



ENERGY STAR[®] Program Requirements Product Specification for Computer Servers

Eligibility Criteria Draft 2 Version 2.0

1 Following is the Version 2.0 ENERGY STAR Product Specification for Computer Servers. A product shall
2 meet all of the identified criteria if it is to earn the ENERGY STAR.

3 **1 DEFINITIONS**

4 **Note:** The definitions in this section largely mirror those distributed with EPA's data assembly
5 documentation. Further revisions are indicated with noteboxes.

6 A) Product Types:

- 7 1) Computer Server: A computer that provides services and manages networked resources for
8 client devices (e.g., desktop computers, notebook computers, thin clients, wireless devices,
9 PDAs, IP telephones, other computer servers, or other network devices). A computer server
10 is sold through enterprise channels for use in data centers and office/corporate environments.
11 A computer server is primarily accessed via network connections, versus directly-connected
12 user input devices such as a keyboard or mouse. For purposes of this specification, a
13 computer server must meet **all** of the following criteria:
- 14 a) is marketed and sold as a computer server;
 - 15 b) is designed for and listed as supporting one or more computer server operating systems
16 (OS) and/or hypervisors, and is targeted to run user-installed enterprise applications;
 - 17 c) provides support for error-correcting code (ECC) and/or buffered memory (including both
18 buffered DIMMs and buffered on board (BOB) configurations)-systems with greater than
19 50 nodes sharing the same chassis are exempt from this requirement; and
 - 20 d) is packaged and sold with one or more ac-dc or dc-dc power supplies; and
 - 21 e) is designed such that all processors have access to shared system memory and are
22 independently visible to a single OS or hypervisor.

23 **Note:** EPA had proposed removing the ECC/buffered memory provision from the Computer Server
24 definition in response to stakeholder concerns about excluding products relying on non-ECC memory
25 solutions. The products at issue contain a significantly higher number of computer nodes than present in
26 both mainstream and blade configurations and offer the opportunity to save energy through use of less
27 resilient memory. This was offset in their design by the ability to power up nodes dynamically to scale
28 capacity with power consumption. These products are targeted at the data center server market.

29 Because EPA recognizes a) the scope challenges possible with a complete removal of the existing
30 memory provision; b) the unique nature of non-ECC memory products and concerns brought to EPA's
31 attention as described above; and c) the information-disclosure goals of this version of the specification,
32 an exemption from the ECC/buffered memory provision is proposed for systems with greater than 50
33 nodes.

- 34 2) Managed Server: A computer server that is designed for a high level of availability in a highly
35 managed environment. For purposes of this specification, a managed server must meet **all** of
36 the following criteria:
- 37 a) is designed to be configured with redundant power supplies; and

- 38 b) contains an installed dedicated management controller (e.g., service processor).
- 39 3) Blade System: A system comprised of a blade chassis and one or more removable blade
40 servers and/or other units (e.g., blade storage, blade network equipment). Blade systems
41 provide a scalable means for combining multiple blade server or storage units in a single
42 enclosure, and are designed to allow service technicians to easily add or replace (hot-swap)
43 blades in the field.
- 44 a) Blade Server: A computer server that is designed for use in a blade chassis. A blade
45 server is a high-density device that functions as an independent computer server and
46 includes at least one processor and system memory, but is dependent upon shared blade
47 chassis resources (e.g., power supplies, cooling) for operation. A processor or memory
48 module that is intended to scale up a standalone server is not considered a Blade Server.
- 49 (1) *Multi-bay Blade Server*: A blade server requiring more than one bay for installation in
50 a blade chassis.
- 51 (2) *Single-wide Blade Server*: A blade server requiring the width of a standard blade
52 server bay.
- 53 (3) *Double-wide Blade Server*: A blade server requiring twice the width of a standard
54 blade server bay.
- 55 (4) *Half-height Blade Server*: A blade server requiring one half the height of a standard
56 blade server bay.
- 57 b) Blade Chassis: An enclosure that contains shared resources for the operation of blade
58 servers, blade storage, and other blade form-factor devices. Shared resources provided
59 by a chassis may include power supplies, data storage, and hardware for dc power
60 distribution, thermal management, system management, and network services.
- 61 c) Blade Storage: A storage device that is designed for use in a blade chassis. A blade
62 storage device is dependent upon shared blade chassis resources (e.g., power supplies,
63 cooling) for operation.
- 64 4) Fully Fault Tolerant Server: A computer server that is designed with complete hardware
65 redundancy, in which every computing component is replicated between two nodes running
66 identical and concurrent workloads (i.e., if one node fails or needs repair, the second node
67 can run the workload alone to avoid downtime). A fully fault tolerant server uses two systems
68 to simultaneously and repetitively run a single workload for continuous availability in a
69 mission critical application.
- 70 5) Resilient Server: A computer server that is designed with resiliency, RAS, and self-correction
71 features integrated in the micro-architecture of the CPU and chipset to ensure data resiliency
72 and accuracy. A resilient server is often used for a limited set of workloads that may include
73 business processing, decision support, or handling of virtualized workloads. For purposes of
74 this specification, a resilient server must meet **all** of the following criteria:
- 75 a) contains hot-swappable components (e.g., I/O, hard drives, and ac-dc power supplies);
- 76 b) contains multiple physical banks of memory and I/O busses;
- 77 c) provides machine check architecture (i.e., both Fault Isolation and Resiliency);
- 78 d) provides memory fault detection and system recovery through DRAM chip sparing,
79 extended ECC, and mirrored memory;
- 80 e) provides support for error-correcting code (ECC) and/or buffered memory (including both
81 buffered DIMMs and buffered on board (BOB) configurations);
- 82 f) provides end-to-end bus retry; and
- 83 g) supports on-line expansion/retraction of hardware resources without the need for
84 operating system reboot (“on-demand” features).

