ENERGY STAR® Program Requirements for Computer Servers

DRAFT 4

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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 a product, it must meet the specification (e.g., Tier 1 or 2) in effect at that time;

- provide clear and consistent identification of ENERGY STAR qualified Computer Server families and configurations. Partner must use the ENERGY STAR mark in all of the following ways:

    1. The ENERGY STAR mark will be included on the Computer Server manufacturer's Internet site specification sheet where product information is displayed and configurations are provided:
        - This ENERGY STAR mark will also serve as a link from the manufacturer's specification sheet to the corresponding Power and Performance Data sheet for the qualified configuration or Product Family.
    2. The ENERGY STAR mark will be included on the ENERGY STAR Power and Performance Data Sheet; and
    3. The ENERGY STAR mark shall be used to identify qualified Product Families and/or configurations in collateral materials, which could include, but not be limited to: user manuals, product guides, marketing brochures, etc.

    If additional information about the ENERGY STAR program(s) or other products is provided by the Partner on its Web site, the ENERGY STAR Web Linking Policy should be followed. The Web Linking Policy can be found in the Partner Resources section on the ENERGY STAR Web site at www.energystar.gov.

Note: EPA is not requiring the attachment of a physical label to the server primarily because the label would not be visible to the users of the Computer Server. Use of the ENERGY STAR mark on the Web site and in product literature continues to be a requirement. EPA's goal for requiring the ENERGY STAR mark, in addition to the words "ENERGY STAR", for qualifying Computer Servers is two-fold:

1. To allow buyers an easy way to identify the most energy efficient Computer Servers in the marketplace, and
2. To provide a vehicle that buyers and end users can use to find additional information on the ENERGY STAR program and qualified configurations or Product Families via the Power and Performance Data Sheet.

Note (Continued): There are numerous opportunities to use the ENERGY STAR mark on the Partner Web site and in product literature. EPA has identified three labeling requirements that support the goals of this specification. The ENERGY STAR mark:

1. Must be used wherever product specifications are displayed for ENERGY STAR qualified Product Families and configurations. EPA assumes the manufacturer Web site will be the primary vehicle for identifying and purchasing Computer Servers and Web-based product specifications provide a high level of visibility for prospective buyers.
2. Must be included on product specification sheets to identify qualifying Product Families or configurations and on the Power and Performance Data Sheet.
3. Must be used to identify qualified Product Families and configurations in the appropriate product literature. EPA is particularly interested in learning more about the product literature that accompanies Computer Servers when shipped and intends to specify additional requirements so that the end user is assured of ENERGY STAR compliance upon receipt of the product.

- Work with Value Added Resellers (VARs) of Partner's products to help ensure that Computer Servers remain in compliance with ENERGY STAR requirements. Any party within the distribution channel of an ENERGY STAR qualified Computer Server that alters the power profile of a product after its date of manufacture through hardware or software modifications must ensure that the product continues to meet the ENERGY STAR requirements before delivering this product to the end customer. If the product no longer meets the requirements, it may not bear the ENERGY STAR mark.

  If a VAR makes any modifications to a product that was previously qualified under this Version 1.0 specification, re-brands the product, and promotes it as ENERGY STAR, it must become an ENERGY STAR Partner and follow the requirements outlined in this Version 1.0 specification.

Note: EPA recognizes that manufacturers have limited control over their equipment once it is shipped. EPA is particularly concerned with VARs who often reconfigure the Computer Servers without re-branding the product and then ship the final configuration to the end user. These upgrades could change the energy profile of a Computer Server originally qualified by the OEM as ENERGY STAR such that it no longer meets the requirements of this specification. It is important that ENERGY STAR manufacturing Partners assist EPA in educating VARs so the end user is informed of the true performance and qualification status of their Computer Server. If an end user wants to purchase an ENERGY STAR qualified Computer Server through a VAR, a system should be in place to guarantee continued ENERGY STAR performance. EPA is proposing that Partners communicate clearly with VARs about qualified configurations and that for products no longer qualifying, VARS must remove any references to ENERGY STAR, as applicable, and clearly state products are no longer qualified. In the case where a VAR re-brands an ENERGY STAR qualified Computer Server and continues to promote it as ENERGY STAR, that VAR will be expected to join the ENERGY STAR program as a Partner. EPA is interested in stakeholder suggestions on approaches to ensure the ENERGY STAR qualified Computer Server sold by the VAR meets consumers expectations regarding energy efficiency performance.

- 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.

Note: Increasingly, more organizations are recognizing the need to confront energy and environmental challenges. Many of these challenges are tied to environmental attributes of products these organizations may buy or sell, and these attributes can be either internal or external to the product itself. The voluntary ENERGY STAR Labeled Products program aims to help a diverse group of product manufacturers share valuable information on efforts to confront these challenges, and in the process, to present business opportunities in addressing these challenges. To that end, EPA encourages Partners to participate in the ENERGY STAR program at various levels and is open to further feedback on how the EPA can partner with industry members to address these energy and environmental challenges.

Below is the **Version 1.0 DRAFT 4** 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.

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 (OS) 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);
- All processors have access to shared system memory and are independently visible to a single OS or hypervisor.

Note: EPA added language to clarify that a single Computer Server is defined such that the processors must have access to shared system memory and be visible to a single OS or hypervisor. This change was made to help differentiate between multi-socket systems, which have multiple processing units that perform as a single Computer Server, and multi-node systems where each node is considered a separate Computer Server, i.e. each node meets the definition above.

B. Blade System: 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 or Storage units in a single enclosure, and are designed to for technicians to easily add or replace multiple Computer Server boards in the field.

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 storage, and hardware for DC power distribution, thermal management, system management, and network services. A Blade Chassis features multiple slots which can be populated with blades of different types.

Computer Server Types

D. Blade Server: A Computer Server consisting of, at minimum, a processor and system memory that relies on shared resources (e.g., power supply, cooling, etc.) for operation. Blade Servers are designed to be installed in a Blade Chassis and are incapable of operating independent of the chassis.

E. Direct Current (DC) Server: A Computer Server with a DC-DC power supply which runs directly off of DC power.

Note: Several stakeholders clarified that DC Servers are typically models originally designed for AC power consumption but which use an alternative DC-DC power supply. Therefore, the definition of a DC Server was modified slightly to indicate that it includes products "with" DC-DC power supplies, instead of "designed to operate with" DC-DC power supplies. To qualify for ENERGY STAR, Computer Servers that are able to operate with either AC-DC or DC-DC power distribution must meet the appropriate power supply requirements for the installed power supply for that configuration, as outlined in Section 3.A, Power Supply Efficiency Requirements.

F. Fully Fault Tolerant Server: A Computer Server designed with complete redundancy, in which every computing component is replicated between two nodes running an identical and concurrent workloads. If one node fails or needs repair, the second node can run the workload alone to avoid any downtime. A Fully Fault Tolerant Server effectively use two systems to simultaneously and repetitively run a single workload for continuous availability in a mission critical application.

Note: In response to manufacturer questions, EPA has included a definition for Fully Fault Tolerant Servers for the purpose of excluding these product types in Section 2, Qualifying Products. Fully Fault Tolerant Servers are highly specialized products aimed at workloads that require extremely high levels of redundancy. It is EPA's understanding that these systems have unique characteristics resulting in a vastly different power profile compared to the Computer Servers intended to be covered by this specification. Fully Fault Tolerant Servers are used only in cases where extreme reliability is needed and are believed to be niche products with very few models available in the current marketplace. Furthermore, it is unclear how these systems would be fairly tested and compared under this specification. For these reasons, Fully Fault Tolerant Servers are excluded under Tier 1. EPA may consider these product types under Tier 2.

G. Managed Server: Computer Servers designed for mission-critical applications in a highly managed environment. A Managed Server ***must have all*** of the following characteristics:

- Capability to operate with redundant power supplies.
- An installed dedicated management controller (e.g., service processor).

Note: EPA has replaced the term "High Availability Systems" with "Managed Servers" in order to identify systems likely found in highly managed environments and with high availability requirements. This change was made in response to several stakeholder comments that the term "high availability" is a common term used in the industry that offers a slightly different definition, which could create confusion. Furthermore, EPA believes that the distinction for models designed for high availability and capability should be based on whether the system *is capable* of redundancy, regardless of whether additional power supplies are installed, and has altered this definition accordingly.

