ENERGY STAR® Program Requirements for Computers

Version 5.0
DRAFT 3

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ENERGY STAR® Program Requirements for Computers

Partner Commitments
Version 5.0
DRAFT 3

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 ENERGY STAR Eligibility Criteria, 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 ENERGY STAR Identity Guidelines, 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;

     Electronic Labeling Option: 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.

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

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

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

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

105
106   •   agree to complete steps to educate users of their products about the benefits of power management
107   by including the following information, in addition to that described in the User Information
108   Requirements found in the ENERGY STAR Eligibility Criteria (Section 3.C), with each computer (i.e.,
109   in the user manual or on a box insert):
110
111   1. Energy saving potential;

112   2. Financial saving potential;

113   3. Environmental benefits;

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

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

117   In addition, a link should be made available to www.energystar.gov/powermanagement from computer
118   product pages, product specifications, and related content pages.
119
120   At the manufacturer's request, EPA will supply suggested facts and figures related to the above
121   criteria, template elements, or a complete template suitable for use in user guides or box inserts.
122
123   •   provide to EPA, on an annual basis, an updated list of ENERGY STAR qualified computer models.
124   Once the Partner submits its first list of ENERGY STAR qualified computer models, the Partner will be
125   listed as an ENERGY STAR Partner. Partner must provide annual updates in order to remain on the
126   list of participating product manufacturers;
127
128   •   provide to EPA, on an annual basis, unit shipment data or other market indicators to assist in
129   determining the market penetration of ENERGY STAR. Specifically, Partner must submit the total
130   number of ENERGY STAR qualified computers shipped (in units by model) or an equivalent
131   measurement as agreed to in advance by EPA and Partner. Partner is also encouraged to provide
132   ENERGY STAR qualified unit shipment data segmented by meaningful product characteristics (e.g.,
133   capacity, size, speed, or other as relevant), total unit shipments for each model in its product line, and
134   percent of total unit shipments that qualify as ENERGY STAR. The data for each calendar year
135   should be submitted to EPA, preferably in electronic format, no later than the following March and may
136   be provided directly from the Partner or through a third party. The data will be used by EPA only for
137   program evaluation purposes and will be closely controlled. Any information used will be masked by
138   EPA so as to protect the confidentiality of the Partner;
139
140   •   notify EPA of a change in the designated responsible party or contacts for computers within 30 days.
141
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143   **Performance for Special Distinction**

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

147

- 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 displays 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;

- join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. SmartWay Transport works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway;

- join EPA's Climate Leaders Partnership to inventory and reduce greenhouse gas emissions. Through participation, companies create a credible record of their accomplishments and receive EPA recognition as corporate environmental leaders. For more information on Climate Leaders, visit www.epa.gov/climateleaders;

- join EPA's Green Power partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities, visit http://www.epa.gov/grnpower.

Below is the Version 5.0 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. Computer: 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 computer display screen to output information. For the purposes of this specification, computers include both stationary and portable units, including desktop computers, gaming consoles, integrated desktop computers, notebook computers, small-scale servers, thin clients, and workstations. Although computers must be capable of using input devices and computer 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. Computer Display: A display screen and its associated electronics encased in a single housing, or within the computer housing (e.g., notebook or integrated desktop 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 computer display technologies are the cathode-ray tube (CRT) and liquid crystal display (LCD).

Note: EPA is actively revising the ENERGY STAR Displays specification (previously "Monitors") and is scheduled to finalize that specification in early 2009. Due to the earlier finalization date of the Computers specification, and to avoid inconsistency with the definition of "Display" to be included in the revised ENERGY STAR Displays specification, EPA has used the more specific term "Computer Display" where requirements impact computer display behavior (e.g. power management, test procedure, etc.). The definition of "Display" in the ENERGY STAR Displays specification is more general, comprising additional products not necessarily used with computers.

The Computer Display definition is derived from applicable portions of the ENERGY STAR Displays definition.

C. Discrete Graphics Processing Unit (GPU): A graphics display device with a local memory controller interface and a local, graphics-specific memory.

Note: The definition above has been added to the specification based on a stakeholder comment and to compliment the Draft 2 definition for Integrated GPU. EPA encourages stakeholders to comment on the applicability of this definition and any suggested revisions.

D. External Power Supply: 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.

E. Integrated Graphics Processing Unit (GPU): A graphics processing unit (GPU) connected directly to an internal peripheral controller device or to internal peripheral devices (storage, network, etc.).

250   A discrete GPU does not comply with the definition of an integrated GPU.
251
252   F.   Internal Power Supply: A component internal to the computer casing and designed to convert ac
253   voltage from the mains to dc voltage(s) for the purpose of powering the computer components.
254   For the purposes of this specification, an internal power supply must be contained within the
255   computer casing but be separate from the main computer board. The power supply must connect
256   to the mains through a single cable with no intermediate circuitry between the power supply and
257   the mains power. In addition, all power connections from the power supply to the computer
258   components, with the exception of a DC connection to a computer display in an Integrated
259   Desktop Computer, must be internal to the computer casing (i.e., no external cables running from
260   the power supply to the computer or individual components). Internal dc-to-dc converters used to
261   convert a single dc voltage from an external power supply into multiple voltages for use by the
262   computer are not considered internal power supplies.
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265   **Computer Types**
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267   G.   Desktop Computer: A computer where the main unit is intended to be located in a permanent
268   location, often on a desk or on the floor. Desktops are not designed for portability and utilize an
269   external computer display, keyboard, and mouse. Desktops are designed for a broad range of
270   home and office applications.
271
272   H.   Small-Scale Server: A computer that typically uses desktop components in a desktop form factor,
273   but is designed explicitly to be a storage host for other computers. A computer must have the
274   following characteristics to be considered a Small-Scale Server:
275
276   •   Designed in a pedestal, tower, or other form factor similar to those of desktop computers such
277   that all data processing, storage, and network interfacing is contained within one box/product;
278   •   Intended to be operational 24 hours/day and 7 days/week, and unscheduled downtime is
279   extremely low (on the order of hours/year);
280   •   Capable of operating in a simultaneous multi-user environment serving several users through
281   networked client units; and
282   •   Designed for an industry accepted operating system for home or low-end server applications
283   (e.g., Windows Home Server, Mac OS X Server, Linux, UNIX and Solaris).
284
285   Small-Scale Servers are designed to perform functions such as providing network infrastructure
286   services (e.g., archiving) and hosting data/media. These products are not designed to process
287   information for other systems or run web servers as a primary function.
288
289   This specification does not cover Enterprise Server computers as defined in the ENERGY STAR
290   Version 1.0 Enterprise Server specification. Small-Scale Servers covered by this specification are
291   limited to computers marketed for non-datacenter operation (e.g. homes, small offices).
292

Note: EPA received comments that certain products in desktop form factors could fit both the Draft 2 Enterprise Server definition and the one above. To clarify, the last clause of the definition is intended to make clear that products falling under the scope of the Enterprise Server specification are not covered by this V5.0 Computer specification. An additional clarification has been added to the definition, stating that Small-Scale Servers must be marketed for use outside the datacenter. Also changed was the characteristic requirement on operating systems to account for small-scale servers shipped without pre-installed operating systems.

