



ENERGY STAR® Program Requirements for Computer Servers

DRAFT 3: Partner Commitments

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13 **Commitment**

14 The following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the
15 manufacturing of ENERGY STAR qualified Computer Servers. The ENERGY STAR Partner must adhere
16 to the following program requirements:

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- 18 • comply with current ENERGY STAR Eligibility Criteria, defining the performance criteria that must be
19 met for use of the ENERGY STAR certification mark on Computer Servers and specifying the testing
20 criteria for Computer Servers. EPA may, at its discretion, conduct tests on products that are referred to
21 as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily
22 supplied by Partner at EPA's request;
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- 24 • comply with current ENERGY STAR Identity Guidelines, describing how the ENERGY STAR marks
25 and name may be used. Partner is responsible for adhering to these guidelines and for ensuring that
26 its authorized representatives, such as advertising agencies, dealers, and distributors, are also in
27 compliance;
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- 29 • qualify at least one ENERGY STAR Computer Server within one year of activating the Computer
30 Servers' portion of the agreement. When Partner qualifies a product, it must meet the specification
31 (e.g., Tier 1 or 2) in effect at that time;
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- 33 • provide clear and consistent labeling of ENERGY STAR qualified Computer Servers. The ENERGY
34 STAR mark must be clearly displayed:
 - 35 1. On the front or back of the product. Labeling on the front or back of the product may be permanent
36 or temporary. All temporary labeling must be affixed to the front or back of the product with an
37 adhesive or cling-type application;
 - 38 2. In product literature (i.e., user manuals, spec sheets, ENERGY STAR Power and Performance
39 Data Sheet, etc.);
 - 40 3. On the manufacturer's Internet site where information about ENERGY STAR qualified models is
41 displayed:
 - 42 – If information concerning ENERGY STAR is provided on the Partner Web site, as specified by
43 the ENERGY STAR Web Linking Policy (this document can be found in the Partner
44 Resources section on the ENERGY STAR Web site at www.energystar.gov), EPA may
45 provide links where appropriate to the Partner Web site;

46 **Note:** EPA previously proposed labeling on the side or front of the Computer Server. Several
47 stakeholders commented that placing the ENERGY STAR label on the front of the Computer Server is
48 not feasible due to front plate designs that seek to maximize air flow. Furthermore, based on how most
49 of these Computer Servers are used (e.g., in racks) placing the label on the side of the product would
50 not provide the desired visibility of the ENERGY STAR mark. Stakeholders also questioned the
51 product packaging requirement based on the fact that several configurations of one model, some of
52 which may not qualify as ENERGY STAR, typically use the same packaging design. While EPA
53 understands these challenges, it is also important that the end user be assured of ENERGY STAR
54 compliance when receiving the product. Therefore, EPA is now proposing that manufacturers choose
55 between using a permanent *or temporary* label on the front or back of the Computer Server. The
56 requirements proposed above are similar to those included in the ENERGY STAR specification for
57 computers. In addition, since these products are not sold in a retail environment, EPA has removed
58 the product packaging requirement. Manufacturers are encouraged to provide additional proposals.

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

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Note: In order to keep the ENERGY STAR qualified product list and online database as current as possible EPA strongly encourages manufacturers to update data on qualified products as soon as they become available on the market.

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- provide to EPA, on an annual basis, unit shipment data or other market indicators to assist in determining the market penetration of ENERGY STAR. Specifically, Partner must submit the total number of ENERGY STAR qualified Computer Servers shipped (in units by model) or an equivalent measurement as agreed to in advance by EPA and Partner. Partner is also encouraged to provide ENERGY STAR qualified unit shipment data segmented by meaningful product characteristics (e.g., capacity, size, speed, or other as relevant), total unit shipments for each model in its product line, and percent of total unit shipments that qualify as ENERGY STAR. The data for each calendar year should be submitted to EPA, preferably in electronic format, no later than the following March and may be provided directly from the Partner or through a third party. The data will be used by EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner;
 - notify EPA of a change in the designated responsible party or contacts for Computer Servers within 30 days.

85 Performance for Special Distinction

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

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- consider energy efficiency improvements in company facilities and pursue the ENERGY STAR mark for buildings;
 - purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes;
 - ensure the power management feature is enabled on all ENERGY STAR qualified monitors in use in company facilities, particularly upon installation and after service is performed;
 - provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified product models;
 - feature the ENERGY STAR mark(s) on Partner Web site and in other promotional materials. If information concerning ENERGY STAR is provided on the Partner Web site as specified by the ENERGY STAR Web Linking Policy (this document can be found in the Partner Resources section on the ENERGY STAR Web site at www.energystar.gov), EPA may provide links where appropriate to the Partner Web site;
 - provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, communicate, and/or promote Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR Web pages, etc. The plan may be as simple

114 as providing a list of planned activities or planned milestones that Partner would like EPA to be aware
115 of. For example, activities may include: (1) increase the availability of ENERGY STAR labeled
116 products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2)
117 demonstrate the economic and environmental benefits of energy efficiency through special in-store
118 displays twice a year; (3) provide information to users (via the Web site and user's manual) about
119 energy-saving features and operating characteristics of ENERGY STAR qualified products, and (4)
120 build awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on
121 one print advertorial and one live press event;

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- 123 • provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability
124 of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
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 - 126 • join EPA's SmartWay Transport Partnership to improve the environmental performance of the
127 company's shipping operations. SmartWay Transport works with freight carriers, shippers, and other
128 stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air
129 pollution. For more information on SmartWay, visit www.epa.gov/smartway.
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 - 131 • join EPA's Climate Leaders Partnership to inventory and reduce greenhouse gas emissions. Through
132 participation companies create a credible record of their accomplishments and receive EPA recognition
133 as corporate environmental leaders. For more information on Climate Leaders, visit
134 www.epa.gov/climateleaders.
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 - 136 • join EPA's Green Power partnership. EPA's Green Power Partnership encourages organizations to buy
137 green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based
138 electricity use. The partnership includes a diverse set of organizations including Fortune 500
139 companies, small and medium businesses, government institutions as well as a growing number of
140 colleges and universities, visit <http://www.epa.gov/grnpower>.