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Note: EPA understands that stakeholders are actively developing a more cohesive set of criteria describing Resilient Servers. EPA plans to evaluate the resulting proposal once available and welcomes comments on this issue.

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6) Multi-node Server: A computer server that is designed with two or more independent server nodes that share a single enclosure and one or more power supplies. In a multi-node server, power is distributed to all nodes through shared power supplies. Server nodes in a multi-node server are not designed to be hot-swappable.

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a) Dual-node Server: A common multi-node server configuration consisting of two server nodes.

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7) Server Appliance: A computer server that is bundled with a pre-installed operating system and application software that is used to perform a dedicated function or set of tightly coupled functions. Server appliances deliver services through one or more networks (e.g., IP or SAN), and are typically managed through a web or command line interface. Server appliance hardware and software configurations are customized by the vendor to perform a specific task (e.g., name services, firewall services, authentication services, encryption services, and voice-over-IP (VoIP) services), and are not intended to execute user-supplied software.

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8) High Performance Computing (HPC) System: TBD.

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Note: A definition for High Performance Computing System was suggested by stakeholders during development of the server dataset. EPA has removed the definition text and intends to engage stakeholders regarding the need to define this product type.

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9) Direct Current (Dc) Server: A computer server that is designed solely to operate on a dc power source.

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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 qualification and test requirements.

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C) Computer Server Form Factors:

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1) Rack-mounted Server: A computer server that is designed for deployment in a standard 19-inch data center rack as defined by EIA-310, IEC 60297, or DIN 41494. For the purposes of this specification, a blade server is considered under a separate category and excluded from the rack-mounted category.

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2) Pedestal Server: A self-contained computer server that is designed with PSUs, cooling, I/O devices, and other resources necessary for stand-alone operation. The frame of a pedestal server is similar to that of a tower client computer.

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D) Computer Server Components:

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1) Power Supply Unit (PSU): A device that converts ac or dc input power to one or more dc power outputs for the purpose of powering a computer server. A computer server PSU must be self-contained and physically separable from the motherboard and must connect to the system via a removable or hard-wired electrical connection.

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a) Ac-Dc Power Supply: A PSU that converts line-voltage ac input power into one or more dc power outputs for the purpose of powering a computer server.

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b) Dc-Dc Power Supply: A PSU that converts line-voltage dc input power to one or more dc outputs for the purpose of powering a computer server. For purposes of this specification, a dc-dc converter (also known as a voltage regulator) that is internal to a computer server and is used to convert a low voltage dc (e.g., 12 V dc) into other dc power outputs for use by computer server components is not considered a dc-dc power supply.

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c) Single-output Power Supply: A PSU that is designed to deliver the majority of its rated

131 output power to one primary dc output for the purpose of powering a computer server.
132 Single-output PSUs may offer one or more standby outputs that remain active whenever
133 connected to an input power source. For purposes of this specification, the total rated
134 power output from any additional PSU outputs that are not primary and standby outputs
135 shall be no greater than 20 watts. PSUs that offer multiple outputs at the same voltage as
136 the primary output are considered single-output PSUs unless those outputs (1) are
137 generated from separate converters or have separate output rectification stages, or (2)
138 have independent current limits.

139 d) Multi-output Power Supply: A PSU that is designed to deliver the majority of its rated
140 output power to more than one primary dc output for the purpose of powering a computer
141 server. Multi-output PSUs may offer one or more standby outputs that remain active
142 whenever connected to an input power source. For purposes of this specification, the
143 total rated power output from any additional PSU outputs that are not primary and
144 standby outputs is greater than or equal to 20 watts.

145 2) I/O Device: A device which provides data input and output capability between a computer
146 server and other devices. An I/O device may be integral to the computer server motherboard
147 or may be connected to the motherboard via through expansion slots (e.g., PCI, PCIe).
148 Examples of I/O devices include discrete Ethernet devices, InfiniBand devices, RAID/SAS
149 controllers, and Fibre Channel devices.

150 a) I/O Port: Physical circuitry within an I/O device where an independent I/O session can be
151 established. A port is not the same as a connector receptacle; it is possible that a single
152 connector receptacle can service multiple ports of the same interface.

153 3) Motherboard: The main circuit board of the server. For purposes of this specification, the
154 motherboard includes connectors for attaching additional boards and typically includes the
155 following components: processor, memory, BIOS, and expansion slots.

156 4) Processor: The logic circuitry that responds to and processes the basic instructions that drive
157 a server. For purposes of this specification, the processor is the central processing unit
158 (CPU) of the computer server. A typical CPU is a physical package to be installed on the
159 server motherboard via a socket or direct solder attachment. The CPU package may include
160 one or more processor cores.

