



# U.S. Environmental Protection Agency ENERGY STAR Server Specification Draft 4 Online Meeting March 16, 2009

**Andrew Fanara**  
EPA ENERGY STAR®  
Product Development Team



Learn more at [energystar.gov](http://energystar.gov)

# Agenda

---



- Introductions/Announcements - 5 minutes
- Main Criteria Review - 15 minutes
- Major changes in the Draft 4 – 1 hour 15 minutes
- Questions and Answers - 25 minutes

# Announcements

---



- Audio Bridge
  - Toll-free: +1 (800) 503-2899
  - Toll: +1 (303) 248-0817
  - Participant code: 8621266
- **Please mute your line [\*6] / unmute [\*7]**
- Please hold all questions until end of presentation
  - Submit verbally or through the Live Meeting Console (use “Q&A” on menubar)
- Slides will be posted to the ENERGY STAR Web site following the meeting

# Agenda

---



- Introductions/Announcements - 5 minutes
- **Main Criteria Review - 15 minutes**
- Major changes in the Draft 4 – 1 hour 15 minutes
- Questions and Answers - 25 minutes

# ENERGY STAR for IT Equipment Goals

---



- Main goal is to **transform the market for greater efficiency in IT Equipment**
  - Expansive market coverage from basic low-end to large complex systems.
  - Popularize advanced power management on both the system and data center level.
  - Encourage the usage of more efficient components.
  - Standardize information reporting to understand differences in energy consumption and operating expenses.
  - Increase the manageability of systems in the data center.

# Why ENERGY STAR for Servers?



- More organizations are recognizing the need to confront **energy & environmental challenges.**
- Environmental attributes of products bought or sold must be recognized, including the energy used.
- ENERGY STAR **helps partners** share valuable information to confront these challenges, and in the process **drives important business opportunities.**

# How Will ENERGY STAR Servers Provide Value to the End-User?



- Allow buyers to easily identify servers which focus on delivering performance while **minimizing energy consumption**.
  - For buyers looking to invest extra money in performing work efficiently, not in achieving incremental performance gains.
- **Greater transparency of information** on the power use and capability of the system.
- **Increased manageability** through better onboard technology.

# Delivering Performance while Minimizing Energy Consumption (1)

---



- **High Power Supply Efficiency** for all systems
  - The power supply is the **energy bottle neck** of the server
  - Established efficiency test procedures available
  - Rewards systems with **minimal power conversion** losses entering the server



# Delivering Performance while Minimizing Energy Consumption (2)



- **Minimize Idle power** for products likely to be found idling in current market
  - For single and dual socket systems (1S & 2S)
  - Reduces energy wasted when servers are at low utilization
  - Base levels plus adders approach **allows for expanded capability and performance**
  - Rewards products with **efficient components and advanced power management**

# Delivering Performance while Minimizing Energy Consumption (3)



- **Processor Power Management** for systems more likely to be more heavily utilized
  - For systems with greater than two processor sockets (3S & 4S)
  - Products more likely to take advantage of the benefits of virtualization or to host heavily utilized applications
  - Rewards products with advanced power management that **scale power use with the amount of work required**
  - Systems still **must test and report Idle power** and make information available for end-user

# Greater Transparency of Information



- ENERGY STAR **Power and Performance Data Sheet** will allow buyers and end-users to compare energy use, thermal characteristics and performance of servers
  - Must be posted with product specifications on mfg. Web site
  - A template for the data sheet will be provided on the EPA Web site
  - Will reward mfgs who are providing efficiency info on their products in an **open and transparent way**

**ENERGY STAR® Power and Performance Data Sheet**  
XYZ Manufacturer Model 12345

System Characteristics	
Form Factor (1U, 2U, pedestal, dual-node, etc.)	1U Server
Available Processor Sockets	2
Available Dimm Slots / Max Memory Capacity	8 Slots / 32 GB
Available PCI or PCIe Slots	2 PCI & 2 PCIe
Minimum and Maximum # of Hard Drives	0 Minimum / 8 Maximum
Input Power Range (AC or DC)	100 - 240 VAC 50-60Hz
Redundant Power Supply Capable?	Yes
ECOC and/or Fully Buffered Dimms	Yes - ECOC and Fully Buffered Dimms
Operating Systems Supported	Windows Server, Linux, etc.

