ENERGY STAR® Program Requirements
Product Specification for Computers

Eligibility Criteria
Final Draft, Version 7.0

1 Following is the **Final Draft, Version 7.0** ENERGY STAR Product Specification for Computers. A product
2 shall meet all of the identified criteria if it is to earn the ENERGY STAR.

3 1   DEFINITIONS

4 A) Product Types:

5   1) Computer: A device which performs logical operations and processes data. For the purposes of
6   this specification, computers include both stationary and portable units, including Desktop
7   Computers, Integrated Desktop Computers, Notebook Computers, Small-Scale Servers, Thin
8   Clients, and Workstations. Although computers are capable of using input devices and displays,
9   such devices are not required to be included with the computer upon shipment. Computers are
10   composed of, at a minimum:

11   a) A central processing unit (CPU) to perform operations. If no CPU is present, then the device
12   must function as a client gateway to a server which acts as a computational CPU;

13   b) User input devices such as a keyboard, mouse, or touchpad; and

14   c) An Integrated Display screen and/or the ability to support an external display screen to output
15   information.

16   2) Desktop Computer: A computer whose main unit is designed to be located in a permanent
17   location, often on a desk or on the floor. Desktop computers are not designed for portability and
18   are designed for use with an external display, keyboard, and mouse. Desktop computers are
19   intended for a broad range of home and office applications, including point of sale applications.

20   a) Integrated Desktop Computer: A Desktop Computer in which the computing hardware and
21   display are integrated into a single housing, and which is connected to ac mains power
22   through a single cable. Integrated Desktop Computers come in one of two possible forms: (1)
23   a system where the display and computer are physically combined into a single unit; or (2) a
24   system packaged as a single system where the display is separate but is connected to the
25   main chassis by a dc power cord and both the computer and display are powered from a
26   single power supply. As a subset of Desktop Computers, Integrated Desktop Computers are
27   typically designed to provide similar functionality as Desktop systems.

28   3) Notebook Computer: A computer designed specifically for portability and to be operated for
29   extended periods of time both with and without a direct connection to an ac mains power source.
30   Notebook Computers include an Integrated Display, a non-detachable, mechanical keyboard
31   (using physical, moveable keys), and pointing device.

32   a) Mobile Thin Client: A computer meeting the definition of a Thin Client, designed specifically
33   for portability, and also meeting the definition of a Notebook Computer. These products are
34   considered to be Notebook Computers for the purposes of this specification.

35   b) Two-In-One Notebook: A computer which resembles a traditional Notebook Computer with a
36   clam shell form factor, but has a detachable display which can act as an independent
37   Slate/Tablet when disconnected. The keyboard and display portions of the product must be
38   shipped as an integrated unit. Two-In-One Notebooks are considered Notebooks in the
39   remainder of this specification and are therefore not referenced explicitly.

40   4) Slate/Tablet: A computing device designed for portability that meets all of the following criteria:

41		a)	Includes an integrated display with a diagonal size greater than 6.5 inches and less than 17.4
42			inches;
43		b)	Lacking an integrated, physical attached keyboard in its as-shipped configuration;
44		c)	Includes and primarily relies on touchscreen input; (with optional keyboard);
45		d)	Includes and primarily relies on a wireless network connection (e.g., Wi-Fi, 3G, etc.); and
46		e)	Includes and is primarily powered by an internal battery (with connection to the mains for
47			battery charging, not primary powering of the device).

48   5)   <u>Portable All-In-One Computer:</u> A computing device designed for portability that meets all of the
49   following criteria:

       a)   Includes an integrated display with a diagonal size greater than or equal to 17.4 inches;

       b)   Lacking keyboard integrated into the physical housing of the product in its as-shipped configuration;

       c)   Includes and primarily relies on touchscreen input; (with optional keyboard);

       d)   Includes wireless network connection (e.g. Wi-Fi, 3G, etc.); and

       e)   Includes an internal battery

56   6)   <u>E-Reader:</u> A device designed for display and consumption of static images. The display is
57   characterized by a low refresh rate and a display made of bistable materials where no energy is
58   needed to maintain a visible image, only to alter the image.

59   7)   <u>Small-scale Server:</u> A computer that typically uses desktop components in a desktop form factor,
60   but is designed primarily to be a storage host for other computers. Small-scale Servers are
61   designed to perform functions such as providing network infrastructure services (e.g., archiving)
62   and hosting data/media. These products are not designed to process information for other
63   systems or run web servers as a primary function. A Small-scale Server has the following
64   characteristics:

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

       b)   Designed to operate 24 hours/day, 7 days/week, with minimal unscheduled downtime (on the order of hours/year);

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

       d)   Designed for an industry accepted operating system for home or low-end server applications (e.g., Windows Home Server, Mac OS X Server, Linux, UNIX, Solaris).

74   8)   <u>Thin Client:</u> An independently-powered computer that relies on a connection to remote computing
75   resources (e.g., computer server, remote workstation) to obtain primary functionality. Main
76   computing functions (e.g., program execution, data storage, interaction with other Internet
77   resources) are provided by the remote computing resources. Thin Clients covered by this
78   specification are (1) limited to devices with no rotational storage media integral to the computer
79   and (2) designed for use in a permanent location (e.g. on a desk) and not for portability.

80   a) <u>Integrated Thin Client</u>: A Thin Client in which computing hardware and display are
81   connected to ac mains power through a single cable. Integrated Thin Client computers
82   come in one of two possible forms: (1) a system where the display and computer are
83   physically combined into a single unit; or (2) a system packaged as a single system
84   where the display is separate but is connected to the main chassis by a dc power cord
85   and both the computer and display are powered from a single power supply. As a subset
86   of Thin Clients, Integrated Thin Clients are typically designed to provide similar
87   functionality as Thin Client systems.

88   b) <u>Ultra-thin Client</u>: A computer with lesser local resources than a standard Thin Client that
89   sends raw mouse and keyboard input to a remote computing resource and receives back
90   raw video from the remote computing resource. Ultra-thin clients cannot interface with
91   multiple devices simultaneously nor run windowed remote applications due to the lack of
92   a user-discernible client operating system on the device (i.e., beneath firmware, user
93   inaccessible).

94   9) <u>Workstation</u>: A high-performance, single-user computer typically used for graphics, CAD,
95   software development, financial and scientific applications among other compute intensive tasks.
96   Workstations covered by this specification (a) are marketed as a workstation; (b) do not support
97   altering frequency or voltage beyond the CPU and GPU manufacturers' as shipped operating
98   specifications; and (c) has system hardware that supports error-correcting code (ECC) that
99   detects and corrects errors with dedicated circuitry on and across the CPU, interconnect, and
100   system memory. In addition, a workstation meets two or more of the following criteria:

101   a) Supports one or more discrete GPU or discrete compute accelerators

102   b) Supports four or more slots of PCI-express, other than discrete GPU, connected to accessory
103   expansion slots or ports where each lane has a bandwidth of 8 gigabits per second (Gb/s) or
104   more.

105   c) Provide multi-processor support for two or more physically separate processor packages or
106   sockets. (this requirement cannot be met with support for a single multi-core processor);
107   and/or

108   d) Certification by 2 or more Independent Software Vendor (ISV) product certifications; these
109   certifications can be in process, but shall be completed within 3 months of certification.

