ENERGY STAR® Program Requirements for Computers

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ENERGY STAR® Program Requirements for Computers

Partner Commitments

Commitments

The following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacturing of ENERGY STAR qualified computers. The ENERGY STAR Partner must adhere to the following program requirements:

- comply with current <u>ENERGY STAR Eligibility Criteria,</u> defining the performance criteria that must be met for use of the ENERGY STAR certification mark on computers and specifying the testing criteria for computers. EPA may, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at EPA's request;

- comply with current <u>ENERGY STAR Identity Guidelines,</u> describing how the ENERGY STAR marks and name may be used. Partner is responsible for adhering to these guidelines and for ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance;

- work with resellers of Partner's products to help ensure that these products remain in compliance with ENERGY STAR requirements. Any party within the distribution channel of an ENERGY STAR qualified computer product that alters the power profile of a product after its date of manufacture through hardware or software modifications must ensure that the product continues to meet the ENERGY STAR requirements before delivering this product to the end customer. If the product no longer meets the requirements, it may not bear the ENERGY STAR mark;

- qualify at least one ENERGY STAR computer model within one year of activating the computers portion of the agreement. When Partner qualifies the product, it must meet the specification (e.g., Tier 1 or 2) in effect at that time;

- provide clear and consistent labeling of ENERGY STAR qualified computers. The ENERGY STAR mark must be clearly displayed:

  1. On the top or front of the product. Labeling on the top or front of the product may be permanent or temporary. All temporary labeling must be affixed to the top or front of the product with an adhesive or cling-type application;

     <u>Electronic Labeling Option</u>: Manufacturers have the option of using an alternative electronic labeling approach in place of this product labeling requirement, as long it meets the following requirements:

     − The ENERGY STAR mark in cyan, black, or white (as described in "The ENERGY STAR Identity Guidelines" available at www.energystar.gov/logos) appears at system start-up. The electronic mark must display for a minimum of 5 seconds;
     − The ENERGY STAR mark must be at least 10% of the screen by area, may not be smaller than 76 pixels x 78 pixels, and must be legible.

     EPA will consider alternative proposals regarding approach, duration, or size for electronic labeling on a case-by-case basis.

2. In product literature (i.e., user manuals, spec sheets, etc.);

3. On product packaging for products sold at retail; and

4. On the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed:

   – If information concerning ENERGY STAR is provided on the Partner Web site, as specified by the ENERGY STAR Web Linking Policy (this document can be found in the Partner Resources section on the ENERGY STAR Web site at www.energystar.gov), EPA may provide links where appropriate to the Partner Web site;

- agree to complete steps to educate users of their products about the benefits of power management by including the following information, in addition to that described in the User Information Requirements found in the ENERGY STAR Eligibility Criteria (Section 3.A.3), with each computer (i.e., in the user manual or on a box insert):

  1. Energy saving potential;

  2. Financial saving potential;

  3. Environmental benefits

  4. Information on ENERGY STAR and a link to www.energystar.gov; and

  5. ENERGY STAR logo (used in accordance with "The ENERGY STAR Identity Guidelines" available at www.energystar.gov/logos).

  In addition to the information contained with the product, the manufacturer will have similar information with a link to www.energystar.gov/powermanagement on the company Web site, readily accessible from computer product pages, product specifications, and related content pages.

  At the manufacturer's request, EPA will supply suggested facts and figures related to the above criteria, template elements, or a complete template suitable for use in user guides or box inserts.

  EPA's goal is to achieve a 40% power management enabling rate nationally by 2010; 60% by 2012; and $\geq$ 80% by 2014. EPA recognizes the importance of documenting enabling rates and encourages industry to develop a collective strategy for securing and funding this research, and sharing findings with EPA and the public.

- provide to EPA, on an annual basis, an updated list of ENERGY STAR qualified computer models. Once the Partner submits its first list of ENERGY STAR qualified computer models, the Partner will be listed as an ENERGY STAR Partner. Partner must provide annual updates in order to remain on the list of participating product manufacturers;

- provide to EPA, on an annual basis, unit shipment data or other market indicators to assist in determining the market penetration of ENERGY STAR. Specifically, Partner must submit the total number of ENERGY STAR qualified computers shipped (in units by model) or an equivalent measurement as agreed to in advance by EPA and Partner. Partner is also encouraged to provide ENERGY STAR qualified unit shipment data segmented by meaningful product characteristics (e.g., capacity, size, speed, or other as relevant), total unit shipments for each model in its product line, and percent of total unit shipments that qualify as ENERGY STAR. The data for each calendar year should be submitted to EPA, preferably in electronic format, no later than the following March and may be provided directly from the Partner or through a third party. The data will be used by EPA only for program evaluation purposes and will be closely controlled. Any information used will be masked by EPA so as to protect the confidentiality of the Partner;

- notify EPA of a change in the designated responsible party or contacts for computers within 30 days.