The definition for Managed Server couples the need for power redundancy capability with the need for an installed management controller, or service processor, to: (1) appropriately differentiate between base system types for purposes of determining base system Idle levels in Section 3.B, Idle Power Requirements, and (2) to identify systems subject to the Data Measurement and Output Requirements in Section 3.D, below. EPA removed the ECC memory requirement from this definition given that the Computer Server definition addresses ECC or buffered memory support. Furthermore, based on EPA collected data, this common attribute does not create a meaningful distinction between Standard and Managed Servers when added to the two characteristics now listed above.

H. Dual-Node Servers: A Dual-Node server consists of a pair of independent Computer Servers contained in a single enclosure and sharing one or more power supplies so that the combined power for all nodes is distributed through the shared power supply(s). Dual-node servers are designed and built as a single enclosure and are not designed to for technicians to easily add or replace multiple Computer Server boards in the field such as with Blade Systems. Multi-node systems which contain greater than two individual Computer Servers in an enclosure are not considered Dual-Node Servers under this definition.

Note: EPA has added a definition for Dual-Node Servers, which consist of two individual Computer Servers sharing one or more power supplies. EPA understands that several manufacturers are offering these systems as an energy-efficient solution in the marketplace. To be eligible for ENERGY STAR these systems must operate independently and be contained in a single enclosure. These systems should not be designed to easily add or replace nodes (e.g., Blade Systems). Stakeholders are encouraged to comment on whether this definition creates a clear separation from Blade Systems under this specification. EPA is proposing that Dual-Node Servers meeting this new requirement be eligible for ENERGY STAR as long as each individual node meets the requirements in Section 3B, Idle Power Requirements.

I. Server Appliance: A self-contained Computer 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 managed through a web or command line 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.

Other Data Center Equipment

J. Blade Storage: A storage specific element that relies on shared resources (e.g., power supply, cooling, etc.) for operation. Blade Storage units are designed to be installed in a Blade Chassis and are incapable of operating independent of the chassis.

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

L. 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 Computer Servers. While storage equipment may contain one or more embedded processors, these processors do not execute user-supplied software applications but may execute data specific applications (e.g. data replication, backup utilities, data compression, install agents, etc.).

Computer Server Components

M. Computer Server Power Supply: A self-contained Computer Server component which converts a voltage input to one or more different DC voltage output(s) for the purpose of powering the Computer 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 with, the system motherboard).

N. AC-DC Power Supply: A power supply which converts line voltage AC input power into one or more different DC output(s) for the purpose of powering the Computer Server.

O. DC-DC Power Supply: A power supply which converts a DC voltage input to one or more different DC voltage output(s) for the purpose of powering the Computer 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 Computer Server components are not considered DC-DC power supplies under this specification.

P. Single-Output Power Supply: A power supply which delivers most of its rated power through one primary DC output for the purpose of powering the Computer Server. Single-Output power supplies may include one or more standby outputs which remain active whenever connected to an input power source. There may be additional outputs besides the primary output and standby

output(s), however, the combined power from all additional outputs must be no greater than 20 watts.

Q. Multi-Output Power Supply: A power supply which delivers its power through more than one primary output, including one or more standby outputs which remain active whenever connected to an input power source. For Multiple-Output Supplies, the combined power from additional outputs other than the primary voltage is greater than 20W.

Note: EPA has altered the definitions for Single and Multi-Output power supplies to allow the inclusion of some low power secondary outputs for Single-Output supplies, provided that the sum of those outputs is less than 20W. EPA has also removed the provision that power supplies with multiple rails are still considered Single-Output if all of the rails are at the same voltage. Under the new definition, power supplies with multiple primary 12V voltage rail outputs would be considered Multi-Output. EPA believes these changes help to further clarify these definitions, affect a very small part of the market, and continue to support the analysis performed and proposed levels developed to date.

R. I/O Devices: Devices which provide data input and output capability to the Computer Server from other networked devices. I/O Devices can either be integrated into the main computer board or can be add-in devices connected though expansion slots such as PCI or PCIe. Examples of I/O Devices include: Ethernet, InfiniBan, and Fibre Channel.

Note: A definition for I/O Devices has been added to clarify which products/components are eligible for the additional Idle power allowance included in section 3.B.1, below.

Other Key Terms

S. Idle: An operational state in which the operating system and other software have completed loading and the Computer Server is capable of completing workload transactions, but no workload transactions are requested or performed by the system (i.e., the Computer Server is operational, but not processing any useful work).

T. Product Family: A group of Computer Server configurations, where every configuration within the Product Family includes the same identical base components which have identical technical specifications and power profiles. In order to be considered in the same Product Family configurations must:

- Use the same model motherboard,
- Use the same model and quantitiy of processor(s), with identical specifications (e.g., speed, cache size, core count, etc.), and
- Incorporate the same model base components listed below (the relative numbers of these components may vary withing the family):
  - Power supply(s)
  - Memory DIMM(s)
  - Hard drive(s)
  - I/O Device(s)

A configuration does not need to incorporate every base component listed above to be considered as part of a qualified Product Family. For example, a configurations without an add-in I/O Device may be included as a base configuration in a Product Family with any number of additional I/O Devices included in other configurations.

Note: EPA understands the concerns raised by manufacturers in regards to testing every possible configuration for ENERGY STAR qualification. While EPA recognizes the challenges that manufacturers face if asked to test multiple configurations, this concern must be balanced with the assurance that all configurations promoted as ENERGY STAR meet the specification requirements. To strike this balance, EPA is allowing Partners to test the *most and least* consumptive configurations within a Product Family as long as the configurations possess similar efficiency characteristics and predictable variances in energy consumption. To ensure that all configurations within a product family meet the ENERGY STAR requirements, EPA has specified that product families include the same quantity and same model of motherboards and processors. Quantities of other system components may vary as long as the components are all the same model with identical attributes. **All configurations qualified under a Product Family must meet the specification requirements.** As indicated in Section 4.C below, if non-qualifying configurations exist within a Product Family, Partners must use a unique identifier in the model name/number to clearly indicate which configurations are qualified. This Product Family approach offers Partners increased flexibility in qualifying a number of configurations under one ENERGY STAR submission. This approach also provides end users with a range of performance for the ENERGY STAR qualified product family.

U. Maximum Configuration: The highest performance system within a Product Family. The Maximum Configuration represents the highest configuration of power supplies, memory, hard drives, and I/O Devices, etc. available in the Product Family. The Maximum Configuration must represent the maximum power consumption possible within the Product Family.

V. Minimum Configuration: A base-model within a Product Family that is minimally configured. Such a system would typically have the minimum number of power supplies, the least amount of system memory, a single hard drive, and a single I/O Device (either integrated or add-in). The Minimum Configuration must be currently available and sold in the marketplace (i.e. the system should be minimally configured but not under configured to a point which is unreasonable). The Minimum Configuration should represent the lowest power consumption possible among shipping configurations within the Product Family.

W. Typical Configuration: An intermediate configuration between the Maximum Configuration and Minimum Configuration of a Product Family. The Typical Configuration should be representative of a configuration with high volume sales which contains a typical number of hard drives and I/O Devices, an average amount of installed memory, etc.

Note: The definitions for Maximum, Minimum and Typical Configurations have been moved from Section 4 to Section 1, above. These definitions have also been modified to indicate the Maximum and Minimum Configurations must define the "bookends" of the specific Product Family which does not necessarily represent the maximum and minimum power consumed by the entire model line. This is necessary because the proposed definition of a Product Family is more focused and will often fit a smaller subset of configurations contained within a model line.