110 **Note**: EPA received stakeholder feedback suggesting that the term "lanes" in criteria b) above is too
111 generic and that the term "slots" (used in Version 6.1) more clearly defines the interfaces intended to
112 identify the differences between a workstation and desktop computer. EPA is proposing to include this
113 revision in the Final Draft as the Agency is concerned that the term "lanes" may unintentionally include
114 small form factor ports such as Thunderbolt 3 which are not the target of this criterion.

115   10) <u>Rack-mounted Workstation</u>: A workstation that is designed to be natively rack mounted as
116   described in IEC 60297-3-101:2004. The rack-mounted workstation may be accessed locally by
117   direct connection to the workstation and display or accessed remotely across a network by one or
118   more users.

119 **Note**: EPA has removed the mobile workstation definition. After further discussions with stakeholders,
120 EPA is aware of interest to consider specific levels for mobile workstations and has requested additional
121 data on the energy performance of mobile workstation products to support that effort. If the data is
122 received, EPA intends to consider TEC criteria for those products as part of a dot revision to Version 7.0.
123 The mobile workstation definition included in Draft 2 would be reintroduced for comment as a part of that
124 process. EPA envisions that this process will follow closely the completion of Version 7.0 and be
125 completed before the Version 7.0 takes effect.   Mobile workstations certified as notebooks presently will
126 remain on the QPX with all other currently certified products until the new specification takes effect
127 November 16, 2018.

128

B) Product Category: A second-order classification or sub-type within a product type that is based on product features and installed components. Product categories are used in this specification to determine certification and test requirements.

C) Computer Components:

1) Graphics Processing Unit (GPU): An integrated circuit, separate from the CPU, designed to accelerate the rendering of either 2D and/or 3D content to displays. A GPU may be mated with a CPU, on the system board of the computer or elsewhere to offload display capabilities from the CPU.

2) Discrete Graphics (dGfx): A graphics processor (GPU) which must contain a local memory controller interface and local graphics-specific memory.

3) Integrated Graphics (iGfx): A graphics solution that does not contain Discrete Graphics.

4) Display: A commercially-available product with a display screen and associated electronics, often encased in a single housing, that as its primary function displays visual information from (1) a computer, workstation or server via one or more inputs (e.g., VGA, DVI, HDMI, DisplayPort, IEEE 1394, USB), (2) external storage (e.g., USB flash drive, memory card), or (3) a network connection.

   a) Enhanced-performance Integrated Display: An integrated Computer Display that has all of the following features and functionalities:

      (1) A contrast ratio of at least 60:1 at a horizontal viewing angle of at least 85°, with or without a screen cover glass;

      (2) A native resolution greater than or equal to 2.3 megapixels (MP); and

      (3) A color gamut of at least sRGB as defined by IEC 61966-2-1. Shifts in color space are allowable as long as 99% or more of defined sRGB colors are supported.

5) External Power Supply (EPS): Also referred to as External Power Adapter. An external power supply circuit that is used to convert household electric current into dc current or lower-voltage ac current to operate a consumer product.

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

D) Operational Modes:

1) Active State: The power state in which the computer is carrying out useful work in response to a) prior or concurrent user input or b) prior or concurrent instruction over the network. Active State includes active processing, seeking data from storage, memory, or cache, including Idle State time while awaiting further user input and before entering low power modes.

2) Idle State: The power state in which the operating system and other software have completed loading, a user profile has been created, activity is limited to those basic applications that the system starts by default, and the computer is not in Sleep Mode. Idle State is composed of two sub-states: Short Idle and Long Idle.

175   a) <u>Long Idle</u>: The mode where the Computer has reached an Idle condition (i.e., 15 minutes
176   after OS boot or after completing an active workload or after resuming from Sleep Mode)
177   and the main Computer Display has entered a low-power state where screen contents
178   cannot be observed (i.e., backlight has been turned off) but remains in the working mode
179   (ACPI G0/S0). If power management features are enabled as-shipped in the scenario
180   described in this definition, such features shall engage prior to evaluation of Long Idle
181   (e.g., display is in a low power state, HDD may have spun-down), but the Computer is
182   prevented from entering Sleep Mode. P_{LONG_IDLE} represents the average power measured
183   when in the Long Idle Mode.

184   b) <u>Short Idle</u>: The mode where the Computer has reached an Idle condition (i.e., 5 minutes
185   after OS boot or after completing an active workload or after resuming from Sleep Mode),
186   the screen is on, and Long Idle power management features have not engaged (e.g.
187   HDD is spinning and the Computer is prevented from entering sleep mode). P_{SHORT_IDLE}
188   represents the average power measured when in the Short Idle mode.

189   3) <u>Off Mode</u>: The lowest power mode which cannot be switched off (influenced) by the user and that
190   may persist for an indefinite time when the appliance is connected to the main electricity supply
191   and used in accordance with the manufacturer's instructions. For systems where ACPI standards
192   are applicable, Off Mode correlates to ACPI System Level S5 state.

193   4) <u>Sleep Mode</u>: A low power mode that the computer enters automatically after a period of inactivity
194   or by manual selection. A computer with Sleep capability can quickly "wake" in response to
195   network connections or user interface devices with a latency of less than or equal to 5 seconds
196   from initiation of wake event to system becoming fully usable including rendering of display. For
197   systems where ACPI standards are applicable, Sleep Mode most commonly correlates to ACPI
198   System Level S3 (suspend to RAM) state.

199 E) <u>Networking and Additional Capabilities</u>:

200   1) <u>Additional Internal Storage</u>: Any and all internal hard disk drives (HDD) or solid state drives (SSD)
201   installed beyond the largest capacity non-volatile storage device present in the system in its as
202   shipped state. This definition does not include external drives.

203   2) <u>Energy Efficient Ethernet (EEE)</u>: A technology which enables reduced power consumption of
204   Ethernet interfaces during times of low data throughput. Specified by IEEE 802.3az.

205   3) <u>Full Network Connectivity</u>: The ability of the computer to maintain network presence while in
206   Sleep Mode or an alternative low power mode (LPM) with power demand of less than or equal to
207   10 watts and intelligently wake when further processing is required (including occasional
208   processing required to maintain network presence). Presence of the computer, its network
209   services and applications, is maintained even though the computer is in a LPM. From the vantage
210   point of the network, a computer with full network connectivity that is in LPM is functionally
211   equivalent to an idle computer with respect to common applications and usage models. Full
212   network connectivity in LPM is not limited to a specific set of protocols but can cover applications
213   installed after initial installation. Also referred to as "network proxy" functionality and as described
214   in the *Ecma-393* standard.

215 **Note**: ENERGY STAR has reverted to the V6.1 definition for Full Network Connectivity. With the
216 proposed changes made in Section 3.5.1 (iii), it is no longer necessary to limit the power demand to two
217 watts for those products that meet a full network connectivity standard. Furthermore, the standards
218 described in that section will effectively act as a ceiling for those products using the full network
219 connectivity mode weighting.

220   a) <u>Network Proxy - Base Capability</u>: To maintain addresses and presence on the network while
221   in LPM, the system handles IPv4 ARP and IPv6 NS/ND.

