



ENERGY STAR[®]

Uninterruptible Power Supply

(UPS)

Version 1.0

Kickoff Meeting

24 March 2010

Welcome and Introductions



US EPA

- Kathleen Vokes
- Andrew Fanara

ICF International

- Sarah Medepalli
- Stephen Pantano
- Sara Mattern

Agenda



Introductions	5 min.
ENERGY STAR Overview	15 min.
UPS Market Assessment	10 min.
Scope	15 min.
Definitions and Concepts	20 min.
Testing Approach	20 min.
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Question and Answer	30 min.

ENERGY STAR Overview



- What is ENERGY STAR?



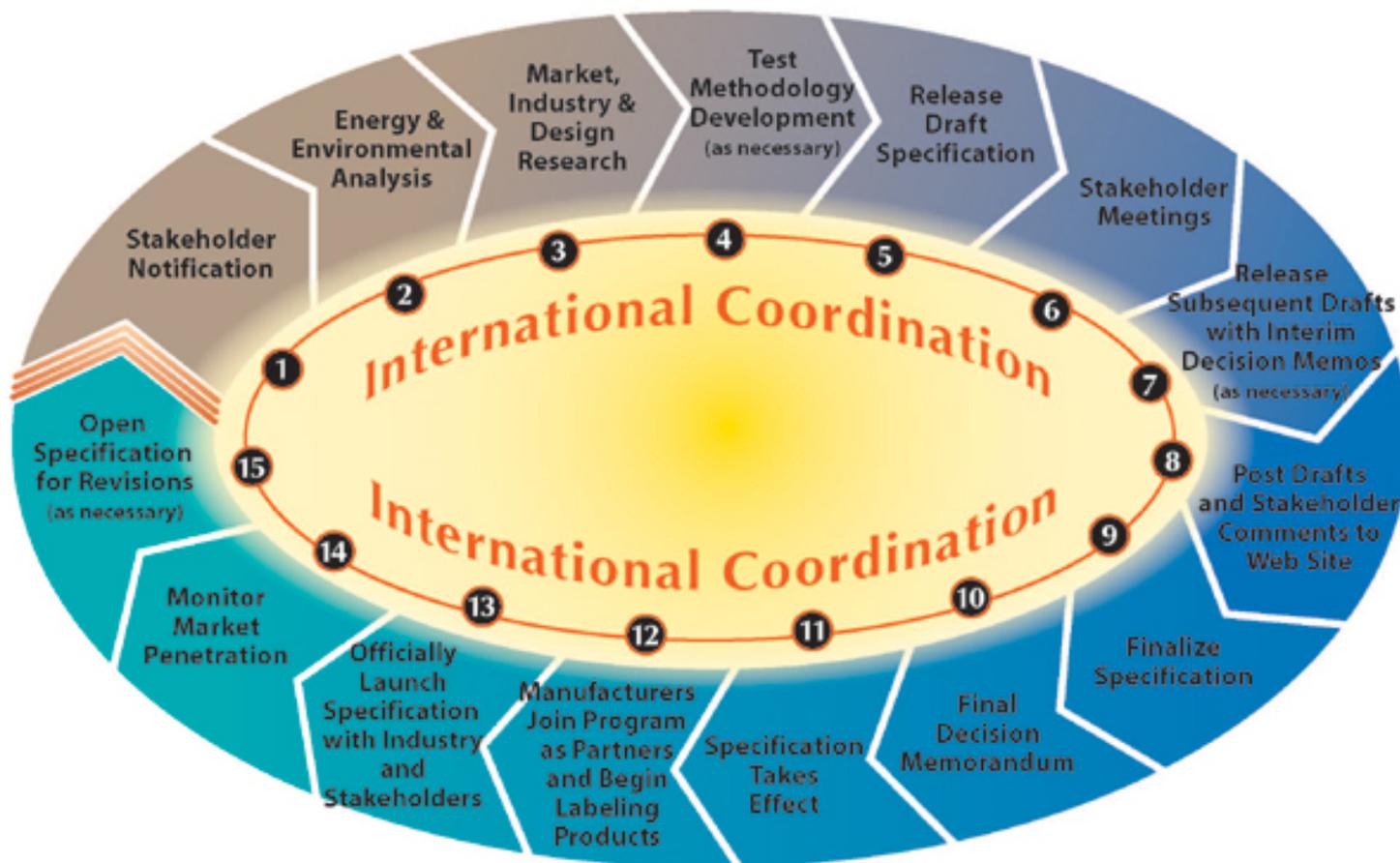
- A voluntary public-private partnership program
- A strategic approach to energy management
- Recognized by over 75% of Americans
- An internationally recognized brand