2) Qualifying Products: A Computer Server must meet the definition provided in Section 1.A, above, to be eligible for ENERGY STAR qualification under this specification. The Tier 1 specification coverage is limited to Computer Servers having at most four processor sockets (i.e. Computer Servers with 1 - 4 individual processor sockets). **Computer Servers with greater than four processor sockets are currently ineligible for ENERGY STAR qualification under the Tier 1 specification but will be considered for inclusion under Tier 2 requirements.**

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

- Fully Fault Tolerant Servers
- Network Equipment
- Server Appliances
- Storage Equipment
- Multi-Node Systems

Note: EPA recognizes that there is a wide range of Computer Server types available in the marketplace. The purpose of Section 2, above, is to clearly define those Computer Servers that are eligible for ENERGY STAR and those that are specifically excluded from this specification. The Computer Server definition provided in Section 1, above, is intended to clearly delineate enterprise class Computer Servers and those systems not already covered by the ENERGY STAR Computer Version 5.0 specification. Within that broad scope, EPA is focusing its Tier 1 development efforts on a subset of Computer Servers that represents the majority of that market. Server Appliances, Computer Servers with greater than four processor sockets, and Fully Fault Tolerant Servers are explicitly excluded due to their high complexity, unusual characteristics, and low relative market share. This explicit exclusion provides a clarification to purchasers to help ensure that public or private procurement guidelines do not unfairly exclude options to purchase these products when the unique functionalities of these products are required by the purchaser. EPA plans to revisit products excluded under Tier 1 based on manufacturer interest, increasing market share, available data and test procedures, and clear differentiation in regards to energy performance.

Inclusion of Blade Servers: Some stakeholders argue that Blade Servers compete directly with rack mounted Computer Servers and therefore, should be provided the same opportunity to qualify for ENERGY STAR. Many manufacturers are promoting Blade Servers as an energy-efficient solution in the data center. EPA recognizes the energy saving potential of Blade Servers and is including testing conditions presented in Appendix A. EPA intends to develop performance requirements that will provide a level playing field for Blade Servers and will represent how these products are actually used in the data center.

One of the challenges that EPA faces with this product category is that the number of Blade Servers sold within the supporting Chassis often varies. As such, Blade Servers do not map 1:1 to the supporting infrastructure in the same way as rack mount servers. This creates a question of how to allocate the Idle power from the supporting infrastructure (Blade Chassis) to the individual Blade Servers which may vary in number within a Chassis. One stakeholder proposed that Idle power for Blade Systems should be measured with the Blade Chassis fully populated. While this represents the optimum efficiency of the Blade System it may not reflect the manner in which these products are installed and used in operation.

To address this issue, EPA is proposing to test these systems three ways: (1) populated with only a single Blade Server, (2) half populated with Blade Servers (rounding up for chassis with uneven number of blade slots, e.g., a seven slot chassis would test with four Blade Servers) and (3) fully populated with identically configured Blade Servers, as indicated in the Idle test method in Appendix A of this specification. The configuration for both the Blade Servers themselves and the Blade Chassis must remain constant for all three tests. EPA also encourages Partners to test the optional condition of the empty Blade Chassis with no installed Blade Servers.

Blade Server Analysis: The three test conditions listed above will provide EPA with enough information to evaluate the efficiency of different arrangements of Blade Systems, including the underpopulated Blade Chassis. As part of the comment process, manufacturers are encouraged to submit data on 1S and 2S Blade Servers, using these test conditions and following the procedure outlined in Appendix A, to EPA by **Friday, March 20**. A Blade Server data collection sheet is provided on the ENERGY STAR Web site. Please note that requirements for Blade Servers are contingent on EPA having a robust Idle data set by the March due date. **Note: EPA is only interested in reviewing data on 1S and 2S Blade Servers for purposes of developing potential Tier 1 levels**. If covered, 3S and 4S Blade Servers would not be required to meet Idle power levels, similar to other 3S and 4S Computer Servers covered by this Tier 1 specification.

EPA's intent is to cover Blade Servers under Tier 1 of this specification but does not want to further delay the finalization of this Version 1.0 specification. If sufficient data from several manufacturers can be collected, EPA will propose requirements for Blade Servers in the Final Draft document. If EPA finds that more data and/or additional discussions are needed it will pursue a separate but parallel path to developing Blade Server requirements and add the product category as an amendment to Version 1.0 as soon as possible. In addition to Idle levels, Blade Servers would also need to meet requirements as proposed in this Draft 4 document for power supply efficiency, standard information reporting, and data measurement and output requirements to qualify as ENERGY STAR.

3) Efficiency Requirements for Qualifying Products: A Computer Server must meet all the requirements provided in Sections 3.A – 3.C, below, to qualify as ENERGY STAR.

Tier 1 Requirements: Effective May 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)	≤ 500 Watts	70%	82%	89%	85%
	501 - 1,000 Watts	75%	85%	89%	85%
	> 1,000 Watts	80%	88%	92%	88%

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 Multi-Output	All Output Levels	N/A	0.80	0.90	0.90
AC-DC Single-Output	≤ 500 Watts	0.65	0.80	0.90	0.90
	501 - 1,000 Watts	0.65	0.80	0.90	0.90
	> 1,000 Watts	0.80	0.90	0.90	0.90

Note: An important element of holistic design for power conversion is to properly size power supplies to keep the operating range of the Computer Server in the high efficiency portion of the efficiency curve. EPA realizes that an unintended consequence of setting levels that are too difficult for lower wattage power supplies could be for manufacturers to use larger (and potentially oversized) power supplies to meet these efficiency requirements. This could result in an increase in the total energy used by the server, which is not EPA's intention.

EPA revisited the dataset to investigate concerns regarding the challenges of low wattage power supplies to overcome fixed losses and meet the 10% and 20% efficiency levels proposed in the Draft 3 specification. One stakeholder suggested that EPA create a separate category for low wattage power supplies (≤ 750 Watts) that includes a slight modification to the 20% load requirements and an exemption from 10% loading requirements. EPA agrees that modified levels are necessary for lower wattage supplies. Due to the dominance of fixed losses at low loading for smaller supplies, efficiency levels appear very low when in reality, relatively little power is actually being lost. EPA considered this proposal and based on further analysis of the data has chosen 500 Watts as the appropriate cutoff for low wattage products. As a result, a new low wattage bin is proposed in Tables 1 and 2, above, with relaxed requirements for efficiency at 10% and 20% loads. Based on available data, EPA has set the 20% load level equal to that of Multi-Output supplies and the 10% load condition efficiency level at 70%. These new levels represent approximately the top 25% of performers in EPA's data set. Since the challenge of fixed losses is applicable only to low loading conditions on the power supply, the proposed levels at 50% and 100% loads remain unchanged. EPA has not modified the power factor requirements for these products because the current levels should be achievable based on EPA's collected data. EPA also realizes, based on industry discussions, that solutions that aim to further reduce fixed losses at low loads are in development. Therefore, EPA anticipates moving efficiency levels for all power supplies to the > 1,000 Watt Single-Output levels under Tier 2.

B. Active Power Requirements

1. Single and Dual Processor Socket Computer Servers (1S & 2S)

To qualify for ENERGY STAR, a Computer Server's Idle power consumption must not exceed the allowed maximum Idle power levels determined from Tables 3 and 4, below. Table 3 presents the Idle power allowance for a base Computer Server system (e.g., minimal memory, single power supply, one hard drive). Table 4 presents additional Idle allowances for components included above the base system level. One and Two processor (1P & 2P) Computer Servers meeting the definition for Managed Servers in Section 1.G, above, must use the base system Idle levels for Category B and Category D in Table 3, below. Any One or Two processor Computer Server not meeting the definition for Managed Servers must meet the standard Computer Servers levels for Category A and C in Table 3, below.

To determine the maximum Idle level for ENERGY STAR qualification, manufacturers should use the base system Idle level from Table 3, based on installed processors, and then add the additional power allowances from Table 4, where appropriate. An example is provided below:

EXAMPLE: A standard single processor Computer Server with 4GB of memory and a single hard drive would need to meet a 55 Watt Idle level. The same Computer Server with an additional hard drive would be provided with an additional 8 Watt allowance and would therefore need to meet a 63 Watt Idle level. If this server was then upgraded to 8 GB of memory, it would be granted another 8 Watts (4 extra GB x 2 Watts/GB) and therefore, would need to meet a 71 Watt Idle level.