Performance for Special Distinction

In order to receive additional recognition and/or support from EPA for its efforts within the Partnership, the ENERGY STAR Partner may consider the following voluntary measures and should keep EPA informed on the progress of these efforts:

- consider energy efficiency improvements in company facilities and pursue the ENERGY STAR mark for buildings;

- purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes;

- ensure the power management feature is enabled on all ENERGY STAR qualified monitors and computers in use in company facilities, particularly upon installation and after service is performed;

- provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified product models;

- provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, communicate, and/or promote Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR Web pages, etc. The plan may be as simple as providing a list of planned activities or planned milestones that Partner would like EPA to be aware of. For example, activities may include: (1) increase the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrate the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) provide information to users (via the Web site and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products: and (4) build awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event;

- provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.

ENERGY STAR® Program Requirements
for Computers

Eligibility Criteria

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Below is the Version 4.0 product specification for ENERGY STAR qualified computers. A product must meet all of the identified criteria to earn the ENERGY STAR.

1) **Definitions:** Below are the definitions of the relevant terms in this document.

A. <u>Computer</u>: A device which performs logical operations and processes data. Computers are composed of, at a minimum: (1) a central processing unit (CPU) to perform operations; (2) user input devices such as a keyboard, mouse, digitizer or game controller; and (3) a display screen to output information. For the purposes of this specification, computers include both stationary and portable units, including desktop computers, gaming consoles, integrated computers, notebook computers, tablet PCs, desktop-derived servers and workstations. Although computers must be capable of using input devices and displays, as noted in numbers 2 and 3 above, computer systems do not need to include these devices on shipment to meet this definition.

Components

B. <u>Display</u>: A commercially-available, electronic product with a display screen and its associated electronics encased in a single housing, or within the computer housing (e.g., notebook or integrated computer), that is capable of displaying output information from a computer via one or more inputs, such as a VGA, DVI, and/or IEEE 1394. Examples of display technologies are the cathode-ray tube (CRT) and liquid crystal display (LCD).

C. <u>External Power Supply</u>: A component contained in a separate physical enclosure external to the computer casing and designed to convert line voltage ac input from the mains to lower dc voltage(s) for the purpose of powering the computer. An external power supply must connect to the computer via a removable or hard-wired male/female electrical connection, cable, cord or other wiring.

D. <u>Internal Power Supply</u>: A component internal to the computer casing and designed to convert ac voltage from the mains to dc voltage(s) for the purpose of powering the computer components. For the purposes of this specification, an internal power supply must be contained within the computer casing but be separate from the main computer board. The power supply must connect to the mains through a single cable with no intermediate circuitry between the power supply and the mains power. In addition, all power connections from the power supply to the computer components must be internal to the computer casing (i.e., no external cables running from the power supply to the computer or individual components). Internal dc-to-dc converters used to convert a single dc voltage from an external power supply into multiple voltages for use by the computer are not considered internal power supplies.

Computer Types

E. <u>Desktop Computer</u>: A computer where the main unit is intended to be located in a permanent location, often on a desk or on the floor. Desktops are not designed for portability and utilize an external monitor, keyboard, and mouse. Desktops are designed for a broad range of home and office applications including, email, web browsing, word processing, standard graphics applications, gaming, etc.

F. <u>Desktop-Derived Server</u>: A desktop-derived server is a computer that typically uses desktop components in a tower form factor, but is designed explicitly to be a host for other computers or applications. For the purposes of this specification, a computer must be marketed as a server and have the following characteristics to be considered a desktop-derived server:

- Designed and placed on the market as a Class B product per EuroNorm EN55022:1998 under the EMC Directive 89/336/EEC and has no more than single processor capability (1 socket on board);

- Designed in a pedestal, tower, or other form factor similar to those of desktop computers such that all data processing, storage, and network interfacing is contained within one box/product;

- Designed to operate in a high-reliability, high-availability application environment where the computer must be operational 24 hours/day and 7 days/week, and unscheduled downtime is extremely low (on the order of hours/year);

- Capable of operating in a simultaneous multi-user environment serving several users through networked client units; and

- Shipped with an industry accepted operating system for standard server applications (e.g., Windows NT, Windows 2003 Server, Mac OS X Server, OS/400, OS/390, Linux, Unix and Solaris).

Desktop-derived servers are designed to perform functions such as processing information for other systems, providing network infrastructure services (e.g., archiving), data hosting and running web servers.

This specification does not cover mid-range or large servers, defined for purposes of this specification as:

- Designed and placed on the market as a Class A product per EuroNorm EN55022:1998 under the EMC Directive 89/336/EEC <u>and</u> designed and capable of having a single or dual processor capability (1 or greater sockets on board);

- Placed on the market as a Class B product, but hardware upgraded from a Class A product, per EuroNorm EN55022:1998 under the EMC Directive 89/336/EEC and designed capable of having a single or dual processor capability (1 or greater sockets on board); and

- Designed and placed on the market as a Class B product per EuroNorm EN55022:1998 under the EMC Directive 89/336/EEC and designed and capable of having a *minimum* dual processor capability (2 sockets on board).

G. <u>Game Consoles:</u> Stand alone computers whose primary use is to play video games. For the purposes of this specification, game consoles must use a hardware architecture based on typical computer components (e.g., processors, system memory, video architecture, optical and/or hard drives, etc.). The primary input for game consoles are special hand held controllers rather than the mouse and keyboard used by more conventional computer types. Game consoles are also equipped with audio visual outputs for use with televisions as the primary display, rather than an external monitor or integrated display. These devices do not typically use a conventional operating system, but often perform a variety of multimedia functions such as: DVD/CD playback, digital picture viewing, and digital music playback.

