ENERGY STAR® Program Requirements for Computer Servers

DRAFT 2: Partner Commitments

Commitment

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

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

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

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

- Provide clear and consistent labeling of ENERGY STAR qualified computer servers. The ENERGY STAR mark must be clearly displayed on the front or side of the product, in product literature (i.e., user manuals, spec sheets, etc.), on product packaging, and on the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed;

- 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;

- 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.

Performance for Special Distinction

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

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

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

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

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

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

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

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

ENERGY STAR® Program Requirements for Computer Servers

DRAFT 2: Eligibility Criteria

Below is the **DRAFT 2** 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 the definitions of the relevant terms in this document.

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 include all*** of the following characteristics:

- Marketed and sold as a server;
- Designed for and listed as supporting Server Operating Systems and/or Hypervisors, and targeted to run user-installed enterprise applications;
- Designed and capable of supporting one or more processor sockets and/or one or more processor boards in the device; and
- Support for error-correcting code (ECC) and/or buffered memory (including both buffered DIMMs and buffered on board (BOB) configurations).

Note: Based on discussions during the Redmond meeting, stakeholders expressed concern that the proposed definition for computer server was too narrow and would exclude servers designed for use in mission critical environments. For example, according to IDC, tower form factors represent about one-third of the data center market and provide EPA a significant opportunity to impact energy consumption by these server types. The goal of developing the server definition is to identify characteristics of products manufactured and meant for use in the data center and other business critical environments. In order to try to capture the full range of server products, EPA has removed the requirements for: (1) service processor, (2) RASM features, and (3) availability in a rack form factor. To further clarify the intended operating environment, EPA has indicated that these products are sold through enterprise channels for use in data centers and business environments. Stakeholders are encouraged to provide feedback to EPA as to whether this newly proposed definition does a better job of covering the entire market, while still maintaining adequate separation from the V5.0 computer specification currently under development.

B. Blade Server: A computer consisting of, at minimum, a processor and system memory that relies on certain shared resources (e.g., power supply, cooling, etc.). Blade servers are designed to be installed in a blade chassis and are incapable of operating independent of the chassis.

C. Blade Chassis: An enclosure containing shared resources for the operation of blade servers and blade storage. These resources include power supply(s) for power conversion, DC power distribution, cooling, network hardware, and system management, and may also contain shared storage. A blade chassis contains multiple slots which can be populated with a number of blades.

D. Blade Storage: A storage specific element that relies on certain shared resources, contained in a blade chassis. Blade storage units are incapable of operating independent of the blade chassis.

E. Direct Current (DC) Server: A computer server designed to operate with a DC-DC power supply or a server which runs directly off DC voltage supplied to internal DC-DC converters from an external source.

F. Server Appliance: A self-contained server system 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 locked down systems managed through a web interface. Server appliance hardware and software configurations are customized by the vendor to perform a specific task, and are not intended to execute user-supplied software. Example services that may be made available via a server appliance include: name services, firewall services, authentication services, encryption services, and voice-over-IP (VoIP) services.

G. Storage Equipment: A system composed of integrated storage controllers, storage devices (e.g. disk drives) and software that provides data storage services to one or more computers. While storage equipment may contain one or more embedded processors, these processors are not made available to execute user-supplied software applications, but may execute data specific applications, e.g. data replication, backup utilities, data compression, install agents, and other tasks.

H. Network Equipment: A product whose primary function is to provide data connectivity among the devices connected to its several ports. This is done by routing packets encapsulated according to Internet Protocol, Fibre Channel, InfiniBand or similar protocol. Common network equipment in data centers includes routers and switches

I. High Redundancy Servers: Server computers with greater than one power supply (2n or n+1), ECC memory and a dedicated management controller (e.g., service processor). High redundancy systems are designed for mission critical applications and very low down time.

J. Standard Redundancy Servers: Basic computer servers with single power supplies and few other Reliability, Accessibility, Serviceability and Management (RASM) features.

Note: To support the additional server categorization proposed in Section 3: Idle Requirements, EPA has included definitions for high redundancy and standard redundancy servers. Stakeholders are encouraged to provide feedback on these definitions.