Systems with multiple add-ins should include all applicable allowances. ***Note: In the tables below, all attributes refer to the amount installed in the system, and not the amount the system is capable of supporting (e.g. installed processors, not processor sockets; installed memory, not supported memory, etc.).***

Table 3: Base System Idle Power Requirements

Computer Server System Type	Idle Power Limit
Category A: Standard Single Installed Processor (1P)	55 Watts
Category B: Managed Single Installed Processor (1P)	65 Watts
Category C: Standard Dual Installed Processor (2P) Servers	100 Watts
Category D: Managed Dual Installed Processor (2P) Servers	150 Watts

Table 4: Additional Power Allowances for Extra Components

System Characteristic	Additional Idle Power Allowance
Additional Power Supplies (Greater than one for the purposes of power redundancy)	20 Watts/PSU
Additional Hard Drives (Greater than one)	8 Watts per Drive
Additional Memory over (4 Gigabytes)	2 Watts / GB
I/O Devices (Greater than 1Gbit)*	
Base: One or two port onboard Ethernet <=1 Gbit	No Allowance
Additional Ethernet less than 1Gbit	No Allowance
Additional 1 Gbit Ethernet	2 W per Active Port
Additional 10 Gbit Ethernet	8 W per Active Port
Fibre Channel or Infiniband	5W per Device

***Notes on I/O Devices:**

- The base configuration is considered a Computer Server with a single or dual port Ethernet device onboard, and therefore products with up to this capability do not receive additional allowances.

- Models may claim power allowances for all I/O Devices listed above in addition to the base configuration. Additional devices can be onboard or external, but must be active on shipment, to claim an allowance.
- Devices with speeds less than 1 Gbit may not qualify for any additional allowances.

Note: EPA has reconsidered Idle power limits and component power allowances based on comments and additional data received from stakeholders in response to the Draft 3 Specification. The levels presented in Tables 3 and 4, above, are based on the most recent version of EPA's Idle dataset available on the ENERGY STAR Server Web page at www.energystar.gov/productdevelopment (click on New Specifications in Development).

Three and Four Socket Systems. In this Draft 4 specification, EPA is proposing to hold off on requiring Idle power for Computer Servers with greater than two sockets (3S and 4S systems) until Tier 2 for the following reasons:

- EPA believes that systems with greater than two sockets are generally purchased for more highly utilized applications compared to single and dual socket systems. These systems are preferred candidates for server consolidation and virtualization, both of which are strategies that are likely to reduce periods of Idle and result in more efficient work output in the data center.
- Systems with greater than two sockets tend to be highly configurable and more complex compared to typical high volume single and dual socket Computer Servers, which has made developing robust Idle levels for these products difficult within the proposed Tier 1 development timeframe. EPA believes more effective levels can be set, if needed, after learning more about these systems and building a more robust data set through Tier 1 reporting requirements.

In lieu of Idle power requirements, EPA is continuing to require challenging power supply requirements for the higher wattage power supplies likely to be used in 3S and 4S systems in Section 3.A, above, and is introducing new processor power management requirements, proposed in Section 3.B.2 below. EPA is confident that combining improved power supply efficiency with effective power management and server consolidation techniques, ENERGY STAR qualified 3S and 4S systems will offer the end-user significant energy savings compared to non-qualified systems.

Although manufacturers will not be required to meet Idle power requirements for 3S and 4S systems, they are required to test and report Idle power results for qualified models using the test method provided in Appendix A of this specification. This will help to inform the end user of the complete energy profile of the system for purposes of comparing similar models across vendor lines. It will also raise awareness of the potential energy wasted when a Computer Server is not fully utilized and left to idle. EPA intends to include Idle power information for all Computer Servers on the ENERGY STAR Qualified Product List, including 3S and 4S systems.

EPA understands that 3S systems are not widely available in the marketplace today. However, in the event that these systems become more widely available following the release of this specification, EPA has addressed 3S systems with the same requirements of 4S systems.

Base System Idle Levels. EPA has reevaluated base Idle levels for 1S and 2S systems. Based on available data, base Idle levels were determined based on the number of installed processors (1P or 2P) and whether or not the system meets the definition for Managed Servers in Section 1.G, above. The Managed Server definition is intended to distinguish systems that will be more highly managed in enterprise environments and use additional power to meet higher levels of manageability and availability. EPA received additional comments on creating additional base system Idle categories based on the number of processor sockets instead of the currently proposed number of installed processors. However, EPA continues to believe that Idle power should be tied to the actual performance of the system as it will be delivered to the end user. Because processors can be seen as the key component that dictates both the computing performance and power needs of the Computer Server, EPA believes that different Computer Servers with equal numbers of processors (regardless of the number of total sockets) should compete directly with each other by being included in the same Idle category for qualification. This approach also rewards systems which reduce the additional power consumed by empty processor sockets.

Note (Continued): Additional Power Allowances. EPA has also expanded the list of components eligible for additional power allowances. These components allow the end user to effectively compare the power usage of different configurations and assess the corresponding energy ramifications of different configuration options, while still allowing a variety of systems of different capabilities to qualify for ENERGY STAR. The list reflects a subset of components that EPA believes are the key elements that determine the relative performance and capability of a general purpose Computer Server in the marketplace today. These components/capabilities also have the greatest impact on Computer Server energy performance:

- Redundant power supplies for greater reliability and serviceability,
- Hard drives for greater storage capability and reliability (e.g., RAID configurations) ,
- System memory for increased compute performance, and
- I/O Devices for greater bandwidth in connecting to other networked devices.

The refinement of the levels proposed for these additional allowances encourage the use of the most efficient components when upgrading a system (i.e., top performers in the marketplace). The following changes are proposed in Table 4, above:

- The existing hard drive adder was changed to 8 Watts per additional hard drive for all drives over one. This change was made in response to comments that there should not be additional power given for the second drive over subsequent drives. EPA had previously proposed 15 Watts for the second hard drive and 8 Watts for subsequent hard drives.
- Based on data and comments submitted by stakeholders, an adder for additional power supplies for the purposes of redundancy is now included. By removing power supplies from the base system classifications, the specification can more directly address the additional power needs of redundant supplies and create incentives for efficient designs that offer both redundancy and reduced total power usage while in Idle. For example, this will help create an incentive to properly size redundant systems and to save power by operating power supplies in the regions of highest efficiency.
- An adder for I/O Devices has now been included based on the type and speed of the device. The I/O Device base configuration is considered a single or dual port Ethernet adapter with a speed $\geq$ 1 Gbit, and products may qualify with additional power allowances for all I/O Devices above this base. Levels were developed from data collected by EPA to date and are considered to represent the most efficient technologies available today. EPA is continuing to collect information on these devices and may revise these levels based on additional data and/or comments received by **Friday, March 20.**

EPA is not considering any additional allowances at this time. The proposed allowances in Table 4, above, represent the most common functionalities that affect the power use and performance of Computer Servers. EPA is confident that Computer Servers with other capabilities for which additional allowances have been requested (e.g., RAID controllers) will still be able to qualify under this specification because the base system requirements and/or adders proposed in this Draft 4 were developed from a data set that includes models containing these features. For example, the incremental power required by a RAID controller is likely to have affected the higher power level for Managed Systems and additional hard drives since these products are more likely to contain this capability. In addition, EPA has not proposed an additional allowance for redundant fan capability. Using intelligent designs for redundancy and enabling technologies such as variable speed fan control, Computer Servers should be able to qualify for this specification with redundant cooling capability.

Performance Based on Cores. EPA received several proposals to set Idle energy limits based on the number of available processor cores rather than the discrete number of installed processors. As an alternative, it was also suggested that EPA include an additional allowance for systems with a core count greater than two per processor. These stakeholders argue that multi-core processors offer higher performance than their single and dual core competitors and while these products may use more energy in Idle, when compared to using multiple processors to reach the same level of performance, they provide a more energy efficient solution for servicing the same workload. EPA continues to believe that the best indicator of base Idle level for Computer Systems is the number of discrete processors, and not the total number of cores. EPA's analysis indicates that the base system Idle levels, and additional power allowances proposed in this specification, are just as challenging for single and dual core processors as for quad core processors.

Note (Continued): In addition, since this specification addresses the power consumed while the Computer Server is at Idle and not performing work, EPA believes that multi-core processors should not necessarily be allowed additional power because aggressive power management techniques should be able to reduce the power consumed by additional cores when not in use. However, EPA also recognizes the opportunity for savings if future core count multi-core technologies (e.g., greater than four cores per processor) do indeed promise greater energy efficiencies for the same workload. EPA has limited data on multi-core systems and may consider alternate proposals for processors with greater than four cores if additional data from multiple manufacturers can be supplied for analysis. As part of the comment process, stakeholders are encouraged to provide data on systems with greater than four cores per processor for EPA consideration. **EPA must receive all information on multi-core technology by Friday, March 20 to consider this change in the Final Draft proposal.**

EPA does not expect additional power allowances to be part of the design of Tier 2 of this specification because both capabilities and performance will be incorporated within the energy efficiency metric.