ENERGY STAR® Program Requirements for Computer Servers

DRAFT 3: Eligibility Criteria

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Below is the **Version 1.0 DRAFT 3** product specification for ENERGY STAR qualified Computer Servers. A product must meet all of the identified criteria if it is to earn the ENERGY STAR.

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

Note: This section has been reorganized to better group the product types addressed by this specification. Stakeholders are encouraged to comment on whether the definitions are sufficient to define ENERGY STAR qualification requirements for Computer Servers.

A. **Computer Server:** A computer that provides services and manages networked resources for client devices, e.g., desktop computers, notebook computers, thin clients, wireless devices, PDAs, IP telephones, other Computer Servers and other networked devices. Computer Servers are sold through enterprise channels for use in data centers and office/corporate environments. Computer Servers are designed to respond to requests and are primarily accessed via network connections, and not through direct user input devices such as a keyboard, mouse, etc. In addition, Computer Servers **must have all** of the following characteristics:

- Marketed and sold as a Computer Server;
- Designed for and listed as supporting Computer Server Operating Systems and/or Hypervisors, and targeted to run user-installed enterprise applications;
- Support for error-correcting code (ECC) and/or buffered memory (including both buffered DIMMs and buffered on board (BOB) configurations).
- Packaged and sold with one or more AC-DC or DC-DC power supply(s)

Note: Based on stakeholder comments, the requirement “Designed and capable of supporting one or more processor sockets and/or one or more processor boards in the device” was removed. All Computer Servers will support at least one processor, so this definition is superfluous. In addition, language was included to specify that Computer Servers must have a power supply to qualify under this specification. This language was added to exclude systems designed to operate without power supplies, such as a server that runs directly off DC power. EPA believes that these products might be at an advantage during Idle because they are able to offload power conversion functions to other equipment in the data center, and the overall efficiency of such an approach is uncertain. EPA may consider adding them to the specification at a later date based on available data and stakeholder interest.

EPA also received comments from multiple stakeholders to revisit the inclusion of a dedicated management controller as a required characteristic of a Computer Server. EPA intends for the Computer Server definition to encompass the majority of Computer Servers sold in the marketplace. Including only Computer Servers with dedicated management controllers would lead to the exclusion of lower-end models that should be addressed by this specification. In fact, a number of Computer Servers in EPA’s Idle data set do not contain service processors. EPA’s intention is to cover as many Computer Servers as possible that are currently used in data center environments. Therefore, this change was not made in this Draft 3 version.

B. **Blade Systems:** A system composed of both a Blade Chassis and one or more removable Blade Servers or Blade Storage units. A Blade System is designed as a scalable solution to efficiently package and operate multiple Computer Servers in a single enclosure.

C. **Blade Chassis:** An enclosure containing shared resources for the operation of Blade Servers and Blade Storage. These resources may include power supply(s) for power conversion, shared

197 storage, and hardware for DC power distribution, thermal management, system management, and
198 network services. A Blade Chassis features multiple slots which can be populated with blades of
199 different types.
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Note: A definition for Blade Systems was added above to highlight the difference in form factor compared to Computer Servers. Blade Systems repackage multiple Computer Servers and are therefore not considered a subset of the larger Computer Server category.

Computer Server Types

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207 D. Blade Server: A Computer Server consisting of, at minimum, a processor and system memory that
208 relies on shared resources (e.g., power supply, cooling, etc.) for operation. Blade Servers are
209 designed to be installed in a Blade Chassis and are incapable of operating independent of the
210 chassis.
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212 E. Direct Current (DC) Server: A Computer Server designed to operate with a DC-DC power supply.
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214 F. Server Appliance: A self-contained Computer Server system bundled with a pre-installed
215 operating system and application software that is used to perform a dedicated function or set of
216 tightly coupled functions. Server Appliances deliver services through one or more networks (e.g,
217 IP or SAN), and are typically managed through a web or command line interface. Server
218 Appliance hardware and software configurations are customized by the vendor to perform a
219 specific task, and are not intended to execute user-supplied software. Example services that may
220 be made available via a Server Appliance include: name services, firewall services, authentication
221 services, encryption services, and voice-over-IP (VoIP) services.
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Note: The definition for DC Server was altered to only cover units that are designed and sold with power supplies.

Computer Server Classification

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228 G. High Availability Server: Computer Server with more than one power supply for the purpose of
229 redundant power delivery (2n or n+1), ECC memory, and a dedicated management controller
230 (e.g., service processor). High availability systems are designed for mission-critical applications
231 and very low downtime
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233 H. Standard Availability Server: Basic Computer Server with a single power supply and few other
234 Reliability, Accessibility, Serviceability and Management (RAS/M) features.
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Note: Based on stakeholder comments, the definitions above have been revised from High and Standard “Redundancy” to High and Standard “Availability”. This change recognizes that a “standard” Computer Server may not come with any redundant features. The definition for High Availability Servers was also revised to focus on those systems that use multiple power supplies for purposes of redundancy.

Other Data Center Equipment

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244 I. Blade Storage: A storage specific element that relies on shared resources (e.g., power supply,
245 cooling, etc.) for operation. Blade Storage units are designed to be installed in a Blade Chassis
246 and are incapable of operating independent of the chassis.
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249 J. Network Equipment: A product whose primary function is to provide data connectivity among
250 devices connected to its several ports. Data connectivity is achieved via the routing of data
251 packets encapsulated according to Internet Protocol, Fibre Channel, InfiniBand or similar protocol.
252 Common network equipment in data centers includes routers and switches.
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254 K. Storage Equipment: A system composed of integrated storage controllers, storage devices (e.g.