161 5) Memory: For purposes of this specification, memory is a part of a server external to the
162 processor in which information is stored for immediate use by the processor.

163 6) Hard Drive (HDD): The primary computer storage device which reads and writes to one or
164 more rotating magnetic disk platters.

165 7) Solid State Drive (SSD): A disk drive that uses memory chips instead of rotating magnetic
166 platters for data storage.

167 E) Other Datacenter Equipment:

168 1) Network Equipment: A device whose primary function is to pass data among various network
169 interfaces, providing data connectivity among connected devices (e.g., routers and switches).
170 Data connectivity is achieved via the routing of data packets encapsulated according to
171 Internet Protocol, Fibre Channel, InfiniBand or similar protocol.

172 2) Storage Equipment: A system composed of integrated storage controllers, storage devices
173 (e.g., hard drives or solid state storage) and software that provides data storage services to
174 one or more computer servers. While storage equipment may contain one or more embedded
175 processors, these processors do not execute user-supplied software applications but may
176 execute data-specific applications (e.g., data replication, backup utilities, data compression,
177 install agents).

178 3) Uninterruptible Power Supply (UPS): Combination of convertors, switches, and energy
179 storage devices (such as batteries) constituting a power system for maintaining continuity of
180 load power in case of input power failure.

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Note: The definition for UPS is updated to align with the Final Draft ENERGY STAR Specification for Uninterruptible Power Supplies.

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F) Operational Modes and Power States:

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1) Idle State: The operational state in which the OS and other software have completed loading, the computer server is capable of completing workload transactions, but no active workload transactions are requested or pending by the system (i.e., the computer server is operational, but not performing any useful work). For systems where ACPI standards are applicable, Idle State correlates only to ACPI System Level S0.

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2) Active State: The operational state in which the computer server is carrying out work in response to prior or concurrent external requests (e.g., instruction over the network). Active state includes **both** (1) active processing and (2) data seeking/retrieval from memory, cache, or internal/external storage while awaiting further input over the network.

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G) Other Key Terms:

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1) Controller System: A computer or computer server that manages a benchmark evaluation process. The controller system performs the following functions:

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a) start and stop each segment (phase) of the performance benchmark;

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b) control the workload demands of the performance benchmark;

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c) start and stop data collection from the power analyzer so that power and performance data from each phase can be correlated;

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d) store log files containing benchmark power and performance information;

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e) convert raw data into a suitable format for benchmark reporting, submission and validation; and

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f) collect and store environmental data, if automated for the benchmark.

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2) Network Client (Testing): A computer or computer server that generates workload traffic for transmission to a UUT connected via a network switch.

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3) RAS Features: An acronym for reliability, availability, and serviceability features. RAS is sometimes expanded to RASM, which adds “Manageability” criteria. The three primary components of RAS as related to a computer server are defined as follows:

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a) Reliability Features: Features that support a server’s ability to perform its intended function without interruption due to component failures (e.g., component selection, temperature and/or voltage de-rating, error detection and correction).

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b) Availability Features: Features that support a server’s ability to maximize operation at normal capacity for a given duration of downtime (e.g., redundancy [both at micro- and macro-level]).

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c) Serviceability Features: Features that support a server’s ability to be serviced without interrupting operation of the server (e.g., hot plugging).

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4) Server Processor Utilization: The ratio of processor computing activity to full-load processor computing activity at a specified voltage and frequency, measured instantaneously or with a short term average of use over a set of active and/or idle cycles.

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5) Hypervisor: A type of hardware virtualization technique that enables multiple guest operating systems to run on a single host system at the same time.

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H) Product Family: 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.

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1) Common Product Family Attributes: A set of features common to all models/configurations

226 within a product family that constitute a common basic design. All models/configurations
227 within a product family must share the following:

- 228 a) Be from the same model line or machine type;
- 229 b) Share the same form factor (i.e., rack-mounted, blade, pedestal);
- 230 c) Either share processors from a single defined processor series or share processors that
231 plug into a common socket.
- 232 d) share PSUs that perform with efficiencies greater than or equal to the efficiencies at all
233 required load points specified in Section 3.2 (i.e., 10%, 20%, 50%, and 100% of
234 maximum rated load for single-output; 20%, 50%, and 100% of maximum rated load for
235 multi-output).

236 2) Product Family Tested Product Configurations:

237 a) Purchase Consideration Variations:

238 (1) Low-end Performance Configuration: The combination of Processor Socket Power,
239 PSUs, Memory, Storage (HDD/SDD), and I/O devices that represents the lowest-
240 price or lowest-performance computing platform within the Product Family.

241 **Note:** The phrase “lowest-performance” has been added to the Low-end Performance definition.

242 (2) High-end Performance Configuration: The combination of Processor Socket Power,
243 PSUs, Memory, Storage (HDD/SDD), and I/O devices that represents either the
244 highest-price or highest-performance computing platform within the Product Family.

245 b) Typical Configuration:

246 (1) Typical Configuration: A product configuration that lies between the Minimum and
247 Maximum Power configurations and is representative of a deployed product with high
248 volume sales.