ENERGY STAR Overview



Specification Development Cycle



ENERGY STAR Overview



- The UPS specification will go into effect immediately when final specification is published.
- As part of ongoing ENERGY STAR program enhancements, EPA is developing enhanced testing requirements for all ENERGY STAR products.

ENERGY STAR Overview



- Guiding Principles of Specification Development
 - Cost-effective efficiency
 - Performance maintained or enhanced
 - Significant energy savings potential
 - Efficiency improvements are achievable with non-proprietary technology
 - Product differentiation and testing are feasible
 - Labeling can be effective in the market

UPS Alignment with ENERGY STAR



- ENERGY STAR for UPS ties well with other facets of the program:
 - **Data center buildings program** (will require metering for PUE measurement at the UPS)
 - **Data center product initiatives** (servers, storage)
 - **Power supply programs** (external/internal PSU requirements across the program)

Coordination with EU



- EPA will collaborate with the European Commission on ENERGY STAR for UPS under the existing agreements on office equipment products
- EU Code of Conduct is currently under revision

UPS Market Assessment

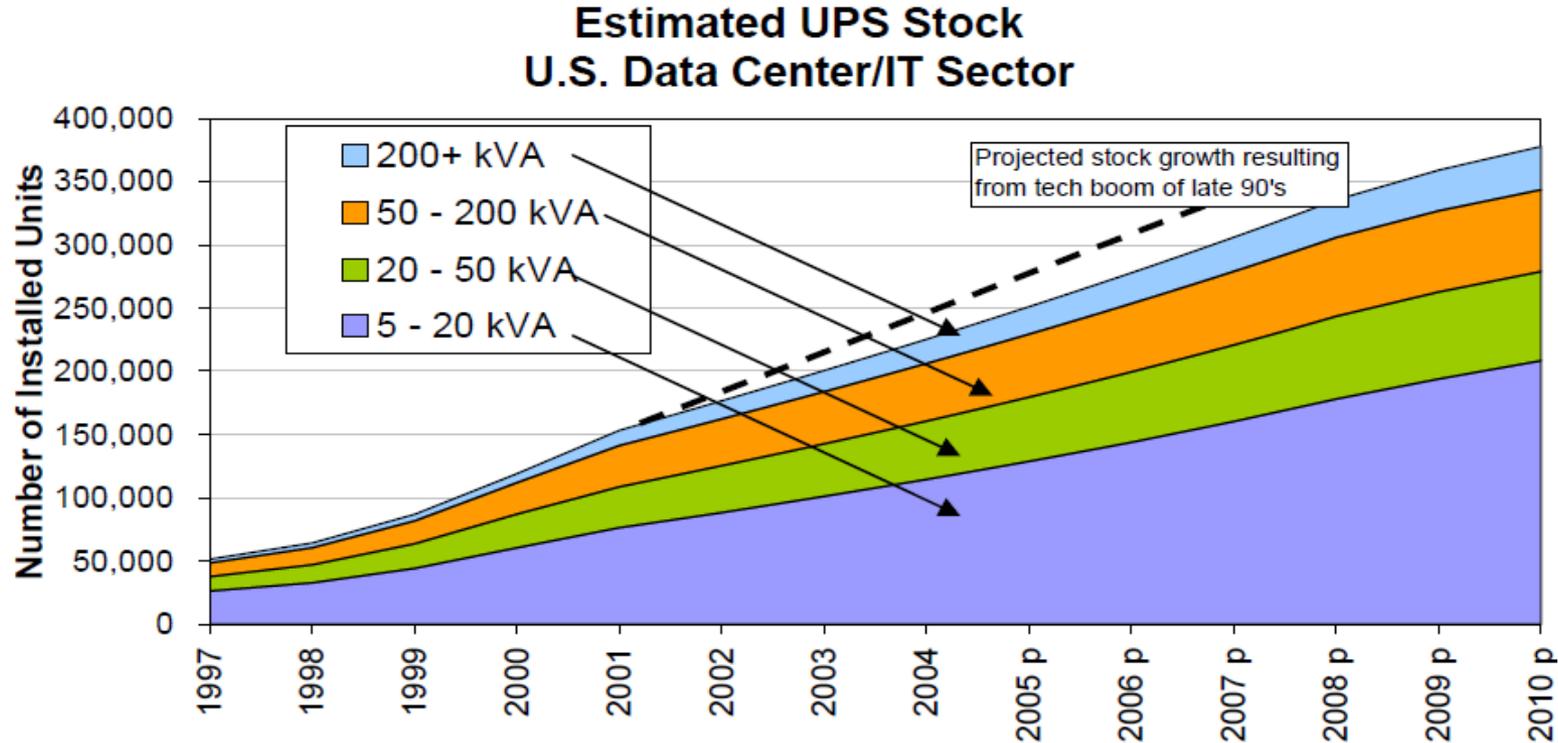


- According to a 2009 Frost & Sullivan report, the UPS market is driven by:
 - Data centers and IT markets, for the constant need for backup power
 - Growing concerns for lack of power quality and reliability with an increased number of end users on the power grids
 - Growing interest in “green” energy storage technologies

UPS Market Assessment



- Steady market demand is projected for UPS devices in the data center/IT market



UPS Market Assessment



- According to the 2005 EPRI (Electric Power Research Institute) report on data center UPS:
 - a voluntary UPS efficiency program would save about 710 million kWh/year in the US
 - a mandatory program would save about 2.8 trillion kWh/year in the US
 - approximately 75% of savings are from the 5-20 kVA market
- ROI for an efficient UPS was estimated at 2 to 3 years

