

**ENERGY STAR Computer Server Specification Stakeholder Meeting  
Microsoft Campus, Redmond, WA**

**July 9, 2008**

**Discussion Notes**

On July 9, 2008, EPA convened a stakeholder meeting with manufacturers, end users, and other industry stakeholders to discuss the latest proposal for an ENERGY STAR computer server specification. More than 80 people attended the discussion. Prior to the meeting, attendees received an ENERGY STAR Discussion Document which outlined the latest versions of proposed definitions, new power supply energy efficiency requirements, and additional items for further discussion, such as idle energy and power management. The Discussion Document, Attendee List, and Power Point presentations from the meeting can be found on the ENERGY STAR Web site at [www.energystar.gov/datacenters](http://www.energystar.gov/datacenters) (Click on ENERGY STAR Server Development Process).

Andrew Fanara, EPA, opened the meeting with a review of ENERGY STAR guiding principles for developing new specifications, including representation of approximately the top 25% of the market, and overarching goal of bridging the computer and server specifications. Mr. Fanara then reviewed the goals of the meeting, which included discussing the key elements of EPA's latest proposal and identifying next steps, and additional research needed, toward releasing a Draft 2 version by mid-August.

Jan Viegand, consultant to the European Commission (EC), presented on the initiatives currently underway in Europe to address data center energy consumption. Mr. Viegand also talked about the Memorandum of Understanding (MOU) between the U.S. EPA and the European Union (EU), which covers IT equipment, including servers. *Please note that the EU responses provided below are not from the EC but an external technical consultant and may not necessarily be agreed on by the EC.*

**Question:** Are there any industry partners on the European Commission ENERGY STAR Board (ECESB) and have they ever pushed back on a proposed specification?

**EU Response:** Usually EICTA, the EU equivalent of ITI (industry association), participates and normally several industry representatives provide input as well. The EC always consults the board on specification revisions before approving even though the board actually cannot formally reject the specification. The 25% goal is very important for both the EC and the board in ensuring that the specification passes.

**ES Response:** If EPA does its job, by the time the specification gets to the board it would have already gone through several reviews, and discussions, by EU representatives.

**Question:** Is there a potential for the ENERGY STAR server specification to become mandatory under the EUP?

**EU Response:** No, the EU is not currently talking about doing this and we do not foresee any discussions in the near future.

**ES Response:** In the U.S., it is true that this has happened for other products (i.e., use ENERGY STAR as federal minimum standards). There is nothing EPA can do to prevent this from happening if regulators want to adopt ENERGY STAR levels. However, there has been no indication that servers will be added at this time. In fact, one could say that the ENERGY STAR specification levels should be reasonably stringent so it doesn't invite regulation. EPA has always argued that voluntary standards like ENERGY STAR are more relevant than regulation for IT equipment because of the rapid advancement of technology.

## **Discussion of Proposed Specification Elements**

ENERGY STAR representatives then walked through the key elements of the specification and outstanding questions as proposed in the Discussion Document. Stakeholder comments and questions are provided below along with initial responses from the ENERGY STAR team.

### **(1) Definitions and Scope**

**Question:** Why is EPA excluding pedestal servers?

**ES Response:** The specification doesn't exactly eliminate all pedestals but rather it excludes those that cannot also be used in rack mountable forms. So, if a server is available in both a rack mountable form as well as the tower form, it could qualify in either form factor. The goal of developing the server definition is to identify characteristics of products manufactured and meant for use in the data center and other business critical environments.

- Manufacturers do actually sell tower servers meant for the data center that are not available in rack mount form factor.
- The goal should be to identify the internal characteristics rather than external form factor when defining servers in this specification.
- Many small businesses will purchase tower form factors (as opposed to rack mounted), which would be excluded from ENERGY STAR under the current definition.
- It's quite common for data center hosting sites to use towers as well as rack mountable systems.

**Question:** The definition includes a requirement for "1 or more processors and 1 or more sockets on the motherboard". Shouldn't this be 1 or more processors OR 1 or more sockets on the motherboard (i.e., take out the "and")? As written, it makes it sound like you need to have both (e.g., 1 or more processors as well as a separate board).

**ES Response:** We will replace "and" from the definition with "and/or".

- As written in the Discussion Document (i.e., Qualifying Products section), eligible servers are limited to those defined in 1A, 1B, and 1C. DC powered servers, as defined in 1E, are excluded but EPA has indicated that it intends to cover these product types.