222   b) <u>Network Proxy - Full Capability</u>: While in LPM, the system supports Base Capability, Remote
223   Wake, and Service Discovery/Name Services.

c) <u>Network Proxy - Remote Wake</u>: While in LPM, the system is capable of remotely waking upon request from outside the local network. Includes Base Capability.

d) <u>Network Proxy - Service Discovery/Name Services</u>: While in LPM, the system allows for advertising host services and network name. Includes Base Capability.

4) <u>Network Interface</u>: The components (hardware and software) whose primary function is to make the computer capable of communicating over one or more network technologies. Examples of Network Interfaces are IEEE 802.3 (Ethernet) and IEEE 802.11 (Wi-Fi).

5) <u>Wake Event</u>: A user, scheduled, or external event or stimulus that causes the computer to transition from Sleep Mode or Off Mode to an active state of operation. Examples of wake events include, but are not limited to: movement of the mouse, keyboard activity, controller input, real-time clock event, or a button press on the chassis, and in the case of external events, stimulus conveyed via a remote control, network, modem, etc.

6) <u>Wake On LAN (WOL)</u>: Functionality which allows a computer to transition from Sleep Mode or Off Mode to an Active State of operation when directed by a network Wake Event via Ethernet.

7) <u>Switchable Graphics</u>: Functionality that allows Discrete Graphics to be disabled when not required in favor of Integrated Graphics.

<u>Note:</u> This functionality allows lower power and lower capability integrated GPUs to render the display while on battery or when the output graphics are not overly complex while then allowing the more power consumptive but more capable discrete GPU to provide rendering capability when required.

F) <u>Marketing and Shipment Channels</u>:

1) <u>Enterprise Channels</u>: Sales channels typically used by large and medium-sized business, government, educational, or other organizations to purchase computers for use in managed client/server environments.

2) <u>Model Name</u>: A marketing name that includes reference to the computer model number, product description, or other branding references.

3) <u>Model Number</u>: A unique marketing name or identification reference that applies to a specific hardware and software configuration (e.g., operating system, processor type, memory, GPU), and is either pre-defined or selected by a customer.

G) <u>Product Family</u>: A high-level description referring to a group of computers sharing one chassis/motherboard combination that often contains hundreds of possible hardware and software configurations. Product models within a family differ from each other according to one or more characteristics or features that either (1) have no impact on product performance with regard to ENERGY STAR certification criteria, or (2) are specified herein as acceptable variations within a product family. For Computers, acceptable variations within a product family include:

1) Color;

2) Housing; and

3) Electronic components other than the chassis/motherboard, such as the processor, memory, GPU, etc.

2 SCOPE

2.1 Included Products

2.1.1 Products that meet the definition of a Computer <u>and</u> one of the following Product Type definitions, as specified herein, are eligible for ENERGY STAR certification, with the exception of products listed in Section 2.2:

268		i.	Desktop Computers and Integrated Desktop Computers;
269		ii.	Notebook Computers;
270		iii.	Slates/Tablets;
271		iv.	Portable All-In-One Computers;
272		v.	Workstations; and
273		vi.	Thin Clients.

2.2 Excluded Products

274

275 2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for
276 certification under this specification. The list of specifications currently in effect can be found at
277 www.energystar.gov/products.

278 2.2.2 The following products are not eligible for certification under this specification:

279   i. Docking Stations;

280   ii. Game Consoles;

281   iii. E-Readers;

282   iv. Handheld gaming devices, typically battery powered and intended for use with an integral
283   display as the primary display;

284   v. Mobile Thin Clients not meeting the definition of Notebook Computer;

285   vi. Personal Digital Assistant devices (PDAs);

286   vii. Point of Sale (POS) products that do not use internal components common to Notebook,
287   Desktop, or Integrated Desktop Computers, including a processor, motherboard, and
288   memory;

289   viii. Slate/Tablet based POS products;

290   ix. Handheld Computers which contain cellular voice capability;

291   x. Ultra-thin Clients; and

292   xi. Small-scale Servers.

293 **Note**: EPA has removed Mobile Workstations from the excluded product list. These products may
294 continue to be ENERGY STAR certified as notebooks at this time.

3 CERTIFICATION CRITERIA

295

3.1 Significant Digits and Rounding

296

297 3.1.1 All calculations shall be carried out with directly measured (unrounded) values.

298 3.1.2 Unless otherwise specified in this specification, compliance with specification limits shall be
299 evaluated using directly measured or calculated values without any benefit from rounding.

300 3.1.3 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR
301 website shall be rounded to the nearest significant digit as expressed in the corresponding
302 specification limit.

303 **3.2 General Requirements**

304 3.2.1 Power supply test data and test reports from testing entities recognized by EPA to perform power
305 supply testing shall be accepted for the purpose of certifying the ENERGY STAR product.

306 3.2.2 <u>Internal Power Supply (IPS) Requirements</u>: IPSs used in Computers eligible under this
307 specification must meet the following requirements when tested using the *Generalized Internal*
308 *Power Supply Efficiency Test Protocol, Rev. 6.6* (available at
309 http://www.plugloadsolutions.com/docs/collatrl/print/Generalized_Internal_Power_Supply_Efficien
310 cy_Test_Protocol_R6.6.pdf).

311 i. IPS with maximum rated output power less than 75 watts shall meet minimum efficiency
312 requirements as specified in Table 1..

313 ii. IPS with maximum rated output power greater than or equal to 75 watts shall meet <u>both</u>
314 minimum efficiency requirements and minimum power factor requirements, as specified in
315 Table 1 or Table 2 as applicable.

316 **Table 1: Requirements for Internal Power Supplies with Rated Output of 500 Watts and Below**

Loading Condition (Percentage of Nameplate Output Current)	Minimum Efficiency (115V)	Minimum Efficiency (230V)	Minimum Power Factor
20%	0.82	0.85	-
50%	0.85	0.88	0.90
100%	0.82	0.85	-

317 **Table 2: Requirements for Internal Power Supplies with Rated Output Above 500 Watts**

Loading Condition (Percentage of Nameplate Output Current)	Minimum Efficiency (115V)	Minimum Efficiency (230V)	Minimum Power Factor
20%	0.87	0.90	-
50%	0.90	0.92	0.90
100%	0.87	0.89	-

318

319 **Note**: EPA received feedback requesting that Table 1 and Table 2 be adjusted to capture 80Plus
320 equivialent computer products with 230 volt non-redundant internal power supplies. EPA has revised
321 both tables so that both the 115 volt and 230 volt requirements are clearly stated, as applicable.

322 3.2.3 <u>External Power Supply (EPS) Requirements</u>: Single- and Multiple-voltage EPSs shall meet the
323 Level V or higher performance requirements under the International Efficiency Marking Protocol
324 when tested according to the Uniform Test Method for Measuring the Energy Consumption of
325 External Power Supplies, Appendix Z to 10 CFR Part 430.

326 i. Single-voltage EPSs shall include the Level VI or higher marking.

327 ii. Multiple-voltage EPSs meeting Level VI or higher shall include the Level VI or higher
328 marking.