249 c) Power Utilization Variations:

250 (1) Minimum Power Configuration: The minimum configuration that is able to boot and
251 execute supported OSs. The Minimum Configuration contains the lowest Processor
252 Socket Power, least number of installed PSUs, Memory, Storage (HDD/SDD), and
253 I/O devices, that is both offered for sale and capable of meeting ENERGY STAR
254 requirements.

255 (2) Maximum Power Configuration: The vendor-selected combination of components that
256 maximize power usage within the Product Family once assembled and operated. The
257 Maximum Configuration contains the highest Processor Socket Power, greatest
258 number of installed PSUs, Memory, Storage (HDD/SDD), and I/O devices that is both
259 offered for sale and capable of meeting ENERGY STAR requirements.

260 **Note:** After examining the results of the data assembly process, EPA is moving forward with the five-point
261 product family approach originally presented in conjunction with dataset development. EPA believes that
262 this structure reduces the product testing burden while providing sufficient information to customers and
263 allows for verification of results.

264 **2 SCOPE**

265 **2.1 Included Products**

266 2.1.1 A product must meet the definition of a Computer Server provided in *Section 1* of this document
267 to be eligible for ENERGY STAR qualification under this specification. Eligibility under Version 2.0
268 is limited to blade-, rack-mounted, or pedestal form factor computer servers with no more than
269 four processor sockets. Products explicitly excluded from Version 2.0 are identified in *Section 2.2*.

270 2.2 Excluded Products

271 2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for
272 qualification under this specification. The list of specifications currently in effect can be found at
273 www.energystar.gov/products.

274 2.2.2 The following products are not eligible for qualification under this specification:

- 275 i. Fully Fault Tolerant Servers;
- 276 ii. Server Appliances;
- 277 iii. Storage Equipment including Blade Storage; and
- 278 iv. Network Equipment.

279 3 QUALIFICATION CRITERIA

280 3.1 Significant Digits and Rounding

281 3.1.1 All calculations shall be carried out with directly measured (unrounded) values.

282 3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using directly
283 measured or calculated values without any benefit from rounding.

284 3.1.3 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR
285 website shall be rounded to the nearest significant digit as expressed in the corresponding
286 specification limit.

287 3.2 Power Supply Requirements

288 3.2.1 Power supply test data and test reports from testing entities recognized by EPA to perform power
289 supply testing shall be accepted for the purpose of qualifying the ENERGY STAR product.

290 3.2.2 Power Supply Efficiency Criteria: Power Supplies used in products eligible under this specification
291 must meet the following requirements when tested using the *Generalized Internal Power Supply*
292 *Efficiency Test Protocol, Rev. 6.6* (available at www.efficientpowersupplies.org).

293 **Note:** The test protocol version is updated to the most recent available – Revision 6.6. Power Supply
294 requirements for efficiency and power factor remain consistent with proposals made in Draft 1.

- 295 i. Pedestal and Rack-mounted Servers: To qualify for ENERGY STAR, a pedestal or rack-
296 mounted computer server must be configured with **only** PSUs that meet or exceed the
297 applicable efficiency requirements specified in Table 1 **prior to shipment**.
- 298 ii. Blade Servers: To qualify for ENERGY STAR, a blade server shipped with a chassis must be
299 configured with **only** PSUs included in the chassis that meet or exceed the applicable
300 efficiency requirements specified in Table 1 **prior to shipment**.

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Table 1: Efficiency Requirements for PSUs

Power Supply Type	Rated Output Power	10% Load	20% Load	50% Load	100% Load
Multi-output (Ac-Dc & Dc-Dc)	All Output Levels	N/A	85%	88%	85%
Single-output (Ac-Dc & Dc-Dc)	All Output Levels	80%	88%	92%	88%

302 3.2.3 Power Supply Power Factor Criteria: Power Supplies used in Computers eligible under this
 303 specification must meet the following requirements when tested using the *Generalized Internal*
 304 *Power Supply Efficiency Test Protocol, Rev. 6.5* (available at www.efficientpowersupplies.org).

- 305 i. Pedestal and Rack-mounted Servers: To qualify for ENERGY STAR, a pedestal or rack-
 306 mounted computer server must be configured with **only** PSUs that meet or exceed the
 307 applicable power factor requirements specified in Table 2 **prior to shipment**, under all
 308 loading conditions for which output power is greater than or equal to 75 watts. Partners are
 309 required to measure and report PSU power factor under loading conditions of less than 75
 310 watts, though no minimum power factor requirements apply.
- 311 ii. Blade Servers: To qualify for ENERGY STAR, a blade server shipped with a chassis must be
 312 configured with **only** PSUs included in the chassis that meet or exceed the applicable power
 313 factor requirements specified in Table 2 **prior to shipment**, under all loading conditions for
 314 which output power is greater than or equal to 75 watts. Partners are required to measure
 315 and report PSU power factor under loading conditions of less than 75 watts, though no
 316 minimum power factor requirements apply.