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300   I.   Game Console: A standalone computer-like device whose primary use is to play video games.
301   Game consoles use a hardware architecture based in part on typical computer components (e.g.,
302   processors, system memory, video architecture, optical and/or hard drives, etc.). The primary
303   input for game consoles are special hand held controllers rather than the mouse and keyboard
304   used by more conventional computer types. Game consoles are also equipped with audio visual
305   outputs for use with televisions as the primary display, rather than (or in addition to) an external or

306		integrated display. These devices do not typically use a conventional PC operating system, but
307		often perform a variety of multimedia functions such as: DVD/CD playback, digital picture viewing,
308		and digital music playback.
309		
310	J.	<u>Integrated Desktop Computer</u>: A desktop system in which the computer and computer display
311		function as a single unit which receives its ac power through a single cable. Integrated desktop
312		computers come in one of two possible forms: (1) a system where the computer display and
313		computer are physically combined into a single unit; or (2) a system packaged as a single system
314		where the computer display is separate but is connected to the main chassis by a dc power cord
315		and both the computer and computer display are powered from a single power supply. As a
316		subset of desktop computers, integrated desktop computers are typically designed to provide
317		similar functionality as desktop systems.
318		
319	K.	<u>Thin Client:</u> An independently-powered computer that relies on a connection to remote computing
320		resources to obtain primary functionality. Main computing (e.g., program execution, data storage,
321		interaction with other Internet resources, etc.) takes place using the remote computing resources.
322		Thin Clients covered by this specification are limited to devices with no rotational storage media
323		integral to the computer. The main unit of a Thin Client covered by this specification must be
324		intended for location in a permanent location (e.g. on a desk) and not for portability.
325		
326	L.	<u>Notebook Computer</u>: A computer designed specifically for portability and to be operated for
327		extended periods of time either with or without a direct connection to an ac power source.
328		Notebooks must utilize an integrated computer display and be capable of operation off an
329		integrated battery or other portable power source. In addition, most notebooks use an external
330		power supply and have an integrated keyboard and pointing device. Notebook computers are
331		typically designed to provide similar functionality to desktops, including operation of software
332		similar in functionality as that used in desktops. For the purposes of this specification, docking
333		stations are considered accessories and therefore, the performance levels associated with
334		notebooks presented in Section 3, below, do not include them. Tablet PCs, which may use touch-
335		sensitive screens along with or instead of other input devices, are considered Notebook
336		Computers in this specification.
337		

338 339 340 341	**Note**: Tablet PCs fall under the same requirements as other Notebook Computers, both as proposed in this draft and in Version 4.0. To simplify specification terminology, "Notebook" now encompasses Tablet PCs in this specification, and the final sentence in the Notebook Computer definition above is added to this end.

342		
343	M.	<u>Workstation</u>: A high-performance, single-user computer typically used for graphics, CAD, software
344		development, financial and scientific applications among other compute intensive tasks. To qualify
345		as a workstation, a computer must:
346		

347   • Be marketed as a workstation;

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

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

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

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

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

356   • Does not support Uniform Memory Access (UMA) graphics;

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

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

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

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365 **Operational Modes**
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367 N. Off Mode: The power consumption level in the lowest power mode which cannot be switched off
368   (influenced) by the user and that may persist for an indefinite time when the appliance is
369   connected to the main electricity supply and used in accordance with the manufacturer's
370   instructions. For systems where ACPI standards are applicable, Off Mode correlates to ACPI
371   System Level S5 state.
372
373 O. Sleep Mode: A low power state that the computer is capable of entering automatically after a
374   period of inactivity or by manual selection. A computer with sleep capability can quickly "wake" in
375   response to network connections or user interface devices with a latency of ≤ 5 seconds from
376   initiation of wake event to system becoming fully usable including rendering of display. For
377   systems where ACPI standards are applicable, Sleep mode most commonly correlates to ACPI
378   System Level S3 (suspend to RAM) state.
379
380 P. Idle State: The state in which the operating system and other software have completed loading, a
381   user profile has been created, the machine is not asleep, and activity is limited to those basic
382   applications that the system starts by default.
383
384 Q. Active State: The state in which the computer is carrying out useful work in response to a) prior or
385   concurrent user input or b) prior or concurrent instruction over the network. This state includes
386   active processing, seeking data from storage, memory, or cache, including idle state time while
387   awaiting further user input and before entering low power modes.
388
389 R. Typical Energy Consumption (TEC): A method of testing and comparing the energy performance
390   of computers, which focuses on the typical electricity consumed by a product while in normal
391   operation during a representative period of time. The key criterion of the TEC approach for
392   computers is a value for typical annual electricity use, measured in kilowatt-hours (kWh), using
393   measurements of average operational mode power levels scaled by an assumed typical usage
394   model (duty cycle).
395
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397 **Networking and Power Management**
398
399 S. Network Interface: The components (hardware and software) whose primary function is to make
400   the computer capable of communicating over one or more network technologies. Network
401   Interface refers to IEEE 802.3 (Ethernet) or IEEE 802.11 (Wi-Fi).
402
403 T. Wake Event: A user, scheduled, or external event or stimulus that causes the computer to
404   transition from Sleep or Off to active mode of operation. Examples of wake events include, but are
405   not limited to: movement of the mouse, keyboard activity, controller input, real-time clock event, or
406   a button press on the chassis, and in the case of external events, stimulus conveyed via a remote
407   control, network, modem, etc.
408
409 U. Wake On LAN (WOL): Functionality which allows a computer to wake from Sleep or Off when
410   directed by a network request.
411
412 V. Full Network Connectivity: The ability of the computer to maintain network presence while in sleep

413	and intelligently wake when further processing is required. Maintaining network presence may
414	include obtaining and/or defending an assigned interface or network address, responding to
415	requests from other nodes on the network, or sending periodic network presence messages to the
416	network all while in the sleep state. In this fashion, presence of the computer, its network services
417	and applications, is maintained even though the computer is in sleep. (Note: More information on
418	this can be found at: http://efficientnetworks.lbl.gov/enet-proxying.html)

Marketing and Shipment Channels

W. <u>Enterprise Channels</u>: Sales channels normally used by large and medium-sized business, government organizations, educational institutions, or other organizations purchasing computers used in managed client/server environments.

X. <u>Model Number</u>: A unique marketing name that applies to a specific configuration that is either pre-defined, or a configuration that is selected by the customer.

Y. <u>Model Name</u>: A marketing name that includes reference to both the PC model family number, a short description of the product, or branding references.

Z. <u>Product Family</u>: A high-level description referring to a group of computers typically sharing one chassis/motherboard combination that often contains hundreds of possible hardware and software configurations.

> **Note**: Stakeholders requested definitions for Model Name, Model Number, and Product Family in Version 5.0 to support labeling and marketing requirements in the specification. EPA has included initial proposals for these three terms above, and encourages stakeholder comments to help solidify these definitions such that the terms are meeting the needs of industry.

2) Qualifying Products: 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. The following table provides a list of the types of computers that are (and are not) eligible for ENERGY STAR.

Products Covered by Version 5.0 Specification	Products Not Covered by Version 5.0 Specification
- Desktop Computers - Integrated Desktop Computers - Notebook Computers - Workstations - Game Consoles - Small-Scale Servers - Thin Clients	- Computer Servers (as defined in Version 1.0 computer server specification) - Handhelds, PDAs, and Smartphones

In order to conduct testing in support of qualification for ENERGY STAR, the computer must be tested in a laboratory that is accredited by an accreditation body that is a signatory, in good standing, to a mutual recognition arrangement of a laboratory accreditation cooperation (i.e. ILAC, APLAC, etc.) that verifies, by evaluation and peer assessment, that its signatory members are in full compliance with ISO/IEC 17011 and that their accredited laboratories comply with ISO/IEC 17025.

Laboratories must be specifically qualified to carry out tests to determine whether computers meet the Computer Key Product Criteria as outlined in the ENERGY STAR Program Requirements for Computers.

> **Note**: The text above reflects the laboratory requirements section of the draft Verification Testing procedures manual to be applied to all laboratories used to acquire ENERGY STAR test data in accordance with verification requirements. EPA is proposing applying this definition to laboratory requirements associated with product qualification. It is EPA's intention to apply this definition to all relevant product specifications.

3) Energy Efficiency and Power Management Criteria: Computers must meet the requirements below to qualify as ENERGY STAR. The Version 5.0 effective date is covered in Section 5 of this specification.

(A) Power Supply Efficiency Requirements - Requirements are applicable to all product categories covered by the ENERGY STAR Computer Specification:

Computers Using an Internal Power Supply: 85% minimum efficiency at 50% of rated output and 82% minimum efficiency at 20% and 100% of rated output, with Power Factor $\geq$ 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 External Ac-Ac and Ac-Dc Power Supplies, Version 2.0. 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.

(B) Efficiency and Performance Requirements:

1) Desktop, Integrated Desktop, and Notebook Levels:

Desktop Categories for TEC Criteria: For the purposes of determining TEC levels, desktops and integrated desktops 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:

- Greater than or equal to 2 Cores.