329 iii. Additional information on the Marking Protocol is available
330 at http://www.regulations.gov/#!documentDetail;D=EERE-2008-BT-STD-0005-0218

331

3.3 Power Management Requirements

3.3.1   Products shall include power management features in their "as-shipped" condition as specified in Table 3, subject to the following conditions:

    i.   For Thin Clients, the Wake-on-LAN (WOL) requirement shall apply for products designed to receive software updates from a centrally managed network while in Sleep Mode or in Off Mode. Thin Clients whose standard software upgrade framework does not require off-hours scheduling are exempt from the WOL requirement.

    ii.   For Notebooks, WOL may be automatically disabled when the product is disconnected from ac mains power.

    iii.   For all products with WOL, directed packet filters shall be enabled and set to an industry standard default configuration.

    iv.   Products that do not support Sleep Mode by default are only subject to the Display Sleep Mode requirement.

345

Table 3: Power Management Requirements

Mode or Mode Transition	Requirement	Desktops	Integrated Desktops	Portable All-In-Ones	Notebooks	Slates/Tablets	Thin Clients	Workstations
System Sleep Mode[i]	(1) Sleep Mode shall be set to activate after no more than 30 minutes of user inactivity. (2) The speed of any active 1 Gb/s or faster Ethernet network links shall be reduced when transitioning to Sleep Mode or Off Mode.	Yes	Yes	Yes	Yes	N/A	Yes	Yes
Display Sleep Mode	(1) Display Sleep Mode shall be set to activate after no more than 15 minutes of user inactivity.	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Wake on LAN (WOL)[i]	(1) Computers with Ethernet capability shall provide users with an option to enable and disable WOL for Sleep Mode.
	(2) Computers with Ethernet capability that are shipped through enterprise channels shall either:
	  (a) be shipped with WOL enabled by default for Sleep Mode, when the computer is operating on ac mains power; or
	  (b) provide users with the ability to enable WOL that is accessible from both the client operating system user interface and over the network.
		Yes	Yes	Yes	Yes	N/A	Yes	Yes

Wake Manage-ment[i]	(1) Computers with Ethernet capability that are shipped through enterprise channels shall:
	  (a) be capable of both remote (via network) and scheduled (via real-time clock) wake events from Sleep Mode, and
	  (b) provide clients with the ability to centrally manage (via vendor tools) any wake management settings that are configured through hardware settings if the manufacturer has control over such features.
		Yes	Yes	Yes	Yes	N/A	Yes	Yes

346

---

i Where Sleep Mode is supported by the UUT by default and Sleep Mode power is used as part of the TEC equation for qualification.

3.4 User Information Requirements

347 **3.4** **User Information Requirements**

348 3.4.1 Products shall be shipped with informational materials to notify customers of the following:

349 i. A description of power management settings that have been enabled by default,

350 ii. A description of the timing settings for various power management features, and

351 iii. Instructions for properly waking the product from Sleep Mode.

352 3.4.2 Products shall be shipped with one or more of the following:

353 i. A list of default power management settings.

354 ii. A note stating that default power management settings have been selected for compliance
355 with ENERGY STAR (within 15 min of user inactivity for the display, within 30 min for the
356 computer, if applicable per Table 3), and are recommended by the ENERGY STAR program
357 for optimal energy savings.

358 iii. Information about ENERGY STAR and the benefits of power management, to be located at
359 or near the beginning of the hard copy or electronic user manual, or in a package or box
360 insert.

361 3.4.3 Provisions 3.4.1 and 3.4.2 may be met through use of either electronic or printed product
362 documentation, provided it adheres to <u>all</u> of the following:

363 i. Documentation is shipped with the product (e.g., in a printed manual or insert, on included
364 optical media, in a file installed with the software load shipped to the customer) or available
365 electronically on the manufacturer's website. In the latter case, instructions for accessing the
366 information on the website shall be provided in the product package or on the Desktop or
367 home screen; and

368 ii. Documentation is included either (a) only with ENERGY STAR certified Computers; or (b) as
369 part of the standard documentation if and only if accompanied by EPA-approved customer
370 guidance on how to identify if their computer configuration is ENERGY STAR certified.

3.5 Requirements for Desktop, Integrated Desktop, and Notebook Computers

371 **3.5** **Requirements for Desktop, Integrated Desktop, and Notebook Computers**

372 3.5.1 Calculated Typical Energy Consumption (E_{TEC}) for Desktop, Integrated Desktop, and Notebook
373 Computers per Equation 1 shall be less than or equal to the maximum TEC requirement
374 (E_{TEC_MAX}) per Equation 2, subject to the following requirements:

375 i. The Additional Internal Storage adder allowance ($TEC_{STORAGE}$) shall be applied if there are
376 more than one internal storage devices present in the product, in which case it shall only be
377 applied once.

378 ii. The Integrated Display adder allowance ($TEC_{INT\_DISPLAY}$) applies only for Integrated Desktops
379 and Notebooks and may be applied for each display. For Enhanced-performance Integrated
380 Displays, the adder is calculated as presented in Table 9 and Equation 3.

381 iii. For a product to certify for the Full Network Connectivity mode weighting, one of the following
382 sets of criteria shall be satisfied:

383 - Option 1:

384 - Products shall meet a non-proprietary Full Network Connectivity standard such as
385 ECMA 393 or another standard that has been approved by EPA as meeting the
386 goals of ENERGY STAR.

387 - Products shall have the applied level of functionality enabled and configured by
388 default upon shipment. If Full Network Connectivity features are not enabled by
389 default, the system shall be tested and reported with Conventional TEC weightings.

390	•	Option 2:
391		- Products shall be capable of Sleep Mode or an alternative low power mode which
392		maintains constant network connectivity with energy consumption less than or
393		equal to 2 watts.

394 **Note**: Full Network Connectivity is a manufacturer-reported parameter. On Mac computers,
395 "Wake for network access" enabled within the Energy Saver/Power Adapter Preferences
396 signifies Base Capability or better. On Windows computers, "ARP Offload" or "NS Offload" or
397 similar enabled within the Advanced Properties of the Network Interface Card (accessed
398 through the Device Manager) signifies Base Capability or better. For systems with a dual
399 Network Interface Card (NIC) configuration, only one NIC configuration needs to comply. The
400 manufacturer can provide further guidance on how to confirm Proxy Support.

401

402 iv. For Notebooks, Desktops, and Integrated Desktops that use an alternative low power mode
403 in place of System Sleep Mode, power in Long Idle (P_{LONG_IDLE}) may be used in place of
404 power in Sleep (P_{SLEEP}) in Equation 1 if the alternative low power mode is less than or equal
405 to 10 watts. In such instances, ($P_{SLEEP} \times T_{SLEEP}$), is replaced by ($P_{LONG\_IDLE} \times T_{SLEEP}$);
406 Equation 1 remains otherwise unchanged.

407 v. Notebooks, Desktops, and Integrated Desktops with switchable graphics may not apply the
408 Discrete Graphics allowance, TEC$_{GRAPHICS}$, from Table 9 in Equation 2. However, for Desktop
409 and Integrated Desktop systems providing Switchable Graphics and enabling it by default, an
410 allowance equal to 50% of the G1 graphics allowance for the platform type (Desktop or
411 Integrated Desktop) may be applied. The switchable graphics incentive only applies to
412 automated switching that is enabled by default. This capability is manufacturer-declared.