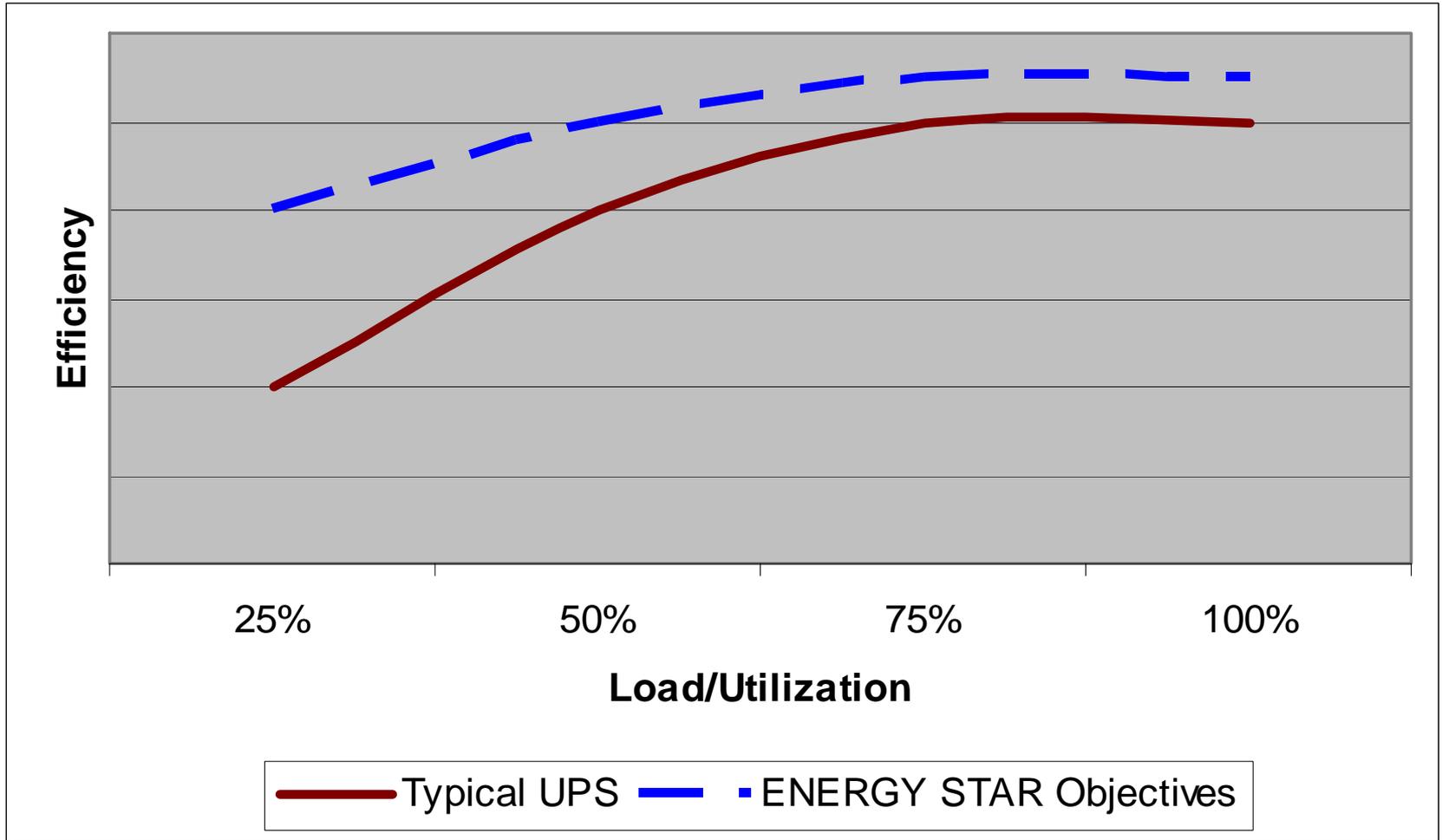
ENERGY STAR Assessment



Approximate UPS shipments for North America (NA) based on 2009 Frost and Sullivan report

UPS Segment (kVA)	2008	2009 Estimated	2010 Estimated
< 20	9.4 mil	8.0 mil	8.0 mil
20 - 200	20 thou	20 thou	20 thou
> 200	10 thou	10 thou	10 thou

