



ENERGY STAR® Data Center Storage Version 1.0

Stakeholder Update

02 February 2010



Agenda

- *Development Schedule Overview*
- *Draft 1 Considerations*
 - Partner Commitments
 - Definitions
 - Product Family
 - Taxonomy
 - PSU Criteria
 - System Efficiency: Data Collection Update (SNIA)
 - Measurement & Reporting Requirements
 - Power & Performance Data Sheet
- Q&A

Development Schedule



- 6/4/09 Framework distributed
- 7/20/09 Stakeholder meeting (San Jose)
- 10/15/09 Test Procedure Workshop (Phoenix)
- 11/3/09 Draft data collection procedure distributed
- 12/28/09 Final data collection procedure
- 2/2/10 Stakeholder meeting
- 2/12/10 Data collection complete
- Feb-2010 Draft 1 distribution
- Feb/Mar Data analysis with stakeholders
- Apr-2010 Draft 2 distribution with Active/Idle criteria



Draft 1: Goals

- *Expose energy performance data for purchasers and operators. Even with minimal requirements on energy performance, the act of reporting in a consistent format will benefit the industry.*
- *Develop a system-level efficiency approach, with minimal component or subsystem requirements (PSUs, etc.)*
- *Develop a model for quantifying & recognizing the efficiency benefits of various software implementations.*

Draft 1: Partner Commitments



- *Partner Commitments are a standard part of every ENERGY STAR product specification. Requirements for:*
 - Product qualification and data submission guidelines for OEMs, VARs, etc.
 - Verification testing
 - Acceptable use of the ENERGY STAR logo
 - Unit Shipment Data reporting requirements
 - Opportunities for special recognition



Draft 1: Definitions

- *A work in progress:*
 - Several modifications have been made to merge & consolidate definitions from the Framework and Data Collection Procedure
 - Most definitions will be further aligned with the Fall 2009 edition of the SNIA Dictionary
- *Definitions are still needed for SNIA Taxonomy categories (“Online”, “Near-online”, etc.)*



Draft 1: Definitions

- *A concise and unambiguous definition for “Storage Product” is critical to the success of the program – subsystems and components will not be eligible for qualification.*
 - 3rd-party components?

Draft 1: Product Family



- *The “product family” concept will be included Draft 1 as a basis for discussion.*
 - Introduced in the Version 1.0 server specification – currently under revision
 - The family concept may be well suited to the data center storage product category due to the high degree of customization and configurability of storage products.
- *Questions:*
 - Based on Servers experience, how can the family structure be best implemented for Storage?

Draft 1: Taxonomy



- *EPA continues to reference the SNIA Taxonomy as a baseline for product characterization.*
 - Intend to define requirements that are consistent across several taxonomy categories, in order to simplify the specification for both Partners and end users.
 - Data collection and ongoing comments may identify necessary deviations from the SNIA structure.
- *Questions:*
 - Are any hybrid systems or blade storage systems currently under test? Do these fit neatly in the taxonomy? If no, how can these be accommodated?



Draft 1: PSU Criteria

- *Objectives:*
 - *Align specification structure with ENERGY STAR Servers / Computers.*
 - *Harmonize with EPRI test method and 80 PLUS / CSCI efficiency criteria*
- *Existing EPRI PSU test method was not applicable to Storage PSUs.*
 - *Typically multi-output, with fan used for PSU and whole-system cooling*
 - *Redundant configurations are common, so load conditions would never typically exceed 50%*