Dual-Node Servers: Dual-Node Servers with one or two sockets per node must meet the above Idle power levels on a per node basis, provided each node in the system is identical in configuration and uses identical components. In this case, the Idle power per node would be found by measuring the combined Idle power of the whole unit (including both Computer Server nodes), as outlined in the Idle power test procedure in Appendix A of this specification, and dividing that total Idle power by two. For example, if two Computer Server nodes share a single power supply, the combined Idle power of the two Computer Servers (measured through the single power supply) would be measured and then the result would be divided by two. The resulting Idle power per node would need to meet the requirements presented in Tables 3 and 4, above, based on the per node configuration, to qualify for ENERGY STAR. However, the full Idle power of the complete system (including both nodes) must be provided via the Power and Performance Data Sheet, as presented in Section 3.C of this specification.

Note: EPA has recently learned that a number of manufacturers sell Dual-Node Computer Servers as defined in Section 1.H of this specification. These Computer Server types may qualify for ENERGY STAR as long as: (1) the unit can be tested using the Idle Test Procedure provided in Appendix A of this specification; (2) each node individually meets the Idle requirements provided in Tables 3 and 4, above; and (3) each node is an identical configuration and uses identical components. Idle power will be determined by measuring the Idle power of both Computer Server nodes through the shared power supply(s) and dividing this measured Idle value by two. Dual-Node Computer Servers will also be expected to meet all other requirements in this specification, as appropriate, including the power supply requirements presented in Tables 1 and 2, above.

2. Computer Servers with Greater than Two Processor Sockets (3S & 4S)

All Computer Servers with greater than two, and up to four, processors must enable processor level power management to reduce power use of the processor during times of low utilization such as Idle. **Systems must be shipped with this function enabled** in the system BIOS, and/or a BMC or Service processor. All systems shipping with a preinstalled supervisor system (operating system or hypervisor) must also have this functionality enabled by default. These systems are not subject to Idle power limits under this Tier 1 specification. This requirement is not applicable to 1S and 2S Computer Servers but manufacturers are encouraged to use these techniques to reduce power use in Idle.

In order to meet this requirement, all processors must be able to reduce their power use in times of low utilization by, either:

- Reducing voltage and/or frequency through Dynamic Voltage and Frequency Scaling (DVFS), or
- Using processor or core reduced power states when a core or socket is not being used.

As with all Computer Servers covered under this specification, Partners must disclose all power management techniques enabled using the Power and Performance Data Sheet described in Section 3C, below. Dual-Node Servers with three or four sockets per node must also meet this requirement.

Note: As discussed in the notebox for Section 3.B.1 of this specification, EPA received several comments from industry stakeholders expressing concern about proposed Idle power requirements for 3S and 4S systems. EPA recognizes the challenges of developing Idle power requirements for systems that are so highly configurable and upgradeable. Furthermore, EPA understands that significant efforts are underway to design and implement power management capabilities for these types of systems, as well as efforts to ensure these technologies are enabled in the field. Therefore, in lieu of an Idle power requirement, EPA proposes requiring Partners to enable processor power management features upon shipping ENERGY STAR qualified 3S and 4S systems. It has been made clear through previous versions of the ENERGY STAR computer specification that requiring power management *capability* is not enough to ensure energy savings in operation. For this reason, EPA is requiring that power management happen at the processor level and that it is enabled through the BIOS or management controller upon shipment. Furthermore, the manufacturer must also report all power management features, enabled and not enabled, to the end user via the Power and Performance Data Sheet. Manufacturers are encouraged to review the provided list of available processor power management techniques and suggest additional approaches that may be used to meet this requirement.

C. Standard Information Reporting Requirements

Manufacturers must provide a standardized *Computer Server Version 1.0 Power and Performance Data Sheet* with each ENERGY STAR qualified Computer Server. This information must be posted on the Partner's Web site where information on the qualified model, or qualified configurations, is posted. Manufacturers are encouraged to provide one data sheet per qualified configuration, but may also provide one sheet per Product Family (as defined in Section 1.T above) with data on the Computer Server's power and performance for maximum, minimum and typical configurations (as defined in Sections 1.U – 1.W, above).

If one data sheet is used to represent many configurations under one Product Family, partners should, when available, also provide a link to a more detailed power calculator where information on the power use of specific system configurations can be found.

Templates for the *Server Version 1.0 Power and Performance Data Sheet* can be found on the ENERGY STAR Web page for Computer Servers at www.energystar.gov/products.

Note: EPA has changed the Standard Information Reporting Requirements to harmonize with the new definition for Product Families in this specification.

EPA has also included text that a template for the Power and Performance Data Sheet will be posted on the ENERGY STAR products page for Computer Servers. A revised draft of the Power and Performance Data Sheet has also been included with this Draft 4 specification. **EPA encourages all stakeholders to review this latest version and provide comments to EPA.**

The revised data sheet includes a few key changes that EPA would like to make stakeholder aware of:

- Since SPECpower is no longer being referenced for Idle power testing, manufacturers are not required to report SPECpower test results on the data sheet. However, EPA is still requiring testing and reporting of at least one benchmark, of the manufacturer's choosing, for inclusion on the data sheet.
- EPA is requiring that Full Load (100%) power be tested and reported along with the method used to determine Full Load power indicated on the data sheet. EPA believes this will provide buyers the necessary information on the full power range of the Computer Server while also allowing EPA to collect valuable data which may be useful in the development of the Tier 2 specification.

D. Data Measurement and Output Requirements

Standardized Data Measurement: One and two socket (1S and 2S) Computer Servers that meet the definition of a Managed Server In Section 1.G, Definitions, and all Computer Servers with greater than two sockets (3S and 4S) must have the ability to provide data on input power consumption in

Watts, inlet air temperature, and utilization of all processor cores during normal operation. **Single socket and dual socket (1S and 2S) products that do not meet the definition of a Managed Server are exempt from this requirement.**

To meet this requirement, applicable Computer Servers may rely on a service processor, embedded power or thermal meter (or other out-of-band technology shipped with the Computer Server), or a preinstalled operating system to collect data and make it available for collection and dissemination over a standard network to third party management systems such as a data center management software suite. Data must be made available in an open format so as to be readable by third party (non-proprietary) management systems. All systems shipped with preinstalled operating systems must have all necessary drivers/software installed to make this information openly available. For systems not shipped with an operating system, documentation of how to access the registers containing the relevant sensor information must be provided in user manuals and online documentation. In addition, when an open and universally available standard becomes available to report and collect this data, manufacturers should incorporate the universal standard into their systems.

Required Accuracy: All measurements should meet the following accuracy levels within typical operating conditions of the Computer Server:

Input power measurements: +/-10% accuracy

Processor utilization measurements: +/-5% accuracy for CPU utilization less than 90%.

Input air temperature measurements: +/- 3° C

Sampling Requirements: Hardware polling rates of the embedded sensors must meet a minimum of one sample per second. Data must be averaged on a rolling basis over a specific time period. A default rolling average of 30 seconds is recommended.

Note: EPA sees the development of increased manageability through better onboard technology as an important element of this specification. EPA intends to encourage and reward this functionality by including requirements for data measurement and reporting. It is critical that managers have access to the proper feedback mechanisms made possible by access to important data on power consumption, inlet air temperature and utilization of their Computer Servers, and that these data measurement and output requirements provide for an open and transparent way of serving this purpose. EPA has received positive feedback on these requirements both from manufacturers and from end users.

The data measurement and output requirements have been refined so that they are only applicable to 3S and 4S Computer Servers and 1S and 2S Managed Servers. This change was made after learning that many low-end Computer Servers in the market currently do not have these capabilities. In fact, EPA could inadvertently exclude otherwise energy efficient solutions by specifying this requirement for standard 1S and 2S systems. However, EPA does believe in the long term importance of assisting data center managers to better monitor and manage data center energy performance. Therefore, all ENERGY STAR qualified Computer Servers will be required to offer this capability under Tier 2 of this specification.