System Configuration	
Processor Information (Model, installed, model number, speed, # of cores, 2 x quad-core 3.0 GHz, etc.)	
Memory Information (Total memory installed, memory type, # DIMMs, DIMM Size, etc.)	4 x 2 GB = 8 GB
Power Supply(s) (W, redundancy configuration n/2n/(n+1), and Wattage)	2 x 100 Watts (2n)
I/O Devices (W and type of device, speed)	2 x 10Gb PCI/10GbT onboard Dual Port
Hard Drive Information (W, speed, capacity)	2 x 150 GB, 7.2K
Installed Operating System for Testing	Windows Server
Power Supply Efficiency at 10%, 20%, 50% and 100% Rated Load	79.0%, 87.0%, 91.0%, 99.0%
Service Processor Installed?	Yes
Other Hardware Features / Accessories	N/A

Power Data	
IEC Category	Category 0, 2P Managed Server
Test Voltage and Frequency	230V/60Hz
ENERGY STAR Idle Power Limit (15 and 25 only)	190.0
Measured Idle Power (watts)	170.0
Power at Full Load (watts)	232.0
Benchmark / Method for Full Load Test	SPECpower_bj_2005
Estimated kWh/year (Assumptions T20)	1979.76
Link to Detailed Power Calculator (if available)	<a href="http://www.vendor.com/powercalculator">http://www.vendor.com/powercalculator</a>

Power and Performance Data for Benchmark #1	
Benchmark(s) Used and Type of Workload	SPECpower_bj_2005
Power @ Active Idle (watts)	148.0
Power @ 100% (watts)	222.0
Performance Score @ 100% (x1_top)	55498
Benchmark and Power Score (max score/max power)	700
Estimated kWh/year (Assumptions T20)	1625.0
Link to Full Benchmark Report	<a href="http://spec.org/power_bj2005/results/sample.html">http://spec.org/power_bj2005/results/sample.html</a>

Power and Performance Data for Benchmark #2	
Benchmark(s) Used and Type of Workload	
Idle Power (watts)	
Maximum Power (watts)	
Benchmark Performance Score(s)	
Benchmark and Power Score (max score/max power)	
Estimated kWh/year (Assumptions T20)	
Link to Full Benchmark Report	

# Increased Manageability



- **Data Measurement and Output Requirements** for highly managed systems
  - Will require that ENERGY STAR servers have greater ability to **monitor and report their power consumption, input air temperature and processor utilization** through standard networks
  - Will give data center operators **greater access to data** on the operating state of their equipment
  - Will reward systems with more advanced onboard technology to help enable greater efficiencies in the data center

# Agenda

---



- Introductions/Announcements - 5 minutes
- Main Criteria Review - 15 minutes
- **Major changes in the Draft 4 – 1 hour  
15 minutes**
- Questions and Answers - 25 minutes

# Key Changes for Draft 4 Spec.



- Removal of product labeling
  - Required Web and product literature labeling
- New PSU efficiency levels for smaller supplies at low loading ( $\leq 500W$ )
- New Idle levels for 1S and 2S Servers
  - Idle Bins based on the installed processor count and level of manageability
  - New adders for redundant PSU and I/O Devices
- Processor level power management for 4S servers
  - Must be enabled in hardware on shipment

# Key Changes for Draft 4 Spec. (2)



- Qualification of Product Families
  - Based on common base components
  - One Power and Performance Data Sheet per Product Family
- Data Measurement and Reporting Requirements
  - Exclusion for some 1S and 2S systems
  - Refined sampling and accuracy requirements to reflect technologies currently on the market
- New Idle test procedure based on ENERGY STAR Computer V5.0 test procedure
  - Eliminates cost and complexity for new partners
  - Modified to include DC Powered Servers, Blades, etc.