H. <u>Integrated Computer</u>: A desktop system in which the computer and display function as a single unit which receives its ac power through a single cable. Integrated computers come in one of two

possible forms: (1) a system where the display and computer are physically combined into a single unit; or (2) a system packaged as a single system where the display is separate but is connected to the main chassis by a dc power cord and both the computer and display are powered from a single power supply. As a subset of desktop computers, integrated computers are typically designed to provide similar functionality as desktop systems.

I. <u>Notebook and Tablet Computers</u>: A computer designed specifically for portability and to be operated for extended periods of time without a direct connection to an ac power source. Notebooks and tablets must utilize an integrated monitor and be capable of operation off an integrated battery or other portable power source. In addition, most notebooks and tablets use an external power supply and have an integrated keyboard and pointing device, though tablets use touch-sensitive screens. Notebook and tablet computers are typically designed to provide similar functionality to desktops except within a portable device. For the purposes of this specification, docking stations are considered accessories and therefore, the performance levels associated with notebooks presented in Table 1 of Section 3, below, do not include them.

J. <u>Workstation</u>: For the purposes of this specification, to qualify as a workstation, a computer must:

- Be marketed as a workstation;

- Have a mean time between failures (MTBF) of at least 15,000 hours based on either Bellcore TR-NWT-000332, issue 6, 12/97 or field collected data; and

- Support error-correcting code (ECC) and/or buffered memory.

    In addition, a workstation must meet three of the following six optional characteristics:

- Have supplemental power support for high-end graphics (i.e., PCI-E 6-pin 12V supplemental power feed);

- System is wired for greater than x4 PCI-E on the motherboard in addition to the graphics slot(s) and/or PCI-X support;

- Does not support Uniform Memory Access (UMA) graphics;

- Includes 5 or more PCI, PCIe or PCI-X slots;

- Capable of multi-processor support for two or more processors (must support physically separate processor packages/sockets, i.e., not met with support for a single multi core processor); and/or

- Be qualified by at least 2 Independent Software Vendor (ISV) product certifications; these certifications can be in process, but must be completed within 3 months of qualification.

Operational Modes

K. <u>Idle State</u>: For purposes of testing and qualifying computers under this specification, this is the state in which the operating system and other software have completed loading, the machine is not asleep, and activity is limited to those basic applications that the system starts by default.

L. <u>Sleep Mode</u>: A low power state that the computer is capable of entering automatically after a period of inactivity or by manual selection. A computer with sleep capability can quickly "wake" in response to network connections or user interface devices. For the purposes of this specification, Sleep mode correlates to ACPI System Level S3 (suspend to RAM) state, where applicable.

M. <u>Standby Level (Off Mode)</u>: The power consumption level in the lowest power mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when the appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions. For purposes of this specification, Standby correlates to ACPI

System Level S4 or S5 states, where applicable.

Networking and Power Management

N. <u>Network Interface</u>: The components (hardware and software) whose primary function is to make the computer capable of communicating over one or more network technologies. For purposes of testing to this specification, Network Interface refers to the IEEE 802.3 wired Ethernet interface.

O. <u>Wake Event</u>: A user, programmed, or external event or stimulus that causes the computer to transition from Sleep or Standby to active mode of operation. Examples of wake events include, but are not limited to: movement of the mouse, keyboard activity, or a button press on the chassis, and in the case of external events, stimulus conveyed via a remote control, network, modem, etc.

P. <u>Wake On LAN (WOL):</u> Functionality which allows a computer to wake from Sleep or Standby when directed by a network request.

2) <u>**Qualifying Products:**</u> Computers must meet the computer definition as well as one of the product type definitions provided in Section 1, above, to qualify as ENERGY STAR. **Please note that EPA will explore additional computer types, such as thin clients, for potential Tier 2 requirements.** The following table provides a list of the types of computers that are (and are not) eligible for ENERGY STAR.

Products Covered by Version 4.0 Specification	Products Not Covered by Version 4.0 Specification
a. Desktop Computers b. Game Consoles c. Integrated Computer Systems d. Notebook Computers/Tablet PCs e. Desktop-Derived Servers f. Workstations	g. Mid-Range and Large Servers (as defined in Section 1F) h. Thin Clients/Blade PCs i. Handhelds and PDAs

3) <u>**Energy Efficiency and Power Management Criteria:**</u> Computers must meet the requirements below to qualify as ENERGY STAR. Effective dates for Tier 1 and Tier 2 are covered in Section 5 of this specification.

A) Tier 1 Requirements - Effective July 20, 2007

(1) Power Supply Efficiency Requirements

Computers Using an Internal Power Supply: 80% minimum efficiency at 20%, 50%, and 100% of rated output and Power Factor > 0.9 at 100% of rated output.

Computers Using an External Power Supply: Must be ENERGY STAR qualified or meet the no-load and active mode efficiency levels provided in the ENERGY STAR Program Requirements for Single Voltage Ac-Ac and Ac-Dc External Power Supplies. The ENERGY STAR specification and qualified product list can be found at www.energystar.gov/powersupplies. Note: This performance requirement also applies to multiple voltage output external power supplies as tested in accordance to the Internal Power Supply test method referenced in Section 4, below.