Computer Server Power Supplies

K. Computer Server Power Supply: A self-contained server component which converts a voltage input to one or more different DC voltage output(s) for the purpose of powering the server. The input voltage can be from either an AC or DC source. A computer server power supply must be separable from the main computer board and must connect to the system via a removable or hard-wired male/female electrical connection, cable, cord or other wiring (i.e. separate from, and not integrated onto the system motherboard).

L. AC-DC Power Supply: A power supply which converts line voltage AC input power into one or more DC output(s) for use by the server.

M. DC-DC Power Supply: A server power supply which converts a DC voltage input to one or more different DC voltage output(s) for the purpose of powering the server. Any DC-to-DC converters (also known as voltage regulators) internal to the product and used to convert low DC voltage (e.g. 12 V DC) into other DC voltages for use by the individual server components are not considered DC-DC power supplies under this specification.

N. Single-Voltage Power Supply: A power supply which outputs only one single DC voltage output. Although single-voltage power supplies only provide one primary voltage for powering the server during operation, they may also include one or more low voltage standby rails (typically 5 V DC) used only to initiate start-up when the main system is powered down.

O. Multi-Voltage Power Supply: A power supply which outputs multiple different DC voltage outputs, including, one or more low voltage standby rails (typically 5 V DC) used only to initiate start-up when the main system is powered down.

2) **Qualifying Products:** A computer server must meet the definition provided in Section 1.A, 1.B, or 1.C above, to be eligible for ENERGY STAR qualification under this specification. In addition, the Tier 1 specification coverage is limited to computer servers and blade servers capable of having at most four processors (i.e. servers with 1 - 4 individual processor sockets). **Servers with greater than 4 processor sockets are currently ineligible for ENERGY STAR qualification but will be considered under the Tier 2 specification.** Storage equipment, blade storage, server appliances, and network equipment, as defined above, are not eligible for ENERGY STAR qualification under this specification.

Note: A statement was added to clearly state that servers with greater than 4 processor sockets are not covered by the Tier 1 ENERGY STAR specification. Several stakeholders were concerned about end user perception (i.e., procurement specifications) regarding the availability of ENERGY STAR qualified servers at all levels of performance. EPA will consider covering these product types under the Tier 2 specification.

DC-DC Powered Servers: EPA continues to be interested in including DC-DC powered servers in this specification based on availability of an industry accepted test procedure and performance data to determine proposed efficiency levels. EPA recently distributed a Draft *Generalized Test Protocol for Calculating the Energy Efficiency of Internal AC-DC and DC-DC Power Supplies – Revision 6.4.1* for review and comment. Stakeholders are encouraged to submit comments to Baskar Vairamohan, EPRI, at BVairamohan@epri.com **by August 29.** Finalizing this test method is a critical first step toward addressing these product types under ENERGY STAR. In the event that DC-DC requirements cannot be determined within the current specification development timeline, EPA will continue to work with interested stakeholders to determine whether these product types can be added to the specification at a later date. If EPA decides to include DC-DC powered servers, an amendment will be drafted and shared with stakeholders for review and will go into effect immediately upon finalization.

Server Appliances: EPA is proposing to exclude server appliances from this specification. These product types provide very specific services to their customers and are highly customized. Server appliances are not intended to run user installed software and therefore, the ability to run benchmarks, and how those benchmarks might be applicable, is unclear. EPA might consider including a subset of server appliances if there is sufficient stakeholder interest and is therefore open to reviewing any proposals to that effect.