# Power Supply Efficiency and Power Factor Requirements



**Table 1: Efficiency Requirements for Computer Server Power Supplies**

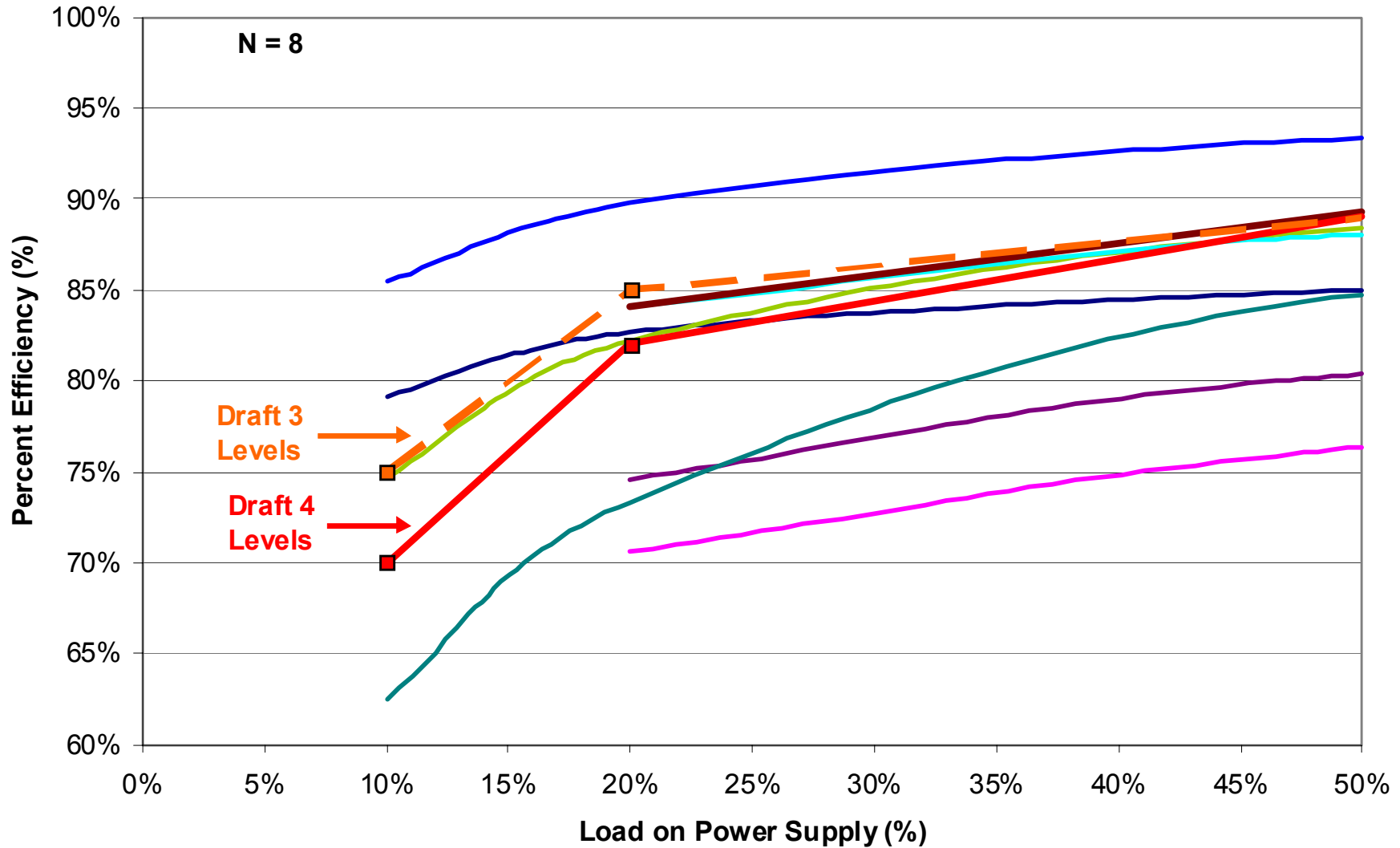
Power Supply Type	Rated Output Power	10% Load	20% Load	50% Load	100% Load
Multi-Output (AC-DC & DC-DC)	All Output Levels	N/A	82%	85%	82%
Single-Output (AC-DC & DC-DC)	≤ 500 Watts	70%	82%	89%	85%
	501 - 1,000 Watts	75%	85%	89%	85%
	> 1,000 Watts	80%	88%	92%	88%

**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



# Single Output Power Supply Efficiency Req. for Small PSUs ( $\leq 500$ W)



# Single Output Power Supply Efficiency and Power Factor Req.



## Efficiency Qualification Rate

Requirement	10% Load Criteria	20% Load Criteria	50% Load Criteria	100% Load Criteria	Total Unit Count	Pass All Loads	Pass (%)
Eff. Small Supplies	70.0%	82.0%	89.0%	85.0%	8	2	25.0%
Eff. Medium Supplies	75.0%	85.0%	89.0%	85.0%	30	9	30.0%
Eff. Large Supplies	80.0%	88.0%	92.0%	88.0%	31	8	25.8%
					69	19	27.5%

## Power Factor Qualification Rate

Requirement	10% Load Criteria	20% Load Criteria	50% Load Criteria	100% Load Criteria	Total	Pass All Loads	Pass (%)
PF Small Supplies	0.65	0.80	0.90	0.90	2	2	100.0%
PF Medium Supplies	0.65	0.80	0.90	0.90	16	13	81.3%
PF Large Supplies	0.80	0.90	0.90	0.90	23	21	91.3%
					41	36	87.8%

Overall Qualification for units with both Efficiency and Power Factor data =  $9/41 = 22.0\%$

# Active Power Requirements



- Draft 4 continues to specify Idle levels for single and dual socket servers
- 3S and 4S systems now have **processor power management** requirement
  - These systems are more likely to be virtualized and **used in highly utilized environments**
  - **Highly configurable and upgradeable** so Idle would be very complicated for 3S & 4S
  - Manufacturers still need to **test and report Idle results to EPA**