  In addition to the requirement above, models qualifying under Category B must be configured with a minimum of 1 of the following 2 characteristics:

- Greater than 2 gigabytes (GB) of system memory; and/or

- A Discrete GPU.

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

- Greater than 2 Cores; and

- Greater than 2 gigabytes (GB) of system memory; and

- A Discrete GPU.

Note: EPA received comments from stakeholders on the Draft 2 three-tier proposal for desktop categorization both at the September 26 meeting and in comments since Draft 2 release. Among the suggestions, the Information Technology Industry Council (ITI) membership provided an alternative proposal with different hardware characteristics determining the three categories. EPA closely evaluated this proposal in development of the Draft 3 requirements. EPA supports the industry's desire to ensure that a binning system accurately describes entry-level products, midrange, and high-end performance systems. The proposal above was developed to balance bins based on the previously-mentioned characteristics with the need to create meaningful delineations for the life of the Version 5.0 specification.

The option provided in Category B represents a balance between integrated graphics (which rely on shared system memory for graphics capability) with lower-end discrete graphics cards. Category C, again reflecting presence of Discrete GPU, represents performance systems both in the near-term and through the life of the specification, when higher core count processors and 64-bit operating systems allowing for utilization of increasing amounts of system memory become increasingly mainstream. All proposed characteristics were supported by characteristics present in the stakeholder-supplied dataset used for level setting.

509	**Notebook Categories for TEC Criteria:** For the purposes of determining TEC levels,
510	notebooks must qualify under Categories A or B as defined below:
511	
512	**Category A:** All notebook computers that do not meet the definition of Category B below
513	will be considered under Category A for ENERGY STAR qualification.
514	
515	**Category B:** To qualify under Category B, notebooks <u>must</u> have:
516	▪ A Discrete GPU.

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Note: Draft 2 proposed a similar two-tier structure for notebooks, but with notebooks with low end discrete GPUs (characterized by a Frame Buffer Width 64-bit or less), falling into the entry-level Category A. As for desktops, ITI members provided an alternative proposal for categorization. Under this proposal, all notebooks with discrete GPUs fell under a higher end category B which industry communicated continuing to reflect the market. The approach above takes this consideration into account.

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In the Draft 2 comments, stakeholders also suggested that "Netbooks," an emerging category of notebook computer typically characterized by low-cost and a smaller form factor, be addressed in a separate category from those categories proposed in Draft 2. EPA agrees with stakeholders that these products could carry a distinct set of capabilities, but did not feel confident that with the limited dataset available at this time and uncertainty surrounding the definition of a Netbook, fair requirements could be set for Version 5.0. EPA intends to follow this product category as this market continues to mature. In this Draft 3 Specification, Netbooks identified by stakeholders in the dataset were excluded for level-setting purposes; these products represented 11 out of 191 non-duplicate systems in the notebook dataset.

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While it is EPA's belief that most Netbooks will fall under Category A for 5.0 qualification based on characterizations of current products containing integrated GPUs, Netbooks will be evaluated under the appropriate category based on their features.

535	**TEC (Desktop and Notebook product categories):** The following tables indicate the required
536	TEC levels for the 5.0 Specification. Table 1 below lists TEC requirements for Version 5.0,
537	while Table 2 gives weightings for each operational mode by product type. TEC will be
538	determined using the formula below:
539	
540	

$$E_{annual} = (8760/1000) * (P_{off} * T_{off} + P_{sleep} * T_{sleep} + P_{idle} * T_{idle})$$

541	
542	where all P_x are power values in watts, all T_x are Time values in % of year, and the TEC E_{annual}
543	is in units of kWh.
544	

Table 1: Annual Energy Consumption

	Desktops and Integrated Computers (kWh)	Notebook Computers (kWh)
TEC (kWh)	**Category A**: ≤ 153 **Category B**: ≤ 175 **Category C**: ≤ 243	**Category A**: ≤ 36.5 **Category B**: ≤ 50.7
Capability Adjustments		
Memory	1 kWh (per GB over 2)	0.4 kWh (per GB over 4)
Premium Graphics (*for Discrete GPUs with specified Frame Buffer Widths*)	28 kWh (FB Width > 128-bit)	3 kWh (64-bit < FB Width ≤ 128-bit)
		13 kWh (FB Width > 128-bit)
Additional Storage	25 kWh	1 kWh

| 545 | |
| 546 | *(see note on next page)* |

547 Note: The TEC levels reflect both the categorization presented in Draft 3 and maintenance of a near-25%
548 compliance level of tested systems in the dataset. Additionally, the capability adjustments were refined based on
549 additional data made available to EPA after Draft 2. Further details on the analysis used to develop these numbers
550 is provided in a companion document, "ENERGY STAR Notes on Draft 3 Data.doc," distributed with this
specification. Below are two specific notes on capability adjustments.
551
552 *Memory Adder – Notebooks:* Category B of EPA's dataset contained a high percentage of notebooks with over
553 4GB of memory – nearly 70% of models. Since the TEC base level reflected characteristics of these systems, the
554 adder for memory is implemented for amounts greater than 4GB.
555
556 *TV Tuner- Desktops*: Stakeholders suggested that TV Tuners be considered for an additional capability adjustment
557 to those above. While data was provided in support of this proposal, EPA was unsure if the limited number of
558 models reflected the market as a whole and how many manufacturers of TV Tuners were considered in the data.
559 EPA continues to believe that TV Tuners, which are not required to be exercised during testing for ENERGY
560 STAR, should not consume power during the test in excess of what is expected for other discrete GPUs in
561 Categories B and C. However, EPA will consider including a capability adjustment for TV tuner, applicable only to
562 Category C Desktops, if EPA through additional assessment concludes that current technology makes unavoidable
563 an additional power draw in the ENERGY STAR idle test and that data supporting any proposed level is based on
564 a representative sample of the TV Tuner market.
565

Table 2: Operational Mode Weighting

	Desktop		Notebook	
	Conventional	Proxying*	Conventional	Proxying*
Toff	55%	40%	60%	45%
Tsleep	5%	30%	10%	35%
Tidle	40%	30%	30%	25%
Note: Proxying *refers to a computer that maintains Full Network Connectivity as defined in Section 1 of this specification. For a system to qualify under the proxying weightings above, it must meet a non-proprietary proxying standard that has been approved by the EPA as meeting the goals of ENERGY STAR. Such approval must be in place prior to submittal of product data for qualification. See Section (C),* Qualifying Computers with Power Management Capabilities, *for further information and testing requirements.*				

566
567 **Note**: The weightings above for conventional desktops and notebooks are maintained from Draft 3. EPA has
568 reduced the difference between the idle weighting for proxying systems in both the Desktop and Notebook cases in
569 response to concerns about enablement rates amongst capable systems in the early stages of the technology's
570 availability. In addition, notes have been added to clarify that a non-proprietary proxying standard must a) be
571 finalized, and b) be approved by EPA before any products can be submitted using the weightings present above.
572 EPA will continue to monitor the Ecma TC32-TG21 standards development process, an effort to create such a
573 standard.
574
575 **Note**: EPA received stakeholder comments on the TEC weightings proposed in Draft 2 and maintained above for
576 conventional systems. Stakeholders were concerned that the weighting above might lead to misleading results
577 about a computer's efficiency. EPA maintains the TEC usage mode weightings based on the following factors:
578 ▪ Supporting Data: as mentioned during development and refinement of Draft 2, the weightings above reflect
579   both the program's internal usage mode information (developed and maintained by Lawrence Berkeley
580   National Lab), and a industry study that reflects activity patterns for a substantial number of computers;
581 ▪ Relative Rankings – To ensure that these weightings did not result in a skewing of relative efficiency (i.e. a
582   system's TEC varied greatly in comparison to other systems if weightings were reallocated), EPA
583   presented a review at the September 26 stakeholder meeting of the impact of shifted TEC weighting to the
584   edges of what is realistic. This review is present in the final three slides of the EPA presentation, available
585   on the ENERGY STAR Computer Specification Development site. EPA found that even with significant
586   reallocation of idle amounts on either side of EPA's proposal, there was minimal difference in the relative
587   ranking of efficiency of systems in EPA's dataset.
588
589 As is the case with the Version 4.0 program, EPA intends to publish modal power levels for qualified systems on
590 the qualified product list, allowing extreme usage scenarios (a computer always left on, for example). However,
EPA continues to support the validity of the weightings presented above and believes they provide a foundation for
comparison of computers' relative energy use and efficiency.