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 January 1, 2009

A. Power Supply Efficiency Requirements

All power supplies in computer servers and blade chassis 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
AC-DC Single Voltage	≤ 1000 Watts	75%	85%	89%	85%
	> 1000 Watts	80%	88%	92%	88%
AC-DC Multi-Voltage	All Output Levels	N/A	82%	85%	82%

237

Table 2: Power Factor Requirements for Computer Server Power Supplies

Power Supply Type	Rated Output Power	10% Load	20% Load	50% Load	100% Load
Single Voltage	≤ 1000 Watts	0.65	0.80	0.90	0.90
	> 1000 Watts	0.80	0.90	0.90	0.90
Multi-Voltage	All Output Levels	NA	0.80	0.90	0.90

238

Note: EPA has modified the proposed power supply levels based on stakeholder comments during the Redmond stakeholder meeting and additional data received to date. A closer review of the dataset indicated a need for different levels for larger (> 1000 Watt output power) and smaller (≤ 1000 Watt output power) ac-DC single voltage supplies. EPA observed that the previously proposed levels were too stringent for smaller supplies yet not challenging enough for the larger supplies. This supports industry claims that larger power supplies, including those used in blade systems, are inherently more energy-efficient. Furthermore, requiring energy efficiency levels that are easier to meet with larger power supplies might provide an incentive to use larger power supplies, which is not EPA's intention. This new approach allows EPA to capture the top performers while also harmonizing with the Climate Savers Computing Initiative (CSCI) Silver level (at 20%, 50% and 100% loading levels). EPA also believes that the 1000 Watt cutoff creates a good separation between smaller power supplies covered under the CSCI program and the larger multi-processor and blade servers currently covered only by this Draft 2 ENERGY STAR specification. The proposed new efficiency levels for the larger supplies at 20%, 50% and 100% loading levels harmonizes with the CSCI Gold level. EPA has also proposed separate power factor levels for large and small supplies. EPA's analysis shows that the currently proposed levels represent approximately the top 25% of the dataset.

Net Power Loss: Because of its many strengths, EPA believes that specifying net power loss may be the preferred approach to addressing power conversion efficiency while also encouraging power supply right sizing. While several stakeholders agree that this approach has potential merit, additional research would need to be done to address issues identified with the approach and to determine impact on product design and procurement. Based on the proposed Tier 1 timeline and the significant additional research required to implement this new approach, EPA has decided to move forward with specifying power supply energy efficiency. In the meantime, EPA plans to continue development of the net power loss approach for use with storage and networking equipment. Based the results of this research, EPA may revisit net power loss under Tier 2 of this specification.

10% Loading: EPA is retaining the 10% loading requirement and continues to believe that some servers, especially redundant configurations, will operate at these low load conditions during the life of this Tier 1 specification. EPA recognizes that several key manufacturers are working to ensure that servers operate at optimum loading conditions (e.g., > 20%). However, EPA also needs to balance this knowledge with ensuring that efficiency requirements cover all servers available in the market, including those that may continue to follow the current trend of operating at low load conditions on the power supply. Furthermore, this specification also intends to reduce idle power in servers, and as idle power drops, more systems might be running at lower load conditions closer to 10%. Discussions with stakeholders and comments received to date indicate an interest in creating an exemption to the 10% load requirement for manufacturers that can verify that their systems do not operate near this loading condition. EPA is open to discussing this idea and encourages stakeholders to submit suggestions on what such an exemption might entail.

***Notes cont.*:** EPA understands that although absolute power losses in a power supply at 10% and 20% loads can be comparable, there may be a large difference in the efficiency level when expressed as a percentage of power drawn. As such, EPA has adjusted the proposed 10% load level so that units which pass at the 20% level generally also pass at the 10% level. Using this approach EPA still covers the 10% loading condition, but not in a manner more stringent than at the 20% and 50% conditions. EPA has also kept the 100% loading condition, but has loosened the criteria, as server computers will generally never run at this operating point, and there are recognized tradeoffs between efficiency at high loads (100%) and low loads (10%).

Multi-Voltage Ac-DC Supplies: EPA decided to retain the levels for multi-voltage supplies previously proposed at the Redmond stakeholder meeting. Our understanding is that multi-voltage supplies are generally found in smaller servers and therefore, separate criteria for larger supplies are not needed. Furthermore, based on the limited data received to date, the levels proposed in Table 1 appear to be relevant to both larger and smaller supplies. Testing at 10% loading is not required based on stakeholder comments that these power supplies are not typically used in redundant configurations. The specification continues to require that these power supplies be tested at 115V. However, EPA is considering altering this requirement to require testing at 230V, which better emulates operating conditions within the data center (i.e., 208V). Stakeholders are encouraged to comment on this voltage requirement and where available, share performance data for EPA consideration.