(2) Operational Mode Efficiency Requirements

Desktop Categories for Idle Criteria: For the purposes of determining Idle state levels, desktops (including integrated computers, desktop-derived servers and game consoles) must qualify under Categories A, B, or C as defined below:

Category A: All desktop computers that do not meet the definition of either Category B or Category C below will be considered under Category A for ENERGY STAR qualification.

Category B: To qualify under Category B desktops <u>must</u> have:

- Multi-core processor(s) or greater than 1 discrete processor; and
- Minimum of 1 gigabyte of system memory.

Category C: To qualify under Category C desktops <u>must</u> have:

- Multi-core processor(s) or greater than 1 discrete processor; and
- A GPU with greater than 128 megabytes of dedicated, non-shared memory.

In addition to the requirements above, models qualifying under Category C must be configured with a minimum of 2 of the following 3 characteristics:

- Minimum of 2 gigabytes of system memory;
- TV tuner and/or video capture capability with high definition support; and/or
- Minimum of 2 hard disk drives.

Notebook Categories for Idle Criteria: For the purposes of determining Idle state levels, notebooks and tablets must qualify under Categories A or B as defined below:

Category A: All notebook computers that do not meet the definition of Category B below will be considered under Category A for ENERGY STAR qualification.

Category B: To qualify under Category B notebooks <u>must</u> have:

- A GPU with a minimum of 128 megabytes of dedicated, non-shared memory.

Workstation Levels: Workstation levels will be determined using a simplified Typical Electricity Consumption (TEC) approach to allow manufacturers energy trade offs between different operating modes, based on a given weighting factor for each mode. The final level will be based on the TEC power level (P_{TEC}) which will be determined by the following formula:

$$P_{TEC} = 0.1 * P_{Standby} + 0.2 * P_{Sleep} + 0.7 * P_{Idle}$$

where, $P_{Standby}$ is the power measured in Standby, P_{Sleep} is the power measured in Sleep, and in P_{Idle} is the power measured in Idle. This P_{TEC} value will then be compared to the TEC budget which is determined by a fixed percentage of the maximum power of the system, including an adder for installed hard drives as indicated in the equation in Table 1. The test procedure for determining the maximum power of workstations can be found in Section 4 of Appendix A.

Power Level Requirements: The following tables indicate the required power allowances for the Tier 1 specification. Table 1 gives the baseline requirements, while Table 2 gives additional power allowances for WOL. For those products that meet the WOL enabling requirement for either Sleep or Standby, a model must meet the energy level provided in Table 1 summed with the appropriate allowances from Table 2. **Note: Products whose Sleep levels meet the Standby power requirements do not need to have a distinct Standby (Off mode), and may qualify for this specification using only Sleep mode.**

Table 1: Tier 1 Energy Efficiency Requirements

Product Type	Tier 1 Requirements

Desktops, Integrated Computers, Desktop-Derived Servers and Gaming Consoles	**Standby (Off Mode):** ≤ 2.0 W
	
	Sleep Mode: ≤ 4.0 W
	
	Idle State:
	    Category A: ≤ 50.0 W
	    Category B: ≤ 65.0 W
	    Category C: ≤ 95.0 W
	
	Note: Desktop-derived servers (as defined in section 1. F) are exempt from the Sleep level above.

Notebooks and Tablets	**Standby (Off Mode):** ≤ 1.0 W
	
	Sleep Mode: ≤ 1.7 W
	
	Idle State:
	    Category A: ≤ 14.0 W
	    Category B: ≤ 22.0 W

Workstations	**TEC Power (P_{TEC}):** ≤ 0.35 * [P_{Max} + (# HDDs * 5)] W *Note: Where P_{max} is the maximum power drawn by the system as tested per the test procedure in Section 4 of Appendix A, and #HDD is the number of installed hard drives in the system.*

Table 2: Tier 1 Capability Adder for Sleep and Standby

Capability	Additional Power Allowance
Wake On LAN (WOL)	+ 0.7 W for Sleep + 0.7 W for Standby

Qualifying Computers with Power Management Capabilities: The following requirements should be followed when determining whether models should be qualified with or without WOL:

Standby: Computers should be tested and reported as shipped for Standby. Models that will be shipped with WOL enabled for Standby should be tested with WOL enabled and will qualify using the extra allowance for Standby found in Table 2 above. Likewise, products shipped with WOL disabled for Standby must be tested with WOL disabled and must meet the baseline requirement for Standby found in Table 1.

Sleep: Computers should be tested and reported as shipped for Sleep. Models sold through enterprise channels, as defined in the Tier 1 Power Management Requirements (Section 3.A.3), shall be tested, qualified, and shipped WOL enabled. Products going directly to consumers through normal retail channels are not required to be shipped with WOL enabled from Sleep, and may be tested, qualified, and shipped with WOL either enabled or disabled. Those models sold

both through enterprise channels and directly to consumers must test and meet both the levels with and without WOL.

Systems where any additional management services are, at the customer's request, pre-provisioned by the manufacturer, do not need to test the systems with these functions in an active state providing the function is not actually activated until there is specific action by the end user (i.e., manufacturer should test in pre-provisioned state and does not have to consider the power use after full provisioning occurs on site).