591   **2) Workstation Levels:**

592
593   **Note**: Use of a Workstation Benchmark for Version 5.0 has been under discussion throughout the Version 5.0
594   development process. Draft 2 presented a structure to implement such a benchmark. Due to limited response to
595   calls for data supporting this effort, EPA is moving forward with continuation of the Version 4.0 approach for this
596   product area. Levels below represent updated modal weightings reflecting those previously proposed in Table 4 of
597   the Draft 2 Version 5.0 Specification. In absence of an active mode benchmark, Idle in Table 4 is intended to
598   represent both idle and the active previously proposed under the benchmark approach in Draft 2.
599
600   EPA intends to continue to evaluate benchmark options for Workstations in future versions of the program.

601
602   **TEC (Workstation product category):** The following tables indicate the required TEC levels
603   for the 5.0 Specification. Table 1 below lists TEC requirements for Version 5.0, while Table 2
604   gives weightings for each operational mode. TEC will be determined using the formula below:

605
606   **TEC = 0.35*Poff + 0.10 *Psleep + 0.55* Pidle**

607
608   where all P_x are power values in watts.

609

Table 3: TEC Requirement - Workstations

TEC ≤ 0.28*[Pmax + (# HDD * 5)]

610

Table 4: Operational Mode Weighting - Workstations

Toff	35%
Tsleep	10%
Tidle	55%
Note: Weightings are included in the PTEC formula, above.	

611
612   **Note**: As presented in the September 26th stakeholder meeting, the idle weighting has been revised to include time
613   in active and idle.

614
615   **Multiple Graphics Cards:** Workstations that meet ENERGY STAR requirements with a single
616   graphics card may also qualify a configuration with more than one graphics card connected in a
617   parallel configuration (e.g. SLI, Crossfire), provided the additional hardware configuration is
618   identical with the exception of the additional graphics card(s). In such cases, manufacturers
619   may submit the single card test data for both configurations without retesting the system.

620
Note: Stakeholders at the September 26th meeting requested that graphics scaling be investigated for inclusion in
Version 5.0. An issue was raised for the first time at this meeting about SPECviewperf compatibility with systems
containing parallel graphics. Above, EPA is proposing that systems with parallel graphics be allowed to qualify
provided that a base configuration, equal in all other hardware components except for graphics, meets ENERGY
STAR requirements.

621	**3) Game Console Levels:**

<table>
<tr><td>622
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632
633</td><td>**Note**: In response to the Draft 2 proposal in Table 5 for Game Consoles, EPA received concerns that the proposed Tier 1 requirements, to be effective with this 5.0 specification, offered very limited savings. EPA had hoped that Tier 1 requirements would encourage near-term efficiencies and also make energy efficiency a design priority for this product area in the coming years. It does appear, however, that the proposed near-term opportunities offer only marginal savings, not in line with the ENERGY STAR intention to deliver savings.

As such, EPA is proposing a set of requirements that combines those proposed previously under two distinct Tiers. This new single Tier has a proposed effective date of July 1, 2010. It is EPA's hope that this approach will give game console manufacturers design lead time, while also ensuring ENERGY STAR qualified game consoles will offer consumers significant energy savings. EPA requests stakeholder comment on the proposed requirements and timeline for Game Consoles.</td></tr>
</table>

634

Table 5: Game Console Requirements – Effective July 1, 2010

Operational Mode Requirements	
Off Mode: ≤ 1 W **Sleep or Auto-Off:** ≤ 5 W	
Power Management and Efficient Operation Requirements	
Sleep or Auto-Off	▪ The console shall power down to a sleep mode after 1 hour of inactivity; and ▪ Provide Game Developers the tools/features allowing APD within games or programs designed for the console; and ▪ Automatically APD when games are in an inactive or paused game state; and ▪ Provide for Full Network Connectivity in sleep.
TV/Display Sleep	▪ The console shall have the ability to drop Component, Composite, DVI outputs (using in-place standards where applicable) when the system is inactive for 15 minutes. Ability to do this in HDMI should be implemented once a HDMI standard for doing so exists; and ▪ Provide visual feedback on the console's integrated display or LEDs calling attention to the consoles continued active state while outputs are dropped.
Power Scaling	▪ Set Top Box (STB) and DVD/Blu Ray/Movie Playback functions must come within 10% of the requirements in place for the ENERGY STAR STB Specification Version 2.0, Tier 2 (finalized on April 23, 2008). Game consoles must be tested using the test procedure in the Set Top Box specification to evaluate their ability to meet the requirement.
Efficient Networking	• Implement IEEE 802.3az and Full Network Connectivity in Sleep for Ethernet and Wi-Fi. • Wireless Access Point functions must use less than 10W.

Note: EPA received further comment requesting that ENERGY STAR include an On Mode cap set at the maximum power consumption of current boxes. This cap could be revisited later and adders could be provided should significant new features that are tied to greater consumption become available.

635   **4) Small-Scale Server Levels:**
636

<div align="center">Table 6: Small-Scale Server Efficiency Requirements</div>

Small-Scale Server Operational Mode Power Requirements	
Off: ≤ 2.0 W **Idle State**: Category A: ≤ 50.0 W Category B: ≤ 65.0 W Category C: ≤ 95.0 W	

Capability	Additional Power Allowance
Wake On LAN (WOL) (Applies only if computer is shipped with WOL enabled)	+ 0.7 W for Off

For the purposes of determining Idle state levels, Small-Scale Servers must qualify under Categories A, B, or C as defined below:

Category A: All Small-Scale Servers 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 Small-Scale Servers must 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 Small-Scale Servers must 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.

637
638   **Note**: As noted in Draft 2, the dataset provided to EPA was not sufficiently robust to create new levels for the
639   Small-Scale Server product category. However, a stakeholder commented that the definition for Category C does
640   not apply to Small-Scale Servers not designed for computer display output. EPA reviewed both the limited
641   stakeholder data submitted earlier this year and the Small-Scale Servers qualified under Version 4.0. In all cases,
642   systems met the characteristics for category B or below. With this in mind, EPA intends to remove Category C for
643   Small-Scale Servers in the Draft Final Version 5.0 specification and encourages stakeholder comment if there are
644   concerns with this proposal.

645
646   **5) Thin Client Levels**
647
648   **Thin Client Categories for Idle Criteria:** For the purposes of determining Idle levels, Thin
649   Clients must qualify under Categories A or B as defined below:
650
651   **Category A:** All Thin Clients that do not meet the definition of Category B, below, will be
652   considered under Category A for ENERGY STAR qualification.
653
654   **Category B:** To qualify under Category B, Thin Clients <u>must</u>:
655   ▪ Support local multimedia encode/decode.