Fan Power: Due to the many different approaches to power supply and system cooling for servers, and the complexity of creating requirements that would be fair to these different approaches, EPA has decided to exclude fan power for single voltage power supply energy efficiency testing. This is inline with the method found in the most recent *Generalized Test Protocol for Calculating the Energy Efficiency of Internal AC-DC and DC-DC Power Supplies* referenced in Section 4, below, and coincides with the majority of the feedback received from stakeholders on this issue. Some of the power supplies within EPA's dataset were tested with fan power included in the calculation, giving artificially low efficiency numbers. To account for this, EPA has adjusted the efficiency numbers based on the average difference between efficiency with fans included and with fans excluded for each individual loading condition, using data supplied by stakeholders on power supplies tested in both conditions. In cases where there were multiple fan configurations (i.e., max fan speed vs. reduced fan speed) EPA took the least consumptive fan mode (reduced speed as opposed to max speed) prior to adjusting the analysis.

Power Factor: EPA received comments that the amount of power saved with high power factor at lighter loads is very small and therefore, EPA should drop the power factor requirement for 10% and 20% loading points. While the impact on an individual server level may be minimal, the collective impact from employing several servers within a data center or office could be significant. In addition, because of the high power draw of these products, they are typically drawing large amounts of power and current even at low loads. The impact of power factor also continues to be of great interest in the utility community. For these reasons, EPA is retaining power factor requirements for all proposed loading points. EPA has also proposed power factor levels for multi-voltage power supplies at 20, 50, and 100% load points to be consistent with the approach and rationale for single voltage supplies. The same power factor levels are proposed for multi-voltage units to be consistent with single voltage. Based on the limited data available, these levels are reasonable for these types of units. Industry members that believe the levels to be too stringent are encouraged to provide additional data for EPA review and consideration. The new levels proposed in Table 2, above, allow the majority of high efficiency power supplies in EPA's dataset to qualify. These levels serve as a cap to ensure that power factor continues to be considered in new energy-efficient designs. There was some concern regarding the trade off between energy efficiency and power factor in power supply design. EPA's dataset shows that there are power supply designs currently available that achieve both high power factor and energy efficiency at all loading points. It is EPA's hope that manufacturers continue to design power supplies keeping both of these energy saving parameters in mind.

Notes cont.

DC-DC Power Supplies: EPA received limited initial data on DC-DC power supplies. The data includes eight power supplies, with single voltage, multi-voltage and blade units, all tested at 48 V DC or -48 V DC. While the current dataset suggests some trends in efficiency, more data is needed to determine proposed levels that are truly representative of the DC-DC server market. Manufacturers are encouraged to test DC-DC power supplies using the test protocol referenced in Section 4, below, and submit this data to EPA for consideration. In addition, EPA is open to creating separate criteria for multi-voltage and single voltage DC-DC supplies (in a similar manner to how AC-DC units are being proposed to be treated) if enough data is collected to support separate criteria for these products.

ENERGY STAR Data Set: A masked version of EPA's AC-DC power supply efficiency dataset is available on the ENERGY STAR computer server specification development Web page at www.energystar.gov/productdevelopment (click on New Specifications in Development).

B. Idle Power

Computer servers qualifying for ENERGY STAR must meet the maximum idle power values based on the appropriate category in accordance with Tables 3 and 4, below**. 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).

Table 3: Maximum Idle Power Requirements for Standard Redundancy Systems

	Low Memory Systems (< 16 GB)	High Memory Systems (≥ 16GB)
Single Processor Systems (1P)	TBD Watts	TBD Watts
More than One Processor Systems (2P & 4P)	TBD Watts	TBD Watts

Table 4: Maximum Idle Power Requirements for High Redundancy Systems

	Low Memory Systems (< 16 GB)	High Memory Systems (≥ 16GB)
Single and Dual Processor Systems (1P or 2P)	TBD Watts	TBD Watts
Multi Processor Systems (4P)	TBD Watts	TBD Watts