413

414 **Equation 1: TEC Calculation (E$_{TEC}$) for Desktop, Integrated Desktop, Thin Client**
415 **and Notebook Computers**

$$E_{TEC} = \frac{8760}{1000} \times (P_{OFF} \times T_{OFF} + P_{SLEEP} \times T_{SLEEP} + P_{LONG\_IDLE} \times T_{LONG\_IDLE} + P_{SHORT\_IDLE} \times T_{SHORT\_IDLE})$$

416 *Where:*
417 ▪ *P_{OFF} = Measured power consumption in Off Mode (W);*
418 ▪ *P_{SLEEP} = Measured power consumption in Sleep Mode (W);*
419 ▪ *P_{LONG_IDLE} = Measured power consumption in Long Idle Mode*
420 *(W);*
421 ▪ *P_{SHORT_IDLE} = Measured power consumption in Short Idle Mode*
422 *(W); and*
423 ▪ *T_{OFF}, T_{SLEEP}, T_{LONG_IDLE}, and T_{SHORT_IDLE} are mode weightings as*
424 *specified in Table 4 (for Desktops, Integrated Desktops, and Thin*
425 *Clients) or Table 5 (for Notebooks).*

426

427 **Table 4: Mode Weightings for Desktop, Thin Clients, and Integrated Desktop Computers**

Mode Weighting	Conventional	Network Proxy - Full Capability
T_{OFF}	45%	20%
T_{SLEEP}	5%	45%
T_{LONG_IDLE}	15%	5%
T_{SHORT_IDLE}	35%	30%

428 **Table 5: Mode Weightings for Notebook Computers**

Mode Weighting	Conventional	Network Proxy - Full Capability
T_{OFF}	25%	25%
T_{SLEEP}	35%	45%
T_{LONG_IDLE}	10%	5%
T_{SHORT_IDLE}	30%	25%

429
430

431 **Equation 2: E_{TEC_MAX} Calculation for Desktop, Integrated Desktop, and Notebook Computers**

432
433
$$E_{TEC\_MAX} = (1+ALLOWANCE_{PSU}) \times (TEC_{BASE} + TEC_{MEMORY} + TEC_{GRAPHICS} + TEC_{STORAGE} + TEC_{INT\_DISPLAY} + TEC_{SWITCHABLE} + TEC_{EEE})$$

434 *Where:*
435 ▪ *$ALLOWANCE_{PSU}$ is an allowance provided to power supplies that*
436 *meet the optional more stringent efficiency levels specified in*
437 *Table 6; power supplies that do not meet the requirements*
438 *receive an allowance of 0;*
439 ▪ *TEC_{BASE} is the Base allowance specified in Table 7 or Table 8;*
440 *and,*
441 ▪ *$TEC_{GRAPHICS}$ is the discrete graphics allowance as specified in*
442 *Table 9, with the exception of systems with integrated graphics,*
443 *which do not receive an allowance, or Desktops and Integrated*
444 *Desktops with switchable graphics enabled by default, which*
445 *receive an allowance through $TEC_{SWITCHABLE}$; and*
446 ▪ *TEC_{MEMORY}, $TEC_{STORAGE}$, $TEC_{INT\_DISPLAY}$, $TEC_{SWITCHABLE}$, and*
447 *TEC_{EEE} are adder allowances as specified in Table 9.*

448 **Table 6: Internal Power Supply Efficiency Allowance**

Power Supply Type	Computer Type	Minimum Efficiency at Specified Proportion of Rated Output Current[ii]				Minimum Average Efficiency[iii]	Allowance$_{PSU}$
		10%	20%	50%	100%		
IPS	Desktop	0.86	0.90	0.92	0.89	-	0.015
		0.90	0.92	0.94	0.90	-	0.03
	Integrated Desktop	0.86	0.90	0.92	0.89	-	0.015
		0.90	0.92	0.94	0.90	-	0.04

449
450 **Note**: EPA has updated the values at 100% loading to harmonize with 80Plus equivalent Platinum and Titanium levels.

451 **Table 7: Base TEC (TEC$_{BASE}$) Allowances for Desktops and Integrated Desktops**

Category Name	Graphics Capability[iv]	Desktop or Integrated Desktop	
		Performance Score, P[v]	Base Allowance
0	Any Graphics dGfx ≤ G7	$P \leq 3$	69.0
I1	Integrated or Switchable Graphics	$3 < P \leq 6$	112.0
I2		$6 < P \leq 7$	120.0
I3		$P > 7$	135.0
D1	Discrete Graphics dGfx ≤ G7	$3 < P \leq 9$	115.0
D2		$P > 9$	135.0

452
453

---

ii   EPSs shall meet the specified requirements when tested using the *Uniform Test Method for Measuring the Energy Consumption of External Power Supplies, Appendix Z to 10 CFR Part 430.* IPSs shall meet the specified requirements when tested using the *EPRI 306 Generalized Internal Power Supply Efficiency Test Protocol, Rev. 6.6.*

iii Average efficiency is the arithmetic mean of efficiencies tested at 25%, 50%, 75%, and 100% of rated output current. EPSs shall meet the specified requirements when tested using the *Uniform Test Method for Measuring the Energy Consumption of External Power Supplies, Appendix Z to 10 CFR Part 430.*

iv   Discrete Graphics capability is categorized based on frame buffer bandwidth, as shown in Table 9.

v   P = [# of CPU cores] × [CPU clock speed (GHz)] , where # of cores represents the number of physical CPU cores and CPU clock speed represents the Max TDP core frequency, not the turbo boost frequency.

454

Table 8: Base TEC (TEC$_{BASE}$) Allowances for Notebooks

Category Name	Notebook	
	Performance Score, P^{v}	Base Allowance
0	$P \leq 2$	6.5
1	$2 < P \leq 8$	8.0
2	$P > 8$	14.0

455

Note: EPA received stakeholder feedback, including additional data on products not submitted to
ENERGY STAR, in response to the November 14, 2017 memo regarding adjusting the category 2 base
allowance for notebooks from 12 to 14 kWh/year. This feedback requested consideration of raising the
base allowance for Category 1 and Category 2 to 9 and 15 kWh/year respectively. After considering the
data received and discussing this data with stakeholders, EPA believes that the currently proposed
category structure adequately differentiates a variety of notebook product types. EPA has also retained
the memory adder to allow for a better selection of higher-end configurations in a product family that
contain notably less memory than the family's representative model.

EPA also received comments requesting that the performance score boundary between category 1 and 2
be adjusted to move a p-score of 8 to category 2. EPA has reviewed the data and comments, and found
the argument compelling and the impact on the specification's effectiveness negligible and has therefore
incorporated this change into the final draft specification.