**ES Response:** EPA intends to include DC powered servers but their inclusion in this version of the specification is dependent on the availability of an industry accepted test procedure and performance data to determine potential levels. If we are not able to add DC powered servers prior to finalizing the specification then EPA will continue to work with interested parties to add them at a later date. This amendment would allow DC powered servers to immediately qualify for ENERGY STAR upon finalization. The Electric Power Research Institute (EPRI) is close to finalizing a first draft of a procedure for testing DC-DC power supplies and stakeholders are encouraged to contribute to this effort.

- Service processor and RASM feature requirements are usually representative of higher end computers.

**ES Response:** These characteristics were included based on suggestions from industry stakeholders. If we remove these requirements are we then introducing units that are not meant for mission critical applications, and therefore, might be more appropriate for the desktop computer specification?

For the ENERGY STAR computer specification, we are developing the specification to represent computers from the bottom up. We need to ensure that this specification covers the layer of products above those covered by the computer specification and avoid overlap.

- There is a broad trend toward virtualization such that redundancy features will eventually go away so EPA shouldn't include RASM features as a requirement.
- There are broad definitions for RASM and several servers used in the data center that are sold without these features.
- The EMC buffered memory has the desired effect that EPA is looking for in separating data center and personal use computers. Although, this could be a challenge in the near future as these abilities will start being seen in desktops.
- Only the top manufacturers are selling servers with RASM features and not all end users need these features.
- What is EPA's intent in identifying characteristics in the definition of a server?

**ES Response:** To give manufacturers specific direction regarding the type and quality of products covered by the specification. To make sure that the investment by partnering manufacturers is protected from gaming of the program. Some manufacturers may claim that a product is a server when it might be better addressed by the desktop computer specification. The intent is to make sure the line between desktop and server specifications is clear.

- The difference between server and workstation is in name only – RASM and service processor are arbitrary and the line between these product types will be difficult to draw.

**ES Response:** We need to make sure there is consistency and yet no overlap between the desktop and server specifications.

- EPA may actually be over-defining and requiring additional components that could add to energy use (e.g.: service processor).
- Market research firm IDC might be able to provide the taxonomy that is used to determine market size and share for purposes of defining eligible products and categories.
- Where do server appliances fit into the specification/definitions?

**ES Response:** We still need to conduct additional research on these product types but from what we have learned from industry this is a more dedicated device that may need special consideration.

- There are certain regions in the U.S. and abroad where there is a large market share of tower form factors. These should be covered by the specification.
- According to IDC research, tower form factors represent about 1/3 of the marketplace so EPA should not exclude them from the specification.
- Features and functions are determined by customers; the marketplace drives what we as manufacturers sell. Any taxonomy needs to be based on the end user perspective.

## **(2) Power Supplies – Net Power Loss Approach**

- While conducting the analysis, did EPA look at steady load sharing of the power supply or fail-over share? The load sharing scenario is more common.

**ES Response:** Data is modeled by load sharing but it would work equally well for the fail-over scenario because it considers total standby use.

- The approach is certainly interesting and could be the way to go but any approach that uses and publishes absolute watts is flawed. The data would need to be normalized based on the total power delivered.

**ES Response:** The intention would be to scale the power allowance based on the dc output or size of the power supply. EPA would not consider an absolute watts allowance that applies to all power supplies regardless of capacity.

- Did EPA consider the work being done by the server and whether there will be different specifications for different types of configuration? Maximum energy use is workload dependent.

**ES Response:** EPA is discussing covering power supplies only at idle and max (e.g., 100% according to SPECpower) which would define the full operating range of the server. It is possible that there would be different specifications at idle and max, so the power supply would not have to meet the same level at high and low loads. Furthermore, net loss allows for a sliding scale approach where the losses will be allowed to rise as the overall power needs rise, so higher power configurations would generally be allowed more power than lower power configurations. It's also possible that the specification would treat redundant and non-redundant power supply configurations differently. EPA would be open to considering different workloads to define maximum power of the system in order to implement this approach.

- The net loss approach could be better suited for Tier 2.
- EPA should not take the SPECpower data too seriously. Many manufacturers are configuring servers specifically to get good SPECpower results but these are not configurations typically sold in the marketplace.
- A server with a given configuration and power supply size may be sold to different customers with different applications, all with different levels of utilization. If you measure only the net power loss then low utilization will have a lower net loss and higher utilization will have a higher net loss. This approach may work for idle but not for max power, which is different for each system.