# Idle Power Levels

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

- Managed Server must have:
  - Capability to operate with redundant power supplies
  - An installed dedicated management controller (e.g., service processor)
- Base system includes: non-redundant PSUs, Single Hard Drive,  $\leq 4$ GB memory, up to dual port 1 Gbit onboard NIC

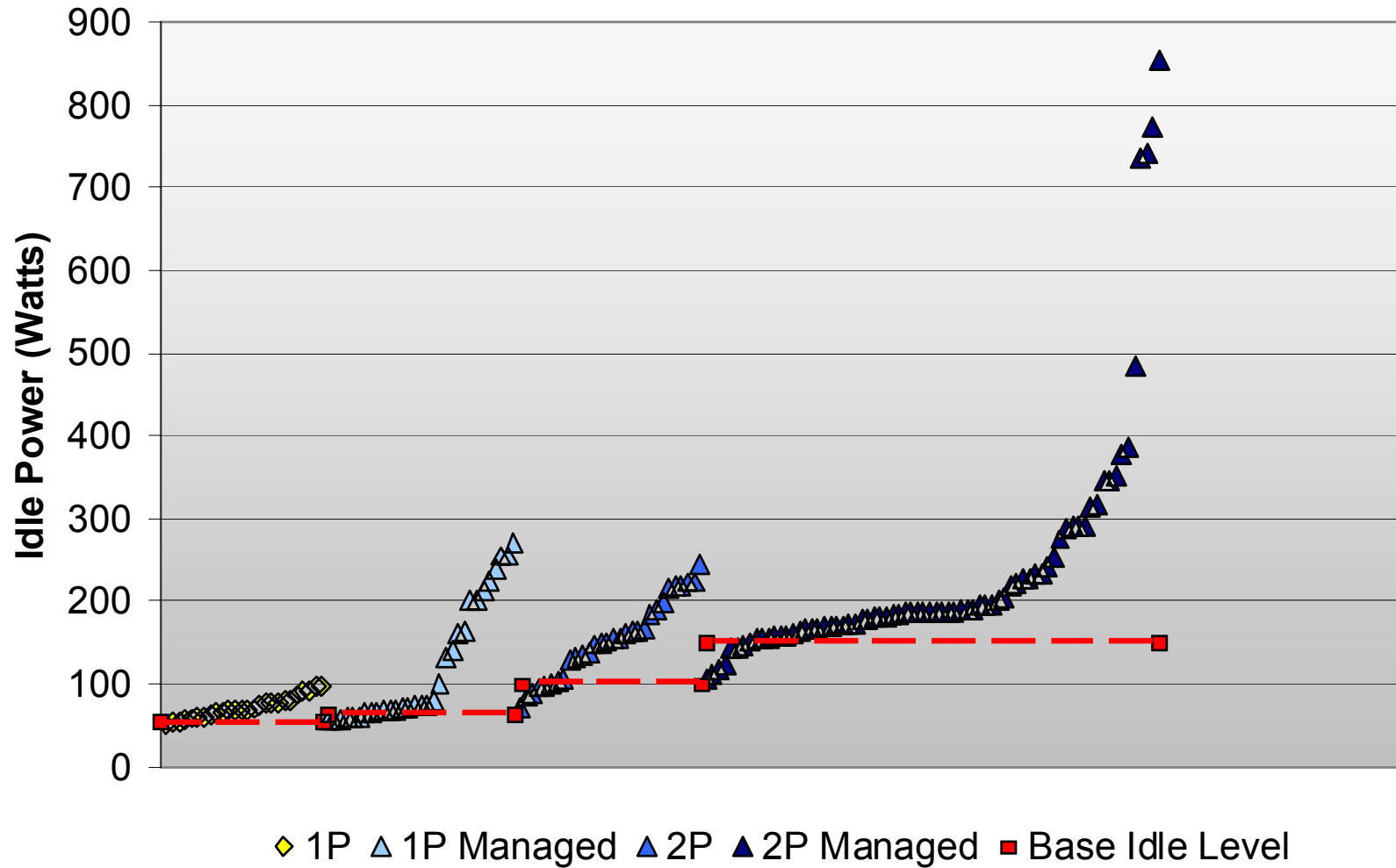
# Idle Power Categories and Levels



Category Label	Unit Count	Average Idle	Estar Level	Pass	Pass %
1P Systems	26	71.9	55	6	23.1%
1P Managed Systems	31	121.2	65	9	29.0%
2P Systems	30	153.8	100	8	26.7%
2P Managed Systems	74	238.7	150	19	25.7%
<b>Sum</b>	<b>161</b>		<b>Sum</b>	<b>42</b>	<b>26.1%</b>