EPA has also made a number of changes to the accuracy and sampling requirements in an attempt to best capture what is available in the market today among systems that have these capabilities. In addition, language was added to ensure that all information is available in an open and transparent way so it can easily be used by third party (non-proprietary) management systems. Also, in response to stakeholder request, EPA added language clarifying that the accuracy requirements are only required in the operating range of the Computer Server. Some stakeholders suggested that the accuracy requirements for power measurement be based on power supply loading (e.g., only at 50%-100% load). However, since this is a system level requirement, EPA firmly believes the accuracy should be based on operating conditions, and in order to be useful, the system must maintain some level of accuracy throughout its entire operating range. This Draft 4 continues to require a rolling average be taken but EPA is not specifying a specific time requirement in order to accommodate the wide variability of rolling averages currently used by manufacturers and management systems today. EPA is recommending a 30 second rolling average and plans to specify a rolling average encompassing no greater than this in Tier 2.

Tier 2 Requirements: Effective October 1, 2010

(1a) Tier 2: TBD

Note: EPA's intent is to create a Tier 2 specification to replace the Tier 1 which will take effect on October 1, 2010. EPA intends to pursue the development of an energy efficiency performance metric for the Tier 2 specification, but sees a wide range of possibilities for approaching a Tier 2 specification and is open to suggestions and proposals from stakeholders. EPA hopes that under Tier 2, a Computer Server could qualify for ENERGY STAR based on a metric incorporating power use, work completed, and the time needed to perform that work (i.e., using performance benchmarks which incorporate energy use, such as, but not limited to, SPECpower). EPA believes that this approach could effectively cover all products included in the Tier 2 scope– from single processor systems to large multiple processor systems – and provide flexibility for future innovations. In the case that such a metric cannot be created in an appropriate timeframe, EPA will move towards the provisional Tier 2 Idle requirements, found below.

- OR -

(1b) Provisional Tier 2 Idle State Requirements. If an energy efficiency performance metric and associated performance levels are not available **by October 1, 2010**, a provisional Tier 2 specification will automatically go into effect and will remain in effect until such a benchmark is established. This provisional Tier 2 would include revised Idle levels for all Computer Server types covered by Tier 1 of this specification with the intention of capturing the top 25% performers in energy efficiency at the time Tier 2 would become effective. in this scenario, EPA would also consider developing Idle levels for product types currently excluded from this specification (Section 2: Qualifying Products).

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

(3) Data Measurement and Output Requirements: Under Tier 2, EPA will also require the Data Measurement and Output Requirements presented in this Version 1.0 Computer Servers specification of all ENERGY STAR qualified Computer Servers covered by the Tier 2 specification. EPA also plans to require a rolling average of data encompassing no greater than 30 seconds under Tier 2.

(4) Energy Efficient Ethernet: EPA intends to require Energy Efficient Ethernet (IEEE 802.3az) for all external physical layer Ethernet interfaces that are covered by the standard as it is ultimately approved by IEEE, most importantly, 1 Gb/s and 10 Gb/s wired Ethernet. More information on the developing standard can be found at http://grouper.ieee.org/groups/802/3/az/.

Note: In the event that provisional Idle levels are needed, EPA continues to plan to develop Idle power for product types currently excluded in this Tier 1 specification, including: Server Appliances, Fully Fault Tolerant Servers, and all Computer Servers with greater than two sockets. EPA has also included a few modifications to the Tier 2 requirements:

- All Computer Servers covered under the Tier 2 specification will be required to meet the data measurement and output requirements in Section 3.D of this specification. For example, 1S and 2S systems that do not meet the current definition for Manged Servers under Tier 1 will be required to incorporate this capability under Tier 2.
- Computer Servers must compute a rolling average of data encompasing no greater than 30 seconds under Tier 2.
- Computer Servers must meet the requirements for IEEE 802.3az for Energy Efficient Ethernet, once approved by IEEE, under Tier 2. By including this capability, ENERGY STAR Computer Servers will be able to both lower their own power consumption and enable other devices in the data center to lower their power during times of low network traffic, resulting in significant additional energy savings.

4) Test Criteria: Manufacturers are required to perform appropriate tests, as outlined below, in order to determine ENERGY STAR qualification for a given configuration or Product Family. These required tests include:

- **Power Supply Efficiency Testing** as outlined in Section 4.A for power supply efficiency requirements and reporting on the Power and Performance Data Sheet for all Computer Servers.
- **Idle Testing** as outlined in Section 4.B for Idle power requirements of Single and Dual socket Computer Servers, and for Idle power reporting of all Computer Servers for the Power and Performance Data Sheet.

The results of those tests may be self-certified by the ENERGY STAR Partner, or by a third-party laboratory on behalf of the Partner, and must be reported to EPA using the ENERGY STAR Computer Server Qualified Product Information (QPI) form. Models that are unchanged or that differ only in finish from those sold in a previous year may remain qualified without the submission of new test data assuming the specification remains unchanged.

Note: EPA is working toward a quality assurance requirement for all testing conducted in support of qualification for ENERGY STAR. Ideally, Computer Servers would be tested in an accredited, independent laboratory. To meet this requirement, the testing laboratory would be accredited by an accreditation body that is a signatory, in good standing, to a mutual recognition arrangement of a laboratory accreditation cooperation (e.g., International Laboratory Accreditation Cooperation, ILAC, Asia Pacific Laboratory Accreditation Cooperation, APLAC) that verifies, by evaluation and peer assessment, that its signatory members are in full compliance with ISO/IEC 17011 and that their accredited laboratories comply with ISO/IEC 17025. The laboratory's Scope of Accreditation would need to reflect their specific competence to carry out the test procedures in this Section 4 of the ENERGY STAR requirements for Computer Servers. Once finalized, EPA will include the new testing requirements under Tier 2, which will provide manufacturers with sufficient time to either obtain accreditation or locate an accredited third-party laboratory to conduct testing.

A. Power Supply Testing

Computer Server manufacturer Partners are required to guarantee power supplies have been tested and found to comply with the power supply efficiency levels in Section 3.A of this specification. Testing should be conducted as follows:

- A Computer Server power supply must be tested for ENERGY STAR qualification using the *Generalized Internal Power Supply Efficiency Test Protocol Rev. 6.4.2.* **Note:** This test procedure is not maintained by EPA and is available at http://efficientpowersupplies.epri.com/methods.asp.

Additional Guidance on Power Supply Testing

1. Power supplies should be tested using the input test conditions specified in Table 5, below, and as indicated in the above referenced test procedure. For AC-DC Multi-Output power supplies capable of operating at both 230 and 115 Volts input, ***testing shall be conducted at both voltages*** for purposes of ENERGY STAR qualification. AC-DC Multi-Output power supplies

capable of operating at only one of these indicated voltages must test only at the applicable voltage. Testing at 230 Volts may be done at either 50Hz or 60Hz.

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

Note: EPA received multiple comments that DC Powered Servers and DC-DC power supplies should be tested at ±52 VDC because this is where many DC infrastructures operate to keep backup batteries at the correct nominal voltage to maintain charge. EPA has chosen to maintain the testing requirement at ±48 VDC for the following reasons:

- Maintain harmonization with the power supply test procedure referenced, above, which was vetted with a wide range of industry stakeholders.
- Power supplies tested for this specification will typically be tested on a lab bench and should use a standard reference test voltage as opposed to a moving voltage which is influenced by voltage drift from connected batteries.
- EPA believes that the reference voltage of ±48 VDC creates a reasonable proxy to assess the efficiency and power use of DC-DC power supplies and DC Powered Servers.

2. **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.

3. **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. Single-Output power supplies must exclude fan power from the measurement and the efficiency calculation.

4. **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.

B. Idle Power Testing

Partner must use the *ENERGY STAR Test Procedure for Determining the Power Use of Computer Servers in Idle* included in **Appendix A** of this specification to measure Idle power use for purposes of ENERGY STAR qualification. All single socket (1S) and dual socket (2S) Computer Servers must meet the Idle power levels presented in Tables 3 and 4 in section 3.B.1 depending on system configuration. Partner must test and report Idle power results for all Computer Servers including three socket (3S) and four socket (4S) Computer Servers.

