERGY STAR intends to compile energy use and performance data on a computer sample set, consistent with the Tier 1 process. Before this occurs, data will be required to support EEPA tool development, specifically with regards to workload and usage patterns. Ecma data collection will focus on usage patterns within times of active use. EPA will need data or estimates for other aspects of usage patterns, preferably from diverse global sources. These cover the total amount of time PCs are typically in active use each year (in homes and offices), patterns of leaving machines on (or putting them to Sleep or Standby/Off) during other times (particularly over nights and weekends), and energy and power implications of additional functions or capabilities.

For Tier 1, it was decided that evaluation of notebook/integrated computers would not factor in the consumption of the display; this was consistent with desktop computer testing, where the monitor is not included in system energy consumption. EPA may reevaluate this position if EEPA data and stakeholder comment supports revision, particularly as some manufacturers have invested in technologies for more efficient displays.

Discussion Questions:

- R. *Should EPA investigate power levels for notebooks and integrated computers that incorporate the energy use of the displays?*
- S. *What data collection is necessary to support the EEPA tool development? To support meaningful ENERGY STAR requirement levels?*
- T. *When a final list of qualifying Tier 2 computers is eventually posted to the ENERGY STAR web site, the program intends to post annual energy consumption figures and performance information to better inform consumers. Posting of this information is also being proposed for televisions. EPA invites feedback on this plan.*

Ecma International: Background

Since May of 2006, Ecma International has worked on developing the concept of a system to evaluate energy use and computer performance/capability. The work has been conducted by Ecma TC38-TG2 on "Energy Efficiency." The graphic below shows the three core concepts of such a system come together. *Performance* is an assessment of the speed of a computer in accomplishing a set of "typical" tasks; *capabilities* include characteristics of value to the consumer and with energy consequences that are not fully reflected in the performance figure (e.g. extra memory, presence of a TV tuner, extra network connectivity); and *energy* is a set of measurements of how much is used during typical active times, while relatively idle, and when asleep and off. In presentations, Ecma states this succinctly as:

Performance

Compute throughput and responsiveness at a component or system level.

Capabilities

Is a feature or set of features that enhances usability and/or experience of a Product

Energy Efficiency

The AC Energy consumed while executing a duty cycle measured in KW-Hr.

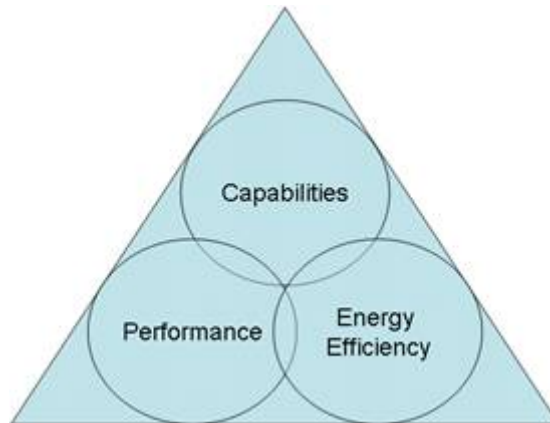
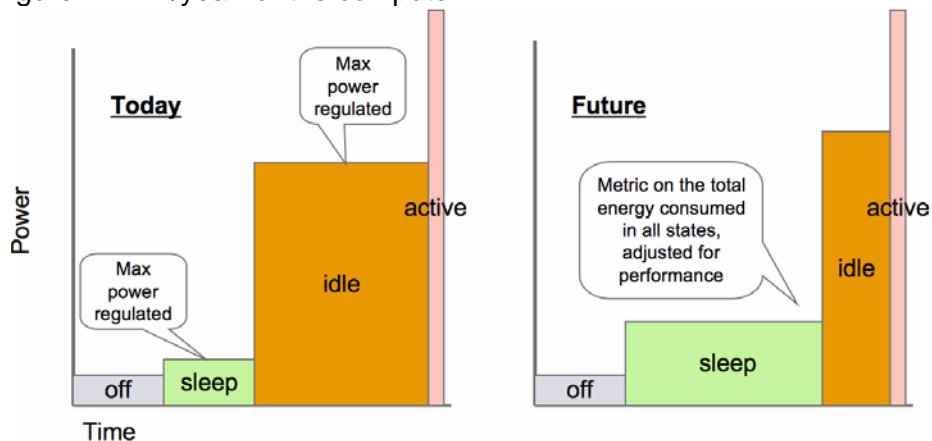


Figure 1. (source: Ecma TC38-TG2 - Energy Efficiency)

The Ecma approach shows how it facilitates calculating a "TEC" (Total Electricity Consumption) value from a set of measurements. Figure 2, below, shows how typical annual hours spent in each major operating mode, including active computation, are summed to arrive at a total annual consumption figure in kWh/year for the computer.



Note: This is simplified conceptual example and represents a sum of activities in each state

Figure 2.

(Ecma, continued)

The Ecma approach would provide measurements of performance as assessed by an underlying software tool (see BAPCo, below). By developing an EEPA around Ecma's approach, ENERGY STAR specification levels for a product could be created as a function of these measurements, other product capabilities, and ability to retain full network connectivity while in sleep.

More on this effort can be found at <http://www.ecma-international.org/memento/TC38-TG2-M.htm>.

BAPCo: Background

BAPCo (the Business Applications Performance Corporation) is working with Ecma to produce software systems that implement an evaluation scheme compliant with the Ecma standard, and that could be used as the basis for the energy portion of the Tier 2 Specification. At present, targets include desktops and notebooks, Windows Vista and Mac OS X, and two workloads: office productivity and rich media. Support for Linux is to be added subsequently.

As currently conceived, EPA could set Specification requirements based on product-type groups, each indexed by a performance metric developed with the use of the BAPCo software. If required under this scenario, any necessary adders could be put forth and would ideally be common across all four groups, though there could be differences between desktop and notebook computers if data justifies it.

More information on BAPCo is available on the consortium website at <http://www.bapco.com/about.html>.