- Categories for managed and standard servers for both single and dual processor servers
- Good representation for each category
- Increasing average Idle
- Balanced qualification rate across categories

# Idle Data and Base Idle Levels



# Idle Power Adders



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) <b>NEW</b>	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)* <b>NEW</b> Base: One or two port onboard Ethernet <=1 Gbit Additional Ethernet less than 1Gbit Additional 1 Gbit Ethernet Additional 10 Gbit Ethernet Fibre Channel or Infiniband	No Allowance No Allowance 2 W per Active Port 8 W per Active Port 5W per Device

- New adders for **redundant power supplies** and **I/O devices**
- Hard drive adder changed to 8 Watts for all additional hard drives
- Memory adder threshold reduced to 4 GB

# Idle Power Adders (2)

---



- Adders only included for key elements that determine the relative performance and capability of a general purpose Computer Server available in marketplace today
- Adders for RAID controllers and redundant fans suggested in Draft 3 comments
  - EPA believes products with these functionalities can qualify with current base levels and adders
- EPA not considering additional adders at this time



# Redundant Power Supply Adder



- With new bins based on Managed/Standard servers, EPA has included an adder for the installation of redundant power supplies
- Allows for a more direct accounting of the additional power required to operate redundant power
- Adder is for all power supplies added for redundancy (i.e. in addition to the minimum needed to run the server)

# Redundant PSU – Examples



Min. PSUs needed	PSUs installed	Adder
1	1	No Adder
2	2	No Adder
1	2	1 x 20W = 20 W
2	3	1 x 20W = 20 W
2	4	2 x 20 W = 40 W



# I/O Adder

- Base system includes up to 2 ports of onboard 1Gbit Ethernet
  - Anything greater gets the additional power allowance
- Adders only for devices  $\geq 1$  Gbit
- 1Gbit and 10 Gbit Ethernet get additional power **per port**
- FibreChannel, InfiniBand get additional power **per device**
- Adders only applied for ports/devices **active on shipment**
- Draft 4 levels based on limited data
  - EPA is in the process of collecting additional data to revise levels **up or down**.

