



ENERGY STAR Program Requirements for Uninterruptible Power Supplies (UPSs)

Certification Body Training

May 31, 2012

U.S. Environmental Protection Agency
U.S. Department of Energy

Webinar Details



- Webinar and application materials will be posted to www.energystar.gov/CBresources
- Audio provided via conference call in:

Call in: 1-866-299-3188

Code: 202-343-9923

- Phone lines will remain open during discussion
- Please keep phone lines on mute unless speaking
- Refer to the agenda for approximate discussion timing

Agenda



- 1** Introduction
- 2** Evaluating UPSs for Certification
- 3** Reporting Requirements and Data Submission
- 4** Test Method Q & A
- 5** Next Steps and Questions

Introduction



- 1 Introduction
- 2 Evaluating UPSs for Certification
- 3 Reporting Requirements and Data Submission
- 4 Test Method Q & A
- 5 Next Steps and Questions

Webinar Objectives



1. Prepare certification body staff to evaluate UPS products for ENERGY STAR certification
2. Describe reporting requirements and data submission processes
3. Address any test method questions

Certification Timeline



Today:
Training Webinar

June:
EPA announces
recognized CBs

August 1, 2012:
EPA posts QPL

CBs submit
applications to
EPA

CBs certify products and
submit data via QPX

Early May 2012:
Specification Published

Application Process



- After this webinar, EPA will begin accepting applications for recognition
- Please send a signed application and evidence that you have contacted your accreditation body requesting a scope expansion for the UPS program to certification@energystar.gov:
- A successful QPX test submission using the UPS web service will also be a pre-requisite for recognition.
- Submission deadline for those CBs that want to be among the first batch recognized will be June 15. EPA will continue to accept applications at any time, but cannot guarantee prompt recognition for those that apply after June 15.

Submission Deadline

June 15, 2012

Evaluating UPSs for Certification



- 1 Introduction
- 2 Evaluating UPSs for Certification**
- 3 Reporting Requirements and Data Submission
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- 5 Next Steps and Questions

Key Questions for Evaluation



1. Is the model's intended application within **Scope**?
2. Is the model **Ac- or Dc-output**?
3. Is the model in a **Product Family**?
4. If Ac-output UPS, is the model a **Multiple-normal-mode UPS**?
5. Does the model have a **meter**?

1. Scope: Included Products

- Included products by application:

Consumer	Commercial	Data Center	Telecommunications
Desktop computers and related peripherals, and/or home entertainment devices: <i>TVs, set-top boxes, DVRs, Blu-Ray, DVD players</i>	Small business/branch office information & communication technology equipment: <i>servers, network switches & routers, small storage arrays</i>	Large installations of information & communication technology equipment: <i>enterprise servers, networking equipment, and large storage arrays</i>	Telecommunication network systems located within a central office or at a remote wireless/cellular site



Increasing Output Power 



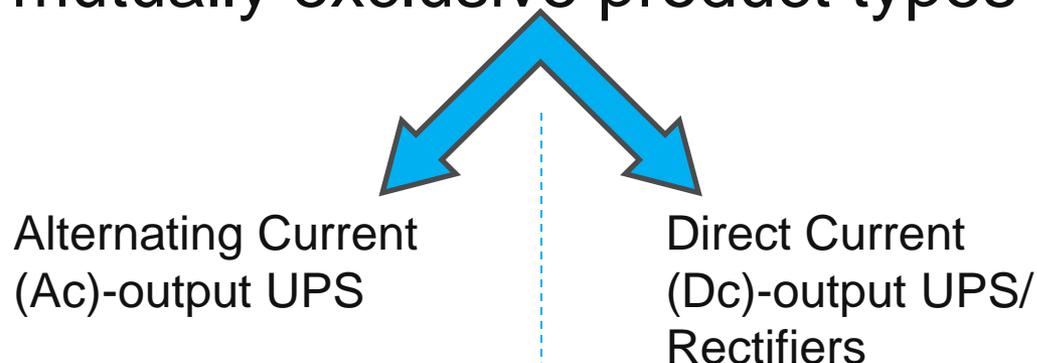
1. Scope: Excluded Products

- Products internal to a computer or another end-use load
- Industrial UPSs
- Electric Utility UPSs
- Cable TV (CATV) UPSs
- UPSs designed to comply with specific UL safety standards for safety-related applications
- UPSs designed for mobile, shipboard, marine or airborne applications