255 disk drives) and software that provides data storage services to one or more Computer Servers.
256 While storage equipment may contain one or more embedded processors, these processors do
257 not execute user-supplied software applications but may execute data specific applications (e.g.
258 data replication, backup utilities, data compression, install agents, etc.).
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260 **Computer Server Power Supplies**

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- 262 L. Computer Server Power Supply: A self-contained Computer Server component which converts a
263 voltage input to one or more different DC voltage output(s) for the purpose of powering the
264 Computer Server. The input voltage can be from either an AC or DC source. A Computer Server
265 power supply must be separable from the main computer board and must connect to the system
266 via a removable or hard-wired male/female electrical connection, cable, cord or other wiring (i.e.
267 separate from, and not integrated onto, the system motherboard).
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- 269 M. AC-DC Power Supply: A power supply which converts line voltage AC input power into one or
270 more different DC output(s) for the purpose of powering the Computer Server.
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- 272 N. DC-DC Power Supply: A power supply which converts a DC voltage input to one or more different
273 DC voltage output(s) for the purpose of powering the Computer Server. Any DC-to-DC converters
274 (also known as voltage regulators) internal to the product and used to convert low DC voltage
275 (e.g. 12 V DC) into other DC voltages for use by the individual Computer Server components are
276 not considered DC-DC power supplies under this specification.
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- 278 O. Single-Output Power Supply: A power supply which converts a voltage input to one single DC
279 voltage output for the purpose of powering the Computer Server. Although Single-Output power
280 supplies provide only one primary voltage for powering the Computer Server during operation,
281 they may also include one or more low voltage standby rails (typically 5 V DC) that may be used
282 to initiate start-up when the main system is powered down. Power supplies with multiple rails are
283 still considered Single-Output if all of the rails are at the same voltage.
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- 285 P. Multi-Output Power Supply: A power supply which converts a voltage input to multiple DC voltage
286 outputs for the purpose of powering the Computer Server, including one or more low voltage
287 standby rails (typically 5 V DC) that may be used to initiate start-up when the main system is
288 powered down.
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290 **Note:** The definitions for “Single-Voltage” and “Multi-Voltage” power supplies have been changed to
291 “Single-Output” and “Multi-Output” to harmonize with the terms used in the power supply test
292 procedure referenced in Section 4 of this specification. Language was also added to indicate that
293 power supplies with multiple rails are still considered Single-Output if all of the rails are at the same
294 voltage.
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296 **Operational States**

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- 298 Q. Idle: An operational state in which the operating system and other software have completed
299 loading and the Computer Server is capable of completing workload transactions, but no workload
300 transactions are requested or performed by the system (i.e. the Computer Server is operational,
301 but not processing any useful work).
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303 **Other Key Terms**

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- 306 R. Standard Performance Evaluation Corporation (SPEC): Non-profit corporation formed to establish,
307 maintain and endorse a standardized set of relevant benchmarks that can be applied to the
308 newest generation of high-performance computers. The SPECpower_ssj2008™ benchmark,
309 referenced in this specification, evaluates the power and performance characteristics of volume
310 server class computers using a Java workload. More information: www.spec.org.
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312 **Note:** Based on several stakeholder requests, a definition for Idle is now included to support the
313 proposed Idle requirements outlined in Section 3, below. This new definition combines language from
314 the ENERGY STAR Version 5.0 Computer Idle definition and the SPECpower_ssj2008™ Run and
315 Reporting Rules. Manufacturers are required to use this SPEC benchmark when measuring power
316 consumption in Idle. Stakeholders are encouraged to provide feedback on this newly proposed
317 definition. In addition, a definition for the SPEC organization was added for reference.
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- 320 **2) Qualifying Products:** A Computer Server must meet the definition provided in Section 1.A, above,
321 to be eligible for ENERGY STAR qualification under this specification. The Tier 1 specification
322 coverage is limited to Computer Servers capable of having at most four processor sockets (i.e.
323 Computer Servers with 1 - 4 individual processor sockets). **Computer Servers with greater than 4**
324 **processor sockets are currently ineligible for ENERGY STAR qualification but will be**
325 **considered under the Tier 2 specification.**

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327 In addition to those products that do not meet the strict definition provided in Section 1.A, the following
328 product types (as defined in Section 1, above) are **explicitly ineligible** for ENERGY STAR
329 qualification:

- 330 • Blade Systems (including Blade Chassis, Blade Servers and Blade Storage)
 - 331 • Network Equipment
 - 332 • Server Appliances
 - 333 • Storage Equipment
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335 **Note:** In addition to Blade Storage, EPA has decided to also exclude Blade Servers and Blade
336 Chassis from this version of the specification. While some specification requirements could be
337 relevant for a Blade Chassis, determining how to measure Idle power in Blade Servers presents
338 significant challenges. Specifically, the SPEC organization has indicated that the SPECpower
339 ssj_2008™ benchmark, which is the proposed method for measuring Idle power consumption under
340 this specification, cannot be run on Blade Systems.
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342 Blade Servers and Chassis can be sold separately, but are often bundled and sold together as a
343 single Blade System, which would compete directly with Computer Servers in the marketplace. For
344 this reason, EPA does not want to set partial performance criteria (i.e. qualification based on power
345 supply efficiency alone without Idle requirements) for Blade Systems. EPA will continue to look for
346 appropriate ways in which to address Blade Systems for inclusion in future versions of this
347 specification.
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349 The SPEC organization has indicated that they are currently developing a SPECpower benchmark
350 appropriate for Blade Systems. Once this benchmark is made publicly available, the EPA will
351 determine its appropriateness for use in this specification, and will work with manufacturers to collect
352 and analyze data to include Blade Systems under the Tier 1 specification as soon as possible. It is
353 also EPA's hope that a specification for Blade Storage can be developed under a separate ENERGY
354 STAR storage specification development effort.

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3) Efficiency Requirements for Qualifying Products: Computer Servers must meet the all the requirements provided below to qualify as ENERGY STAR.