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Table 2: Power Factor Requirements for PSUs

Power Supply Type	Rated Output Power	10% Load	20% Load	50% Load	100% Load
Dc-Dc (All)	All Output Ratings	N/A	N/A	N/A	N/A
Ac-Dc Multi-output	All Output Ratings	N/A	0.80	0.90	0.95
Ac-Dc Single-output	Output Rating ≤ 500 W	N/A	0.80	0.90	0.95
	Output Rating > 500 W and Output Rating ≤ 1,000 W	0.65	0.80	0.90	0.95
	Output Rating > 1,000 watts	0.80	0.90	0.90	0.95

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319 **3.3 Power Management Requirements**

320 3.3.1 Server Processor Power Management: To qualify for ENERGY STAR, a server must offer
 321 processor power management that is enabled by default in the BIOS and/or through a
 322 management controller or service processor. **All** processors must be able to reduce power
 323 consumption in times of low utilization by

- 324 i. reducing voltage and/or frequency through Dynamic Voltage and Frequency Scaling (DVFS),
 325 or
- 326 ii. enabling processor or core reduced power states when a core or socket is not in use.

327 3.3.2 Supervisor Power Management: To qualify for ENERGY STAR, a product which offers a pre-
328 installed supervisor system (e.g., operating system, hypervisor) must offer supervisor system
329 power management that is enabled by default.

330 3.3.3 Power Management Disclosure: To qualify for ENERGY STAR, all power management
331 techniques that are enabled by default must be itemized on the Power and Performance Data
332 Sheet.

333 3.4 Blade System Criteria

334 3.4.1 Blade Chassis Thermal Management: To qualify for ENERGY STAR, a blade chassis that is (1)
335 shipped with an ENERGY STAR qualified blade server, or (2) marketed for use with an ENERGY
336 STAR qualified blade server, must provide real-time chassis temperature monitoring and fan
337 speed management capability that is enabled by default.

338 3.4.2 Blade Server Shipping Documentation: To qualify for ENERGY STAR, a blade server that is
339 shipped to a customer independent of a blade chassis must be packaged with documentation to
340 inform the customer that the blade server is ENERGY STAR qualified only if it is installed in a
341 blade chassis meeting requirements in *Section 3.4.1* of this document. A list of qualifying blade
342 chassis and ordering information must also be provided as part of product collateral provided with
343 the blade in either a printed format or an alternative format approved by EPA.

344 **Note:** References to blade chassis power requirements have been removed. After discussions with
345 stakeholders and review of blade systems currently on the market, EPA has determined that setting
346 levels applicable to the range of chassis solutions available is not possible due to differences in how
347 vendors choose to design shared resources. While a chassis power disclosure option was also
348 considered to allow for investigation in future versions, EPA believes that such information for different
349 blade systems would not be comparable for the same reason.

350 3.5 Active State Efficiency Criteria

351 3.5.1 Active Mode Efficiency Disclosure: To qualify for ENERGY STAR, a computer server or computer
352 server family must be submitted for qualification with the following information disclosed in full
353 and in the context of the complete active mode efficiency rating test report:

- 354 i. final rating tool results; and
355 ii. intermediate rating tool results over the entire test run at **all** of the following load levels:
356 **[TBD]**.

357 Public disclosure and formatting requirements are discussed in *Section 3.7* of this specification.

358 3.5.2 Incomplete Disclosure: Partners shall not selectively report individual workload module results, or
359 otherwise presenting efficiency rating tool results in any form other than a complete test report, in
360 customer documentation or marketing materials.

361 **Note:** Section 3.5 remains to be determined and will be updated as the SERT development process
362 comes to a close.

363 3.6 Idle Mode and Full Load Efficiency Criteria – One-Socket (1S) and Two-Socket (2S) 364 Servers

365 3.6.1 Idle Mode Efficiency: Measured Idle State power (P_{IDLE}) shall be less than or equal to the
366 Maximum Idle State Power Requirement (P_{IDLE_MAX}), as calculated per Equation 1.

367 **Note:** The Idle State Power requirement structure above is maintained from Version 1 for single and dual
368 socket systems. Guidance for application of adders and allowances also remain consistent with Version
369 1.

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Equation 1: Calculation of Maximum Idle State Power

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$$P_{IDLE_MAX} = P_{BASE} + \sum_{i=1}^n P_{ADDD_i}$$

Where:

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- P_{IDLE_MAX} is the Maximum Idle State Power Requirement,
- P_{BASE} is the base idle power allowance, as determined per Table 3,
- P_{ADDD_i} is the Idle State power allowance for additional components, as determined per Table 4

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i. These Idle power limits are applicable to single and dual socket systems only, regardless of the number of processors (e.g., a three or four socket system with only one or two processors installed would not be subject to this requirements).

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ii. All quantities in Table 3 and Table 4 refer to the number of components installed in the system, not the maximum number of components the system can support (e.g., installed processors, not processor sockets; installed memory, not supported memory; etc.)

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iii. Additional Power Supply allowance: TBD.

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iv. For the purposes of determining Idle power allowances, all memory capacities shall be rounded to the nearest GB.

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v. The Additional I/O Device allowance may be applied for all I/O Devices over the Base Configuration (i.e., Ethernet devices additional to two ports of 1 Gigabit per second (Gbit/s), onboard Ethernet, plus any non-Ethernet I/O devices), including on-board I/O devices and add-in I/O devices installed through expansion slots.

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vi. The Additional I/O Device allowance shall be calculated based upon the rated link speed of a single connection, rounded to the nearest Gbit. I/O devices with less than 1 Gbit speed do not qualify for the Additional I/O Device allowance.