2. Ac- vs. Dc-output UPS

- Two mutually exclusive product types



- Two different data submission templates
- Important differences:
 - efficiency criteria,
 - referenced standards,
 - reported product characteristics, and
 - Modular UPS approach

2. Ac- vs. Dc-output UPS

Typically Ac-output

Typically Dc-output/Rectifiers

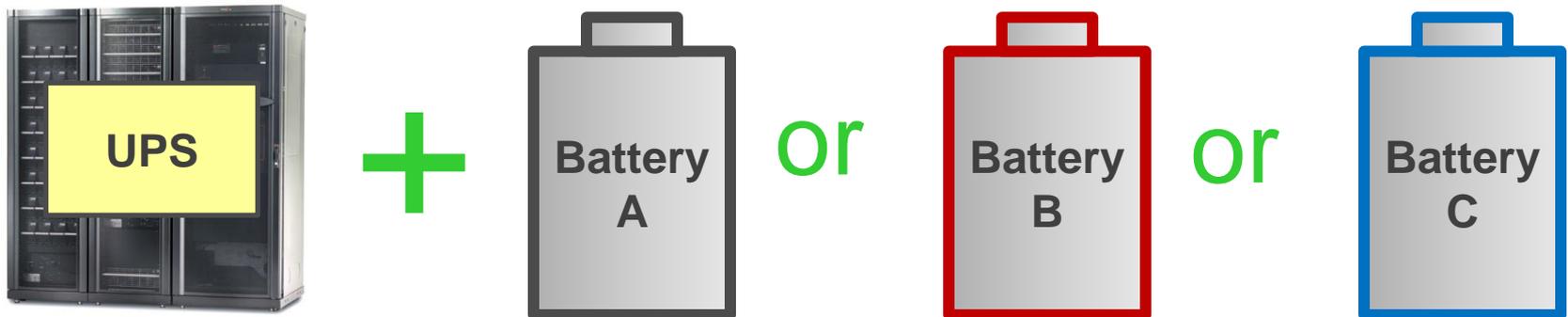
Consumer	Commercial	Data Center
Desktop computers and related peripherals, and/or home entertainment devices: <i>TVs, set-top boxes, DVRs, Blu-Ray, DVD players</i>	Small business/branch office information & communication technology equipment: <i>servers, network switches & routers, small storage arrays</i>	Large installations of information & communication technology equipment: <i>enterprise servers, networking equipment, and large storage arrays</i>

Telecommunications
Telecommunication network systems located within a central office or at a remote wireless/cellular site

3. Product Families and Representative Models



- For certification of **Product Families**, the **highest energy** using configuration within the Product Family shall be considered the Representative Model
 - **Exception:** internal and external energy storage system variations (i.e., no need to look at battery maintenance current when selecting highest energy using configuration)

