



IBM Systems and Technology Group

ENERGY STAR® for Computer Servers Version 1.0

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ENERGY STAR Program

Is a joint program of the US Environmental Protection Agency (EPA) and the US Department of Energy (DOE)

Is a **voluntary** labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions

Is a self certifying process wherein the “Energy Star Partner” (requires a “Partner Agreement”, which IBM does have with the EPA) submits the required information to the EPA. They validate the submission and post it to their web site.

The goal of all Energy Star specifications is to set requirements such that only 25% of the products sold would be able to qualify as compliant. As market penetration increase, the EPA would revise the standards upward to maintain the 25% target.

But . .

US Federal Government, and often state and local agencies are required to buy Energy Star compliant models . . . if they are available for the class of product they are procuring.

- The EPA has agreements with EU and AP countries that they will utilize Energy Star as basis for their own Standards on energy efficiency.
- <http://www.energystar.gov/>

ENERGY STAR for Computer Servers – Version 1.0

- Tier 1 Specification: was effective upon publication on May 15, 2009
- **Qualifying Products:**
Servers with 1 to 4 processor “sockets”
 - Includes dual node systems (two servers in the same mechanical package)
- **Ineligible Products:**
 - Servers with more than 4 processor sockets
 - **Blade Systems** including Blade Servers and Blade Chassis
 - Fully Fault Tolerant Servers
 - Server Appliances
 - Multi Node Servers (more than 2 servers in one package)
 - Storage Equipment including Blade Storage
 - Network Equipment

Note: The EPA intends to add Blades Systems as a covered product via the release of version 1.x of the Specification for Servers

Tier 1 Efficiency Requirements

1. Power Supply Targets

- Tier 1 Power Supply Requirements specify the minimum power conversion efficiency and power factor requirements.
- Limits set for multi-output power supplies and 3 categories of single output PSs based on output wattage.

2. Active (IDLE) Power Limits

3. Standard Information Reporting

4. Data Measurement and Output

Tier 1 Power Supply Efficiency Requirements

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%
	> 500–1,000 watts	75%	85%	89%	85%
	> 1,000 watts	80%	88%	92%	88%
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	0.8	0.9	0.95
AC-DC Single-Output	≤ 500 watts	N/A	0.8	0.9	0.95
	> 500–1,000 watts	0.8	0.9	0.9	0.95
	> 1,000 watts	80%	88%	92%	88%

Note: Power factor requirements pertain to all loading conditions where the output power is **greater than or equal to 75 watts**. Manufacturers are still required to measure and report power factor values for loading conditions less than 75 watts to qualify for ENERGY STAR.

Tier 1 Efficiency Requirements

1. Power Supply Targets

2. Active (IDLE) Power Limits

- System level measurement for Single and Dual Processor Socket computer Servers must have an Idle power consumption which does not exceed the allowed maximum Idle power levels determined from the specification
- Three or Four socket servers are Not subject to Idle power limits (values must still be reported to the EPA). These servers must enable processor level power management to reduce power use of the processor during time of low utilization

3. Standard Information Reporting

4. Data Measurement and Output

Active (IDLE) Power Requirements – 1S and 2S

Single and Dual Processor Socket Computer Servers (1S & 2S)	
Base System Idle Power Requirements (up to 4GB memory, 1 HDD, 1 NIC active)	
Computer Server System Type	Idle Power Limit
Category A: Standard Single Installed Processor (1P) Servers	55.0 watts
Category B: Managed Single Installed Processor (1P) Servers	65.0 watts
Category C: Standard Dual Installed Processor (2P) Servers	100.0 watts
Category D: Managed Dual Installed Processor (2P) Servers	150.0 watts

Additional Idle Power Allowances for Extra Components	
System Characteristic	Additional Idle Power Allowance
Additional Power Supplies	20.0 watts per Power Supply
Additional Hard Drives	8.0 watts per Hard Drive over the base (1 HDD)
Additional Memory	2.0 watts per GB above the base (4GB)
Additional I/O Devices	<1Gbit: No Allowance =1Gbit: 2.0 watts / Active Port >1Gbit and <10Gbit: 4.0 watts / Active Port ≥10 Gbit: 8.0 watts / Active Port