Note: EPA continues to receive requests to investigate a simpler, low cost test procedure that could be used instead of SPECpower_ssj2008 to measure Idle power. These concerns stem primarily from smaller manufacturers who do not have the resources to join SPEC or acquire the test procedure and licenses. In addition, the current SPECpower_ssj2008 run and reporting rules do not directly address DC-DC Servers, which are covered by this specification, or Blade Servers. In response, EPA has developed a draft test procedure (Appendix A) based on the Idle test method used in the Version 5.0 ENERGY STAR Computer specification. Implementing a simpler test procedure achieves the following:

- Increase participation in the program by simplifying the process and eliminating the barrier to entry of potential first time partners and smaller manufacturers.
- Provide for an immediate inclusion of DC Powered Servers, avoiding the need to create an additional and separate test method for these product types.

Although SPECpower testing is no longer proposed under this Tier 1 specification, EPA intends to work with SPEC and other benchmarking organizations in the pursuit of a Tier 2 efficiency metric which is based on the energy consumption for a given workload (i.e., energy efficiency performance benchmark).

1. **Test as shipped:** Computer Servers must be tested as shipped and with all power supplies connected and operational and the installed or representative operating system (see 4.B.2, below) installed. In addition, manufacturers must ensure that any power management techniques, or power saving features, used during testing are enabled on shipment.

2. **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, as outlined in Appendix A, any power management features which require the presence of an operating system (i.e. those that are not explicitly controlled by the BIOS or management controller) must be tested using only those power management features enabled by the operating system by default. Manufactures must also clearly indicate on the Power and Performance Data Sheet which power management features were active during testing.

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

C. Qualifying Configurations and Families Under this Specification

Partners are encouraged to test and submit qualified product data on all individual configurations for ENERGY STAR. However, a partner may qualify multiple configurations under one Product Family designation as long as all of the configurations within that Product Family meet one of the following requirements:

- Subsequent units are built on the same platform and are identical in every respect to the tested, representatitve model except for housing and color.
- Subsequent units meet the requirements of a Product Family, as defined in Section 1.T, above. In this case, partners must test and submit Idle power data on a maximum and minimum configuration, as defined in Sections 1.V and 1.W of this specification. Partners are also required to include a Power and Performance Data Sheet for each Product Family as described in Section 3.C of this speciifcation.

All configurations associated with a Product Family, for which a Partner is seeking ENERGY STAR qualification, must meet the ENERGY STAR requirements, including those for which data was not reported. If a Partner wishes to qualify individual configurations within a Product Family for which non-qualifying configurations exist, the Partner must assign the qualifying configurations an identifier in the model name/number that is unique to ENERGY STAR Qualified configurations. This identifier must be used consistently in association with the qualifying configurations in marketing/sales materials and on the ENERGY STAR list of qualified products (e.g. model A1234 for baseline configurations and A1234-ES for ENERGY STAR qualifying configurations).

Note: Ideally EPA would like to receive, review, and post data on every Computer Server configuration marketed and sold as ENERGY STAR qualified. End users would benefit from such granularity of data, which would allow them to make better purchasing decisions based on their particular needs. However, EPA realizes that testing every configuration would be difficult and expensive for prospective ENERGY STAR partners. To address this concern, EPA has attempted to balance simplicity and the need for the appropriate granularity of information for end users. Because of the highly variable nature of both power and performance within Computer Server model lines, EPA has developed a definition (in Section 1.T, above) for a Product Family that focuses on systems with common attributes including: power supplies, processors, memory, hard drives and I/O Devices.

In order to qualify configurations within a Product Family, Partners must submit Idle data on a maximum and minimum configuration (defined in section 1.U and 1.V, above) to represent that Product Family. Both maximum and minimum configurations must meet all applicable requirements of this specification.

Note (Continued): Requiring that all configurations qualifying for ENERGY STAR under the Product Family approach use identical components, and requiring manufacturers to report minimum and maximum configurations, will help to assure the end user that the configuration they purchase will provide high efficiency performance compared to non-ENERGY STAR models. **Each configuration represented by the ENERGY STAR qualified Product Family must meet the Tier 1 requirements to be promoted and sold as ENERGY STAR, whether or not data specific to the configuration is reported to EPA.**

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 **May 1, 2009**.

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

Note: There are several new requirements and approaches proposed in this Draft 4 specification. To allow stakeholders sufficient time to review and provide comments and to allow EPA time to review stakeholder feedback and analyze additional data submittals, the effective date has been moved to May 1, 2009. EPA does not intend on delaying this effective date any further and anticipates releasing a Final Draft document by early to mid-April. If requirements for Blade Servers cannot be determined within this timeframe, EPA will continue working with manufacturers to refine those requirements and add this product category to the Version 1.0 specification, effective immediately upon finalization.

EPA is proposing the following timeline to ensure Tier 2 is in place by October 1, 2010:

- June 2009: Draft Tier 2 Framework document is released, which includes EPA's key objectives.
- July 2009: EPA hosts an industry stakeholder meeting to discuss Framework document.
- August 2009: Draft 1 Tier 2 specification is released, indicating areas for data collection.
- August – October: Draft 1 comment period and data collection.
- October – February: Subsequent drafts released for comment, as needed.
- March 2010: Tier 2 specification is finalized, effective October 1, 2010.

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:
ENERGY STAR Test Procedure for Determining the Power Use of Computer Servers in Idle

The following protocol should be followed when measuring power consumption levels of Computer Servers for compliance with the Idle levels provided in the ENERGY STAR Version 1.0 Computer Server Specification. Partners must measure a representative sample of the configuration as it would be shipped to the customer. However, the Partner does not need to consider power consumption changes made by the end-user that may result from component additions, BIOS and/or software settings made by the Computer Server end-user after purchase of the product. *This procedure is intended to be followed in order.*

*Computer Servers must be tested with configuration and settings as shipped, unless otherwise specified. Partners wishing to qualify Computer Servers that are shipped without operating systems must test the Computer Server with a representative operating system and make clear in all program literature which operating system and power management settings were used to qualify the model. Steps requiring alternative setup which may differ from "As-shipped" settings are marked with an asterisk (" * ").*

I. Definitions

Unless otherwise specified, all terms used in this document are consistent with the definitions contained in the Version 1.0 ENERGY STAR Eligibility Criteria for Computer Servers.

UUT
UUT is an acronym for "unit under test," which in this case refers to the Computer Server being tested.

UPS
UPS is an acronym for "Uninterruptible Power Supply," which refers to a combination of converters, switches and energy storage means, for example batteries, constituting a power supply for maintaining continuity of load power in case of input power failure.

II. Testing Requirements

Required Power Analyzer Attributes
Approved analyzers will include the following attributes:

- Ability to measure true power for all AC sources;
- An available current crest factor of 3 or more at its rated range value;
- Frequency response of at least 3 kHz; and
- Calibration with a standard that is traceable to the U.S. National Institute of Standards and Technology (NIST) or similar relevant standards for other countries. Calibration must be current and within the past year.

Approved analyzers also must have the capability to either:

- Average power accurately over any user selected time interval (this is usually done with an internal calculation dividing accumulated energy by time within the analyzer, which is the most accurate approach), or
- Be capable of integrating energy over any user selected time interval and integrating time displayed with a resolution of 1 second or less.

Note: EPA has modified the Required Analyzer Attributes from those found in the Version 5.0 Computer Specification because some of the stricter requirements are included in that specification in order to test very low power levels for Sleep and Standby, which are also measured in the Computer test procedure. This specification only addresses Idle power measurement, and not low power modes, so the EPA has removed some of these requirements. Stakeholders are encouraged to provide comments as to whether these requirements are appropriate for Computer Server Idle power testing.

In addition, EPA has clarified language that additional attributes, such as measuring true power, current calibration and the ability to accumulate power readings or report average power, are all required for this test procedure.

Accuracy

Measurements of power of 0.5 W or greater shall be made with an uncertainty of less than or equal to 2% at the 95% confidence level. The power measurement instrument shall have a resolution of:

- 0.01 W or better for power measurements of 10 W or less;
- 0.1 W or better for power measurements of greater than 10 W up to 100 W; and
- 1 W or better for power measurements of greater than 100 W.

All power figures should be in Watts and rounded to the first decimal place

Test Conditions

Idle power consumption must be tested with the test conditions specified in the table below. Input voltage and frequency conditions for AC Powered Computer Servers are based on the power supply type (i.e. Single-Output vs. Multi-Output). Computer Servers with Multi-Output PSUs must be tested at all applicable conditions (e.g., 115 V and/or 230 V) where the unit is capable of operating.