656
657

Table 7 : Thin Client Efficiency Requirements

Thin Client Operational Mode Power Requirements	
Off Mode: ≤ 2 W	
Sleep Mode (*if applicable*)**:** ≤ 2 W	
Idle State:	
Category A: ≤ 12.0 W	
Category B: ≤ 15.0 W	

Capability	Additional Power Allowance
Wake On LAN (WOL) (*Applies only if computer is shipped with WOL enabled*)	+ 0.7 W for Sleep + 0.7 W for Off

658
659 **Note**: Stakeholders requested a multi-category approach for thin clients. EPA's initial data collection efforts did not
660 yield enough data points to support such an approach. Shortly before release of this Draft 3, thin client
661 manufacturers presented EPA and the EC with some additional data and proposals on possible category
662 delimiters. After evaluation of the data, the levels above were set with local media encoding/decoding splitting the
663 categories. While data yielded a small delta between Idle limits, it is EPA's belief that such a structure in this first
664 set of requirements for Thin Clients provides a foundation for Thin Clients in the ENERGY STAR Computer
665 Program and provides significant client energy savings based on data received to date.
666
667

668 **(C) Power Management Requirements**: Products must meet the power management requirements
669 detailed in Table 5, below, and be tested as shipped.
670
671

Table 8: Power Management Requirements

Specification Requirement		Applicable to	
Shipment Requirements			
Sleep Mode	Shipped with a Sleep mode which is set to activate within 30 minutes (1 hr for Game Consoles) of user inactivity. (*Note: Thin Clients and Game Consoles may transition to a full off mode within the timeframe above in lieu of sleep provided such functionality is capable of meeting the desired ≤ 5 second latency listed in definition O, above. Game Consoles need not take latency into consideration*)	Desktop Computers	√
		Integrated Desktop Computers	√
		Notebook Computers	√
		Workstations	√
		Game Consoles	√
		Small-Scale Servers	
		Thin Clients	√
Display Sleep Mode	Shipped with the display's Sleep mode set to activate within 15 minutes of user inactivity.	Desktop Computers	√
		Integrated Desktop Computers	√
		Notebook Computers	√
		Workstations	√
		Game Consoles	√
		Small-Scale Servers (if computer display is present)	√
		Thin Clients	√
Network Requirements for Power Management			
Wake on LAN (WOL)	Computers with Ethernet capability shall have the ability to enable and disable WOL for Sleep mode.	Desktop Computers	√
		Integrated Desktop Computers	√
		Notebook Computers	√

		Workstations	√
		Game Consoles	
		Small-Scale Servers	√
		Thin Clients (*Only applies if software updates from the centrally managed network are conducted while the unit is in sleep or off mode. Thin Clients whose standard framework for upgrading client software does not require, off-hours scheduling are exempt from the requirement.*)	√
	Applies to computers shipped through Enterprise Channels, only: Computers with Ethernet capability must meet one of the following requirements: ▪ be shipped with Wake On LAN (WOL) enabled from the Sleep mode when operating on ac power (i.e. notebooks may automatically disable WOL when disconnected from the mains); or ▪ provide control to enable WOL that is sufficiently-accessible from both the client operating system user interface and over the network if computer is shipped to enterprise without WOL enabled.	Desktop Computers	√
		Integrated Desktop Computers	√
		Notebook Computers	√
		Workstations	√
		Game Consoles	
		Small-Scale Servers	√
		Thin Clients (*Only applies if software updates from the centrally managed network are conducted while the unit is in sleep or off mode. Thin Clients whose standard framework for upgrading client software does not require, off-hours scheduling are exempt from the requirement.*)	√
Wake Management	*Applies to computers shipped through Enterprise Channels, only:* Computers with Ethernet capability 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.	Desktop Computers	√
		Integrated Desktop Computers	√
		Notebook Computers	√
		Workstations	√
		Game Consoles	
		Small-Scale Servers	√
		Thin Clients	√

672
673   For all computers with WOL enabled, any directed packet filters shall be enabled and set to an
674   industry standard default configuration. Until one (or more) standards are agreed upon, partners are
675   asked to provide their direct packet filter configurations to EPA for publication on the Website to
676   stimulate discussion and development of standard configurations.
677
678   **Qualifying Computers with Power Management Capabilities**: The following requirements should
679   be followed when determining whether models should be qualified with or without WOL:
680
681   **Off:** Computers shall be tested and reported as shipped for Off. Models that will be shipped with

682	WOL enabled for Off shall be tested with WOL enabled. Likewise, products shipped with WOL
683	disabled for Off shall be tested with WOL disabled.
684	
685	**Sleep:** Computers shall be tested and reported as shipped for Sleep. Models sold through
686	enterprise channels, as defined in Section 1, definition V, shall be tested, qualified, and shipped
687	with WOL enabled based on the requirements in Table 8. Products going directly to consumers
688	through normal retail channels only are not required to be shipped with WOL enabled from Sleep,
689	and may be tested, qualified, and shipped with WOL either enabled or disabled.
690	
691	**Proxying:** Desktop, Integrated Desktop, and Notebook Computers shall be tested and reported
692	for Idle, Sleep, and Off with proxying features enabled or disabled as shipped. For a system to
693	qualify using TEC weightings for proxying, it must meet a proxying standard that has been
694	approved by the EPA as meeting the goals of ENERGY STAR. Such approval must be in place
695	prior to submittal of product data for qualification.
696	
697	
698	
699	
700	

> **Note**: The language above has been added to clarify that systems submitted for qualification under the proxying requirements must be tested with such features enabled. As noted elsewhere in this draft, a proxying standard must be finalized and be approved by EPA before computers may attempt to qualify against the proxying requirements.

701	
702	**Customer Software and Management Service Pre-Provisioning**:
703	The Partner will remain responsible for testing products and qualifying them as they ship them. If
704	the product meets and is qualified as ENERGY STAR at this point, it can be labeled as such.
705	
706	If the Partner is hired by a customer to load a custom image, the Partner must take the following
707	steps:
708	▪ The Partner must let the customer know that their product may not meet ENERGY STAR
709	with the custom image loaded *(a sample letter is available for use from the ENERGY*
710	*STAR website that can be shared with customers).*
711	▪ The Partner must encourage their customer to test the product for ENERGY STAR
712	compliance.
713	▪ The Partner must encourage their customer, should the product no longer meet ENERGY
714	STAR, to make use of EPA's free technical assistance that can assist with Power
715	Management performance. Please see tools as well as contact information at:
716	www.energystar.gov/fedofficeenergy.
717	
718	Although EPA believes that Partners in partnership with EPA can help ensure their products
719	continue to be leadership products when it comes to efficiency once deployed. EPA is committed
720	to helping to reduce the likelihood that custom images will disrupt a product's ability to meet
721	ENERGY STAR requirements. For example, EPA is engaging in federal desktop core
722	configuration discussions with the intention of facilitating the development of a core configuration
723	for Federal Agencies that supports energy efficiency. In April 2008, EPA also launched the
724	ENERGY STAR Low Carbon IT Campaign in an effort to get more businesses and organizations
725	to implement power management. More information on the campaign can be found at:
726	www.energystar.gov/lowcarbonit.
727	
728	**User Information Requirement:** In order to ensure that purchasers/users are properly informed on
729	the benefits of power management, the manufacturer will include with each computer, one of the
730	following:
731	
732	• Information on ENERGY STAR and the benefits of power management in either a hard copy or
733	electronic copy of the user manual. This information should be near the front of the user guide; or
734	• A package or box insert on ENERGY STAR and the benefits of power management.
735	
736	Either option must at least include the following information:
737	

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

741

742

743 **(D) Voluntary Requirements**

744

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

751

752

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

755

756 • In performing these tests, partner agrees to use the test procedures provided in Table 6, below.
757 • The test results must be reported to EPA or the European Commission, as appropriate.

758

759 Additional testing and reporting requirements are provided below.

760

761 A. Number of Units Required for TEC or Idle Testing: Manufacturers may initially test a single unit for
762 qualification. If the initial unit tested is less than or equal to the applicable requirement for TEC or
763 Idle but falls within 10% of that level, one additional unit of the same model with an identical
764 configuration must also be tested. Manufacturers shall report test values for both units. To qualify
765 as ENERGY STAR, both units must meet the maximum TEC or Idle level for that product and that
766 product category.

767

768 **Note:** This additional testing is only required for TEC qualification (*Desktops, Integrated Desktops,*
769 *Notebooks, Workstations*) and Idle qualification (*Small-Scale Servers, Thin Clients*) – only one unit
770 is required to be tested for Sleep and Standby if such requirements apply. The following
771 examples further illustrate this approach:

772

773 1. Category A Desktops must meet a TEC level of 153 kWh or less, making 137.7 kWh the
774 10% threshold for additional testing.
775 • If the first unit is measured at 136 kWh, no more testing is needed and the model qualifies
776 (134 kWh is 12% more efficient than the specification and is therefore "outside" the 10%
777 threshold).
778 • If the first unit is measured at 137.7 kWh, no more testing is needed and the model
779 qualifies (137.7 kWh is exactly 10% more efficient than the specification).
780 • If the first unit is measured at 140 kWh, then an additional unit must be tested to
781 determine qualification (140 kWh is only 8% more efficient than the specification and is
782 "within" the 10% threshold).
783 • If the two units are then tested at 140 and 154 kWh, the model does not qualify as
784 ENERGY STAR—even though the average is 147 kWh — because one of the values
785 exceeds the ENERGY STAR specification.
786 • If the two units are then tested at 140 and 152 kWh, the model does qualify as ENERGY
787 STAR because both values meet the ENERGY STAR specification of 153 kWh.