**ES Response:** Based on what we know about power supplies, efficiency and net losses both rise in the area of typical operation based on the amount of power being converted. Low utilization will actually have higher net loss relative to power delivered while higher utilization will have lower net loss relative to power delivered.

- The problem also lies in product development. A manufacturer would have to guess what efficiency power supply to use based on estimates of power used by the system and procure that PSU from their vendor, test the power supply in the server, and then redesign after test to improve net power loss.
- Power supply sizing has to do with the predicted maximum configuration shipped.
- Manufacturers already have hundreds of power supply testing requirements, which we try to optimize down to a handful to keep down expenses. This new approach will increase complexity and cost more to implement. Plus, we don't even know if the customer demands, or will even understand, this information. They understand power supply efficiency.
- Does EPA have an example of what might be specified under such as requirement?

**ES Response:** For any given category, there may be a net loss requirement based on redundancy and the power delivered by the system. The approach would be similar to requiring a % efficiency level. Commenter misunderstands how net losses would be measured. This proposal does not require more or additional testing; it requires testing at fewer load conditions than the current methods used by ENERGY STAR, 80 Plus, and Climate Savers in other test procedures.

- Not to take a step back but I think we need to look at the reason why a data center end user would purchase an ENERGY STAR server?

**ES Response:** Larger organizations such as Microsoft may have available resources to test servers with all applications and workloads but EPA is trying to write a specification that all end users can use to identify the most energy efficiency models in the marketplace, without the need for in house testing if they do not have the facilities or budget.

End users have told EPA that yes, they would like to know how much energy their servers are consuming and to have access to tools that identify energy-efficient solutions. We are simply trying to serve that request.

- What about power factor under the net loss approach?

**ES Response:** Whatever approach EPA decides to put forth, power factor will be addressed in the specification.

- From the utility point of view, DC output doesn't matter in regards to power supply conversion because there is no impact on the electric bill at the end of the day. However, this will help on the infrastructure side (i.e., total site energy used).
- How did EPA define values for idle and max power in the analysis?

**ES Response:** The latest SPECpower data was used, which we understand represents the energy used to perform a specific workload. This is really 100% performance as opposed to true max power in the design sense, while idle is measured simply as the absence of a workload.

- When you do not have a system identified, how do you specify idle and max power? It's the chicken and the egg issue regarding the development process.
- Is ENERGY STAR given to specific platforms or specific configurations?

**ES Response:** Ideally, EPA would like to see every configuration tested that is sold as ENERGY STAR, as every unit marketed and sold as ENERGY STAR must meet the specification requirements.

- The use of SPECpower will be arbitrary.

**ES Response:** EPA prefers to work off agreed upon industry standards. In lieu of such standards, EPA looks to industry groups developing such standards, such as SPEC, to provide a standard metric, which is an outcome of industry collaboration. EPA realizes SPECpower is not perfect, but feels that they are the furthest along in developing such a useful standard.

- Applaud efforts to address the energy wasted by the server but addressing power loss based on DC output will become obsolete based on EPA's plans for Tier 2. There is a lot of complexity and cost in developing this approach – is it worth it for a Tier 1 specification with such a short life span?

**ES Response:** EPA feels there may be significant advantages to the net power loss approach which are worthy of consideration and expects that a Tier 1 will be in place for at least 12 months.

- If the idle state does not approach the 10% load point then can we assume that discussion around that load point is dropped?

**ES Response:** The net power loss approach removes the focus on any arbitrary load conditions and measures the efficiency of the power supplies at the load conditions where they actually operate in the server. Under the more conventional power supply efficiency approach, ENERGY STAR doesn't need to specify 10% load condition efficiencies in servers that never reach that load condition. However, idle power specifications and design changes to enable power management will have the effect of lowering idle power consumption, so EPA still believes that many server power supplies will be operating near the 10% load condition when servers are idling.

- What would the ENERGY STAR specification look like based on a net loss approach?

**ES Response:** If EPA decides to take this approach then a proposal will be put forward in the Draft 2 specification. We would need more data – real information on idle, max, and power supply efficiency, as opposed to conceptual.

- The net loss approach, while interesting, is very new to this industry. EPA should use what industry is familiar with now, which is energy efficiency, especially if we want to finalize the specification by the end of this year. Furthermore, net power loss will be difficult to convey to end users.