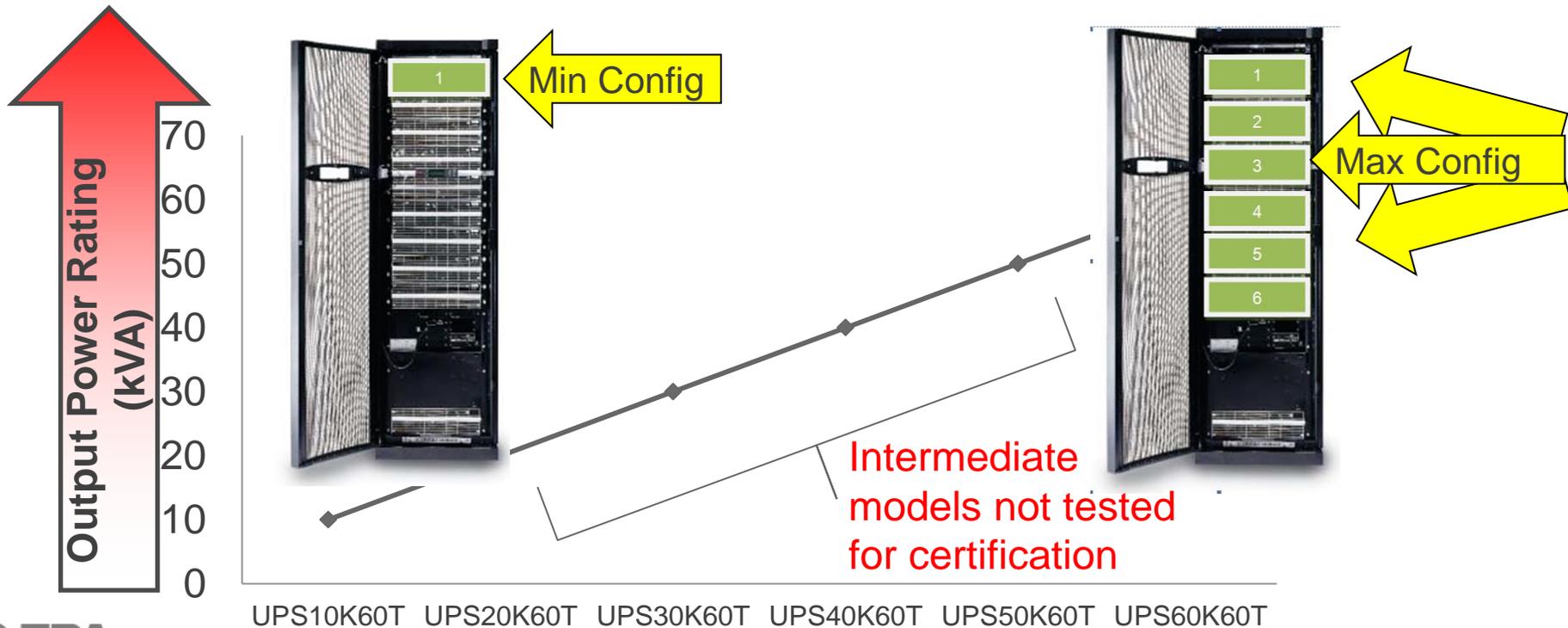


All models within the product family are expected to meet qualification criteria and may be subject to verification testing

3. Product Families and Representative Models



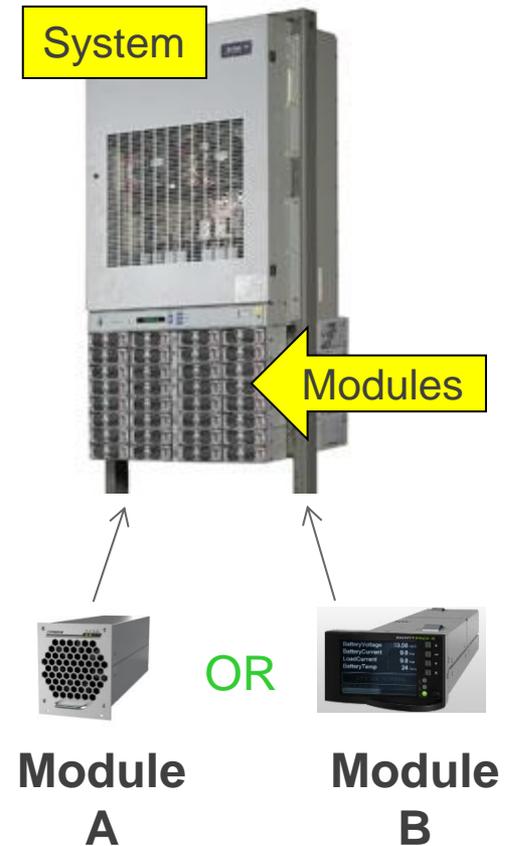
- For certification of a **Modular UPS Product Family**, manufacturers shall select the **minimum** and **maximum** configurations to serve as Representative Models for testing