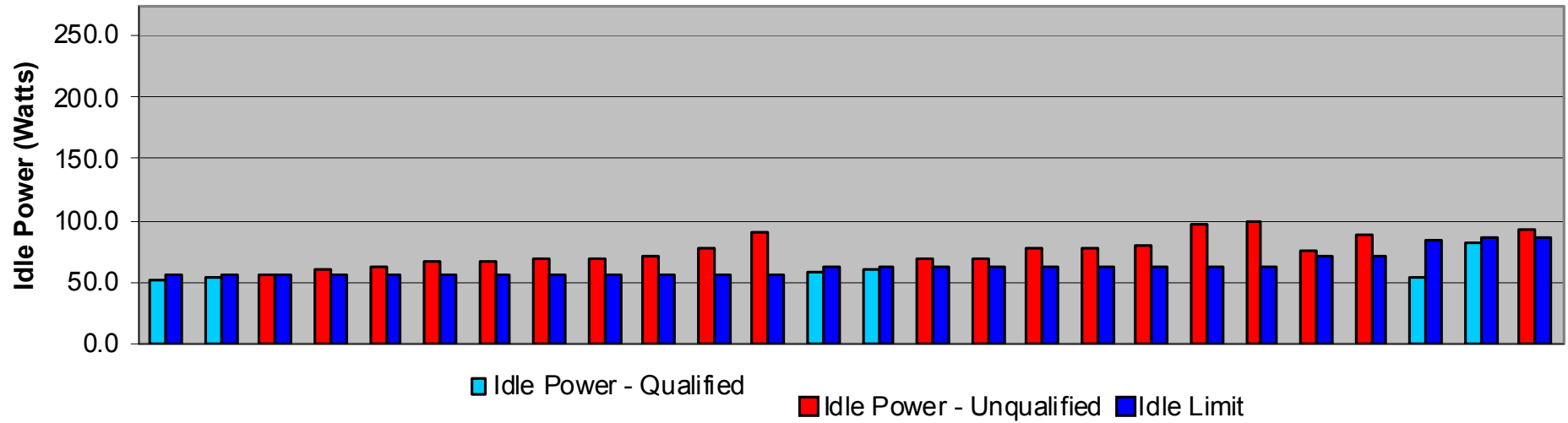


# I/O Adder – Examples

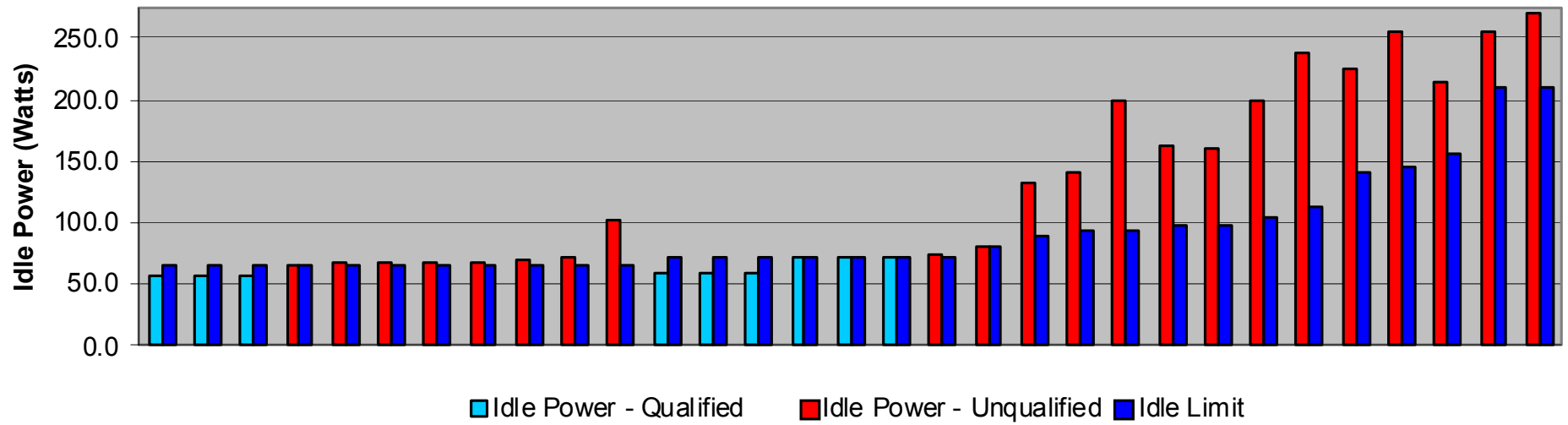
---

- Server with a 4 port onboard 1 Gbit Ethernet adapter would get a 2 x 2W adder (two 1 Gbit Adders above the base)
- Server with a 2 port onboard 1 GBit Ethernet and a 4 port PCI 1 Gbit Ethernet Adapter would get a 4 x 2W adder (four 1 Gbit Adders above the base)
- Server with a 2 port onboard 1 GBit Ethernet; a 2 port PCI 10 Gbit Ethernet adapter; and a FibreChannel device would get a 2 x 8W + 1 x 5W (=21 W) adder

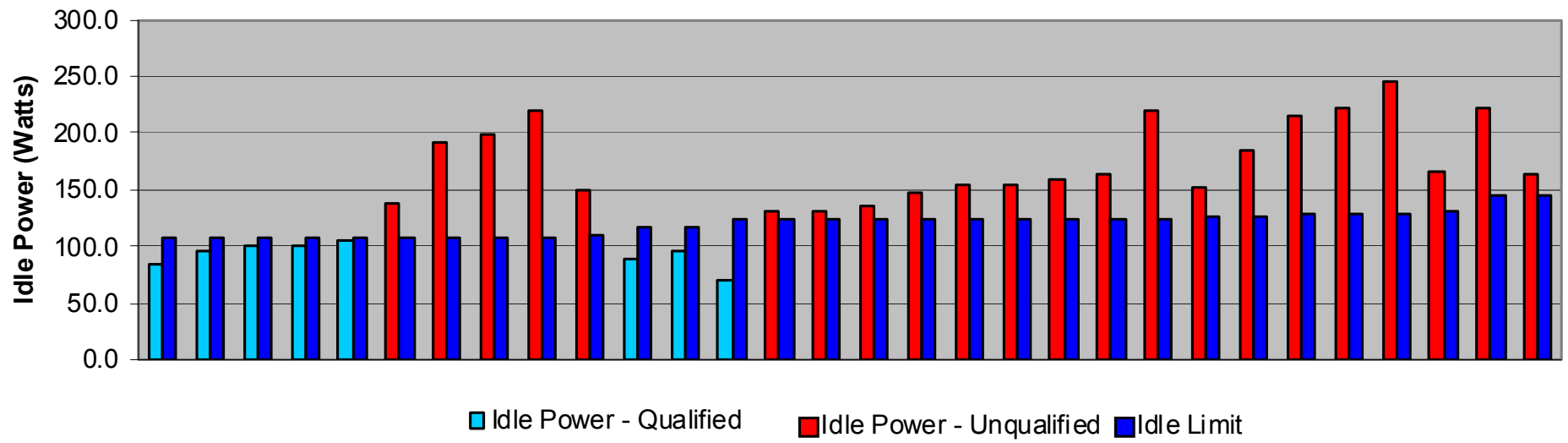
### Idle Power and Levels for 1P Systems