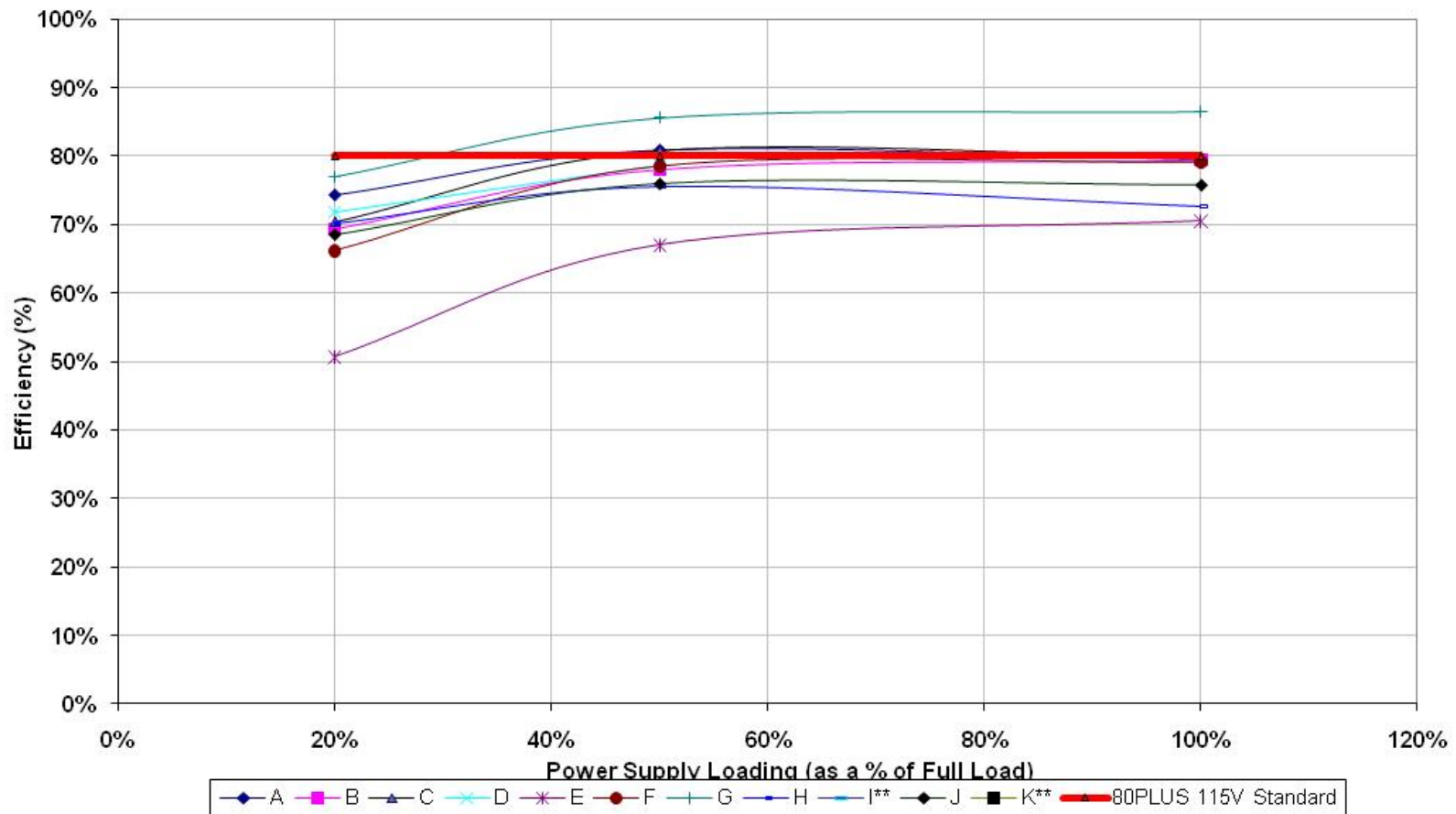
Draft 1: PSU Criteria

- *SNIA & 80 PLUS jointly tested 11 storage PSUs from 6 OEMs at EPRI in 4Q-09.*
- *Goal to inform revisions to EPRI Generalized Test Procedure*
 - Efficiency results if fan power included vs. excluded
 - Variation between tests at 50 Hz vs. 60 Hz