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vii. The Additional I/O Device allowance shall only be applied for I/O devices that are active/enabled upon shipment, and are capable of functioning when connected to an active switch.

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Table 3: Base Idle State Power Allowances for 1S and 2S Servers

Category	Number of Installed Processors (# P)	Managed Server	Base Idle State Power Allowance, P_{BASE} (watts)
A	1	No	55.0
B	1	Yes	65.0
C	2	No	100.0
D	2	Yes	150.0

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Note: EPA thanks stakeholders for the information provided during the data assembly process for this version of the Servers specification. Based on the information received as well as data contained in the ENERGY STAR Servers Qualified Product List, EPA has not revised the Base Idle Levels for 1 and 2 socket servers. The above levels, combined with updated allowances for components in Table 6 below, meet EPA's goal of ensuring a sufficient range of labeled products are available to consumers while maintaining the program's focus on recognizing superior energy efficiency.

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Table 4: Additional Idle Power Allowances for Extra Components

System Characteristic	Applies To:	Additional Idle Power Allowance
Additional Power Supplies	Power supplies installed explicitly for power redundancy ⁽ⁱⁱⁱ⁾	[TBD] watts per Power Supply
Additional Hard Drives (including solid state drives)	Installed hard drives greater than one	8.0 watts per Hard Drive
Additional Memory	Installed memory greater than 4 GB ^(iv)	0.75 watts per GB ^(iv)
Additional I/O Devices ^{(v), (vi), (vii)}	Installed Devices greater than two ports of 1 Gbit, onboard Ethernet	< 1Gbit: No Allowance = 1 Gbit: 2.0 watts / Active Port > 1 Gbit and < 10 Gbit: 4.0 watts / Active Port ≥ 10 Gbit: 8.0 watts / Active Port

407 **Note:** Power Adders for Additional Hard Drives and I/O devices are maintained from Version 1 as current
408 data shows that these levels continue to recognize the more energy efficient products.

409 The adder for Additional Power Supplies is changed to TBD. EPA believes that a revision to both the
410 magnitude and application of this adder is warranted and invites stakeholder comment on the most
411 appropriate approach to determine this allowance.

412 The Additional Memory Adder is reduced to 0.75 watts per GB to reflect EPA's review of the current
413 generation of memory technology and opportunities to reduce Idle power through memory selection. EPA
414 received a recommendation from a stakeholder suggesting that a reduction to as low as 0.5 W/GB would
415 be feasible based on the capability of the memory itself. In reviewing the ENERGY STAR dataset, EPA
416 noted a) that the Version 1.0 adder of 2.0 W/GB resulted in numerous systems eligible for adders in
417 excess of consumed Idle Power; and b) that there was variation among systems in the dataset when the
418 scaling of system Idle Power was examined in relation to memory installed. The proposed adder is
419 intended to provide an updated allowance for memory without ignoring the possibility of differences in
420 system overhead suggested in the dataset.

421 3.6.2 Full Load Data Disclosure: Measured Full Load power (P_{FULL_LOAD}) shall be measured and
422 reported, both in qualification materials and as required in Section 4.

423 **3.7 Idle Mode and Full Load Efficiency Criteria – Three-Socket (3S) and Four-Socket** 424 **(4S) Servers**

425 3.7.1 Idle Mode Data Disclosure: Measured Idle State power (P_{IDLE}) shall be measured and reported,
426 both in qualification materials and as required in Section 4.

427 3.7.2 Full Load Data Disclosure: Measured Full Load power (P_{FULL_LOAD}) shall be measured and
428 reported, both in qualification materials and as required in Section 4.

429 **3.8 Idle Mode and Full Load Efficiency Criteria – Blade Servers**

430 3.8.1 Idle Mode Data Disclosure: Measured Idle State power (P_{IDLE}) shall be measured and reported,
431 both in qualification materials and as required in Section 4.

432 3.8.2 Full Load Data Disclosure: Measured Full Load power (P_{FULL_LOAD}) shall be measured and
433 reported, both in qualification materials and as required in Section 4.

434 **3.9 Other Testing Criteria**

435 3.9.1 GPGPUs: For all Computer Servers sold with GPUs installed for general-purpose tasks
436 (GPGPUs), the following additional criteria apply to meet Idle Mode criteria:

- 437 i. For single configurations: All Idle Mode testing shall be conducted both with and without the
438 GPGPU installed. Idle Power measurements taken both with the GPGPU installed and
439 removed shall be submitted to EPA as part of ENERGY STAR qualification materials.
- 440 ii. For Product Families: All Idle Mode testing shall be conducted both with and without the
441 GPGPU installed in no less than one of the defined test points in 1.H)2).
- 442 iii. Idle Power measurements taken both with the GPGPU installed and removed shall be
443 submitted to EPA as part of ENERGY STAR qualification materials.
- 444 iv. Idle Power data with the GPGPU removed shall be used as P_{BASE} for the purposes of
445 qualification of the single configuration or Product Family test point.

446 **Note:** 3.9.1 is intended to support acquisition of data showing the power impact of GPGPUs installed in
447 Computer Servers. EPA welcomes stakeholder input on any existing industry-recognized benchmarks
448 that might be referenced as part of this requirement.