3. Product Families: Dc-output UPS Systems and Modules



- Manufacturers can qualify **Dc-output UPS systems and/or individual modules:**
 - Full modular systems shall be qualified as Modular UPS Products using a single model of installed module
 - Individual modules may be qualified on their own
 - Creating a full system out of qualified modules does not mean the system is qualified
 - The full system itself must be tested



Product Family Example 1



- **Model A:**
Active Power Rating: 500 W
Battery Runtime: 8 min
- **Model B:**
Active Power Rating: 500 W
Battery Runtime: 20 min
- **Model C:**
Active Power Rating: 500 W
Battery Runtime: 30 min
- **Model D:**
Active Power Rating: 500 W
Battery Runtime: 40 min

From the definition of Product Family:

For UPSs, acceptable variations within a product family include:

- 1) Number of installed modules;
- 2) Redundancy;
- 3) Type and quantity of input and output filters;
- 4) Number of rectifier pulses^o;
- 5) Energy storage system capacity.

Any model may be tested as the Representative Model provided other differences do not impact energy use

Product Family Example 2



Intermediate configurations

- **Model A:**
Active Power Rating: 1000 W
- **Model B:**
Active Power Rating: 2000 W
- **Model C:**
Active Power Rating: 3000 W
- **Model D:**
Active Power Rating: 4000 W

From the definition of Product Family:

For UPSs, acceptable variations within a product family include:

- 1) Number of installed modules;
- 2) Redundancy;
- 3) Type and quantity of input and output filters;
- 4) Number of rectifier pulses⁶;
- 5) Energy storage system capacity.

Model A & Model D must be tested and evaluated against the eligibility criteria. Modular UPS models may also vary in the other characteristics identified above.

Product Family Example 3



- **Model/Configuration A:**
Dc-output UPS system with one Model C rectifier module installed, **500 W**
- **Model/Configuration B:**
Dc-output UPS system with four Model C rectifier modules installed, **2000 W**
- **Model C:** Rectifier module, 500 W

Model A & Model B must be tested and evaluated against the eligibility criteria for Dc-output UPSs. The Dc-output UPS system is only certified for operation with rectifier Model C.

A manufacturer may also choose to qualify and report the efficiency of the Model C rectifier module separate from the qualification of any associated systems. In this case, the CB submits separate data entries for the system and rectifier to EPA.

Review:

Key Questions for Evaluation



1. Is the model's intended application within **Scope**? ✓
2. Is the model **Ac- or Dc-output**? ✓
3. Is the model in a **Product Family**? ✓
4. If Ac-output UPS, is the model a **Multiple-normal-mode UPS**?
5. Does the model have a **meter**?

4. Normal Mode Definition

Applies to both Ac-output and Dc-output UPS

- 1) Normal Mode: Stable mode of operation that the UPS attains under the following conditions:
 - a) Ac input supply is within required tolerances and supplies the UPS.
 - b) The energy storage system remains charged or is under recharge.
 - c) The load is within the specified rating of the UPS.
 - d) The Bypass is available and within specified tolerances (if applicable).

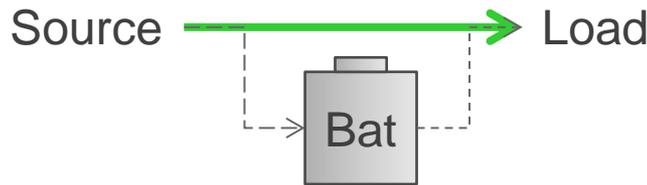
Bypass and Stored Energy Modes ARE NOT tested or evaluated in the specification.