Draft 1: PSU Criteria



SNIA Power Supply Test Results (115V, 60Hz) - Efficiency



** indicates the samples that were not tested at 115V because the operating voltage was 180-240Vac

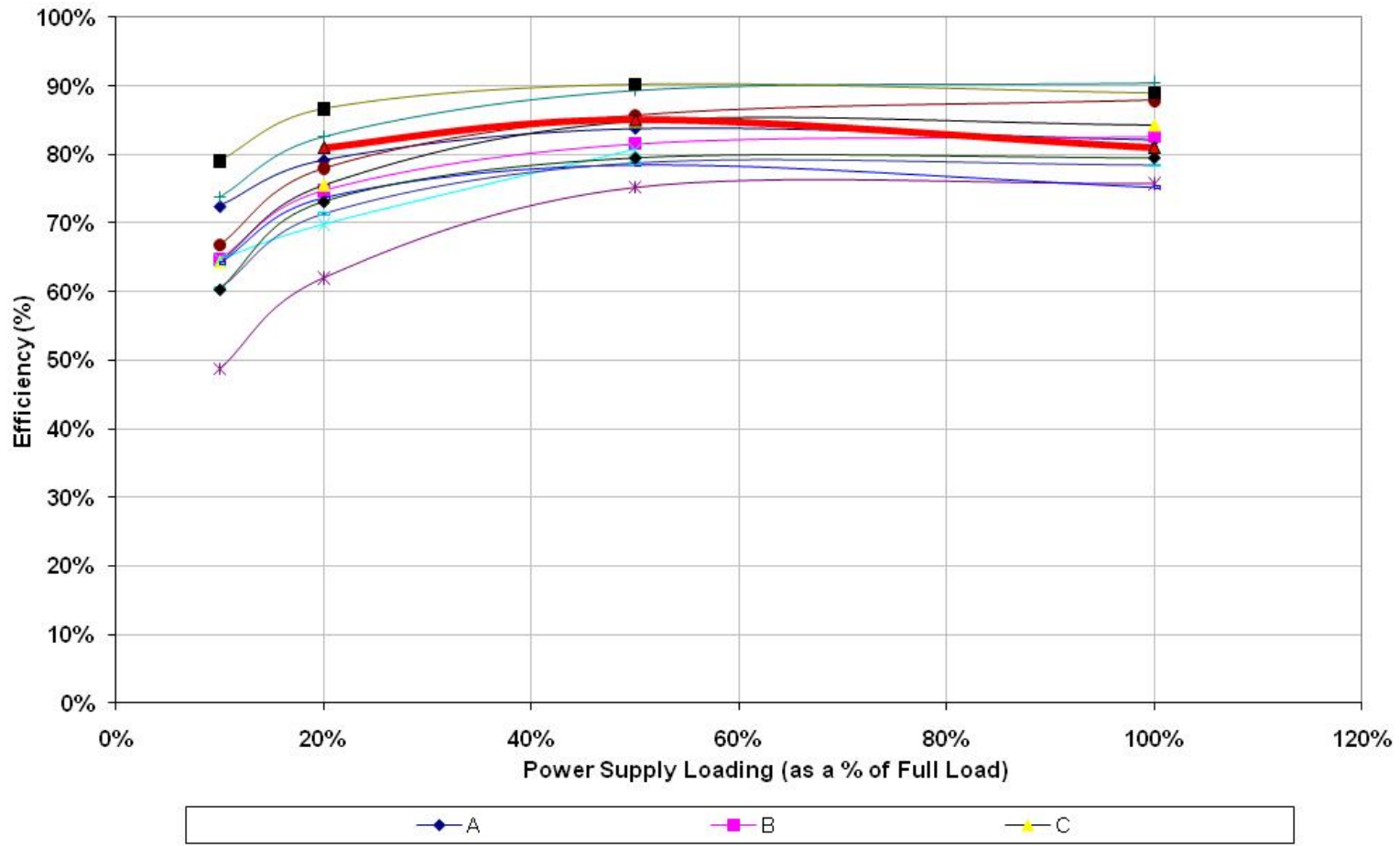


Source: SNIA / 80 PLUS presentation

Draft 1: PSU Criteria



SNIA Power Supply Test Results (230V, 60Hz) - Efficiency



Draft 1: PSU Criteria



- *Results (Source: SNIA / 80 PLUS presentation)*
 - Testing at 60 Hz is representative of 50Hz or 60Hz. Observed worst case is 0.38% variation between same unit reading at one data point
 - No PSUs meet 80 PLUS Bronze @ 115V/60 Hz, 2 PSUs meet @ 230V/60Hz. All units met 80 PLUS and CSCI power factor criteria
 - Efficiency and PF performance of Storage PSUs is not significantly different from Desktop or Server PSUs

Draft 1: PSU Criteria



- *The ENERGY STAR perspective:*
 - Full support of the SNIA / 80 PLUS / EPRI effort
 - Concur that fan power should be excluded from storage PSU efficiency measurements (for drawer PSUs). However, fan power will be included in the system-level efficiency measurement, so there will be motivation for improved efficiency, variable speed fans, etc.
 - One or more unique hardware-based characteristics of storage PSUs must be identified, to avoid crossover with other PSU types & criteria.
 - Efficiency criteria for drawer and controller PSUs still TBD, but will consider a phased approach to allow time for hardware improvements.

Data Collection Update



*The Storage Networking
Industry Association*



Draft 1: Efficiency Criteria

- *Data collection in progress through 2/12.*
- *Data analysis will include significant stakeholder involvement to ID key factors for storage energy efficiency.*
- *Questions:*
 - What can we expect re: number of vendors, systems, discrete test points?
 - Suggested format for data analysis: In-person workshop(s)? Webinar?

Draft 1: Data M&R



- *Data Measurement & Reporting requirements are intended to provide operators with real-time information to drive efficient decisions.*