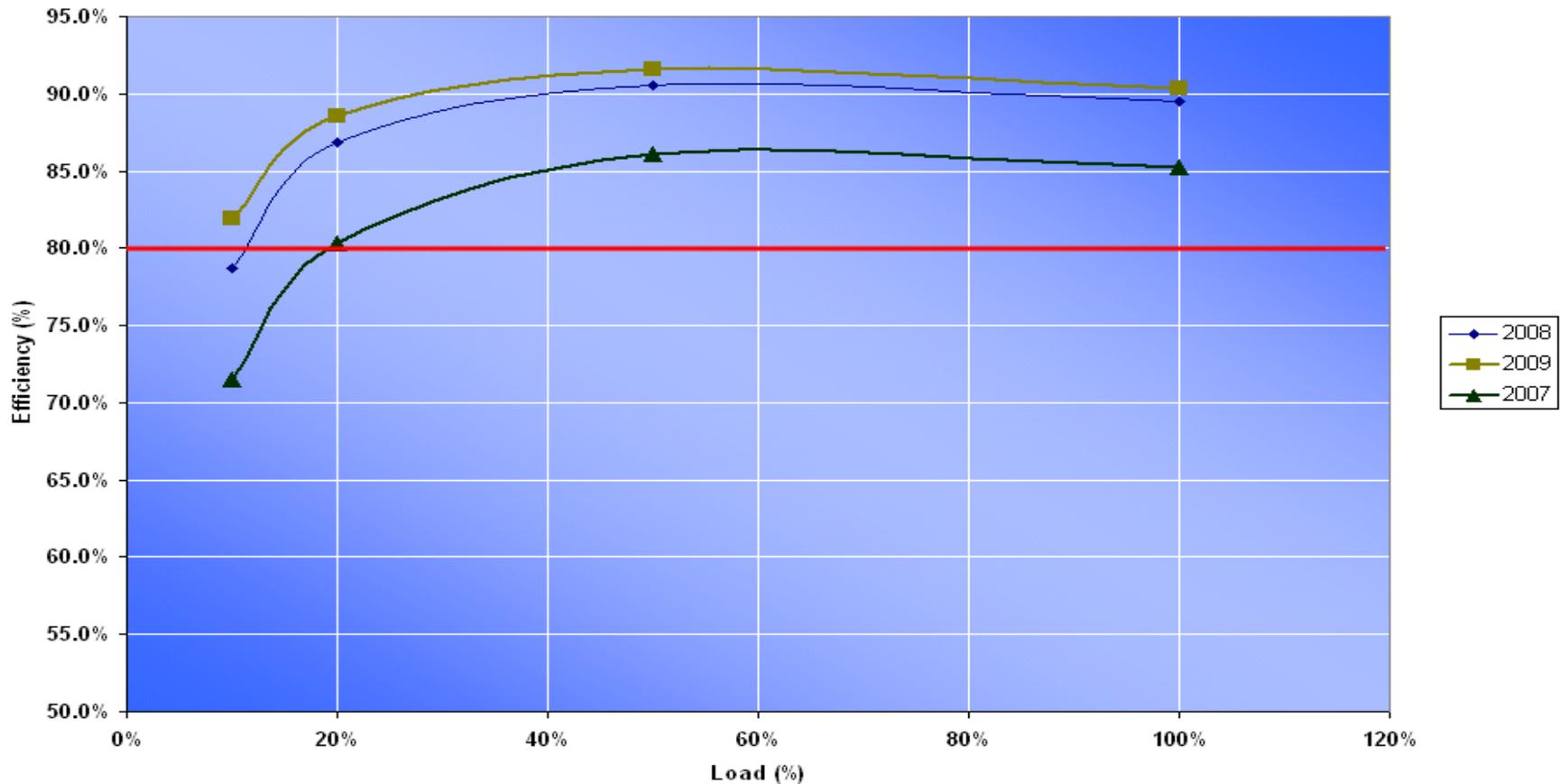
UPS Efficiency vs. Utilization



Example: Server PSU Efficiency



230V Server Power Supplies - Efficiency Vs. Load



ENERGY STAR Goals for UPS



- Provide purchasers with the means to identify the most energy efficient UPS solutions for their specific end-use application
- Establish uniform testing conditions and reporting criteria to ensure fair and reliable product comparisons
- For data centers, provide tools and information to designers and managers looking to improve the efficiency of the data center operations

Scope



- UPS devices used in data center, small office / home office, and home entertainment applications
- The ultimate goal is to develop one test procedure and one set of requirements to cover all eligible UPS products
- If unique requirements are necessary, EPA will develop a hardware-based categorization scheme, to avoid ambiguities. Options for categorization include:
 - Rated output power (kVA)
 - Input power (3-phase vs. Single-phase)

Products Under Consideration



	Rotary UPS	DC UPS
Scope	Included	Not Included
Application	Data Center/Facility Loads, >200kVA	Telecom, Data Centers
Market	Small (<1000* Units Shipped Worldwide in 2008)	Small (No Market Data)
Advantages	Low Total Cost of Ownership (TCO), Low Maintenance	High Efficiency (No DC to AC Conversion)

Definitions



- EPA prefers to adopt existing definitions that are generally accepted by industry
- If accepted definitions are not available or appropriate, EPA will work with stakeholders to develop new definitions

Definitions: System Topology



- **Passive Standby:** A UPS device that exists solely to protect the load from power disruptions. The load is primarily powered by utility power without interaction from the UPS.
- **Line-interactive:** A UPS device that maintains continuity of load power through the use of an inverter or a power interface, while conditioning primary power at the input supply frequency.
- **Double Conversion:** A UPS device that continuously supplies total load power by regulating utility electricity before it reaches the load.

Definitions: Operating States



- **Normal State:** The operating state in which the load is continuously supplied by the utility and the UPS device is ready and available to provide backup power in the event of a utility power disruption.
- **Stored-energy State:** The operating state in which the electric load is actively being supplied by the UPS due to a utility power disruption.
- **Bypass State:** The operating state in which the UPS is available to be disconnected without disruption to the load.