788

789 2. A Category A Small-Scale Server must meet an Idle level of 50 watts or less, making
790 45 Watts the 10% threshold for additional testing. The following scenarios could then
791 occur when testing a model for qualification:

792   • If the first unit is measured at 44 watts, no more testing is needed and the model qualifies
793   (44 watts is 12% more efficient than the specification and is therefore "outside" the 10%
794   threshold).
795   • If the first unit is measured at 45 watts, no more testing is needed and the model qualifies
796   (45 watts is exactly 10% more efficient than the specification).
797   • If the first unit is measured at 47 watts, then an additional unit must be tested to determine
798   qualification (47 Watts is only 6% more efficient than the specification and is "within" the
799   10% threshold).
800   • If the two units are then tested at 47 and 51 watts, the model does not qualify as
801   ENERGY STAR—even though the average is 49 watts— because one of the values (51)
802   exceeds the ENERGY STAR specification.
803   • If the two units are then tested at 47 and 49 watts, the model does qualify as ENERGY
804   STAR because both values meet the ENERGY STAR specification of 50 watts.
805

806 **Note**: The section above is modified from Version 4.0 and is included to show thresholds for multiple unit testing in
807 Version 5.0. This Draft 3, representing a second review of levels for most product categories in the specification,
808 provided a more meaningful opportunity to reintroduce this section.
809

810   B. Models Capable of Operating at Multiple Voltage/Frequency Combinations: Manufacturers shall
811   test their products based on the market(s) in which the models will be sold and promoted as
812   ENERGY STAR qualified.
813

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

823

Table 9: Test Procedures

Product Category	Specification Requirement	Test Protocol	Source
All Computers	Power Supply Efficiency	IPS: Internal Power Supply Efficiency Protocol EPS: ENERGY STAR Test Method for External Power Supplies *Note: Should any information/procedures in addition to those described by the Internal Power Supply Efficiency Protocol be required in order to test an Internal Power Supply, partners must make available to EPA upon request the test setup used to acquire IPS data used in a product submittal.*	IPS: www.efficientpowersupplies.org EPS: www.energystar.gov/powersupplies
Desktop, Integrated, and Notebook Computers	Annual Energy Consumption	ENERGY STAR Computer Test Method (Version 5.0), Section III	Appendix A
Workstations	Standby (Off Mode), Sleep Mode, Idle State and Maximum Power	ENERGY STAR Computer Test Method (Version 5.0), Section III-IV	Appendix A
Game Consoles	Off Mode, and Sleep/Auto-Off	ENERGY STAR Computer Test Method (Version 5.0), Section V	Appendix A
Small-Scale Servers	Off Mode and Idle State	ENERGY STAR Computer Test Method (Version 5.0) , Section III	Appendix A
Thin Clients	Off Mode, Sleep Mode, and Idle State	ENERGY STAR Computer Test Method (Version 5.0) , Section III	Appendix A

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830

Note: The current Energy Star specification for Imaging Products allows products powered by low-voltage direct current (e.g. USB, Power over Ethernet--PoE) to qualify if meeting the specification requirements. While initially introduced for USB scanners, PoE opens up a much wider range of products that could be powered by dc, including notebooks.

To allow for product data submittal, the Imaging Specification includes a provision in the Power Measurement Method for manufacturers to test and report the effective ac consumption of these products. To create a similar channel for computers powered by low-voltage DC, this approach could be included in the test procedures in Appendix A, or the measured DC consumption could be divided by 0.80 to reflect an implicit 80% efficient power conversion. A product that could be powered through ac or standard dc would continue to be tested only on its ac supply.

EPA seeks comment on whether such a provision would be valued by manufacturers in Version 5.0, or whether such technology is better addressed in future versions of the program as markets and product availability matures.

C. <u>Qualifying Families of Products:</u> 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; there must not be higher consuming configurations of the same product model than the representative configuration. 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.

All units/configurations associated with a product model designation, for which a Partner is seeking ENERGY STAR qualification, must meet the ENERGY STAR requirements. If a Partner wishes to qualify configurations of a model for which non-qualifying alternative configurations exist, the Partner must assign the qualifying configurations an identifier in the model name/number that is unique to ENERGY STAR Qualified configurations. This identifier must be used consistently in association with the qualifying configurations in marketing/sales materials and on the ENERGY STAR list of qualified products (e.g. model A1234 for baseline configurations and A1234-ES for ENERGY STAR qualifying configurations).

Note: The final paragraph above has been revised to allow for marketing identifiers, used consistently with configurations on the ENERGY STAR Qualified Product list and all product sales and marketing materials, to be used to designate compliant configurations.

5) **Effective Date:** The date that manufacturers may begin to qualify products as ENERGY STAR will be defined as the *effective date* of the agreement. The ENERGY STAR Version 5.0 Computers

887 Specification effective date is July 1, 2009. All products (except for Game Consoles), including
888 models originally qualified under Version 4.0, with a **date of manufacture** on or after **July 1, 2009**
889 must meet the Version 5.0 requirements in order to qualify for ENERGY STAR. Game Consoles with a
890 **date of manufacture** on or after **July 1, 2010** must meet the Version 5.0 requirements in order to
891 qualify for ENERGY STAR. Any previously executed agreement on the subject of ENERGY STAR
892 qualified computers shall be terminated effective June 30, 2009.

893
894 **Note**: The effective date language above reflects the July 1, 2010 staggered effective date for Game Consoles. All
895 other product types remain under a July 1, 2009 effective date as planned.

896

897 **6)** <u>**Future Specification Revisions:**</u> EPA reserves the right to revise the specification should
898 technological and/or market changes affect its usefulness to consumers or industry or its impact on
899 the environment. In keeping with current policy, revisions to the specification will be discussed with
900 stakeholders. In the event of a specification revision, please note that ENERGY STAR qualification is
901 not automatically granted for the life of a product model. To qualify as ENERGY STAR, a product
902 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/Game Consoles in Off, Sleep, and Idle

> **Note**: Based on feedback received during EEcoMark development, there has been a request to test all computers with displays on, thereby streamlining test setup among the products in the computer program. EPA sees the benefits to this proposal, but cannot accommodate this revision at this time due to inconsistency with the data collection procedures used in acquiring data for Version 5.0. Additionally, various industry representatives expressed concerns with this proposal when it was raised at the stakeholder meeting. As part of this discussion, some agreement formed around an alternative of requiring that computer displays to be off for testing, but forcing graphics cards to remain on and active during the test. This alternative would require coordination with OS and graphics card manufacturers to implement.
>
> Additionally, stakeholders requested a 2 minute rolling average to be used instead of an average of the total 15 minute measurement period. EPA feels this is not feasible unless a tool for automating this rolling average test was available to ENERGY STAR's smaller OEM partners who may not have the resources to develop such a test.

The following protocol should be followed when measuring power consumption levels of computers/game consoles for compliance with the Off, Sleep, and Idle levels provided in the ENERGY STAR Version 5.0 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 5.0 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).