(3) Power Management Requirements

Shipment Requirement: Products must be shipped with the display's Sleep mode set to activate within 15 minutes of user inactivity. All products, except for desktop-derived servers which are exempt from this requirement, must be shipped with a Sleep mode which is set to activate within 30 minutes of user inactivity. Products may have more than one low power mode but these proposed criteria address Sleep mode as defined in this specification. Computers shall reduce the speed of any active 1 Gb/s Ethernet network links when transitioning to Sleep or Standby.

All computers, regardless of distribution channel, shall have the ability to enable and disable WOL for Sleep mode. Systems shipped through enterprise channels must have Wake On LAN (WOL) enabled from the Sleep mode when operating on ac power (i.e. notebooks may automatically disable WOL when operating on their portable power sources). For the purpose of this specification, "enterprise channels" are defined as sales channels normally used by large and medium-sized business, government organizations, and educational institutions, with the intent of identifying machines that will be used in managed client/server environments. For all computers with WOL enabled any directed packet filters shall be enabled and set to an industry standard default configuration. Until one (or more) standards are agreed upon, partners are asked to provide their direct packet filter configurations to EPA for publication on the Website to stimulate discussion and development of standard configurations. Systems in which the Sleep mode maintains full network connectivity, providing the same fully connected network state found in Idle, can be considered to meet the WOL enabling requirement and may qualify using the corresponding WOL capability adder.

All machines shipped to enterprise customers shall be capable of both remote and scheduled wake events from Sleep mode. Manufacturers shall ensure, where the manufacturer has control (i.e., configured through hardware settings rather than software settings), that these settings can be managed centrally, as the client wishes, with tools provided by the manufacturer**.**

User Information Requirement: In order to ensure that purchasers/users are properly informed on the benefits of power management, the manufacturer will include with each computer, one of the following:

- Information on ENERGY STAR and the benefits of power management in either a hard copy or electronic copy of the user manual. This information should be near the front of the user guide; or
- A package or box insert on ENERGY STAR and the benefits of power management.

Either option must at least include the following information:

- Notice that the computer has been shipped enabled for power management and what the time settings are; and
- How to properly wake the computer from Sleep mode;

(B) Tier 2 Requirements - Effective January 1, 2009

(1a) Tier 2 Energy Efficiency Performance Metric. All computers will be required to meet the

following minimum performance per unit energy metric:

Energy Efficiency Performance Software and Associated Levels: **TBD**

- OR -

(1b) Provisional Tier 2 Idle State Requirements. If an energy efficiency performance metric and associated performance levels are not ready to go into effect **by January 1, 2009**, a provisional Tier 2 specification will automatically go into effect and will remain in effect until such a benchmark is established. This provisional Tier 2 will include revised Idle state levels for all computer types (those included in Tier 1 as well as others as appropriate [e.g., thin clients]) with the intention of capturing the top 25% performers in energy efficiency.

Additional topics, including the following, will also be re-examined under a provisional Tier 2:

- Idle levels for notebooks and integrated computers that incorporate the energy use of the displays;

- Quantitative distinctions between desktop categories (e.g., megabytes of video memory, number of processor cores, megabytes of system memory) to ensure that these distinctions remain current;

- Sleep levels for desktop-derived servers; and

- Allowances for additional management tools, such as service processors in Sleep and Standby, which may aid in the adoption of computer power management.

In the case of the implementation of a provisional Tier 2, EPA and the European Commission will re-examine these new topics and finalize new levels at least six months prior to the effective date for Tier 2.

(2) Power Management Requirements: In addition to the requirements provided under Tier 1, above, ENERGY STAR qualified computers must maintain full network connectivity while in Sleep mode, according to a platform-independent industry standard. 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.

C) Voluntary Requirements

User Interface: Although not mandatory, manufacturers are strongly recommended to design products in accordance with the Power Control User Interface Standard — IEEE 1621 (formally known as "Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments"). Compliance with IEEE 1621 will make power controls more consistent and intuitive across all electronic devices. For more information on the standard see http://eetd.LBL.gov/Controls.

4) **Test Procedures:** Manufacturers are required to perform tests and self-certify those models that meet the ENERGY STAR guidelines.

- In performing these tests, partner agrees to use the test procedures provided in Table 3, below.

- The test results must be reported to EPA or the European Commission, as appropriate.

Additional testing and reporting requirements are provided below.
A. Number of Units Required for Idle Testing: Manufacturers may initially test a single unit for

qualification. If the initial unit tested meets the maximum power level for Idle but falls within 10% of that level, one additional unit of the same model with an identical configuration must also be tested. Manufacturers shall report Idle values for both units. To qualify as ENERGY STAR, both units must meet the maximum Idle level for that product category. **Note:** This additional testing is only required for Idle qualification – only one unit is required to be tested for Sleep and Standby. The following example further illustrates this approach:

Category A desktops must meet an Idle level of 50 watts or less, making 45 Watts the 10% threshold for additional testing. The following scenarios could then occur when testing a model for qualification:

- If the first unit is measured at 44 watts, no more testing is needed and the model qualifies (44 watts is 12% more efficient than the specification and is therefore "outside" the 10% threshold).
- If the first unit is measured at 45 watts, no more testing is needed and the model qualifies (45 watts is exactly 10% more efficient than the specification).
- If the first unit is measured at 47 watts, then an additional unit must be tested to determine qualification (47 Watts is only 6% more efficient than the specification and is "within" the 10% threshold).
- If the two units are then tested at 47 and 51 watts, the model does not qualify as ENERGY STAR—even though the average is 49 watts— because one of the values (51) exceeds the ENERGY STAR specification.
- If the two units are then tested at 47 and 49 watts, the model does qualify as ENERGY STAR because both values meet the ENERGY STAR specification of 50 watts.