449 A stakeholder raised the topic of add-in compute capability via I/O cards as a similar topic to GPGPUs.
450 EPA is interested in discussing this issue further with stakeholders, particularly on the appropriate scope
451 (GPGPUs, add-in I/O cards, etc.) and measurements to take in support of the possible future inclusion of
452 adders for these components.

453 **4 STANDARD INFORMATION REPORTING REQUIREMENTS**

454 **4.1 Power and Performance Datasheet (PPDS)**

455 **Note:** As part of the ENERGY STAR Uninterruptible Power Supply (UPS) specification development
456 effort, EPA has initiated development of an improved approach to the Power and Performance Datasheet
457 process. Under this approach, data will be maintained in a centralized database instead of individual
458 forms, with a consumer-facing “widget” available for embedding on websites. It is anticipated that such a
459 system would also have the benefit of tying data from qualification directly into the online PPDS, reducing
460 the level of effort for ENERGY STAR Partners.

461 Information about this approach will be provided in conjunction with further drafts of the Version 2.0
462 Server Specification.

463 4.1.1 Data for a standardized Power and Performance Data Sheet (PPDS) shall be submitted to
464 EPA for each ENERGY STAR qualified Computer Server or Computer Server Product Family.

- 465 i. Partners are encouraged to provide one set of data for each ENERGY STAR qualified
466 product configuration, though EPA will also accept a data set for each qualified product
467 family.
- 468 ii. A product family PPDS must include data for all defined test points in 1.H)2), as applicable.
- 469 iii. Whenever possible, Partners must also provide a hyperlink to a more detailed power
470 calculator on their Web site that purchasers can use to understand power and performance
471 data for specific configurations within the product family.

472 4.1.2 Templates for the Power and Performance Data Sheet can be found on the ENERGY STAR
473 Web site at www.energystar.gov/products.

474 The PPDS contains the following information:

- 475 i. model name and number, identifying SKU and/or configuration ID;
- 476

- 477 ii. system characteristics (form factor, available sockets/slots, power specifications, etc.);
- 478 iii. system configuration(s) (including Low-end Performance Configuration, High-end
- 479 Performance Configuration, Minimum Power Configuration, Maximum Power Configuration,
- 480 and Typical Configuration for Product Family qualification);
- 481 iv. Data from required Active State Efficiency Criteria testing;
- 482 v. power data for Idle and full load, estimated kWh/year, link to power calculator (where
- 483 available);
- 484 vi. additional power and performance data for at least one benchmark as chosen by the Partner
- 485 from the EPA list of power-performance benchmarks;
- 486 vii. available and enabled power saving features (e.g., power management);
- 487 viii. power consumption and performance data, along with guaranteed accuracy levels for all
- 488 power and temperature measurements, disclosure of the time period used for data averaging,
- 489 and a hyperlink to a detailed power calculator, as available;
- 490 ix. a list of selected data from the ASHRAE Thermal Report;
- 491 x. for product family qualifications, a list of qualified configurations with qualified SKUs or
- 492 configuration IDs; and
- 493 xi. for a blade server, a list of compatible blade chassis that meet ENERGY STAR qualification
- 494 criteria.
- 495 4.1.3 EPA may periodically revise this PPDS, as necessary, and will notify and invite stakeholder
- 496 engagement in such a revision process.

497 **5 STANDARD PERFORMANCE DATA MEASUREMENT AND OUTPUT**

498 **REQUIREMENTS**

499 **5.1 Measurement and Output**

- 500 5.1.1 A computer server must provide data on input power consumption (W), inlet air temperature
- 501 (°C), and utilization of all logical CPUs. Data must be made available in a published or user-
- 502 accessible format that is readable by third-party, non-proprietary management software over a
- 503 standard network. For blade servers and systems, data may be aggregated at the chassis
- 504 level.
- 505 5.1.2 Servers classified as Class B equipment as set out in EN 55022:2006 are exempt from the
- 506 requirements to provide data on input power consumption and inlet air temperature in 5.1.1.
- 507 Class B refers to household and home office equipment (intended for use in the domestic
- 508 environment). All servers in the program must meet the requirement and conditions to report
- 509 utilization of all logical CPUs.

510 **Note:** Provision 5.1.2 is added to exclude “value” products intended for non-datacenter use from the

511 scope of the measurement and output requirements. Stakeholders suggested an alternative approach to

512 instead exclude single processor socket pedestal servers. EPA welcomes comments on whether there

513 are products in the single socket pedestal category that might be managed remotely.

514 **5.2 Reporting Implementation**

- 515 5.2.1 Products may use either embedded components or add-in devices that are packaged with the
- 516 computer server to make data available to end users (e.g., a service processor, embedded
- 517 power or thermal meter (or other out-of-band technology), or pre-installed OS);

- 518 5.2.2 Products that include a pre-installed OS must include all necessary drivers and software for
 519 end users to access standardized data as specified in this document. Products that do not
 520 include a pre-installed OS must be packaged with printed documentation of how to access
 521 registers that contain relevant sensor information;
- 522 5.2.3 When an open and universally available data collection and reporting standard becomes
 523 available, manufacturers should incorporate the universal standard into their systems;
- 524 5.2.4 Evaluation of the accuracy (5.3) and sampling (5.4) requirements shall be completed through
 525 review of data from component product datasheets. If this data is absent, Partner declaration
 526 shall be used to evaluate accuracy and sampling.