Tier 1 Requirements: Effective February 1, 2009

A. Power Supply Efficiency Requirements

All power supplies in Computer Servers must meet the minimum efficiency and power factor requirements contained in Tables 1 and 2, below.

Table 1: Efficiency Requirements for Computer Server Power Supplies

| 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 | 82% | 85% | 82% |
| Single-Output (AC-DC & DC-DC) | ≤ 1,000 Watts | 75% | 85% | 89% | 85% |
| | > 1,000 Watts | 80% | 88% | 92% | 88% |

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Table 2: Power Factor Requirements for Computer Server Power Supplies

| Power Supply Type | Rated Output Power | 10% Load | 20% Load | 50% Load | 100% Load |
|---------------------|--------------------|----------|----------|----------|-----------|
| DC-DC (All) | All Output Levels | N/A | N/A | N/A | N/A |
| AC-DC Single-Output | ≤ 1,000 Watts | 0.65 | 0.80 | 0.90 | 0.90 |
| | > 1,000 Watts | 0.80 | 0.90 | 0.90 | 0.90 |
| AC-DC Multi-Output | All Output Levels | NA | 0.80 | 0.90 | 0.90 |

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Efficiency Levels

The efficiency levels for AC-DC power supplies being proposed above are the same as what was presented in the previous Draft 2 specification. EPA has decided to retain these levels for the following reasons:

- (1) Several stakeholders support the levels claiming that they are challenging but achievable.
- (2) The current levels do a better job of fairly treating different sizes and types of power supplies compared to other approaches analyzed by EPA.
- (3) The proposed approach, and accompanying levels, allow for alignment with the Climate Savers Computer Initiative levels while still meeting the goal of allowing only the top 25% of EPA's data set to qualify.

One stakeholder commented that the 1000 Watt cutoff between large and small AC-DC power supplies was an artificial dividing line, with no technical justification, and that a better division would be at 1200 Watts. EPA reviewed this proposal, but found that the power supplies in the EPA data set listed between 1000 Watts and 1200 Watts demonstrate very high efficiency. Therefore, lower efficiency levels would be inappropriate. Using a higher cutoff would actually reduce the need for separate levels and does not treat large and small power supplies equally with respect to the required 25% qualification rate.

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One stakeholder commented that a 1% efficiency margin should be included to account for variability in the manufacturing of power supplies. To be consistent with other IT specification development initiatives, EPA has decided not to factor in such a margin and believes that this specification contains a set of challenging yet technically achievable efficiency levels for this product category.

DC-DC Power Supply Requirements

DC-DC power supplies have been added to Tables 1 and 2, above. Several manufacturers tested their DC-DC power supplies in a manner consistent with the EPRI test procedure referenced in Section 4, below, and submitted this data to EPA for review. As proposed in Table 1, above, DC-DC power supplies would need to meet the same efficiency levels as corresponding AC-DC supplies to qualify for ENERGY STAR.

According to the limited data (i.e., 12 data points) received by EPA, and based on comments and discussions with stakeholders, EPA believes the Draft 3 specification levels are challenging but achievable for DC-DC power supplies. In addition, because DC Servers compete with AC Servers in the marketplace, EPA believes that DC-DC power supplies should be held to the same standard of efficiency as AC-DC power supplies. EPA is interested in stakeholder comments on this proposal and encourages manufacturers to submit additional data to further evaluate these levels. As referenced in the power supply test procedure referenced in Section 4.A, power factor is not relevant for DC-DC power supplies, so no requirements are proposed in Table 2, above. EPA's DC-DC power supply data set can be viewed on the ENERGY STAR Web site at www.energystar.gov/productdevelopment (Click on New Specifications in Development).

Low Load Efficiency Requirements

Several manufacturers have expressed concern about power supply efficiency and power factor requirements at low loads (i.e., $\leq 20\%$), especially for smaller power supplies. EPA continues to hear that as a result of the way that Computer Servers are operated by end users, the typical Computer Server spends a significant amount of time in periods of low utilization. This is further supported by data collected by EPA that suggests power supply loading is typically less than 20% when Computer Servers are in Idle. In addition, as advanced power management techniques are implemented on a wider scale, Idle power consumption will continue to decrease. For these reasons, EPA maintains that efficiency requirements at both 10% and 20% loading points are needed to adequately cover the current power supply operating range and promote further reductions in energy consumption.

However, EPA does recognize that smaller power supplies are at a disadvantage at low loads because of the impact that fixed losses have on the efficiency of these units at low power draw. EPA shares a common goal with manufacturers of ensuring that high efficiency, properly sized power supplies are incorporated into all Computer Servers. Using smaller, more efficient power supplies will further help to reduce the total energy used by Computer Servers, which EPA supports. For this reason, EPA is interested in proposals on setting requirements that address energy consumption at low loads (i.e., $\leq 20\%$) without penalizing smaller power supplies. For example, EPA received the following proposal:

- PSUs rated at 750W or lower are exempt from efficiency and power factor levels at 10% of rated load. Furthermore, PSUs rated at 375W or lower must meet 80% efficiency and 0.6 Power Factor at 20% of rated load instead of the normal requirements in Tables 1 and 2, above.

EPA is interested in developing a similar proposal in order to set baseline levels for smaller power supplies to ensure: (1) that these units can qualify for ENERGY STAR and (2) manufacturers continue to consider energy consumption at these lower load points in future Computer Server design.

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B. Idle Power

To qualify for ENERGY STAR, a Computer Server's Idle results must not exceed the maximum Idle power levels for its category, per Tables 3 and 4, below. Specifically, to determine the maximum Idle level for ENERGY STAR qualification, manufacturers should use the base Idle level presented in Table 3 and then add the additional power allowances from Table 4, where appropriate. For example, a Computer Server (1P) with a single hard drive would need to meet a 60 Watt Idle level. The same Computer Server with an additional hard drive would be provided with an additional 15 Watt allowance and would therefore need to meet a 75 Watt Idle level. **Note:** In the below tables, processor counts (i.e., 1P-4P) and memory capacity refer to the amount installed in the system, and not the amount the system is capable of supporting (i.e. installed processors, not processor sockets; and installed memory, not supported memory).