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

956
957 It is also desirable for measurement instruments to be able to average power accurately over any user
958 selected time interval (this is usually done with an internal math's calculation dividing accumulated
959 energy by time within the meter, which is the most accurate approach). As an alternative, the
960 measurement instrument would have to be capable of integrating energy over any user selected time
961 interval with an energy resolution of less than or equal to 0.1 mWh and integrating time displayed with
962 a resolution of 1 second or less.
963
964 **Accuracy**
965 Measurements of power of 0.5 W or greater shall be made with an uncertainty of less than or equal to
966 2% at the 95% confidence level. Measurements of power of less than 0.5 W shall be made with an
967 uncertainty of less than or equal to 0.01 W at the 95% confidence level. The power measurement
968 instrument shall have a resolution of:
969
970 • 0.01 W or better for power measurements of 10 W or less;
971 • 0.1 W or better for power measurements of greater than 10 W up to 100 W; and
972 • 1 W or better for power measurements of greater than 100 W.
973
974 All power figures should be in watts and rounded to the second decimal place. For loads greater than
975 or equal to 10 W, three significant figures shall be reported.
976
977 **Test Conditions**
978

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 %	

979 (Reference IEC 62301: Household Electrical Appliances – Measurement of Standby Power, Sections 3.2, 3.3)
980
981 **Test Configuration**
982 Power consumption of a computer shall be measured and tested from an ac source to the UUT.
983
984 The UUT must be connected to an Ethernet network switch capable of the UUT's highest and lowest
985 network speeds. The network connection must be live during all tests.
986
987
988 III. **Test Procedure for Off, Sleep and Idle for All Computer Products**

989 Measurement of ac power consumption of a computer should be conducted as follows:
990
991 **UUT Preparation**
992 1. Record the manufacturer and model name of the UUT.
993 2. Ensure that the UUT is connected to network resources as detailed below, and that the UUT
994 maintains this live connection for the duration of testing, disregarding brief lapses when
995 transitioning between link speeds.

996		a. *Desktops, Integrated Desktops, and Notebooks* shall be connected to a live Ethernet
997		(IEEE 802.3) network switch as specified in Section II., "Test Configuration," above. The
998		computer must maintain this live connection to the switch for the duration of testing,
999		disregarding brief lapses when transitioning between link speeds. Computers without
1000		Ethernet capability must maintain a live wireless connection to a wireless router or
1001		network access point for the duration of testing.
1002		b. *Small-Scale Servers* shall be connected to a live Ethernet (IEEE 802.3) network switch as
1003		specified in Section II., "Test Configuration," above, and that the connection is live.
1004		c. *Thin Clients* shall be connected to a live server via a live Ethernet (IEEE 802.3) network
1005		switch and shall run intended terminal/remote connection software.
1006		
1007		
1008		
1009		
1010	3.	Connect an approved meter capable of measuring true power to an ac line voltage source set to
1011		the appropriate voltage/frequency combination for the test.
1012	4.	Plug the UUT into the measurement power outlet on the meter. No power strips or UPS units
1013		should be connected between the meter and the UUT. For a valid test to take place the meter
1014		should remain in place until all Off, Sleep, and Idle power data is recorded.
1015	5.	Record the ac voltage.
1016	6.	Boot computer and wait until the operating system has fully loaded. If necessary, run the initial
1017		operating system setup and allow all preliminary file indexing and other one-time/periodic
1018		processes to complete.
1019		

> **Note**: In the comment period after Draft 2, EPA received specific instructions from a stakeholder on processes in a single OS that should be disabled to ensure the intended completion of one-time/periodic events. EPA continues to intend for this test procedure to be as platform-agnostic as possible and as such has not included the proposed text directly in the test procedure. EPA is open to discussing if stakeholders would like to collaborate on a companion "Testing FAQ" document created after specification finalization that could include such details.

1026	7.	Record basic information about the computer's configuration – computer type, operating system
1027		name and version, processor type and speed, and total and available physical memory, etc.[2]
1028	8.	Record basic information about the video card or graphics chipset (if applicable) - video
1029		card/chipset name, resolution, amount of onboard memory, and bits per pixel.[3]
1030	9.	Ensure that the UUT is configured as shipped including all accessories, power management
1031		settings, WOL enabling and software shipped by default. UUT should also be configured using
1032		the following requirements for all tests:
1033		a. *Desktop* systems shipped without accessories should be configured with a standard
1034		mouse, keyboard and external computer display.
1035		b. *Notebooks* should include all accessories shipped with the system, and need not include
1036		a separate keyboard or mouse when equipped with an integrated pointing device or
1037		digitizer.
1038		c. *Notebooks* should have the battery pack(s) removed for all tests. For systems where
1039		operation without a battery pack is not a supported configuration, the test may be
1040		performed with fully charged battery pack(s) installed, making sure to report this
1041		configuration in the test results.
1042		d. *Small-Scale Servers* and *Thin Clients* shipped without accessories should be configured
1043		with a standard mouse, keyboard and external computer display (if server has display
1044		output functionality).

[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.*

1045	e. Power to wireless radios should be turned off for all tests. This applies to wireless
1046	network adapters (e.g., 802.11) or device-to-device wireless protocols.
1047	
1048	10. The following guidelines should be followed to configure power settings for computer displays
1049	(adjusting no other power management settings):
1050	a. For computers with external computer displays (most desktops): use the computer
1051	display power management settings to prevent the display from powering down to ensure
1052	it stays on for the full length of the Idle test as described below.
1053	b. For computers with integrated computer displays (notebooks and integrated systems):
1054	use the power management settings to set the display to power down after 1 minute.
1055	

Note: Based on Stakeholder feedback with respect to testing with monitors on, the test procedure in this draft is representative of the calls for data that were released over the summer, which did not include this provision. However, EPA believes there is merit to this proposal and intends to discuss this topic at the September 26 stakeholder meeting. EPA's proposal is as follows:

1. All computers are tested for Idle *with displays active, not power managed.* This is consistent for external displays, but a modification for integrated; and
2. A capability adjustment, based on the ENERGY STAR Displays/Monitors requirements in effect at the time of test and percentage of time in Idle, is subtracted from the TEC level of compliance to adjust for the additional TEC amount.

EPA welcomes comments during the comment period of this document and in advance of the meeting to allow for a more productive discussion of potential approaches.

| 1069 | 11. Shut down the UUT. |
| 1070 | |

Off Mode Testing

12. With the UUT shut down and in Off, 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

13. 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. Between 5 and 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

14. 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.
15. 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 15, recording Sleep power necessary for this alternate configuration.

Reporting Test Results

---

[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.*

1096	16. The test results must be reported to EPA or the European Commission, as appropriate, taking
1097	care to ensure that all required information has been included.
1098	

1099   IV. **Maximum Power Test for Workstations**

1100

1101 **Note**: The maximum power test used in Version 4.0 has been again included in the test procedure to reflect the Workstation test approach.

1102

1103 The maximum power for workstations is found by the simultaneous operation of two industry standard
1104 benchmarks: Linpack to stress the core system (e.g., processor, memory, etc.) and SPECviewperf®
1105 (latest available version for the UUT) to stress the system's GPU. Additional information on these
1106 benchmarks, including free downloads, can be found at the URLs found below:

1107

    Linpack   http://www.netlib.org/linpack/

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

1108

1109 This test must be repeated three times on the same UUT, and all three measurements must fall within
1110 a ± 2% tolerance relative to the average of the three measured maximum power values.

1111 Measurement of the maximum ac power consumption of a workstation should be conducted as
1112 follows:

1113 **UUT Preparation**
1114   1. Connect an approved meter capable of measuring true power to an ac line voltage source set to
1115   the appropriate voltage/frequency combination for the test. The meter should be able to store and
1116   output the maximum power measurement reached during the test or be capable of another
1117   method of determining maximum power.
1118   2. Plug the UUT into the measurement power outlet on the meter. No power strips or UPS units
1119   should be connected between the meter and the UUT.
1120   3. Record the ac voltage.
1121   4. Boot the computer and, if not already installed, install Linpack and SPECviewperf as indicated on
1122   the above Websites.
1123   5. Set Linpack with all the defaults for the given architecture of the UUT and set the appropriate
1124   array size "n" for maximizing power draw during the test.
1125   6. Ensure all guidelines set by the SPEC organization for running SPECviewperf are being met.
1126

1127 **Maximum Power Testing**
1128   7. Set the meter to begin accumulating true power values at an interval of 1 reading per second, and
1129   begin taking measurements. Run SPECviewperf and as many simultaneous instances of Linpack
1130   as needed to fully stress the system.
1131   8. Accumulate power values until SPECviewperf and all instances have completed running. Record
1132   the maximum power value attained during the test.
1133

1134 **Reporting Test Results**
1135   9. The test results must be reported to EPA or the European Commission, taking care to ensure that
1136   all required information has been included.
1137   10. Upon submittal of data, manufacturers must also include the following data:
1138   a. Value of the n (the array size) used for Linpack,
1139   b. Number of simultaneous copies of Linpack run during the test,
1140   c. Version of SPECviewperf run for test,
1141   d. All compiler optimizations used in compiling Linpack and SPECviewperf, and
1142   e. A precompiled binary for end users to download and run of both SPECviewperf and
1143   Linpack. These can be distributed either through a centralized standards body such as
1144   SPEC, by the OEM or by a related third party.