Testing Approach



- Test procedure should be simple, repeatable, verifiable, and representative of actual use
- Adopt or refine existing test procedures to evaluate efficiency and power factor
- Efficient operation at part-load conditions is important, because efficiencies typically decrease dramatically at low loads
- EPA believes that performance in Normal State is most representative of typical UPS implementation and should be the focal point for testing

Test Procedures



- Two candidates under consideration:
 - [IEC 62040-3 \(1999\)](#): Uninterruptible Power Systems (UPS) – Method of specifying performance and test requirements
 - [CSA C813.1.01 \(2001\)](#): Performance Test Method for Uninterruptible Power Supplies
- Applicable to all major UPS topologies
- Methods for calculating electrical efficiency (output power / input power) and total harmonic distortion (THD)
- Standard data reporting formats

Test Procedures



	IEC-62040	CSA-C318
Scope	Excludes Rotary UPS	Does Not Exclude Rotary UPS
Operating Modes	Normal and Stored-energy Mode	Normal Mode
Loads	Full-load and No-load (0%, 100%)	Full-load and Partial Loads (0%, 25%, 50%, 75%, 100%)
Metrics	Includes Power Factor	Does Not Include Power Factor

Sizing and Provisioning



- Data center UPS are often provisioned for future capacity needs. This reduces initial utilization (and efficiency)
- Explore how ENERGY STAR can help purchasers understand UPS provisioning impacts on efficiency
 - Consider modular (scalable) solutions
 - Provide clear and comparable data over a load curve, with a focus on low loads

Value Added Reseller Considerations



- ENERGY STAR typically requires the manufacturing Partner to test/qualify a product, and to be responsible for meeting ENERGY STAR commitments. VARs who make changes to products may assume this responsibility.
- Unlike Servers or Storage, EPA believes that VARs play only a limited role in UPS sales channels.
- Do typical VAR software or hardware changes impact the energy efficiency of the UPS?

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
ESD 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(s) (watts)	250
Minimum and Maximum # of Power Supplies	1
Input Power Range (AC or DC)	100-240VAC
Power Supply Efficiency at Specified Loadings ¹	74.15% @ 10%, 82.6% @ 20%, 86.0% @ 50%, 88.8% @ 100%
Power Supply Power Factor at Specified Loadings ¹	0.96 @ 10%, 0.96 @ 20%, 0.96 @ 50%, 0.96 @ 100%
Operating Systems Supported ²	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

¹ Power supply information is for a single power supply only.
² Available operating systems are supported configurations from the factory.
³ Minimum supported 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
IO Devices	2 onboard 1 GB NIC ports	2 onboard 1 GB NIC ports	2 onboard 1 GB NIC ports
Power Supply Member and Redundancy Configuration	1	1	1
Management Controller for Service Processor (if tabled)	Yes	Yes	Yes
Other Hardware Features / Accessories			DRAC6 e11, iDR6, SAS 6LR

Power Data

	Minimum	Typical	Maximum
Link Category (1S and 2S only)	Category D: Managed Data Center Data Center Processor (DP) Servers		
ENERGY STAR Idle Power Allowance (1S and 2S only)	55	63	87
Measured Idle Power (watts)	36.1	41.5	69.1
Power at Full Load (watts)	114.6	114.3	185.8
Benchmark / Method Used for Full Load Test	Standard System Use 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	0.727 to 2.011	1.211 to 3.255
Link to Detailed Power Calculator (if available)	www.Dell.com/CA/PC		

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 Calculated kWh/year gives the absolute range of energy use you could expect from continuous operation (24x7x365) and represents 100% utilization to 100% utilization operation. The calculation also includes typical data center overhead at a rate of 1.1x of the total energy 1.1x of 115V/60Hz according to a PUE of 2.0. Other approximations may be found by using established power calculation 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 System Use 4.2		
Avg. Power Measured During Benchmark Run	114.6	114.3	185.8
Benchmark Performance Score	51	51	80
Power Performance Ratio (score/avg. power)	0.45	0.44	0.43
Link to Full Benchmark Report (if available)			

- Section 1: System Characteristics
- Section 2: System Configuration
- Section 3: Power Data
- Section 4: Benchmark Results
- Section 5: Power Saving Features
- Section 6: Power & Temperature Measurement / Reporting
- Section 7: Thermal Information

Timeline: Upcoming Milestones

- April 2
 - Comments due on UPS Framework
- April
 - Draft test procedure distributed for review
- May
 - Comments due on draft test procedure
- May-July
 - Data collection



Question and Answer

Thank You



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Visit the ENERGY STAR UPS Web page at
www.energystar.gov/NewSpecs