Supply Voltage:	Servers with AC-DC Single-Output PSUs:	230 (± 1%) Volts AC, 50 Hz or 60 Hz (± 1%)
	Servers with AC-DC Multi-Output PSUs:	230 (± 1%) Volts AC, 50 Hz (± 1%) and/or, 115 (± 1%) Volts AC, 60 Hz (± 1%)
	DC Powered Servers:	± 48 (± 1%) Volts DC
	Optional Testing Conditions For AC-DC Japanese Market†:	100V (± 1%) Volts AC, 50 Hz / 60 Hz (± 1%) *Note:* For products rated for > 1.5 kW maximum power, the voltage range is ± 4%
Total Harmonic Distortion (THD) (Voltage):	< 2% THD (< 5% for products which are rated for > 1.5 kW maximum power)	
Ambient Temperature:	23°C ± 5°C	
Relative Humidity:	10 – 80 %	

(Reference IEC 62301: Household Electrical Appliances – Measurement of Standby Power, Sections 4.2, 4.3, 4.4; and, Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies – Revision 6.4.2, Section 5.2)

† **Note on Japanese Test Voltage:** Products are encouraged to be tested at the above referenced standard voltages for products with Single-Output or Multiple-Output power supplies. However, products sold into the Japanese market may also be tested at the optional 100V testing condition for Idle power testing.

Note: In the above test Conditions, EPA has included voltage and frequency requirements which are consistent with those outlined in the specification. EPA has also included the ambient temperature and relative humidity requirements as included in the Version 5.0 Computer test protocol, but understands that environmental conditions and requirements may be different for Computer Servers which are often operated in a more controlled data center environment. Stakeholders are encouraged to comment on whether these proposed conditions are appropriate for Idle testing of Computer Servers.

EPA has added an optional testing condition of 100V for products sold into the Japanese market. Stakeholders have indicated that Japanese data centers typically operate at this voltage. Manufacturers may test products that are sold in Japan at 100V for purposes of ENERGY STAR qualification.

Test Configuration

Power consumption of the UUT shall be measured and tested from an external AC or DC source to the UUT.

The UUT must have at least one port connected to an Ethernet network switch capable of the UUT's highest and lowest network speeds. The network connection must be live during all tests.

Dual-Node Servers must have identical configurations for each node including all hardware components and software/power management settings. These systems must also be measured in a way to ensure that all power from both nodes is being captured by the analyzer during the entire test.

Blade Systems must be tested in three configurations with all three sets of data reported under this test procedure. These configurations include:

- A Single Blade Server installed in the Chassis. The single Blade Server should be identical in configuration to the Blade Servers used in the half and fully populated configurations provided below, including all hardware components and software/power management settings.
- The Chassis half populated with Blade Servers (rounding up for chassis with an uneven number of blade slots, e.g., a seven slot chassis would test with four Blade Servers for this condition).
- With the Blade Chassis fully populated with the maximum number of identical Blade Servers.

In addition, a test procedure has been included for the optional test for testing the empty Blade Chassis with no installed Blade Servers.

The configurations of both the individual Blade Servers and the Chassis should remain constant for all tests, including all hardware components and software/power management settings.

III. Idle Test Procedure for All Computer Server Products

Measurement of AC or DC power consumption of a Computer Server should be conducted as follows:

A. UUT Preparation

1. Record the manufacturer and model name of the UUT. Also record all basic information about the UUT's configuration including, operating system name and version, processor type and speed, installed power supply(s), physical memory, hard drive configuration, installed I/O Devices, power management features enabled, etc.
2. Ensure that the UUT is connected to a live Ethernet (IEEE 802.3) network switch as specified in Section II., "Test Configuration," above. The UUT must maintain this live connection to the switch for the duration of testing, disregarding brief lapses when transitioning between link speeds.
3. Connect an appropriate power analyzer (as defined in Section II, Testing Requirements) to an AC or DC voltage source set to the appropriate voltage for the test. AC sources should also be set to the appropriate frequency for the test.
4. Plug the UUT into the measurement power outlet on the power analyzer, as follows:
   a. No UPS units should be connected between the analyzer and the UUT.

b. UUTs with multiple power supplies must have all power supplies connected and operational during the test. If necessary, a PDU, or Power Distribution Unit (such as a simple plug multiplier or power strip), may be used to connect multiple power supplies to a single source. In this case, any overhead electrical use from the PDU must be included in the measurement of Idle power for the UUT.
c. For a valid test to take place the analyzer should remain in place until the Idle power data is fully recorded.

5. Record the AC or DC voltage. Record the frequency for AC sources.

B. Configuration and Testing for Computer Servers and Populated Blade Systems

1. Boot UUT and wait until the operating system has fully loaded. If necessary, run the initial system setup and allow all one-time/periodic processes to complete.
2. Ensure that the UUT is configured as shipped including the operating system and all other software shipped by default. The UUT must be configured using the following requirements for all tests:
   a. The UUT must be configured with any applicable operating systems installed and set with default, as shipped settings. All other software must also be configured as shipped by default. If the UUT is shipped without an operating system, it must be tested with a representative operating system configured with only default settings.
   b. Only power management features that are shipped enabled may be enabled during testing, and all power management features used must be reported.
   c. If the UUT is shipped without accessories, it should be configured with a standard mouse, keyboard and external computer display (if server has display output functionality), or accessed through a remote access application that is appropriate for the UUT's operating system to monitor UUT Idle status.
   d. Primary storage devices integral to the UUT may not be power managed ("spun-down") during Idle testing unless containing non-volatile cache integral to the drive (e.g. "hybrid" hard drives). If more than one internal hard drive is installed as shipped, the non-primary, hard drive(s), including any shared hard drives installed in a Blade Chassis, must be tested with hard drive power management enabled as shipped. If these additional drives are not power managed when shipped to customers, they must be tested without such features implemented.

Note: The EPA has included guidance from the Version 5.0 Computer specification on disabling power management on the primary hard drive during Idle testing. This is to ensure that the Computer Server is mimicking a short term Idle condition that would be found between servicing individual workloads, and also is seen to be consistent with Idle as measured by the SPECpower_ssj2008 workload. However, in order to capture the potential energy savings from enabling power management on non primary drives, the EPA has indicated that enabling power management on these drives is acceptable for testing given that this functionality is enabled on shipment to the end-user.

3. Shutdown the UUT.
4. Switch on the Computer Server and begin recording elapsed time, starting either when the Computer Server is initially switched on, or immediately after completing any log in activity necessary to fully boot the system. Dual-Node Servers should be booted and logged on concurrently. Once logged in with the operating system fully loaded and ready, close any open windows so that the standard operational desktop screen or equivalent ready screen is displayed. Between 5 and 15 minutes after the initial boot or log in, set the analyzer to begin accumulating power values at an interval of greater than or equal to 1 reading per second. Accumulate power values for 5 additional minutes and record the average (arithmetic mean) value observed during that 5 minute period.

Note: EPA has proposed that Idle measurements be measured between 5 and 15 minutes after the initial boot or log in, to be consistent with the Version 5.0 Computer Test method. However, EPA understands there may be certain benefits to running a workload prior to Idle measurement, as is done in the SEPCpower_ssj2008 benchmark, such as warming up the system and ensuring the system is operating normally. If such a workload were determined to be necessary, EPA would intend to use a publicly available benchmark such as the Dhrystone or other similar benchmark.

C. Configuration and Testing for Empty Blade Chassis (Optional)

1. Ensure that the UUT is configured as shipped, and must be configured using the following requirements for all tests:
   a. Only power management features that are shipped enabled may be enabled during testing, and all power management features used must be reported.
   b. Shared hard drives installed in the UUT must be tested with hard drive power management enabled as shipped. If these additional drives are not power managed when shipped to customers, they must be tested without such features implemented.
2. Power up the UUT, either by switching it on or connecting it to mains power, and begin recording elapsed time. Between 5 and 15 minutes after Powering up the UUT, set the analyzer to begin accumulating power values at an interval of greater than or equal to 1 reading per second. Accumulate power values for 5 additional minutes and record the average (arithmetic mean) value observed during that 5 minute period.

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