1145
1146
1147 V. **Test Procedure for All Modes for Game Consoles**

1148 Measurement of ac power consumption of a computer should be conducted as follows:
1149
1150 **Note**: The Maximum Power test for workstations present in V4.0 has been removed. This section has been added
1151 to provide an ordered test procedure for collecting ENERGY STAR compliance data for Game Consoles.
1152
1153 **UUT Preparation**
1154 1. Record the manufacturer and model name of the UUT.
1155 2. Record basic information about the computer's configuration – computer type, operating system
1156 name and version, processor type and speed, and total and available physical memory, etc.
1157 3. Ensure that the UUT is connected to a TV(s) which support all of the output types supported by
1158 the UUT.
1159 a. *For each output that supports APD, repeat step 10 of this procedure.*
1160 4. Connect an approved meter capable of measuring true power to an ac line voltage source set to
1161 the appropriate voltage/frequency combination for the test.
1162 5. Plug the UUT into the measurement power outlet on the meter. No power strips or UPS units
1163 should be connected between the meter and the UUT. For a valid test to take place the meter
1164 should remain in place until all power data is recorded.
1165 6. Record the ac voltage.
1166 7. Turn on the console and wait until the operating system has fully loaded.
1167 8. If necessary, run the initial system setup and allow all preliminary tasks and other one-
1168 time/periodic processes to complete.
1169 9. Ensure that the UUT is configured as shipped including all accessories, power management
1170 settings and software shipped by default
1171 10. For each applicable output, wait for 15 minutes and ensure the output drops after the prescribed
1172 time.
1173 11. Place the system in a state without the game loaded.
1174 12. Then wait one hour and verify the system goes into a low power state.
1175 13. Bring the console back into its OS loaded state
1176 14. Load a game and bring it to the games menu.
1177 15. Begin game play and pause the game.
1178 16. Wait one hour and verify the system goes into a low power state. (Applicable after Version 5.0)
1179 17. Shut down the UUT.
1180
1181 **Off Mode Testing**
1182 18. With the UUT shut down and in Off, set the meter to begin accumulating true power values at an
1183 interval of 1 reading per second. Accumulate power values for 5 additional minutes and record
1184 the average (arithmetic mean) value observed during that 5 minute period.[5]
1185
1186 **Sleep/APD Mode Testing**
1187 19. After completing the Off mode measurements, place the computer in it's Sleep/APD mode. Reset
1188 the meter (if necessary) and begin accumulating true power values at an interval of 1 reading per
1189 second. Accumulate power values for 5 additional minutes and record the average (arithmetic
1190 mean) value observed during that 5 minute period.
1191
1192 VI. **Continuing Verification**
1193
1194 This testing procedure describes the method by which a single unit may be tested for compliance. An
1195 ongoing testing process is highly recommended to ensure that products from different production runs
1196 are in compliance with ENERGY STAR.

---

[5] *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.

1197
1198
VII. Verification Testing Requirements

1199
1200
1201   The following requirements outline a manufacturer-financed quality assurance system that allows for
1202   independent evaluation of ENERGY STAR qualified computers. These requirements will be effective
1203   with Version 5.0. EPA may request manufacturers to submit products for verification testing as
1204   described below. EPA reserves the right to modify these procedures based on experience gained in
1205   their implementation. The Procedures Manual for this program will be available on the ENERGY
1206   STAR Office Equipment Partner Resources page on the ENERGY STAR website.
1207
1208   Product Selection: EPA will select computers each year for verification testing. The manufacturer of
1209   each selected product will be required to commission third-party testing of the specified computer by a
1210   manufacturer-independent testing lab. The testing lab will procure one (1) sample of each computer
1211   model on the open market (if possible). EPA will make exceptions on a case-by-case basis for
1212   computers that are unreasonable to obtain on the open market (e.g., cost more than $5000 or highly
1213   customized), by allowing the manufacturer to provide a model directly to the laboratory for testing.
1214   Specific testing details are outlined in the ENERGY STAR for Computers Verification Testing
1215   Guidelines and Procedures Manual.
1216
1217   Schedule Requirements: The manufacturer must retain a qualified third-party testing lab within
1218   fourteen (14) business days of EPA notification. The laboratory must complete all testing within 30
1219   calendar days of notification of test start date to EPA.
1220
1221   If the sample fails to meet the performance requirements of the ENERGY STAR specification, the
1222   failure will be addressed under EPA's product failure and dispute protocol and if applicable, the
1223   procedure for delisting products.

APPENDIX B:
Sample Calculations

Note: The appendix B below has been added to address stakeholder requests for sample calculations in support of the TEC Product categories. As this is a new section in the specification and it is intended to aid stakeholders in evaluating products for ENERGY STAR, stakeholder comments are encouraged.

I. **Desktop, Integrated Desktop, Notebook Computers:** Below is a sample TEC calculation intended to show how levels for compliance are determined based on functional adders and operational mode measurements.

Example: Notebook Computer, Category A

1. Measure values using the Appendix A test procedure.
    Off = 1W
    Sleep = 1.7W
    Idle = 10W

2. Determine which Capability Adjustments apply.
    Integrated Graphics? Does not apply for Premium Graphics.
    8GB Memory installed. Does meet memory adjustment level: 8yields a 1.6kWh
    *adjustment (4 * 0.4kWh).*

3. Apply Weightings based on Table 2 to calculate TEC:

    Table 2 (for conventional notebook):

Toff	60%
Tsleep	10%
Tidle	30%

    E_{annual} = (8760/1000) * (P_{off} * T_{off} + P_{sleep} * T_{sleep} + P_{idle} * T_{idle})
    = (8760/1000) * (P_{off} * .60 + P_{sleep} *.10 + P_{idle} * .30)
    = (8760/1000) * (1 * .60 + 1.7 * .10 + 10 * .30)
    = 33.03 kWh

4. Determine "adjusted TEC" for evaluation by subtracting any capability adjustments (step 2) from the measured TEC (step 3).

    33.03 kWh – 1.6kW = 31.43 kWh

5. Compare the adjusted TEC to the ENERGY STAR levels to determine if the model qualifies.

    Category A requirement: Category A: ≤ 36.5
    Adjusted TEC: 31.43 kWh
    31.43kWh< 36.5
    Notebook meets ENERGY STAR requirements.

II. **Workstations:** Below is a sample TEC calculation for a Workstation with 2 hard drives.

1. Measure values using the Appendix A test procedure.

1276	*Off =*	*2 W*
1277	*Sleep =*	*4W*
1278	*Idle =*	*80W*
1279	*Max Power =*	*180W*

1280
1281   2. Note number of Hard Drives installed.
1282   *Two hard drives installed during test.*

1283
1284   3. Apply Weightings based on Table 4 to calculate TEC:

1285
1286   Table 2 (for conventional notebook):

1287

Toff	35%
Tsleep	10%
Tidle	55%

1288
1289
1290 $P_{TEC} = (.35 * P_{off} + .10 * P_{sleep} + .55 * P_{idle})$
1291 $= (.35 * 2 + .10 * 4 + .55 * 80)$
1292   **= 45.10 W**

1293
1294   4. Calculate the TEC requirement.

1295
1296 $P_{TEC} = 0.28*[Pmax + (\# HDD * 5)]$
1297 $P_{TEC} = 0.28*[180 + 2 * 5)]$
1298 $P_{TEC} = 53.2$

1299
1300   5. Compare the adjusted TEC to the ENERGY STAR levels to determine if the model qualifies.

1301
1302   *45.10< 53.2*
1303   ***Workstation meets ENERGY STAR requirements.***