B. Models Capable of Operating at Multiple Voltage/Frequency Combinations: Manufacturers shall test their products based on the market(s) in which the models will be sold and promoted as ENERGY STAR qualified. EPA and its ENERGY STAR Country Partners have agreed upon a table with three voltage/frequency combinations for testing purposes. Please refer to the Test Conditions in the Test Procedure (Appendix A) for details regarding international voltage/frequency combinations for each market.

For products that are sold as ENERGY STAR in multiple international markets and, therefore, rated at multiple input voltages, the manufacturer must test at and report the required power consumption or efficiency values at all relevant voltage/frequency combinations. For example, a manufacturer that is shipping the same model to the United States and Europe must measure, meet the specification, and report test values at both 115 Volts/60 Hz and 230 Volts/50 Hz in order to qualify the model as ENERGY STAR in both markets. If a model qualifies as ENERGY STAR at only one voltage/frequency combination (e.g., 115 Volts/60 Hz), then it may only be qualified and promoted as ENERGY STAR in those regions that support the tested voltage/frequency combination (e.g., North America and Taiwan).

Table 3: Test Procedures for Measuring Operational Modes

Specification Requirement	Test Protocol	Source
Standby (Off Mode), Sleep Mode, Idle State and Maximum Power	ENERGY STAR Computer Test Method (Version 4.0)	Appendix A

Power Supply Efficiency	IPS: Internal Power Supply Efficiency Protocol EPS: ENERGY STAR Test Method for External Power Supplies	IPS: www.efficientpowersupplies.org EPS: www.energystar.gov/powersupplies

C. Qualifying Families of Products: Models that are unchanged or that differ only in finish from those sold in a previous year may remain qualified without the submission of new test data assuming the specification remains unchanged. If a product model is offered in the market in multiple configurations or styles, as a product "family" or series, the partner may report and qualify the product under a single model number, as long as all of the models within that family or series meet either of the following requirements:

- Computers that are built on the same platform and are identical in every respect except for housing and color may be qualified through submission of test data for a single, representative model.

- If a product model is offered in the market in multiple configurations, the partner may report and qualify the product under a single model number that represents the highest power configuration available in the family, rather than reporting each and every individual model in the family. In this case, the highest configuration would consist of: the highest power processor, the maximum memory configuration, the highest power GPU, etc. For desktop systems which meet the definition for multiple desktop categories (as defined in section 3.A.2) depending on the specific configuration, manufacturers will have to submit the highest power configuration for each category under which they would like the system to qualify. For example, a system that could be configured either as a Category A or a Category B desktop would require a submittal of the highest power configuration for both categories in order to qualify as ENERGY STAR. If a product could be configured to meet all three categories, it would then have to submit data for the highest power configuration in all categories. Manufacturers will be held accountable for any efficiency claims made about all other models in the family, including those not tested or for which data was not reported.

5) Effective Date: The date that manufacturers may begin to qualify products as ENERGY STAR, under this Version 4.0 specification, will be defined as the *effective date* of the agreement. Any previously executed agreement on the subject of ENERGY STAR qualified computers shall be terminated effective July 19, 2007.

1. Qualifying Products Under Tier 1 of the Version 4.0 Specification: The first phase of this specification will commence on **July 20, 2007**. All products, including models originally qualified under Version 3.0, with a **date of manufacture** on or after **July 20, 2007**, must meet the new (Version 4.0) requirements in order to qualify for ENERGY STAR. The **date of manufacture** is specific to each unit and is the date (e.g., month and year) of which a unit is considered to be completely assembled.

2. Qualifying Products Under Tier 2 of the Version 4.0 Specification: The second phase of this specification, Tier 2, will commence on **January 1, 2009**. All products, including models originally qualified under Tier 1, with a **date of manufacture** on or after **January 1, 2009**, must meet the Tier 2 requirements in order to qualify for ENERGY STAR.

3. Elimination of Grandfathering: EPA will not allow grandfathering under this Version 4.0 ENERGY STAR specification. **ENERGY STAR qualification under previous versions is not automatically granted for the life of the product model.** Therefore, any product sold,

marketed, or identified by the manufacturing partner as ENERGY STAR must meet the current specification in effect at the time of manufacture of the product.

6) <u>Future Specification Revisions</u>: EPA reserves the right to revise the specification should technological and/or market changes affect its usefulness to consumers or industry or its impact on the environment. In keeping with current policy, revisions to the specification will be discussed with stakeholders. In the event of a specification revision, please note that ENERGY STAR qualification is not automatically granted for the life of a product model. To qualify as ENERGY STAR, a product model must meet the ENERGY STAR specification in effect on the model's date of manufacture.