Tier 1 Efficiency Requirements

1. Power Supply Targets
2. Active (IDLE) Power Limits
- 3. Standard Information Reporting**
4. Data Measurement and Output

Standard Information Reporting Requirement

- Energy Star partner Must provide:
 - Qualified Product Information sheet for each ENERGY STAR qualified Computer Server (or server family).
 - A standardized *Version 1.0 Power and Performance Data Sheet*
 - Data Sheet must be posted on Partner’s web site upon the EPA approval of the submission
- May provide one data sheet per qualified configuration OR one per Product Family with data on the Computer Server’s power and performance with Minimum, Typical, and Maximum configurations.
- Reports must include Performance/Watt testing results
 - Choice of “benchmark” left to the Partner

Tier 1 Efficiency Requirements

1. Power Supply Targets
2. Active (IDLE) Power Limits
3. Standard Information Reporting
4. **Data Measurement and Output**

Data Measurement and Output Requirements

- Managed 1S & 2S Computer Servers and ALL 3S & 4S Computer Servers must be able to report the following data, on a 30 second interval in a published or accessible format that is readable by third party data center management systems:
 - Input power consumption: Reading of input power to the server power supply.
 - Inlet Air Temperature measurements
 - Processor Utilization measurements: This measurement is an estimate only, based on the available utilization measurement provided by the processor with or without support from the operating system or hypervisor software.

IBM will use Active Energy Manager to satisfy the first two items. The third is via the OS.

- Power measurement accuracy limits ($\pm 10\%$) detailed in Tier 1 are “recommended”.

ENERGY STAR Impact on Server Design

Tier 2 – planning for the future

Specification considerations

1. Power Supply Targets
2. Active (IDLE) Power Limits
3. Standard Information Reporting
4. Data Measurement and Output

Tier 2 Specification

- Targeted Effective Date: October 15, 2010
- The EPA intends to develop an energy efficiency performance metric (perf/watt workload)
 - Industry is working with SPEC.org
- Revise Idle Power consumption requirements*
 - Based on achieving the 25% market penetration of Energy Star servers.
- Revise Power Supply Efficiency requirements
 - Eliminate the distinction between output power ranges
- Reporting Accuracy Limits will be “required”
 - PS: $\pm 5\%$ (± 5 Watts min) Thermal Sensors: $\pm 3^{\circ}\text{C}$
- The EPA is investigating expanding coverage to include:
 - Blade Systems (likely in a version 1.x spec) - Systems with greater than four sockets
 - Fully Fault Tolerant Servers - Server Appliances
 - Multi-Node Servers

* Implemented if performance/efficiency metric cannot be developed by the target date.

Tier 1 Impact on Server Design

Specification considerations

1. Power Supply Targets

design all PSs to >1,000 watt PS limits (**or better**, especially at 10 to 20% Load)

80% @ 10% load

88% @ 20% load

92% @ 50% load

88% @ 100% load

2. Active (IDLE) Power Limits

- Focus on power conversion losses

- increased light load efficiencies for all DC/DC converter designs
- right size the pwr designs, phase add/shed, flatter efficiency curves

- Focus on the loads:

- power management/bios settings to reduce load demands when idle

3. Standard Information Reporting

- IBM is an active member of SPEC working on the performance benchmark definition and creation

4. Data Measurement and Output

- Metering built into bulk power supplies already required by IBM. Continued focus on accuracy.

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References:

Energy Star for Servers Home Page:

http://www.energystar.gov/index.cfm?c=ent_servers.enterprise_servers

Specification:

http://www.energystar.gov/ia/partners/product_specs/program_reqs/servers_prog_req.pdf

QPI FORM

http://www.energystar.gov/ia/partners/product_specs/qpi/servers_qpi_form.xls

Note: EPA is currently also working on a Tier 1 Specification for Storage products

Tier 1 Specification for Storage is under development

Questions?



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