### **(3) Power Supply Efficiency**

- To draw the conclusion from SPECPower results that all servers run at low utilization is wrong. This is an area where industry is actually ahead and Climate Savers has already proposed levels at 20, 50, and 100% loads.
- Do the data points presented represent a single power supply tested or the average performance of many units tested? Are the power supply samples considered “middle of the pack” in terms of performance? These are important distinctions when analyzing power supply efficiencies.
- There is a question of measurement accuracy at 10% load.
- Overall, 10% is not an issue because servers are being designed to run at higher utilizations and therefore, higher loads. Manufacturers are focused on increasing energy efficiencies at 20 and 50% loads, which is where servers realistically operate. Lastly, the losses at 10% load are only fixed losses, which are more difficult to improve.
- Regarding fan power during testing, any restrictions could hurt creativity re: server cooling strategies.
- In developing levels, Climate Saver representatives collected data on what power supply vendors said they could easily achieve in regards to efficiency.

**ES Response:** The levels proposed in the Discussion Document are based on data received from power supply and server manufacturers over the last several weeks. In order to justify proposed levels, and ensure that we adhere to the ENERGY STAR guiding principle of representing the top 25% of performers, EPA needs data. If that data supports harmonization with Climate Savers levels then that is a possibility.

- Manufacturers have been targeting designs based on energy efficiency performance at 20, 50, and 100% loads. If EPA introduces a 10% loading requirement then that will disrupt current design cycles. It will be very difficult to implement quickly and will be costly. Manufacturers need a long lead time for safety testing, etc. The development process is already underway.
- In many configurations, 10% utilization doesn't necessarily mean a 10% load on the power supply. The load on the power supply could actually be 40-50% in some scenarios.
- By including a 10% load you are creating an incentive to design energy efficiency at the very load that industry is working to avoid. Furthermore, if you specify performance at 10% then you need to relax the level at 100% - can't address both loads at once.
- Why focus on 100% loading at all since servers never operate at that point? Most servers operate between 30 – 80% utilization. Why provide an incentive for a loading point (i.e., 10%) that people are working hard to avoid?
- The 100% data is still being used by some end users in the data center industry and it's just as easy to include it.
- If you ease off the 10% and 100% loads then manufacturers could focus on optimizing designs for the “sweet spot”.

**ES Response:** We would be interested in learning more about which loads make sense based on the points at which servers currently operate. However, we are concerned that even if the Tier 1 manufacturers are addressing sizing, some of the lower tier manufacturers might still have models running at these low levels.

- The 20% loading point really drives decisions. If a power supply is efficient at 20% then it will also be efficient at 10%.
- Power supplies are sized for maximum configurations of any particular model for safety reasons.
- The concept of right sizing a power supply – is this based on allowing for some growth in computing?

**ES Response:** We have seen that for many servers, customers typically do not add capability and components after the fact.

- Actually, for high end servers (4 processor sockets and above) about ½ are sold as under-configured. Over time about ½ of these are fitted with increased capacity. This is less true for 1-2 socket servers.

**ES Response:** EPA understands that IT is continuing to expand and it is important to allow for this growth. However, we also want to make sure that some consideration is given to power supply sizing when designing the equipment.

- Every server manufacturer is forcing their component vendors/manufacturers to increase the energy efficiency of their products.

**ES Response:** Would industry support an exception to the 10% loading requirement if it is proven that the server is not designed to run at low loads?

- Yes, industry would be supportive of this approach. Manufacturers could demonstrate that the idle never drops below a certain level using the SPECPower benchmark.
- What is EPA's motivation for considering fans in the power supply efficiency testing? Roughly 90% of power supply fans are used to cool the entire system. If we include it in the net loss or efficiency approach, it will provide incentive for the wrong thing. They will remove the fan from the power supply and put a bigger, more energy consuming one in the system.

**ES Response:** EPA's intent was to identify and separate the two types of power supplies to provide an equal playing field in regards to qualification.

- Including fan power is a challenge because in many cases the server controls the power supply fan. This is one reason Climate Savers took fans out of the equation. People will game the system – take fans out of the power supply and put it into the server. Also, you would need to somehow separate fans for the test procedure, which is difficult.
- The 80 Plus test procedure currently excludes fans and EPA should adopt this approach.

#### **(4) Idle Power**

- The SPECPower benchmark does not take into account disk operation at idle and at max.
- EPA should not set levels based on 1U and 2U servers. Different levels are needed for different configurations.
- One approach could be to take systems of similar capacities and require a % of max power.
- For SPECPower, idle is always tied to the performance of a given system. This is why manufacturers are required to report both idle and max power consumption. Also, the SPECPower benchmark measures power at 100% based on that workload. It is not the same

as maximum power (i.e., full loading) that the system can provide. This 100% will be different in every machine and even different for each benchmark.