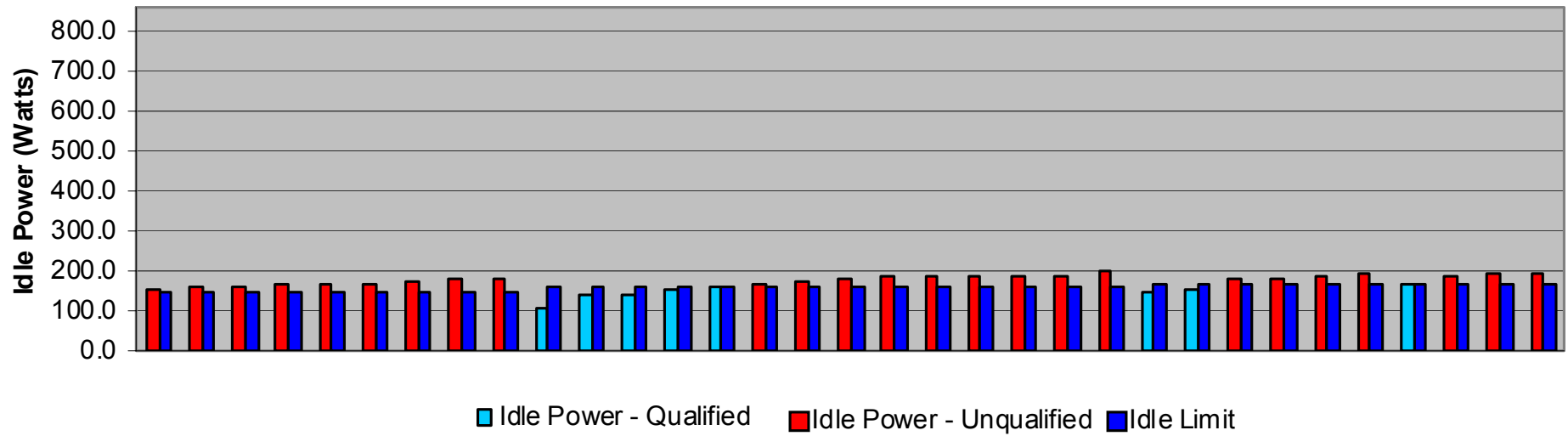
### Idle Power and Levels for 1P Managed Systems



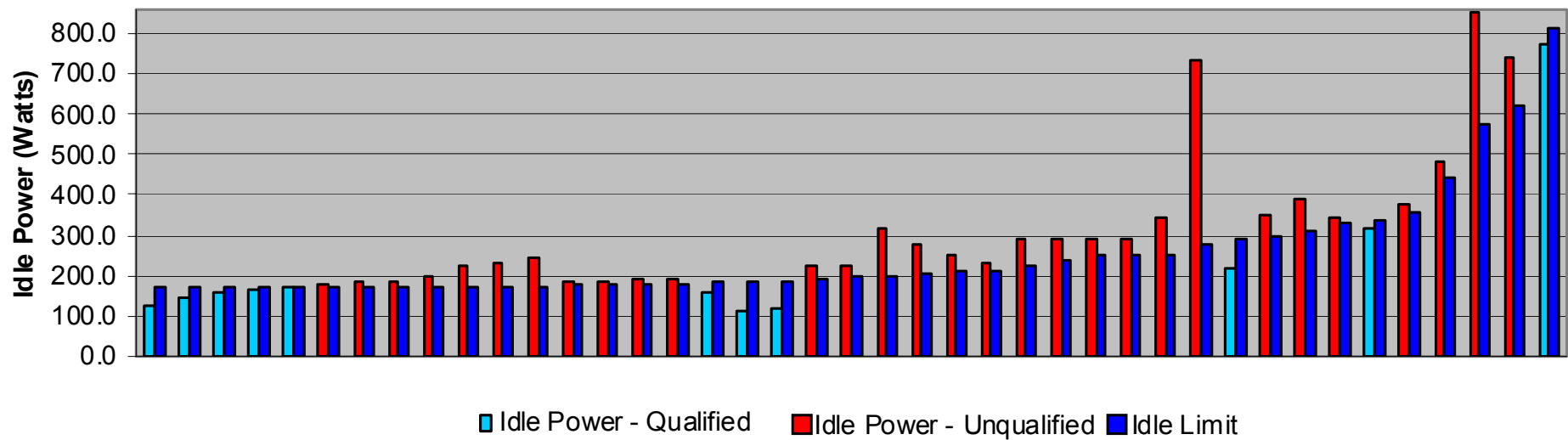
### Idle Power and Levels for 2P Systems