4. Multiple-normal-mode UPS

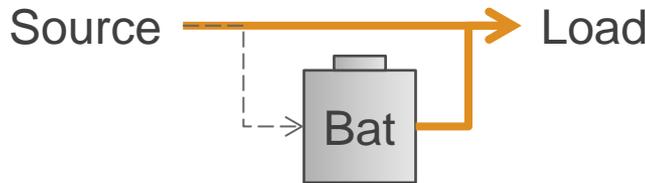


Some Ac-output UPSs can have multiple normal modes:

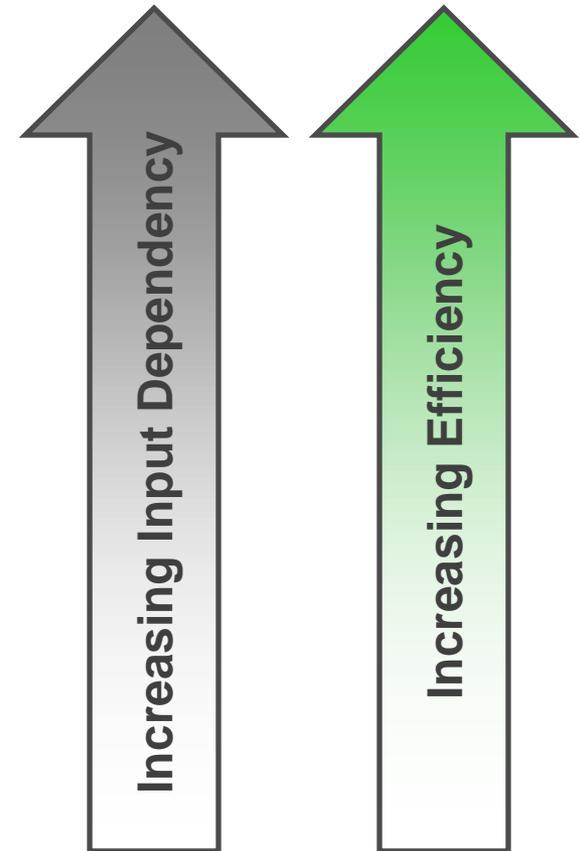
- Voltage and Frequency Dependent (VFD)



- Voltage Independent (VI)



- Voltage and Frequency Independent (VFI)



5. Metering Ability



- If UPS has output power $> 10,000$ W
 - *and* –
 - If UPS has **a meter**
- 1% Efficiency Incentive
- For purposes of third-party certification, meter requirements ***shall not be reviewed*** when products are initially qualified or during subsequent verification
 - **Instead, manufacturers shall maintain documentation on file that products meet these requirements**
 - **EPA reserves the right to request this documentation at any time**

5. Metering Ability

Manufacturer responsible for verifying the following meter characteristics:

<ul style="list-style-type: none"> Shipped with UPS model at point of sale 		
<ul style="list-style-type: none"> Measures UPS output energy in kWh in each tested Normal Mode 		
<ul style="list-style-type: none"> Communicates measurement results over a network using one of the following protocols: <i>Modbus RTU, Modbus TCP, or SNMP (v1, 2, or 3)</i> 		
<ul style="list-style-type: none"> If external to UPS, meets Section 3.6.2 requirements. <ol style="list-style-type: none"> meets industry standard; meter error $\leq 2\%$; <i>or</i> system error $\leq 5\%$ 	OR	<ul style="list-style-type: none"> If integral to UPS, meets Section 3.6.3 requirements. <ul style="list-style-type: none"> - <i>only</i> system error $\leq 5\%$



Eligible for 1% Efficiency Incentive

Review:

Key Questions for Evaluation



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Model now ready for evaluation against efficiency requirements

Ac-output UPS

Avg Efficiency Calculation



- A weighting is applied to each tested loading point (n% of the Reference Test Load) based on rated **output power** and **input dependency**

$$Eff_{AVG} = t_{25\%} \times Eff|_{25\%} + t_{50\%} \times Eff|_{50\%} + t_{75\%} \times Eff|_{75\%} + t_{100\%} \times Eff|_{100\%}$$