- It doesn't make sense to take idle data from SPECpower because it is tied to a specific workload and configuration.
- End users will find idle power use information interesting but absolute watts doesn't make sense for a requirement. Something like idle as a % of total rated power would be better for an idle specification.
- Maximum power has no meaning because it is different for each server manufacturer (i.e., how they test) – we should look at nameplate instead.
- Actually, end users do want absolute watts for idle energy but this should be a reporting requirement, not a specification (i.e., pass/fail) requirement.
- If open to binning products, how many categories was EPA thinking of for an idle requirement?

**ES Response:** In a perfect world we would only have one category, which would be easier to develop, understand, and implement. However, having one category may benefit only the more basic configurations. We need to consider what is reasonable with observations from data analysis. Individual categories will be tied to performance. For example, are there significant differences in energy consumption across categories? If so then, EPA will probably look at the top 25% of each of these categories.

- Servers are designed to perform computing functions, not to idle. Even if your idle energy is low it doesn't mean that you will get better performance. Isn't it better to shut the server down completely or require power management capabilities?

**ES Response:** We are not arguing that shutting off the server won't result in the larger savings but we don't want user driven savings. Many servers are idling today and we need to somehow ensure that they are doing so using minimal energy.

- Manufacturers are not allowed to test servers for SPEC that are downgraded or not available at retail. Also, it is true that SPECpower does not address disk drive energy consumption and it is designed for one workload (Java). However, SPEC is coming out with additional workloads to cover more applications.
- The methodology that SPEC uses to test idle via the SPECpower\_ssj benchmark is valid because there is no workload. However, servers tested with SPECpower are configured for that workload, which impacts the idle energy use.
- There are agreements about what manufacturers can do with the SPECpower information regarding full disclosure.

**ES Response:** As indicated earlier in the discussion, EPA is open to creating different idle levels for different categories, based on specific configuration data.

- A low idle number does drive goodness in the overall system – it's a very good indicator of energy efficiency performance.
- Providing information on idle can help end users to make informed decisions about power management features, etc.

## (5) Performance Data Sheet

- EPA should use ASHRAE 90.1 for some of the reporting requirements. This could include active links to information already reported in a standardized way.
- EPA should leave it open to different types of benchmarks in regards to performance reporting.



- Airflow is an important element of reporting because it dictates the environmental conditions needed within the data center. ASHRAE currently has requirements regarding airflow reporting.
- Minimum and maximum airflow rates, idle, and maximum power are the most critical elements of data center design.
- With a wide range of customers and configurations, the performance data sheet needs to somehow indicate that it is for a base configuration.
- HP offers a configuration calculator – the challenge is getting everyone to do it in the same look and feel, otherwise it would be confusing.
- The requirement of a performance data sheet is a great idea from an end user perspective but it is an extra burden on the manufacturer because it would need to be constantly updated.

**ES Response:** Manufacturers would be given time to do these updates based on their own schedules.

- Could the performance data sheet be present in a format that is searchable (e.g. XML file)?

**ES Response:** EPA is interested in any suggestions on how to best present this information so that it is user friendly.

## **(6) Power Management**

- Not all servers are shipped with power management enabled because it is typically controlled at the rack level.
- Specific criteria and approaches may not work for all cases. For example, there may be fans that only use 15 watts and don't make sense for variable speed design, for example.
- EPA should require reporting versus mandatory requirements. Another option could be to come up with a list of options and require that the server meet 2-3 of these options.
- Systems are going to have power management features anyway but are there other things EPA could require along these lines such as a uniform mechanism to power on servers or thermal data extraction?

**ES Response:** EPA will address thermal and energy measurement and reporting within the specification.

- The way you address idle is through power management caps. So instead of having an idle requirement, EPA should specify power management criteria.
- The difference between max workload power and idle power is going to be determined by whether the power management feature is turned on.
- We don't want to include power management/virtualization on servers where they will never be used.

**ES Response:** The intent of having virtualization and/or power management requirements in the specification was to provide the "hooks" to help support data center best practices. Additional discussions with industry stakeholders are needed to determine whether the specification should address virtualization and/or power management either as a pass/fail requirement or as a reporting requirement.

## **Next Steps**

Andrew Fanara concluded the meeting at 4 pm PDT reminding attendees to send follow-up comments and questions for EPA consideration while preparing the Draft 2 specification, which is targeted for release in mid-August.