Note: Due to a variety of factors, EPA believes many servers will continue to spend significant amounts of time operating in an idle mode for the foreseeable future. As a result, EPA believes there is an important opportunity to establish criteria recognizing those server models that idle at lower power levels compared to their peers. EPA also understands that any attempt to address idle should not be a one-size-fits-all specification and must address the variety of possible configurations and computing capabilities available in the marketplace. Based on stakeholder comments and observations of data collected to date, EPA is proposing a simple categorization system for server systems based on system redundancy, number of processors, and the amount of installed memory. EPA believes this proposed system creates a good balance between fair system coverage and simplicity. However, the final categories must be based on noticeable and significant differences in energy performance between categories. To ensure fair and balanced categories, EPA is requesting that additional idle and configuration data be submitted using the accompanying data collection sheet. Manufacturers are encouraged to submit data on multiple units with varying configurations within each proposed category. Proposals for new categories beyond those proposed here should be supported by accompanying data. Absent sufficient data, EPA may be required to eliminate or combine certain categories. EPA also realizes that there are other energy using components, such as I/O and storage (hard disks), which are not included in the proposed categorization system at this time. With appropriate supporting data, EPA might consider additional power allotment for extra devices above a single I/O device and single hard disk. However, it's important to note that extending the list of components, which may have to be maintained over time to account for new devices, and requiring additional power allotment per component will bring added complexity to the specification.

Notes cont.

The test that will be performed to determine idle mode consumption will be based on the SPECpower_ssj2008 methodology (http://www.spec.org/power_ssj2008/docs/SPECpower-Methodology.pdf). Several industry stakeholders have indicated that this benchmark serves as an acceptable proxy for emulating the idle state. Any data submitted by manufacturers will be kept strictly confidential and would only be shared in a masked form, which does not reveal manufacturer or model names. Data should be sent to Arthur Howard, ICF International, at ahoward@icfi.com by **September 19**.

Several approaches to addressing active power efficiency have been discussed and EPA continues to believe that proposing idle requirements based on product categorization is the best option. However, EPA is also open to discussing additional proposals that include a clear path forward and accompanying data to support the approach. Some of the alternatives that have been proposed include 1) idle power normalized for specific features (e.g., number of processors, amount of RAM, or number of disk drives); 2) idle power as a percent of maximum power; 3) a base power allowance plus adders for additional features such as processors, RAM, or disk drives; and 4) a power-saving feature checklist (power management capability, low power components, etc.). EPA has included specific comments on some of these proposals, below.

Idle as a Percent of Maximum Power: Some stakeholders suggested specifying idle power as a percent of the maximum power of the system. This approach would allow the idle ceiling to scale with increased performance and complexity in configuration. EPA has considered this approach but has some reservations about its implementation. The goal of including an idle requirement is to reduce the amount of energy being consumed by servers absent of a workload. Using an approach based on maximum power of the system will not guarantee a reduction in the absolute power drawn by the system during idle. In addition, determining a consistent method of measuring maximum power will be a challenge since a variety of different approaches are being used in the marketplace. Furthermore, several stakeholders have suggested that SPECpower ssj_2008 cannot serve this role because it does not effectively stress certain components, such as hard disks and I/O. This and other factors would give such an approach added complexity and yet questionable benefits in terms of energy saved by the metric. However, EPA remains open to discussing this approach if stakeholders can produce compelling information that alleviates these concerns.

Power Saving Checklist: Several stakeholders have suggested a system of active power savings based on available power saving functions in lieu of an idle requirement. Some of the proposals received include a list of specific power management features that would be required in an ENERGY STAR system. EPA has considered this approach, but anticipates several issues emerging, such as:

- Savings through power management are difficult to characterize to determine programmatic savings and are user-dependant.
- Addressing power saving features instead of the absolute watts drawn could overlook new energy saving technologies, unrelated to power management, which enter the market after the specification takes effect.
- A prescriptive approach will become quickly outdated. EPA believes that specifics about power management features are best identified as a reporting requirement rather than a pass/fail requirement.

As such, the power management section has been removed from this version of the specification. Power management features will be required to be reported via the Power and Performance Data Sheet.