 - Temperature and airflow reporting for integration with monitoring systems and data center management infrastructure
- *Questions:*
 - What real-time data is most important to storage system operators to ensure efficient operation?
 - Would the presence of temperature & power consumption data at the shelf level (vs. Rack/PDU level) provide substantial benefits to a data center operator? What are the costs and benefits?

Draft 1: P&P Data Sheet



- *The Power & Performance Data Sheet is intended to facilitate informed purchasing decisions, right-sizing to actual end-use needs, and predictions of energy consumption under various operational scenarios*
 - A PPDS must be published for every ENERGY STAR qualified product.
 - Contains details of system configuration, performance, and power consumption

Power & Performance Data Sheet



ENERGY STAR® Power and Performance Data Sheet
Dell PowerEdge R210 Featuring the Dell Energy Smart N250E Power Supply

System Characteristics

Form Factor	1U
Available Processor Sockets	1
Available DIMM Slots / Max. Memory Capacity	4/16 GB
ECC and/or Fully Buffered DIMMs	Yes
Available Expansion Slots	1 PCI-E
Minimum and Maximum # of Hard Drives	1 to 2
Redundant Power Supply Capable?	No
Power Supply Make and Model	Dell Energy Smart N250E-60
Power Supply Output Rating* (watts)	250
Minimum and Maximum # of Power Supplies	1
Input Power Range (AC or DC)	100-240VAC
Power Supply Efficiency at Specified Loadings†	74.15% @ 10%, 82.6% @ 20%, 86.0% @ 50%, 86.8% @ 100%
Power Supply Power Factor at Specified Loadings†	0.96 @ 10%, 0.98 @ 20%, 0.99 @ 50%, 0.99 @ 100%
Operating Systems Supported‡	Microsoft Windows® Server 2003 and 2008 Microsoft Windows Essential Business Server 2008 Microsoft Windows Small Business Server 2008 Red Hat Enterprise Linux 4 and 5 SUSE Linux Enterprise Server 10 and 11
Installed Operating System for Testing	Microsoft Windows Server 2008 Microsoft Windows Essential Business Server 2008

†. Power supply information is for a single power supply only.
‡. Available operating systems are shipped configurations from the factory.
3. Minimum shipped configuration is installed 50 disk.