Table 9: Functional Adder Allowances for Desktop, Integrated Desktop, Thin Client, and Notebook Computers

Function			Desktop	Integrated Desktop	Notebook
TEC$_{MEMORY}$ (kWh)^{vi}			0.8		2.4 + (0.294 $\times$ GB)
TEC$_{GRAPHICS}$ (kWh)^{vii}	Graphics Category^{viii}	**G1** *(FB_BW ≤ 16)*	36		29.3 $\times$ tanh(0.0038 $\times$ FB_BW − 0.137) + 13.4
		G2 *(16< FB_BW ≤ 32)*	51		
		G3 *(32 < FB_BW ≤ 64)*	64		
		G4 *(64 < FB_BW ≤ 96)*	83		
		G5 *(96 < FB_BW ≤ 128)*	105		
		G6 *(FB_BW > 128; Frame Buffer Data Width < 192 bits)*	115		
		G7 *(FB_BW > 128; Frame Buffer Data Width ≥ 192 bits*	130		

---

vi TEC$_{MEMORY}$ Adder: *GB* applies per GB installed in the system.

vii TEC$_{GRAPHICS}$ Adder: Applies to only the first dGfx installed in the system, but not Switchable Graphics.

viii FB_BW: Is the display frame buffer bandwidth in gigabytes per second (GB/s). This is a manufacturer declared parameter and should be calculated as follows: (Data Rate [Mhz] $\times$ Frame Buffer Data Width [bits]) / (8 $\times$ 1000)

TEC$_{SWITCHABLE}$ (kWh)[ix]	$0.5 \times G1$		N/A
TEC$_{EEE}$ (kWh) [x]	$8.76 \times 0.2 \times (0.15 + 0.35)$		N/A
TEC$_{STORAGE}$ (kWh)[xi]	26		2.6
Function	**Desktop**	**Integrated Desktop**	**Notebook**
TEC$_{INT\_DISPLAY}$ (kWh) [xii]	N/A	$8.76 \times 0.35 \times (1+EP) \times (4 \times r + 0.05 \times A)$	$8.76 \times 0.30 \times (1+EP) \times (0.43 \times r + 0.0263 \times A)$

Note: EPA received stakeholder feedback in response to the November 14, 2017 memo supporting the revision of the memory adder which recognizes more low-end configurations with 4GB of memory which are not reported as representative models in QPX, as well as scaling down the adder beyond 16GB as it was found to be too generous for high-end systems.

Equation 3: Calculation of Allowance for Enhanced-performance Integrated Displays

$$EP = \begin{cases} 0, & No\ Enhanced\ Performance\ Display \\ 0.3, & Enhanced\ Performance\ Display, d < 27 \\ 0.75, & Enhanced\ Performance\ Display, d \geq 27 \end{cases}$$

Where:
- *d is the diagonal of the screen, in inches;*

3.6 Requirements for Slates/Tablets and Portable All-In-One Computers

3.6.1 Slates/Tablets and Portable All-In-One Computers shall follow **all** of the requirements for Notebook Computers in Section 3.5 above, including calculations of the following:

i. Calculated Typical Energy Consumption (E$_{TEC}$), using Equation 1 with the Notebook Computer Mode Weightings from Table 5.

ii. Calculated Maximum Allowed Typical Energy Consumption (E$_{TEC\_MAX}$), using Equation 2 with the appropriate base Notebook Computer allowance from Table 8, and applicable Notebook Computer functional adder allowances from Table 9.

3.7 Requirements for Workstations

3.7.1 Weighted power consumption (P$_{TEC}$) as calculated per Equation 4 shall be less than or equal to the maximum weighted power consumption requirement (P$_{TEC\_MAX}$) as calculated per Equation 5.

Equation 4: P$_{TEC}$ Calculation for Workstations

$$P_{TEC} = P_{OFF} \times T_{OFF} + P_{SLEEP} \times T_{SLEEP} + P_{LONG\_IDLE} \times T_{LONG\_IDLE} + P_{SHORT\_IDLE} \times T_{SHORT\_IDLE}$$

---

ix TEC$_{SWITCHABLE}$ Incentive: Applies to automated switching that is enabled by default in Desktops and Integrated Desktops.
x TEC$_{EEE}$: Applies per IEEE 802.3az-compliant (Energy Efficient Ethernet) Gigabit Ethernet port enabled as shipped.
xi TEC$_{STORAGE}$ Adder: Applies once if system has more than one Additional Internal Storage element.
xii TEC$_{INT\_DISPLAY}$ Adder: EP is the Enhanced Performance Display allowance calculated per Equation 3; r is the Screen resolution in megapixels; and A is viewable screen area in square inches.

493   *Where:*
494   ■ *P_{OFF} = Measured power consumption in Off Mode (W);*
495   ■ *P_{SLEEP} = Measured power consumption in Sleep Mode (W);*
496   ■ *P_{LONG_IDLE} = Measured power consumption in Long Idle Mode*
497   *(W);*
498   ■ *P_{SHORT_IDLE} = Measured power consumption in Short Idle Mode*
499   *(W); and*
500   ■ *T_{OFF}, T_{SLEEP}, T_{LONG_IDLE}, and T_{SHORT_IDLE} are mode weightings as*
501   *specified in Table 10.*

502 **Table 10: Mode Weightings for Workstations**

T_{OFF}	T_{SLEEP}	T_{LONG_IDLE}	T_{SHORT_IDLE}
35%	10%	15%	40%

503

504 **Equation 5: P_{TEC_MAX} Calculation for Workstations**

505 $$P_{TEC\_MAX} = 0.28 \times (P_{MAX} + N_{HDD} \times 5)$$
506 $$+ \ 8.76 \times P_{EEE} \times (T_{SLEEP} + T_{LONG\_IDLE} + T_{SHORT\_IDLE})$$

507   *Where:*
508   ■ *P_{MAX} = Measured maximum power consumption (W)*
509   ■ *N_{HDD} = Number of installed hard disk drives (HDD) or solid state*
510   *drives (SSD)*
511   ■ *P_{EEE} is an EEE allowance of 0.2 W per IEEE 802.3az-*
512   *compliant (Energy Efficient Ethernet) Gigabit Ethernet*
513   *port.*
514   ■ *T_{OFF}, T_{SLEEP}, T_{LONG_IDLE}, and T_{SHORT_IDLE} are mode weightings as*
515   *specified in Table 10.*
516

517 3.7.2   <u>Active State Benchmark</u>: To be ENERGY STAR certified, a Workstation must be submitted for
518   certification with the following information disclosed in full:

519   i.   Linpack benchmark test results, compiler optimizations, and total energy consumed over the
520   duration of the test; and

521   ii.   SPECviewperf benchmark test results, configuration options, total duration of the test, and
522   total energy consumed over the duration of the test.

523 3.7.3   <u>Desktop Workstations</u>: Products marketed as workstations may be ENERGY STAR certified
524   under the Desktop requirements in Section 3.5 instead of the Workstation requirements in
525   Section 3.6, at the Partner's option. EPA will identify Workstations certified as Desktops as
526   "Desktops" in all ENERGY STAR marketing materials, on certified product lists, etc.

527 **3.8   Requirements for Thin Clients**

528 3.8.1   Calculated Typical Energy Consumption (E_{TEC}) per Equation 1 shall be less than or equal to the
529   Maximum TEC Requirement (E_{TEC_MAX}), as calculated per Equation 6, subject to the following
530   requirements.

531   i.   Allowances can only be applied if the corresponding adders are enabled by default.

532   ii.   Thin Clients can utilize the proxy weightings in Table 4when calculating E_{TEC}.