Blade Systems: EPA understands that the currently available SPECpower benchmark (ssj_2008) is not intended to run on blade server systems. According to industry sources, the next update of the SPECpower benchmark should include this capability. Given that an idle test methodology is not yet available using SPECpower, manufacturers are encouraged to provide recommendations on how to define and measure idle for blade servers for purposes of this Tier 1 specification.

B. Standard Information Reporting Requirements

Manufacturers must provide standardized power and performance data with each ENERGY STAR qualified computer server that includes the information provided in **Appendix A** of this specification. This information must be posted on manufacturer's Web site where information for the qualified model is posted. A Manufacturer may provide one data sheet per model number with information on maximum, minimum, and typical configurations, and is encouraged to link to a power calculator where information on the power use of individual user configurations can be found.

Note: EPA believes key areas of interest on the data sheet are available power management functions (including which are enabled upon shipment and which were active for power testing), available benchmark scores and related power information, and idle power. EPA has included a list of potential characteristics in Appendix A of this Draft 2 specification, which would be required for each model. As proposed, manufacturers would be required to provide information on maximum, minimum, and typical configurations for any given model. At this juncture, EPA is very interested in feedback regarding the specific format and/or layout for displaying this information in a standardized way across server vendors.

EPA is also interested in a list of vendor neutral terms for key power saving features and envisions a checklist of the most common features where manufacturers can indicate which are enabled for shipment (and used during testing) and other features that are available but require end-user enabling. EPA has included an initial list of possible features in Appendix A, based on stakeholder comments, and is interested in suggestions to further refine this list.

During the Redmond meeting, several stakeholders suggested that EPA coordinate with ASHRAE on some of the proposed reporting requirements, specifically in regards to reporting of airflow and thermal characteristics. EPA has referenced the TC9.9 Thermal Report and is working with ASHRAE to identify further areas for coordination.

C. Power and Temperature Measurement Requirements

Standardized Data Measurement: All servers must have the ability to provide real time data on AC power consumption, inlet air temperature, and processor utilization during server operation.

Note: EPA has received significant support for a standardized data measurement requirement from both manufacturers and end users. Currently, there are a number of different specifications being used to transfer this information, including DMTF, IPMI, DCMI and SNMP. To encourage continued innovation and competition in the marketplace, EPA is only requiring standardization of the type of information being reported as opposed to specific technologies used to measure and display the data. Stakeholders are encouraged to provide any additional suggestions on how EPA can ensure that the data is easily accessible and comprehensive for purposes of end user monitoring.

Tier 2 Requirements: Effective TBD

TBD

4) Test Criteria: Manufacturers are required to perform standardized tests to determine ENERGY STAR compliance for a given product model. The results of those tests may be self-certified by the ENERGY STAR Partner, or by a third-party laboratory on behalf of the manufacturer, and must be reported to EPA using the ENERGY STAR Computer Server Qualified Product Information (QPI) form. When testing computer servers, the partner agrees to use the following test procedures to determine ENERGY STAR compliance:

- **Power Supply Efficiency:** Generalized Internal Power Supply Efficiency Test Protocol Rev. 6.2.
- **Idle Power:** Idle output as collected using SPECpower_ssj2008

Power supplies should be tested with the following input test conditions, as indicated in the above test procedure:

Power Supply Type	Input Test Conditions
AC-DC Single-Voltage	230 Volts, 60 Hz
AC-DC Multi-Voltage	115 Volts, 60 Hz
DC-DC (All)	48 Volts or -48 Volts DC

Note: EPA intends to adopt the test procedure above for purposes of evaluating power supply efficiency under this specification. As noted earlier in this document, EPA is considering using the more recent version of this test procedure (revision 6.4.1), which addresses DC-DC power supply testing. If DC-DC powered servers are added to the specification, EPA will update this test procedure reference, as appropriate. More information can be found at http://efficientpowersupplies.epri.com.