System Configurations

	Minimum	Typical	Maximum
Configuration ID			
Processor Information	1, Intel Xeon 3430	1, Intel Xeon 3430	1, Intel Xeon 3470
Memory Information	1 DIMM, 1 GB	2 DIMMs, 1 GB each	4 DIMMs, 4 GB each
Internal Storage	1 HDD	1 HDDs / 1 DVD	2 HDDs / 1 DVD
I/O Devices	2 onboard 1 GB NIC ports	2 onboard 1 GB NIC ports	2 onboard 1 GB NIC ports
Power Supply Number and Redundancy Configuration	1	1	1
Management Controller for Service Processor Installable	Yes	Yes	Yes
Other Hardware Features / Accessories			DRACs 6110, 6110e, SAS 6LR

Power Data

Wk Category (S and 2S only)	Minimum	Typical	Maximum
ENERGY STAR Idle Power Allowance (S and 2S only)	55	63	87
Measured Idle Power (watts)	36.1	41.5	69.1
Power for Full Load (watts)	114.6	114.8	185.8
Benchmark / Method Used for Full Load Test		Std @ 0.1 Hz / 4.2	
Test Voltage and Frequency for Idle and Full Load Test		115 V/60 Hz	
Range of Total Estimated Energy Usage** (kWh/year)	0.633 to 2.008	0.721 to 2.011	1.211 to 3.255
Link to Detailed Power Calculator (if available)		www.Dell.com/CALC	

*. Full load power represents the absolute, average power at 100% load of the power workload, and does not necessarily represent the absolute peak power or the highest average sustained power possible for other workloads.
** Calculated kWh/year gives the absolute range of energy use you could expect from continuous operation (24x7x365) and ranges from 100% utilization to 100% utilization operation. The calculation also includes typical data center overhead at a utilization level of 100% based on energy use of 114.8 (Power for Full Load) and 55 (Power Allowance) kWh/year. These approximations may be found by using established power calculation and specification about the intended operating environment (e.g., average time of day, data center PUE, etc.).

Power and Performance for Benchmark#1

	Minimum	Typical	Maximum
Benchmark Used and Type of Workload		Std @ 0.1 Hz / 4.2	
Avg. Power Measured During Benchmark Run	114.6	114.8	185.8
Benchmark Performance Score	51	51	80
Power Performance Ratio (performance/power)	0.45	0.44	0.43
Link to Full Benchmark Report (if available)			

Section 1: System Characteristics

- Form Factor
- Processor Socket, Expansion Slot, HDD, Memory Qty.
- Power Supply Unit (PSU)
 - Make, Model, Output Rating
 - Min/Max Quantity
 - Redundant Config Capability
 - Input Power Range
 - Efficiency & Power Factor
- OS Supported / Installed

Section 2: System Configuration

- Processor, Memory, Internal Storage, I/O Devices
- PSU Qty & Redundant Config
- Mgt Controller or Svc Proc?



Power & Performance Data Sheet



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¹ Power supply information is for single power supplies.
² Available operating systems are shipped configurations from the factory.
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Internal Storage	1 HDD	1 HDDs / 1 DVD	2 HDDs / 1 DVD
IO Devices	2 onboard 1 GB NIC ports	2 onboard 1 GB NIC ports	2 onboard 1 GB NIC ports
Power Supply Number and Redundancy Configuration	1	1	1
Management Controller for Service Processor Installable ³	Yes	Yes	Yes
Other Hardware Features / Accessories			DRACs, eSATA, SAS 6GB

Power Data

Item Category (S and 2S only)	Minimum	Typical	Maximum
ENERGY STAR Idle Power Allowance (1S and 2S only)	55	63	87
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Benchmark Method Used for Full Load Test	Standard 3D Synthetic Work 4.2		
Test Voltage and Frequency for Idle and Full Load Test	115 V/60 Hz		
Range of Total Estimated Energy Usage ¹ (kWh/year)	0.633 to 2.008	0.721 to 2.011	1.211 to 3.255
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¹ Full load power represents the sustained, average power at 100% load of the power workload, and does not necessarily represent the absolute peak power or the highest average sustained power possible for other workloads.