Table 3: Base Idle Power Requirements

| System Type | Idle Power Limit |
|--|------------------|
| Single Installed Processor (1P – All systems) | 60 Watts |
| Two or Three Installed Processors (2P & 3P) | |
| Standard Availability Systems | 151 Watts |
| High Availability, Low Installed Memory (<16GB) Systems | 169 Watts |
| High Availability, High Installed Memory (≥16GB) Systems | 221 Watts |
| Four Installed Processors (4P) | 271 Watts |

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Table 4: Additional Power Allowances for Extra Components

| System Characteristic | Additional Idle Power Allowance |
|-------------------------------------|---------------------------------|
| Second Hard Drive | 15 Watts |
| Additional Hard Drives Over Two | 8 Watts per Drive |
| Additional Memory over 32 Gigabytes | 2 Watts / GB |

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Note: EPA received several comments regarding the Draft 2 proposal for Idle power categorization along with a significant number of Idle data points from more than 10 manufacturers. Specifically, stakeholders expressed their concern with grouping systems with 2- and 4-processors. Based on further analysis of the collected data and additional input from various industry members, EPA is proposing a new approach to categorization that: (1) addresses a number of stakeholder comments; (2) is based on observable trends in the dataset; and (3) represents approximately 25% of models in the dataset, across all bins and system characteristics (e.g., # of processors and hard drives, installed memory, redundancy level, etc.).

In creating this new categorization system, EPA started with a large number of categories using the methodology from the Draft 2 specification (i.e. based on processor number, redundancy level and high or low memory configuration). EPA then combined some of these bins in situations where limited data was available for a category (i.e., 1P High Availability Servers) or where EPA noticed similar energy performance between two categories (i.e. 2P Standard Availability Servers). This creates what EPA believes is a simple system which effectively covers a wide range of system types while taking computing capability and redundancy into account. Manufacturers are encouraged to provide feedback on this new categorization and additional data to support any proposed changes to the proposed levels.

477 **Note continued**

478
479 In addition to the base categories, several stakeholders pointed out that the number of hard drives and
480 amount of memory are two key drivers of Idle power consumption and are the most interchangeable
481 components in a Computer Server. Data submitted to EPA appears to support this relationship. As a
482 result, EPA is now proposing additional Idle power allowances for these key characteristics in Table 4,
483 above. These additional power allowances were determined both by looking at models submitted with
484 many different hard drive and memory configurations, and by observing the effects of different adders
485 on the qualification rate across different bins and system characteristics. Some stakeholders
486 suggested that additional consideration also be given for I/O devices (e.g., network cards, etc.).
487 However, based on the current data set there is insufficient data to support such an allowance. EPA
488 would be willing to consider adding I/O to this list of characteristics if additional data is submitted to
489 support such a need.

490
491 EPA also received some support for specifying Idle as a percentage of maximum power (e.g., power
492 at 100% load of SPECpower_ssj2008™ [or another benchmark] or rated power supply output). EPA
493 considered this idea by analyzing the data made available and decided not to pursue this approach.
494 While it appears to have the advantage of being simpler and more equitable, EPA's analysis showed
495 the opposite. With respect to the data set, the "percentage of maximum power" approach did not
496 appear to be equitable across different server characteristics including high memory configurations,
497 multiple hard drive systems, and High Redundancy Servers. In order to make this approach workable,
498 EPA would likely have to create several different levels for different Computer Server categories, with
499 additional adders. Therefore, the "percentage of maximum power" approach would actually not be
500 simpler than the current Idle bin approach. Furthermore, there is no clear path regarding what metric
501 to use to determine "maximum power". For these reasons, EPA is not pursuing the percentage of
502 maximum power approach and instead, continuing to require flat Idle levels with adders based on
503 system characteristics identified in Tables 3 and 4.

504
505 Data used to determine the levels proposed in Table 3 and 4, as well as a summary of EPA's analysis,
506 is available on the ENERGY STAR Web site at: www.energystar.gov/productdevelopment (Click on
507 New Specifications in Development). **EPA is particularly interested in viewing additional data
508 that substantiates or challenges the power allowances proposed in Table 4, above.**

509
510 **C. Standard Information Reporting Requirements**

511
512 Manufacturers must provide a standardized **Computer Server Version 1.0 Power and Performance**
513 **Data Sheet** with each ENERGY STAR qualified Computer Server, which can be found on the
514 ENERGY STAR Web site. This information must be posted on the manufacturer's Web site where
515 information for the qualified model, or qualified configurations, is posted. Manufacturers may provide
516 one data sheet per qualified configuration, or one sheet per model number with information on
517 maximum, minimum, and typical configurations, as defined below.

518
519 If one data sheet is used to represent many configurations under one model number, the manufacturer
520 must clearly indicate on the data sheet those configurations that qualify as ENERGY STAR. In this
521 case, and when available, manufacturers should also provide a link to a more detailed power
522 calculator where information on the power use of specific system configurations can be found. In
523 addition, manufacturers must indicate power and performance levels for the maximum, minimum and
524 typical configurations as defined below:

525
526 Maximum Configuration: The highest performance system with all processor sockets, memory slots,
527 I/O slots, hard drive bays, etc. fully populated with the highest performance components that are
528 available for the model. The maximum configuration typically represents the maximum power
529 consumption case.

530
531
532 Minimum Configuration: A base-model system that is minimally configured. Such a system would
533 typically have the lowest number of processors available, low memory, a single hard drive, and a
534 single I/O device. This configuration should, however, represent a reasonable configuration that is

535 currently available and sold in the marketplace (i.e. the system should be minimally configured but not
536 under configured to a point which is unreasonable).