533	iii.	For Thin Clients that lack a discrete System Sleep Mode, Long Idle State power (P_{LONG_IDLE})
534		may be used in place of Sleep Mode Power (P_{SLEEP}) in Equation 1 so long as the system
535		meets the Thin Client TEC allowance. In such instances, ($P_{SLEEP} \times T_{SLEEP}$), is replaced by
536		($P_{LONG\_IDLE} \times T_{SLEEP}$); Equation 1 remains otherwise unchanged.

Equation 6: Calculation of E_TEC_MAX for Thin Clients

$$E_{TEC\_MAX} = TEC_{BASE} + TEC_{GRAPHICS} + TEC_{WOL} + TEC_{INT\_DISPLAY} + TEC_{EEE}$$

Where:

- *TEC_{BASE} is the Base Allowance specified in Table 11;*
- *$TEC_{GRAPHICS}$ is the Discrete Graphics allowance specified in Table 11 if applicable;*
- *TEC_{WOL} is the Wake-on-LAN allowance specified in Table 11 if applicable;*
- *$TEC_{INT\_DISPLAY}$ is the Integrated Display allowance for Integrated Desktops specified in Table 9 if applicable; and*
- *TEC_{EEE} is the Energy Efficiency Ethernet incentive for Desktops specified in Table 9 if applicable, per IEEE 802.3az-compliant (Energy Efficient Ethernet) Gigabit Ethernet port.*

Table 11: Adder Allowances for Thin Clients

Adder	Allowance (kWh)
TEC_{BASE}	31
$TEC_{GRAPHICS}$	36
TEC_{WOL}	2

Note: Products intended for sale in the US market are subject to minimum toxicity and recyclability requirements. Please see ENERGY STAR® Program Requirements for Computers: Partner Commitments for details.

4   TESTING

4.1   Test Methods

4.1.1   When testing Computer products, the test methods identified in Table 12 shall be used to determine ENERGY STAR certification.

Table 12: Test Methods for ENERGY STAR Certification

Product Type or Component	Test Method
All	ENERGY STAR Test Method for Computers, Rev. March-2016

4.2 Number of Units Required for Testing

565

566 4.2.1 Representative Models shall be selected for testing per the following requirements:

567   i. For certification of an individual product configuration, the unique configuration that is
568   intended to be marketed and labeled as ENERGY STAR is considered the Representative
569   Model.

570   ii. For certification of a Product Family of all product types, with the exception of Workstations,
571   product configurations that represent the worst-case power consumption for each product
572   category within the family are considered Representative Models. When submitting Product
573   Families, manufacturers continue to be held accountable for any efficiency claims made
574   about their products, including those not tested or for which data were not reported. This
575   includes ensuring that all models shipped as ENERGY STAR certified within the product
576   family maintain the same power management settings and default display brightness settings
577   used when testing the Representative Model(s).

578 **Note**: EPA received feedback stating that some ENERGY STAR certified models are being sold with
579 default brightness settings that do not match the settings used to test the Representative Model for
580 certification. EPA has clarified that all certified products must maintain the as-shipped conditions used
581 during the certification process for products sold with the ENERGY STAR label.

582   iii. For systems that meet the definition for multiple categories (as defined in Section 1.B)
583   depending on the specific configuration, manufacturers will have to submit the highest power
584   configuration for each category under which they would like the system to be ENERGY STAR
585   certified. For example, a system that could be configured as either a Category 0 or 1
586   Desktop, as defined in Table 7 would require submittal of the highest power configuration for
587   both categories in order to be ENERGY STAR certified. If a product could be configured to
588   meet all categories, it would then have to submit data for the highest power configuration in
589   all categories.

590   iv. For certification of a Product Family of Workstations under the Workstation or Desktop
591   product type, the product configuration that represents the worst-case power consumption
592   with a single GPU within the family is considered the Representative Model.
593
594   Note: Workstations that meet ENERGY STAR requirements with a single graphics device
595   may also have a configuration with more than one graphics device be ENERGY STAR
596   certified, provided the additional hardware configuration is identical with the exception of the
597   additional graphics device(s). The use of multiple graphics includes, but is not limited to,
598   driving multiple displays and ganging for high performance, multi-GPU configurations (e.g.
599   ATI Crossfire, NVIDIA SLI). In such cases, and until such time as SPECviewperf® supports
600   multiple graphics threads, manufacturers may submit the test data for the workstation with
601   the single graphics device for both configurations without retesting the system.

602 4.2.2 A single unit of each Representative Model shall be selected for testing.

603 4.2.3 All units/configurations for which a Partner is seeking ENERGY STAR certification, must meet the
604   ENERGY STAR requirements. However, if a Partner wishes to certify configurations of a model
605   for which non-ENERGY STAR certified alternative configurations exist, the Partner must assign
606   the certified configurations an identifier in the model name/number that is unique to ENERGY
607   STAR certified configurations. This identifier must be used consistently in association with the
608   certified configurations in marketing/sales materials and on the ENERGY STAR list of certified
609   products (e.g. model A1234 for baseline configurations and A1234-ES for ENERGY STAR
610   certified configurations).

611   **Note:** There may be cases—as described in the paragraph above—where not all
612   units/configurations will meet ENERGY STAR requirements. If so, the worst-case configuration
613   for test will be the worst-case certified configuration, and not one of the presumably even higher-
614   energy consuming non-certified configurations.

4.3 International Market Certification

4.3.1 Products, and all applicable components, shall be tested for certification at the relevant input voltage/frequency combination for each market in which they will be sold and promoted as ENERGY STAR.

Note: EPA received feedback stating that some computer products bearing the ENERGY STAR label in the EU have power supplies that are not measured using the relevant voltage/frequency combination appropriate for the EU market. EPA is clarifying that test results for applicable components such as internal power supplies, should be provided for the U.S. market as well as any other applicable ENERGY STAR markets that require that data.

4.4 Customer Software and Management Service Pre-Provisioning

4.4.1 If a manufacturing Partner is hired by a customer to load a custom image on an ENERGY STAR certified computer, the Partner shall take the following steps:

    i. Inform the customer that their product may not meet ENERGY STAR with the custom image. A sample notification letter is available on the ENERGY STAR Web site.

    ii. Encourage the customer to test the product for ENERGY STAR compliance.

    iii. Encourage the customer, should the product no longer meet ENERGY STAR, to make use of EPA's free technical assistance that can assist with Power Management performance, which can be found at www.energystar.gov/fedofficeenergy.

5 USER INTERFACE

5.1.1 Manufacturers are encouraged to design products in accordance with the user interface standard IEEE 1621: Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments. For details, see http://eetd.LBL.gov/Controls.

6 EFFECTIVE DATE

6.1.1 <u>Effective Date</u>: The Version 7.0 ENERGY STAR Computers specification shall take effect **November 16, 2018**. To be ENERGY STAR certified, a product model shall meet the ENERGY STAR specification in effect on its date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is considered to be completely assembled.

Note: EPA intends for the Version 7.0 specification to be finalized in February 2018 and become effective on November 16, 2018.

6.1.2 <u>Future Specification Revisions</u>: EPA reserves the right to change this specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through stakeholder discussions. In the event of a specification revision, please note that the ENERGY STAR certification is not automatically granted for the life of a product model.