Note: 5.2.4 is added to clarify CB responsibilities in evaluating requirements in Section 5.

In conversation, a stakeholder raised the topic of required timestamping of environmental data (power and temperature) as a necessary prerequisite to generation of useful output. EPA seeks stakeholder feedback on this topic and the capability of Computer Servers to meet a possible timestamping requirement for power and temperature.

532 **5.3 Measurement Accuracy**

- 533 5.3.1 *Input power:* Measurements must be reported with accuracy of at least $\pm 5\%$ of the actual
 534 value, with a maximum level of accuracy of $\pm 10W$ for each installed PSU (i.e., power reporting
 535 accuracy for each power supply is never required to be better than ± 10 watts) through the
 536 operating range from Idle to full power;
- 537 5.3.2 *Processor utilization:* Utilization must be estimated for each logical CPU that is visible to the
 538 OS and must be reported to the operator or user of the computer server through the operating
 539 environment (OS or hypervisor);
- 540 5.3.3 *Inlet air temperature:* Measurements must be reported with an accuracy of at least $\pm 2^{\circ}C$.

541 **5.4 Sampling Requirements**

- 542 5.4.1 *Input power and processor utilization:* Input power and processor utilization measurements
 543 must be collected at a rate of ≥ 1 measurement per contiguous 10 second period. A rolling
 544 average, encompassing a period of no more than 30 seconds, must be reported at a
 545 frequency of greater than or equal to once per ten seconds.
- 546 5.4.2 *Inlet air temperature:* Inlet air temperature measurements must be collected at a rate of ≥ 1
 547 measurement every 10 seconds.

548 **6 TESTING**

549 **6.1 Test Methods**

- 550 6.1.1 When testing Computer Server products, the test methods identified in Table 5 shall be used to
 551 determine ENERGY STAR qualification.

552 **Table 5: Test Methods for ENERGY STAR Qualification**

Product Type or Component	Test Method
All	ENERGY STAR Test Method for Computer Servers, Rev. TBD

553 **6.2 Number of Units Required for Testing**

- 554 6.2.1 Representative Models shall be selected for testing per the following requirements:

555 i. For qualification of an individual product configuration, the unique configuration that is
556 intended to be marketed and labeled as ENERGY STAR is considered the Representative
557 Model.

558 ii. For qualification of a product family of all product types, one product configuration for each
559 of the five points identified in definitions 1.H)2) within the family are considered
560 Representative Models. All such representative models shall have the same Common
561 Product Family Attributes as defined in 1.H)1).

562 **Note:** The section above is added to specify representative testing based on the definitions for Product
563 Family.

564 6.3 Qualifying Families of Products

565 6.3.1 Partners are encouraged to test and submit data on individual product configurations for
566 qualification to ENERGY STAR. However, a Partner may qualify multiple product
567 configurations under one Product Family designation if each configuration within the family
568 meets one of the following requirements:

569 i. Individual products are built on the same platform, are eligible under and meet the same
570 specific requirements in this specification, and are identical in every respect to the tested,
571 representative product configuration except for housing and color; or

572 ii. Individual products meet the requirements of a product family, as defined in Section H),
573 above. In this case, partners must test and submit data as required in Section 6.2.1ii.

574 6.3.2 Partners are required to submit a Power and Performance Data Sheet for each product family
575 that is submitted for qualification.

576 6.3.3 **All** product configurations within a product family that is submitted for qualification must meet
577 ENERGY STAR requirements, including products for which data was not reported.

578 6.3.4 If a Partner wishes to qualify individual product configurations within a product family that
579 contains non-qualifying products, the Partner must assign a unique identifier to ENERGY
580 STAR qualified product configurations. This identifier must be used consistently in association
581 with qualifying configurations in marketing collateral and on the ENERGY STAR Qualified
582 Product List (e.g., model A1234 for baseline configurations and A1234-ES for ENERGY STAR
583 qualifying configurations).

584 7 EFFECTIVE DATE

585 7.1.1 Effective Date: The Version 2.0 ENERGY STAR Computer Server specification shall take effect
586 on the dates specified in Table 6, below. To qualify for ENERGY STAR, a product model shall
587 meet the ENERGY STAR specification in effect on its date of manufacture. The date of
588 manufacture is specific to each unit and is the date (e.g., month and year) on which a unit is
589 considered to be completely assembled.

590 7.1.2 Future Specification Revisions: EPA reserves the right to change this specification should
591 technological and/or market changes affect its usefulness to consumers, industry, or the
592 environment. In keeping with current policy, revisions to the specification are arrived at through
593 stakeholder discussions. In the event of a specification revision, please note that the ENERGY
594 STAR qualification is not automatically granted for the life of a product model.

595

Table 6: Specification Effective Dates

Effective Date	
Version 2.0	TBD

596

8 CONSIDERATIONS FOR FUTURE REVISIONS

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598

8.1 TBD

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601
602

APPENDIX A: Sample Calculations

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Note: This appendix will ultimately include sample calculations for reference in calculating performance levels for products covered in this specification.