537
538 Typical Configuration: An intermediate configuration between the maximum and minimum
539 configuration. This should be representative of a configuration with high volume sales with an
540 average number of processors, installed memory, number of hard drives, I/O devices, etc.

541
542 **Note:** Additional language has been included regarding the required configurations to be reported
543 using the Power and Performance Data Sheet. Manufacturers have the option to create a data sheet
544 for every configuration that qualifies for ENERGY STAR. EPA realizes that in some cases where
545 there are multiple configurations of a particular model, it would be burdensome to require a separate
546 data sheet for each configuration. However, it is also important that end users understand which
547 product configurations qualify for ENERGY STAR. Therefore, EPA is allowing manufacturers to use
548 one data sheet to represent models that include multiple configurations as long as the specific
549 configurations that qualify for ENERGY STAR are clearly identified on the data sheet.

551 **D. Data Measurement and Output Requirements**

552
553 **Standardized Data Measurement:** All Computer Servers must have the ability to provide data on
554 input power consumption in Watts, inlet air temperature, and utilization of all processor cores during
555 normal operation.

556
557 To meet this requirement, Computer Servers may rely on a service processor, embedded power or
558 thermal meter (or other out-of-band technology), or a preinstalled operating system to collect data and
559 make it available for collection and dissemination over a standard network to third party management
560 systems such as a data center management software suite. All systems shipped with preinstalled
561 operating systems must have all necessary drivers/software installed to make this information
562 available. For systems not shipped with an operating system, documentation of how to access the
563 registers containing the relevant sensor information must be provided. In addition, when an open and
564 universally available standard becomes available to report and collect this data, manufacturers should
565 incorporate the universal standard into their systems.

566
567 **Required Accuracy:** All measurements should meet the following accuracy levels:

568 Input power measurements: +/-10% accuracy

569
570 Utilization measurements: +/-5% accuracy

571
572 Input air temperature measurements: +/- 2° C

573
574
575 **Sampling Requirements:** Hardware polling rates of the embedded sensors must meet a minimum of
576 one sample per second. Data should be averaged on a rolling basis of 15, 30 and 60 seconds. All
577 three rolling averages shall be made available for collection.

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580

581 **Note:** At stakeholder request, EPA has included more information on the required measurement of
582 power, temperature, and utilization. EPA's intention with this requirement is for ENERGY STAR
583 Computer Servers to have functionality which allows easy and vendor neutral access to information on
584 the operating conditions of the Computer Server. Giving data center operators easier access to this
585 information will help operators better manage their data centers for increased energy savings.
586

587 The key criteria is that the information should be available and useful to vendor neutral data center
588 management systems. To facilitate this, EPA has indicated that this information must be available via
589 a service processor or other out-of-band technology, or be available via an operating system with all
590 appropriate drivers preinstalled. Multiple rolling averages were selected to allow trends to be
591 embedded in the information sent back to the monitoring station. Based on the averages, an ideal
592 transmission rate would be once per 15 seconds but given the multitude of available ways for
593 transmitting this data, specifying a transmission rate could potentially have an adverse effect on
594 scalability, reliability, and power/performance of monitored system.
595

596 Ideally this information would be available through the network using an open industry standard
597 protocol, but as no such open standard is fully vetted and universally available at this time. EPA has
598 indicated that manufacturers should conform to such a standard if one is developed.
599

600 In addition, and at stakeholder request, EPA has added standard data collection accuracy, data
601 averaging, and sampling rate requirements to the specification. EPA's intention with the accuracy and
602 averaging requirements is to set reasonable limits based on technology available as of February 2009
603 to ensure that the data available is useful on the data center level. Stakeholders are encouraged to
604 comment on whether these requirements will be too onerous to meet with current technology and to
605 provide additional data to EPA to help set reasonable levels of accuracy and averaging for these
606 requirements.
607

608 EPA received stakeholder comments that inlet air flow also be a required measurement to help gauge
609 the health of the system, and is open to further stakeholder comments on the need for this
610 measurement.
611

612 EPA also received comments that certain Computer Server types (i.e., pedestal servers, 1U or 1P
613 Computer Servers, and/or Computer Servers with single power supplies) should be excluded from
614 these data collection requirements. As explained above, EPA's intention with this requirement is to
615 give data center managers better access to information about actual operating conditions of the
616 Computer Servers within a data center. EPA believes that the data collection requirement should be
617 applicable to all Computer Server types including 1U/1P/1PSU systems, so the Agency is not
618 proposing such an exclusion at this time. However, EPA is open to further discussions as to whether
619 this exclusion is necessary. If no 1U/1P/1PSU units currently exist in the marketplace that can meet
620 these requirements, EPA may decide to exclude these products from meeting these requirements
621 under Tier 1 with the intention of reconsideration under Tier 2.
622

623 **Tier 2 Requirements: Effective October 1, 2010**

624 **(1a) Tier 2 Energy Efficiency Performance Metric.** All servers would be qualified based on their
625 consumption of energy for a given amount of work completed (i.e., energy efficiency performance
626 benchmark approach).
627
628

629 - OR -
630

631 **(1b) Provisional Tier 2 Idle State Requirements.** If an energy efficiency performance metric and
632 associated performance levels are not ready to go into effect **by October 1, 2010**, a provisional Tier 2
633 specification will automatically go into effect and will remain in effect until such a benchmark is
634 established. This provisional Tier 2 will include revised Idle levels for all Computer Server types
635 (those included in Tier 1 as well as others as appropriate with the intention of capturing the top 25%
636 performers in energy efficiency).
637
638

639 **(2) Power Supply Requirements:** EPA intends to pursue a Net Power Loss requirement for
640 Computer Server power supplies under Tier 2 of this specification. This approach would aim to
641 specify a maximum allowed power loss through the power supply at actual operating conditions of the
642 Computer Server (e.g., Idle and Maximum Power). If a Net Power Loss approach is not determined,
643 EPA plans to reevaluate both Multi-Output and Single-Output power supply efficiency and power
644 factor levels. At a minimum, EPA intends to eliminate the lower efficiency requirement for Single-
645 Output power supplies with less than or equal to 1000 W power output and requiring that all Single-
646 Output power supplies would need to meet the same efficiency levels (i.e., 80% efficiency at 10%
647 load; 88% at 20% load; 92% at 50% load; and 88% at 100% load).
648