7 CONSIDERATIONS FOR FUTURE REVISIONS

7.1.1 **Desktop and Workstation Requirements**: EPA intends revise the desktop and workstation energy requirements in Version 8.0, including a possible recategorization of desktops to more effectively highlight the most efficient products in the market.

653 7.1.2 **Mode Weightings:** EPA will continue to accept any large scale data sets that help inform
654   updates to the existing mode weighting values which have become dated.

655 7.1.3 **Low Load IPS Requirements:** EPA would like to work with stakeholders to investigate revising
656   future IPS requirements to focus on lower power supply load levels which are more
657   representative of the low power modes computers persist in when not performing work.

658 7.1.4 **Active Mode:** EPA will continue to monitor developments in test methodology that addresses
659   active mode, where the computer is actively performing tasks, and assess whether these
660   measurements warrant inclusion into the ENERGY STAR Computers specification.

661

APPENDIX A:
Sample Calculations

662

663

664

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

668

669 *Following is a sample E_{TEC} evaluation for a 2.0 GHz, dual core Notebook with Switchable Graphics,*
670 *8 GB Memory, Energy Efficient Ethernet (EEE), and 1 hard disk drive (HDD).*

671

672   A) Measure values using the ENERGY STAR Computers Test Method:

673   1) Off Mode = 0.5 W

674   2) Sleep Mode = 1.0 W

675   3) Long Idle State = 6.0 W

676   4) Short Idle State = 10.0 W

677   B) Determine the proxy support provided by the operating system and network card. This is a
678 manufacturer-reported parameter.

679   1) On Mac computers, "Wake for network access" enabled within the Energy Saver/Power
680 Adapter Preferences signifies Base Capability or better.

681   2) On Windows computers, "ARP Offload" or "NS Offload" or similar enabled within the
682 Advanced Properties of the Network Interface Card (accessed through the Device Manager)
683 signifies Base Capability or better. OEM can provide further guidance on how to confirm
684 Proxy Support

685   C) Calculate E_{TEC} from power measurements and mode weightings—this example assumes no
686 Proxy Support/Conventional Weightings:

T_{OFF}	25%
T_{SLEEP}	35%
T_{LONG_IDLE}	10%
T_{SHORT_IDLE}	30%

687   1) $E_{TEC} = \frac{8760}{1000} \times (P_{OFF} \times T_{OFF} + P_{SLEEP} \times T_{SLEEP} + P_{LONG\_IDLE} \times T_{LONG\_IDLE} + P_{SHORT\_IDLE} \times$
688 $T_{SHORT\_IDLE})$

689   2) $E_{TEC} = \frac{8760}{1000} \times (0.5\,\text{W} \times 25\% + 1.0\,\text{W} \times 35\% + 6.0\,\text{W} \times 10\% + 10.0\,\text{W} \times 30\%)$

690   3) E_{TEC} = 35.7 kWh / year

691   *D)* Determine which Base TEC allowance applies based on graphics capability and performance
692 score: *P = [# of CPU cores] × [CPU clock speed (GHz)] = 2×2 GHz = 4.*

| 693 | **Table 8: Base TEC (TEC$_{BASE}$) Allowances for Notebooks** |

Category Name	Notebook	
	Performance Score, P^v	Base Allowance
1	$2 < P \leq 8$	8.0

694

695   E) Determine which Functional Adder Allowances apply:

696
697   1) Memory: *8 GB installed, so a TEC$_{MEMORY}$ allowance of* $2.4 + (0.294 \times 8) = 4.75 \text{ kWh}$ *applies*

698   2) Discrete Graphics? *No, therefore TEC$_{GRAPHICS}$ allowance does not apply.*

699   3) Switchable Graphics? *Yes, but TEC$_{SWITCHABLE}$ allowance does not apply to Notebooks.*

700   4) Energy Efficient Ethernet (EEE)? *Yes, but TEC$_{EEE}$ allowance does not apply to Notebooks.*

701   5) Storage? *No, the notebook has only one hard disk drive, so no storage allowance applies.*

702
703
704
705   6) Integrated Display? *Yes, and assuming a non-enhanced performance, 14 inch display with an area of 83.4 square inches and a resolution of 1.05 megapixels, a TEC$_{INT\_DISPLAY}$ allowance of* $8.76 \times 0.30 \times (1 + EP) \times (0.43 \times r + 0.0263 \times A) = 8.76 \times 0.30 \times (0.43 \times 1.05 \text{ MP} + 0.0263 \times 83.4 \text{ in}^2) = 6.95 \text{ kWh}$ *applies.*

706   F) Calculate E$_{TEC\_MAX}$:

707   1) E$_{TEC\_MAX}$ = 8.0 kWh + 4.75 kWh + 6.95 kWh

708   2) E$_{TEC\_MAX}$ = 19.7 kWh/yr

709   G) Compare E$_{TEC}$ to the E$_{TEC\_MAX}$ to determine if the model qualifies:

710
711   35.7 kWh/yr > 19.7 kWh/yr

712   **Therefore, the Notebook does not meet ENERGY STAR requirements.**

713

714
715 II. **Workstations:** Below is a sample P$_{TEC}$ calculation for a Workstation with 2 hard drives and no Energy Efficient Ethernet capability.

716   A) Measure values using the ENERGY STAR Computers Test Method:

717   1) Off Mode = 2 W

718   2) Sleep Mode = 4 W

719   3) Long Idle State = 50 W

720   4) Short Idle State = 80 W

721   5) Max Power = 180 W

722   A) Note number of Hard Drives installed: Two hard drives installed during test.

723   B) Calculate P$_{TEC}$ from power measurements and mode weightings using Equation 4:

T_{OFF}	T_{SLEEP}	T_{LONG_IDLE}	T_{SHORT_IDLE}
35%	10%	15%	40%

724   1) $P_{TEC} = (35\% \times P_{OFF} + 10\% \times P_{SLEEP} + 15\% \times P_{LONG\_IDLE} + 40\% \times P_{SHORT\_IDLE})$

725   2) $P_{TEC} = (35\% \times 2 \text{ W} + 10\% \times 4 \text{ W} + 15\% \times 50 \text{ W} + 40\% \times 80 \text{ W})$

726   3) P_{TEC} = 40.6 W

727   C) Calculate the P_{TEC_MAX} requirement using Equation 5:

728   *1)* *$P_{TEC\_MAX} = 0.28 \times (P_{MAX} + N_{HDD} \times 5) + 8.76 \times P_{EEE} \times (T_{SLEEP} + T_{LONG\_IDLE} + T_{SHORT\_IDLE})$*

729   *2)* *$P_{TEC\_MAX} = 0.28 \times (180 + 2 \times 5) + 8.76 \times 0 \times (T_{SLEEP} + T_{LONG\_IDLE} + T_{SHORT\_IDLE})$*

730   *3)* *$P_{TEC\_MAX} = 53.2 + 0$*

731   D) Compare P_{TEC} to the ENERGY STAR levels to determine if the model qualifies:

732   40.6 W ≤ 53.2 W

733
734   **Therefore, the Workstation meets ENERGY STAR requirements.**

735