APPENDIX A
ENERGY STAR Test Procedure for Determining the
Power Use of Computers in Standby, Sleep, Idle and Maximum Power

The following protocol should be followed when measuring power consumption levels of computers for compliance with the Standby, Sleep, and Idle levels provided in the ENERGY STAR Version 4.0 Computer Specification. Partners must measure a representative sample of the configuration as shipped to the customer. However, the Partner does not need to consider power consumption changes that may result from component additions, BIOS and/or software settings made by the computer user after sale of product. *This procedure is intended to be followed in order and the mode being tested is labeled where appropriate.*

I. **Definitions**

Unless otherwise specified, all terms used in this document are consistent with the definitions contained in the Version 4.0 ENERGY STAR Eligibility Criteria for Computers.

UUT
UUT is an acronym for "unit under test," which in this case refers to the computer being tested.

UPS
UPS is an acronym for "Uninterruptible Power Supply," which refers to a combination of converters, switches and energy storage means, for example batteries, constituting a power supply for maintaining continuity of load power in case of input power failure.

II. **Testing Requirements**

Approved Meter
Approved meters will include the following attributes[1]:

- Power resolution of 1 mW or better;
- An available current crest factor of 3 or more at its rated range value; and
- Lower bound on the current range of 10mA or less.

The following attributes in addition to those above are suggested:

- Frequency response of at least 3 kHz; and
- Calibration with a standard that is traceable to the U.S. National Institute of Standards and Technology (NIST).

It is also desirable for measurement instruments to be able to average power accurately over any user selected time interval (this is usually done with an internal math's calculation dividing accumulated energy by time within the meter, which is the most accurate approach). As an alternative, the measurement instrument would have to be capable of integrating energy over any user selected time interval with an energy resolution of less than or equal to 0.1 mWh and integrating time displayed with a resolution of 1 second or less.

Accuracy
Measurements of power of 0.5 W or greater shall be made with an uncertainty of less than or equal to 2% at the 95% confidence level. Measurements of power of less than 0.5 W shall be made with an

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[1] *Characteristics of approved meters taken from IEC 62301 Ed 1.0: Measurement of Standby Power*

uncertainty of less than or equal to 0.01 W at the 95% confidence level. The power measurement instrument shall have a resolution of:

- 0.01 W or better for power measurements of 10 W or less;
- 0.1 W or better for power measurements of greater than 10 W up to 100 W; and
- 1 W or better for power measurements of greater than 100 W.

All power figures should be in watts and rounded to the second decimal place. For loads greater than or equal to 10 W, three significant figures shall be reported.

Test Conditions

Supply Voltage:	North America/Taiwan:	115 (± 1%) Volts AC, 60 Hz (± 1%)
	Europe/Australia/New Zealand:	230 (± 1%) Volts AC, 50 Hz (± 1%)
	Japan:	100 (± 1%) Volts AC, 50 Hz (± 1%)/60 Hz (± 1%)
		Note: For products rated for > 1.5 kW maximum power, the voltage range is ± 4%
Total Harmonic Distortion (THD) (Voltage):	< 2% THD (< 5% for products which are rated for > 1.5 kW maximum power)	
Ambient Temperature:	23°C ± 5°C	
Relative Humidity:	10 – 80 %	

(Reference IEC 62301: Household Electrical Appliances – Measurement of Standby Power, Sections 3.2, 3.3)

Test Configuration
Power consumption of a computer shall be measured and tested from an ac source to the UUT.

The UUT must be connected to an Ethernet network switch capable of the UUT's highest and lowest network speeds. The network connection must be live during all tests.

III. **Test Procedure for Standby, Sleep and Idle for All Products**

Measurement of ac power consumption of a computer should be conducted as follows:

UUT Preparation
1. Record the manufacturer and model name of the UUT.
2. Ensure that the UUT is connected to a live Ethernet (IEEE 802.3) network switch as specified in Section II., "Test Configuration," above, and that the connection is live. The computer must maintain this live connection to the switch for the duration of testing, disregarding brief lapses when transitioning between link speeds.
3. Connect an approved meter capable of measuring true power to an ac line voltage source set to the appropriate voltage/frequency combination for the test.
4. Plug the UUT into the measurement power outlet on the meter. No power strips or UPS units should be connected between the meter and the UUT. For a valid test to take place the meter should remain in place until all Standby, Sleep, and Idle power data is recorded.
5. Record the ac voltage.
6. Boot computer and wait until the operating system has fully loaded.
7. If necessary, run the initial operating system setup and allow all preliminary file indexing and other one-time/periodic processes to complete.