EPA has also added a table that provides additional direction on the required input test conditions to be used for ENERGY STAR testing. Several stakeholders have suggested that EPA require multi-voltage power supply testing at 230 Volts since the specification is intended for data center environments, which typically draw 208 Volts. However, it is EPA's understanding that many servers that use multi-voltage power supplies are used in office environments and requiring testing at 115V would also represent the worst case scenario in terms of efficiency. EPA's goal is to provide a consistent voltage so that power supplies can be fairly compared and where possible, to create testing conditions that best emulate how the server will be used in practice. Stakeholders are encouraged to comment on this requirement.

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

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

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

Note: This specification will take effect on the date specified by EPA in its final document. EPA is continuing to work toward finalizing Tier 1 requirements by the end of this year and will present a timeline for Tier 2 in the final specification. As a reminder, new ENERGY STAR specifications are established to recognize approximately the top 25% of models currently available in the marketplace and available from a variety of manufacturers across a range of product types. It is also important that these products provide energy efficiency in a cost-effective manner to the end user. Over time EPA will assist in creating demand for ENERGY STAR qualified models and will look to manufacturers to design, manufacture and sell an increasing number of new compliant products in response to this demand. EPA intends to initiate plans to begin working towards a Tier 2 framework in late 2008. The goal is to finalize Tier 2 requirements in 2009, well before the Tier 1 expiration date, to provide manufacturers ample transition time to redesign to the new requirements. EPA understands that such a transition may result in an initial decrease in the number of available models during this transition period but expects market share to again increase over time.

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

APPENDIX A : REQUIRED ENERGY STAR QUALIFIED PRODUCT INFORMATION (SERVER MODEL NAME AND NUMBER)

- System Characteristics
  - Form factor (e.g., 1u, 2u, tower, blade chassis, etc.)
  - Available processor sockets
  - Available Dimm slots / maximum memory capacity
  - Available I/O slots
  - Minimum and maximum # of hard drives
  - Service processor availability
  - OS listed as being supported

- System Configurations for Maximum, Minimum and Typical Configurations (As tested)
  - Processor information (# installed, model number, speed, # of cores, etc.)
  - Memory information (total memory installed, memory types, # Dimms, Dimm Size, etc.)
  - Power supply – #, redundancy configuration (n / 2n / n+1), and size (Watts)
  - I/O capability (# and type of devices, speed)
  - Hard drive information (#, speed, size)
  - Installed operating system
  - Service processor installed?
  - Other hardware features / accessories

- Power Saving Features Enabled on Shipment (used for testing) and Those Available Once Enabled by User (a check list of vendor neutral terms as well as room for "other" features not included on check list):
  - Dynamic voltage and frequency scaling of processor(s);
  - Processor/core sleep;
  - Power capping;
  - Dropping into lower static power modes as workload reduces;
  - Variable speed cooling fan control based on power or thermal readings;
  - Lower power memory states;
  - Lower power I/O interfaces;
  - Liquid cooling capability;
  - Available low power components

- Air Flow Rate Information/Delta T (as reported in ASHRAE Thermal Guidelines, ASHRAE, Atlanta GA, 2004)
  - Total power dissipation for maximum (full), minimum and typical configurations at 100% load
  - Delta T at exhaust of server for full, minimum and typical configurations at 100% load (i.e., temperature rise across system)
  - Airflow at maximum fan speed (CFM) at nominal and at peak (35C ambient inlet) temperatures
  - Airflow at minimum fan speed (CFM) at nominal and at peak (35C ambient inlet) temperatures

- Power and Temperature Measurement and Reporting
  - Compatible protocols for data collection (DMTF, IPMI, DCMI, SNMP, etc.)
  - AC input power available?
  - DC power available (power supply output)?
  - Input/output temperature available?
  - Processor utilization available?

- Power and Performance Data for Maximum, Minimum and Typical Configurations
  - Benchmark(s) used and type of workload
  - Benchmark performance score(s)
  - Link to full benchmark results where applicable (e.g., SPECpower_ssj2008)
  - Maximum power
  - Idle power
  - Power supply efficiency at 10%, 20%, 50% and 100% rated load (10% only for single voltage supplies)
  - Estimated kWh/year (*Assumptions TBD*)

- Link to manufacturer supplied savings calculator for power numbers on customer specific configurations