## Idle Power and Levels for 2P Managed Systems



## Idle Power and Levels for 2P Managed Systems (Continued)



# PM Requirement for 3S and 4S



- All processors must be able to reduce their power use in times of low utilization by:
  - 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
- Capability must be enabled **on the hardware level** to qualify



# Data Measurement and Reporting



- Required for:
  - 1S and 2S **Managed** Servers
  - **All** 3S and 4S Servers
- Exclusion for 1S and 2S systems that don't meet the definition of Managed Servers
  - EPA intends to require this **for ALL servers under Tier 2**

# Data Measurement and Reporting (2)



- Refined sampling and accuracy requirements
  - Input power measurements: +/-10% accuracy
  - Processor utilization measurements: +/-5% accuracy for CPU utilization less than 90%.
  - Input air temperature measurements: +/- 3° C
  - Hardware polling rates of at least one sample per second.
  - Data must be averaged on a rolling basis over a specific time period. Default rolling average of 30 seconds is recommended.

# Standard Information Reporting



- **Looking for comments on the draft Power and Performance Data Sheet**
  - Layout and format
  - Information required
  - Ability to implement
- **Draft 4 Changes**
  - SPECpower testing no longer required
  - Must test and report **at least one benchmark** score (vendors choice)
  - Must test and report **power at full load**, along with method of testing.
- **Questions**
  - Is the information useful to buyers?
  - Is any key information missing?



# Idle Test Procedure

---

- Eliminated requirement to run SPECpower
  - Decreases cost and complexity and lowers barrier to entry for new partners
- Draft 4 contains draft Idle test procedure
  - Based on Computer V5.0 Idle test procedure, modified for unique characteristics of servers
  - Includes procedure for DC powered servers and Blade systems

# Implementation - Families



- Manufacturers will now be able to qualify Product Families
  - Must use identical model motherboard and processor
  - Relative numbers of components (PSUs, DIMMs, hard drives, I/O Devices) may change, but **components must be identical**
  - Submit data on Maximum and Minimum configurations
  - One data sheet per family
  - All units qualified with the family **must still individually meet all the ENERGY STAR requirements**

# Implementation - VARs



- Value Added Resellers (VARs)
  - Partners must work with VARs to ensure continued compliance of altered configurations
  - Otherwise all indication of ENERGY STAR qualification must be removed
  - VARs which re-brand products may sign on as partners and qualify products
- EPA is looking for feedback on how to best accommodate various sales channels while maintaining the integrity of the ENERGY STAR brand

# Implementation - Labeling

---



- Please note that manufacturers **may not promote Servers as being ENERGY STAR qualified, or use the label, until the effective date of May 1, 2009.**
  - New partners must sign a partnership agreement
  - Partners in other ENERGY STAR programs (e.g., current computer partners) must still sign onto the Computer Server program

# Tier 2



- Tier 2 Specification
  - Development to begin immediately after Tier 1 effective
  - Take effect 12 – 24 months after Tier 1
  - Focus on performance benchmark, regardless of configuration (i.e. eliminate adders)
  - Raise all PSU targets (e.g., CSCI Gold for all Single-Output PSUs)
  - Data Measurement and Reporting for all Servers
  - Energy-Efficient Ethernet (IEEE 802.3az)





# Servers: Timeline

---

- Draft 4 version released on **February 20**
- Comments on Draft 4 Due **March 20**
- Schedule moving forward
  - **Stakeholder Web Meeting: March 16**
  - **Final Draft released:** Early April
  - **Web Meeting on Implementation:** Mid April
  - **Final Spec released/effective:** by May 1, 2009
  - **Tier 2 plans initiated:** March/April 2009
    - Draft Tier 2 framework document to be distributed
- Tier 1 Specification will take effective immediately upon finalization
  - Will be in place 12 to 24 months

# Agenda

---



- Introductions/Announcements - 5 minutes
- Main Criteria Review - 10 minutes
- Major changes in the Draft 4 – 1 hour 15 minutes
- **Questions and Answers - 30 minutes**

# Contact / More Information

---



- Andrew Fanara, EPA ENERGY STAR
  - [Fanara.andrew@epa.gov](mailto:Fanara.andrew@epa.gov)
- Arthur Howard, ICF International
  - [ahoward@icfi.com](mailto:ahoward@icfi.com)
- Send Draft 4 Comments to Rebecca Duff, ICF International **by March 20**
  - [rduff@icfi.com](mailto:rduff@icfi.com)

[www.energystar.gov/productdevelopment](http://www.energystar.gov/productdevelopment)

[www.energystar.gov/datacenters](http://www.energystar.gov/datacenters)