² Estimated kWh/year provides the absolute range of energy use you could expect from continuous operation (24x7x365) and ranges from 100% utilization to 100% utilization operation. The calculation also includes typical data center overhead at a rate of 1.1x of power for every 1 watt of load (corresponding to a PUE of 2.0). Other approximations may be found by using established power calculators and specific information about the intended operating environment (e.g., average time of day, data center PUE, etc.).

Power and Performance for Benchmark#1

	Minimum	Typical	Maximum
Benchmark Used and Type of Workload	Standard 3D Synthetic Work 4.2		
Avg. Power Measured During Benchmark Run	114.6	114.3	185.8
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Power Performance Ratio (performance/power)	0.45	0.44	0.43
Link to Full Benchmark Report (if available)			

Section 3: Power Data

- ENERGY STAR Power Allowance
- Measured Power (Watts)
- Test Voltage / Frequency
- Estimated Energy Usage (kWh/year)
- Link to Detailed Power Calculator

Section 4: Benchmark Results

- Workload & Performance Data
- Link to Full Benchmark Report (Where Available)



Power & Performance Data Sheet



ENERGY STAR Power and Performance Data Sheet
Dell PowerEdge R210 Featuring the Dell Energy Smart N200E Power Supply
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Power Saving Features	Enabled on Shipment	End-User Enabling Required
Processor Dynamic Voltage and Frequency Scaling	Yes	No
Processor Core Reduced Power State	Yes	No
Power Capping	Yes	Yes
Variable Speed Fan Control Based on Power or Thermal Readings	Yes	No

Power and Temperature Measurement and Reporting

Input Power Available & Accuracy?	No
Input Air Temp Available & Accuracy?	No
Processor Utilization Available?	Yes
Other Data Measurements Available & Accuracy?	NA
Compatible Protocol for Data Collection	NA
Averaging Method and Time Period	NA

Thermal Information¹

	Minimum	Typical	Maximum
Total Power Dissipation (watts)	116 W	143 W	195 W
Delta Temperature at Exhaust at 35C Peak Temp. (°C)	10.8 (19.9 at nominal temp)	9.8 (19.4 at nominal temp)	9.4 (18.9 at nominal temp)
Airflow at Maximum Fan Speed (CFM) at 35C Peak Temp.	22.3	18.2	19.6
Airflow at Nominal Fan Speed (CFM) at 25C Nominal Temp.	17	17	17

¹ ASHRAE Certified Environmental Chamber Test August 1, 2009. Thermal Guidelines for Data Processing Environments, ASHRAE, 2009, ISBN 1-907-3024-9-0. Peak temperature is defined as 35 °C. Nominal temperature is defined as 25 °C.

Section 5: Power Saving Features

• Enabled on Shipment? User Enable Required?

Section 6: Power & Temperature Measurement / Reporting

- Input Power & Air Temp
- Compatible Data Collection Protocols
- Averaging Method

Section 7: Thermal Information

- Total Power Dissipation (watts)
- Delta Temp at Exhaust at 35C Peak Temp. (°C)
- Airflow at Maximum & Nominal Fan Speed (CFM)

Next Steps



- *Data collection results due to EPA 2/12/10*
- *Draft 1 specification to be distributed for review & comment in the next couple of weeks. Expect a 6-week comment period.*
- *Data analysis working groups to be scheduled for March & April 2010.*

Acknowledgments



*Thanks to The Green Grid for hosting today's
Servers & Storage events*



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