8. Record basic information about the computer's configuration – computer type, operating system name and version, processor type and speed, and total and available physical memory, etc.[2]
9. Record basic information about the video card - video card name, resolution, amount of onboard memory, and bits per pixel.[3]
10. Ensure that the UUT is configured as shipped including all accessories, power management settings, WOL enabling and software shipped by default. UUT should also be configured using the following requirements for all tests:
    a. Desktop systems (including workstations and desktop-derived servers) shipped without accessories should be configured with a standard mouse, keyboard and external monitor.
    b. Notebooks and tablets should include all accessories shipped with the system, and need not include a separate keyboard or mouse when equipped with an integrated pointing device or digitizer.
    c. Notebooks and tablets should have the battery pack(s) removed for all tests. For systems where operation without a battery pack is not a supported configuration, the test may be performed with fully charged battery pack(s) installed, making sure to report this configuration in the test results.
    d. Power to wireless radios should be turned off for all tests. This applies to wireless network adapters (e.g., 802.11) or device-to-device wireless protocols.
11. The following guidelines should be followed to configure power settings for displays (adjusting no other power management settings):
    a. For computers with external displays (most desktops): use the monitor power management settings to prevent the monitor from powering down to ensure it stays on for the full length of the Idle test as described below.
    b. For computers with integrated monitors (notebooks, tablets and integrated systems): use the power management settings to set the monitor to power down after 1 minute.
12. Shut down the computer.

Standby (Off Mode) Testing
13. With the UUT shut down and in Standby, set the meter to begin accumulating true power values at an interval of 1 reading per second. Accumulate power values for 5 additional minutes and record the average (arithmetic mean) value observed during that 5 minute period.[4]

Idle Mode Testing
14. Switch on the computer and begin recording elapsed time, starting either when the computer is initially switched on, or immediately after completing any log in activity necessary to fully boot the system. Once logged in with the operating system fully loaded and ready, close any open windows so that the standard operational desktop screen or equivalent ready screen is displayed. Exactly 15 minutes after the initial boot or log in, set the meter to begin accumulating true power values at an interval of 1 reading per second. Accumulate power values for 5 additional minutes and record the average (arithmetic mean) value observed during that 5 minute period.

Sleep Mode Testing
15. After completing the Idle measurements, place the computer in Sleep mode. Reset the meter (if necessary) and begin accumulating true power values at an interval of 1 reading per second. Accumulate power values for 5 additional minutes and record the average (arithmetic mean) value observed during that 5 minute period.

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[2] On Windows-based machines, much of this information can be found by selecting the following window: Start / Programs / Accessories / System Tools / System Information.

[3] *On Windows-based machines, this can be found by selecting the following window: Start / Programs / Accessories / System Tools / Components / Display.*

[4] *Laboratory-grade, full-function meters can integrate values over time and report the average value automatically. Other meters would require the user to capture a series of changing values every 5 seconds for a five minute period and then compute the average manually.*

16. If testing both WOL enabled and WOL disabled for Sleep, wake the computer and change the WOL from Sleep setting through the operating system settings or by other means. Place the computer back in Sleep mode and repeat step 14, recording Sleep power necessary for this alternate configuration.

Reporting Test Results
17. The test results must be reported to EPA or the European Commission, as appropriate, taking care to ensure that all required information has been included.

IV. **Maximum Power Test for Workstations**

The maximum power for workstations is found by the simultaneous operation of two industry standard benchmarks: Linpack to stress the core system (e.g., processor, memory, etc.) and SPECviewperf® (version 9.x or higher) to stress the system's GPU. Additional information on these benchmarks, including free downloads, can be found at the URLs found below:

Linpack	http://www.netlib.org/linpack/
SPECviewperf®	http://www.spec.org/benchmarks.html#gpc

This test must be repeated three times on the same UUT, and all three measurements must fall within a ± 2% tolerance relative to the average of the three measured maximum power values.

Measurement of the maximum ac power consumption of a workstation should be conducted as follows:

UUT Preparation
1. Connect an approved meter capable of measuring true power to an ac line voltage source set to the appropriate voltage/frequency combination for the test. The meter should be able to store and output the maximum power measurement reached during the test or be capable of another method of determining maximum power.
2. Plug the UUT into the measurement power outlet on the meter. No power strips or UPS units should be connected between the meter and the UUT.
3. Record the ac voltage.
4. Boot the computer and, if not already installed, install Linpack and SPECviewperf as indicated on the above Websites.
5. Set Linpack with all the defaults for the given architecture of the UUT and set the appropriate array size "n" for maximizing power draw during the test.
6. Ensure all guidelines set by the SPEC organization for running SPECviewperf are being met.

Maximum Power Testing
7. Set the meter to begin accumulating true power values at an interval of 1 reading per second, and begin taking measurements. Run SPECviewperf and as many simultaneous instances of Linpack as needed to fully stress the system.
8. Accumulate power values until SPECviewperf and all instances have completed running. Record the maximum power value attained during the test.

Reporting Test Results
9. The test results must be reported to EPA or the European Commission, taking care to ensure that all required information has been included.
10. Upon submittal of data, manufacturers must also include the following data:
    a. Value of the n (the array size) used for Linpack,
    b. Number of simultaneous copies of Linpack run during the test,
    c. Version of SPECviewperf run for test,
    d. All compiler optimizations used in compiling Linpack and SPECviewperf, and

e. A precompiled binary for end users to download and run of both SPECviewperf and Linpack. These can be distributed either through a centralized standards body such as SPEC, by the OEM or by a related third party.

V. **Continuing Verification**

This testing procedure describes the method by which a single unit may be tested for compliance. An ongoing testing process is highly recommended to ensure that products from different production runs are in compliance with ENERGY STAR.