Note: It continues to be EPA's intent to develop a Tier 2 specification that uses industry accepted efficiency performance benchmarks to derive new minimum performance levels. However, benchmarks representing all of the different workloads run by Computer Servers are not yet available and have not yet been evaluated by EPA to determine if they meet the needs of the ENERGY STAR program. Therefore, provisional requirements are proposed above to encourage continued efficiency in product design. In addition, EPA intends to pursue a Net Power Loss approach to encourage and reward power supply right sizing in addition to high efficiency. EPA has also added a provisional requirement for power supply efficiency that eliminates the division between low output and high output power supplies.

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660 **4) Test Criteria:** Manufacturers are required to perform standard tests to determine ENERGY STAR
661 compliance for a given product model. The results of those tests may be self-certified by the
662 ENERGY STAR Partner, or by a third-party laboratory on behalf of the Partner, and must be reported
663 to EPA using the ENERGY STAR Computer Server Qualified Product Information (QPI) form.
664

665 **A. Power Supply Testing**

666
667 All Computer Server power supplies tested for ENERGY STAR qualification must be tested using the
668 *Generalized Internal Power Supply Efficiency Test Protocol Rev. 6.4.2*. **Note:** This test procedure is
669 not maintained by EPA and is available at <http://efficientpowersupplies.epri.com/methods.asp>.
670

671 Power supplies should be tested using the input test conditions specified in Table 5, below, and as
672 indicated in the above referenced test procedure. For AC-DC Multi-Output power supplies capable of
673 operating at both 230 and 115 Volts input, testing shall be conducted at both voltages for purposes of
674 ENERGY STAR qualification. **Note:** testing at 230 Volts may be done at either 50Hz or 60Hz. AC-DC
675 Multi-Output power supplies capable of operating at only one of these indicated voltages must test
676 only at the applicable voltage.
677

678 **Table 5: Input Conditions for Power Supply Efficiency Testing**

| Power Supply Type | Input Test Conditions |
|-----------------------|---|
| AC-DC Single-Output | 230 Volts, 50Hz or 60 Hz |
| AC-DC Multi-Output | 115 Volts, 60 Hz and/or 230 Volts, 50Hz or 60Hz |
| DC-DC (± 48 VDC) | 48 Volts or -48 Volts DC |

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Note: EPA has noted that AC-DC Multi-Output power supplies must be tested at all voltages that the unit is capable of operating. This change is based on stakeholder comments and addresses two important issues:

1. Products intended to operate both at U.S. mainline voltage and higher voltage in data centers (or European mainline voltage) will be required to meet efficiency requirements at both voltages.
2. Products designed to operate only at high line voltage for use in the data center will not be required to test at 115V, and therefore, will not have to be optimized for efficiency at voltages outside of their intended operating range.

EPA has also indicated that 230V testing may be performed at either 50Hz or 60Hz, as recent research by EPRI has shown negligible differences in efficiency between these two frequencies. This change addresses both high line voltage in Europe (at 50Hz) as well as high line voltage in US data centers (at 60Hz).

- a. **10% Loading Condition:** As referenced in the power supply efficiency requirements in Section 3.A, all Single-Output power supplies must be tested at 10% loading in addition to the standard 20%, 50% and 100% loading conditions indicated in the test procedure.
- b. **Fan Power:** As indicated in the power supply test procedure referenced above, Multi-Output power supplies must be tested with internal fan power included in the measurement and efficiency calculation. For Single-Output power supplies, fan power must be excluded from the measurement and the efficiency calculation.
- c. **Efficiency and Power Factor Reporting:** For purposes of qualifying, power supplies must meet the levels presented in Tables 1 and 2 without the assistance of rounding. When submitting power supply efficiency and power factor results to EPA, manufacturer should report to the first decimal place (e.g. 85.2%) and three decimal points (e.g., .856), respectively.

Note: Additional guidance regarding the reporting and qualification of power supply efficiency and power factor results is provided above. Power supplies used in ENERGY STAR qualifying Computer Servers must meet the requirements in Tables 3 and 4 without the use of rounding. For purposes of reporting to EPA, and verification by ENERGY STAR staff, results should be rounded to the first decimal place for efficiency and three decimal places for power factor. Similar guidance is provided for Idle in Section B, below.

B. Idle Power Testing

All Computer Server Idle power values shall be collected using the SPECpower_{ssj2008}TM benchmark¹. When using the benchmark, manufacturers must also meet the following conditions:

- a. **Supply Voltage:** Idle power consumption must be tested with the input conditions specified in Table 5, above. For example: Computer Servers with Single-Output power supplies must be tested at 230V 50Hz/60Hz only, while Computer Servers with Multi-Output power supplies must be tested at all voltages at which the Computer Server can operate.
- b. **Test as shipped:** Computer Servers must be tested as shipped and with all power supplies connected and operational and the intended operating system installed. In addition, manufacturers must ensure that any power management technique or power saving feature used during testing is enabled on shipment.
- c. **Computer Servers shipped without a preinstalled operating system:** For Computer Servers shipped without an operating system preinstalled, manufacturers must clearly indicate on the Power and Performance Data Sheet (Section 3.B) which operating system was used in testing for the purposes of ENERGY STAR qualification. In addition, for any power management features which require the presence of an operating system (i.e. those that are not controlled by the BIOS or management controller), manufactures may only test with power management

¹ <http://www.spec.org/specpower/>

735 features enabled by the operating system by default. Manufactures must also clearly indicate on
736 the Power and Performance Data Sheet which power management features were active during
737 testing.
738

739 d. **Idle Reporting:** Computer Servers must meet the Idle levels presented in Tables 3 and 4 without
740 the assistance of rounding. When submitting Idle results to EPA, manufacturer should report to
741 the first decimal place (e.g. 125.6 Watts).
742

743 e. **Qualifying Configurations Under this Specification:** Manufacturers must test every
744 configuration or SKU which they want to qualify and market as ENERGY STAR.
745

Note: EPA has included a requirement that Idle input test conditions be determined by the power supply type included with the Computer Server as determined in section 4.A. Consistent with other ENERGY STAR specifications, EPA also proposes that all units be tested “as shipped”, with all included power supplies connected and operational and using only those power management features which are enabled by default on shipment. This will help to ensure that ENERGY STAR qualified Computer Servers are able to provide the end user with the expected energy savings in actual operation. EPA is also interested in suggestions on how to encourage third party resellers to sell ENERGY STAR qualified models per the manufacturer settings to further ensure that they meet the specification requirements as delivered to the end user.

It is also EPA's understanding that many Computer Servers are shipped without operating systems (OS) installed. Manufacturers shipping Computer Servers without an OS preinstalled may test and qualify these models as ENERGY STAR using a commercially available, representative OS as long as it is clearly indicated which OS was used for testing and qualification on the Power and Performance Data Sheet and ENERGY STAR QPI form. This approach provides buyers the ability to purchase these models with a clear understanding of the conditions in which the model meets the ENERGY STAR requirements. Lastly, rounding requirements are provided for purposes of reporting Idle test results for ENERGY STAR qualification.

DC Powered Servers

There is some concern with using the SPECpower_ssj2008™ benchmark on DC Servers. Specifically, that the benchmark was initially created for AC Servers and guidance provided in the SPEC Run and Reporting Rules is not applicable to DC Servers. EPA continues to be interested in using the SPECpower_ssj2008™ benchmark to measure idle power of DC Servers and encourages stakeholders to provide suggestions on a means for applying the benchmark to these product types.

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774 **5) Effective Date:** The date that manufacturers may begin to label and promote qualifying products as
775 ENERGY STAR will be defined as the *effective date* of the agreement.
776

777 A. Tier 1 Requirements: The first phase of this specification will commence on **February 1, 2009**.
778

779 B. Tier 2 Requirements: The second phase of this specification, Tier 2, will commence on **October 1,**
780 **2010**. All products, including models originally qualified under Tier 1, with a **date of manufacture**
781 on or after **October 1, 2010**, must meet the Tier 2 requirements in order to qualify for ENERGY
782 STAR.
783

784 **Note:** As each new ENERGY STAR product specification is completed, it is intended to recognize top
785 performing products currently available in the marketplace, while ensuring adequate product selection
786 across a range of manufacturers. Consistent with that approach, EPA expects its Tier 1 Computer Server
787 specification to be available in the marketplace to assist purchasers as soon as it is finalized.
788

789 EPA continues to hear from the end user community that there is an immediate need for an ENERGY
790 STAR Computer Server specification to help differentiate efficient models. This is a different situation than
791 a specification revision (e.g., computers), where manufacturers need time to transition product literature
792 and other materials.
793

794 **Stakeholders are encouraged to provide feedback on the Draft 3 specification by December 3,**
795 **2008.** Following the comment period, EPA envisions the following prospective timeline towards the
796 implementation of Tier 1:
797

- 798 1. EPA will review stakeholder feedback on Draft 3 and work to distribute a Final Draft for stakeholder
799 review in late December/early January.
- 800 2. EPA will review stakeholder feedback on the Final Draft and then publish a Final Specification
801 Document with an effective date of February 1, 2009.
802

803 **Note:** EPA has an agreement with the European Union (EU) that provides for harmonization across the
804 ENERGY STAR programs regarding all office equipment categories. EPA continues to work with the
805 European Commission to include servers in this agreement; however the timing of this inclusion is not
806 linked to the effective date of the specification and will likely officially occur several months afterward.
807 While EPA intends to finalize the server specification consistent with the timeline above, approval of the
808 specification for use by the EU member government will likely occur later in 2009. EPA will keep its
809 partners apprised of the progress being made. The administrative procedure followed by the EU to
810 approve specifications for use by its member governments requires additional time to ensure that it is
811 properly implemented according to procurement policy guidelines.
812

813 **Tier 2 Effective Date and Timeline**

814 Shortly after the Tier 1 requirements are finalized and become effective, EPA will commence work to
815 develop proposed Tier 2 requirements that are intended to take effect on October 1, 2010. Guidance from
816 EPA on this process is forthcoming. The development process will be similar to Tier 1 with the hope of
817 finalizing Tier 2 requirements as soon as possible. On October 1, 2010, EPA will sunset Tier 1 and will
818 replace it with new Tier 2 criteria and performance levels. All existing ENERGY STAR qualified models
819 that met Tier 1 requirements, but do not meet Tier 2 requirements, will be removed from the ENERGY
820 STAR qualified product list by EPA and can no longer bear the ENERGY STAR mark or designation for
821 any purpose.
822

- 823
- 824 **6) Future Specification Revisions:** EPA reserves the right to change the specification should
825 technological and/or market changes affect its usefulness to consumers, industry, or the environment.
826 In keeping with current policy, revisions to the specification are arrived at through industry
827 discussions. In the event of a specification revision, please note that ENERGY STAR qualification is
828 not automatically granted for the life of a product model. To carry the ENERGY STAR mark, a product
829 model must meet the ENERGY STAR specification in effect on the model's date of manufacture.
830

831 **Blade Chassis and Blade Servers:** ENERGY STAR plans to revisit this specification once a
832 benchmark is made available that can test and measure Blade Server Idle power. At that time,
833 performance requirements for both Blade Servers and Blade Chassis will be considered and shared
834 with industry stakeholders for review and comment
835

836 **Note:** Language has been added above regarding EPA's intentions of revisiting the specification for
837 purposes of including performance requirements for Blade Chassis and Blade Servers.