Rated Output Power, P, in watts (W)	Input Dependency Characteristic	Proportion of Time Spent at Specified Proportion of Reference Test Load, t _{n%}			
		25%	50%	75%	100%
P ≤ 1500 W	VFD	0.2	0.2	0.3	0.3
	VI or VFI	0	0.3	0.4	0.3
1500 W < P ≤ 10,000 W	VFD, VI, or VFI	0	0.3	0.4	0.3
P > 10,000 W	VFD, VI, or VFI	0.25	0.5	0.25	0

Multiple-normal-mode UPS Avg Efficiency Calculation



- Tested and reported data in both modes regardless of default operation:
 - **Eff₁**: Lowest Input Dependency Normal Mode Avg. Efficiency
 - **Eff₂**: Highest Input Dependency Normal Mode Avg. Efficiency

	Does Not Ship with Highest Input Dependency Enabled by Default	Ships with Highest Input Dependency Enabled by Default
Eff₁	Efficiency results compared against lowest input dependency requirements in Table 2 or 3	} Eff₁ and Eff₂ averaged according to Equation 2 and results compared against lowest input dependency required in Table 2 or 3
Eff₂	Tested and reported but not used for qualification	

Equation 2: $Eff_{Avg} = 0.75 \times Eff_1 + 0.25 \times Eff_2$

Dc-Output UPSs/Rectifiers Average Efficiency Calculation



- Efficiency is measured at six loading points from 30% to 80%
- Each loading point measurement is weighted equally

Equation 3: Calculation of Average Efficiency for All Dc-output UPSs

$$Eff_{AVG} = \frac{Eff|_{30\%} + Eff|_{40\%} + Eff|_{50\%} + Eff|_{60\%} + Eff|_{70\%} + Eff|_{80\%}}{6}$$

Minimum Avg Eff Requirements



- Representative Model(s) must meet the minimum average efficiency requirements as specified in the appropriate table:

	Does Not Meet Meter Requirements	Meets Meter Requirements
Ac-output UPS	Table 2	Table 3
Dc-output UPS	Table 4	Table 5

← Based on output power and input dependency

← Uniform requirement independent of output power

Power Factor Requirement



- *Applies only to Ac-output UPS*
- Measured at 100% of the Reference Test Load
- Required for all **VFI and VI Normal Modes** tested for qualification. *VFD Normal modes are excluded.*

Table 6: UPS Minimum Input Power Factor Requirement for Ac-output UPSs

Minimum Power Factor Requirement
0.90

Review: Ac-output UPS



Test Configurations

Output Power/ Configuration	Input Dependency Characteristic	Report Data From this Test Configuration?
Minimum	Lowest	Reported for ALL MODELS
Minimum	Highest	Reported for all Multiple-normal-mode UPSs.
Maximum	Lowest	Reported for all Modular UPSs
Maximum	Highest	Reported for all Modular Multiple-normal-mode UPSs

Review: Ac-output UPS (cont.)



- Traditional

	Output Power		
Input Dependency		Min	Max
	Highest		
	Lowest	X	

- Modular

	Output Power		
Input Dependency		Min	Max
	Highest		
	Lowest	X	X

- Multiple-Normal Mode

	Output Power		
Input Dependency		Min	Max
	Highest	X	
	Lowest	X	

- Modular Multiple-Normal Mode

	Output Power		
Input Dependency		Min	Max
	Highest	X	X
	Lowest	X	X

Review: Dc-output UPS



- Dc-output UPSs have only **one Normal Mode**
- Modular Dc-output UPSs shall be tested in the minimum and maximum configuration
 - Certified to operate only with the tested rectifier module model
- Rectifier modules can be treated as a separate model/certification
 - Tested, certified, and reported **separately** regardless of system certification

Questions



- The line is now open to receive any questions related to evaluating UPSs for certification.

Reporting Requirements and Data Submission



- 1 Introduction
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Using the QPX



A few notes:

- Each Product Family should have at least one data submission
 - For Modular UPS, min & max configs are reported in the same data submission
 - There may be some redundancy as there will be a model name/number and min config/number
 - Some fields may also serve double-duty
 - E.g., Min config fields used for non-Modular UPSs:

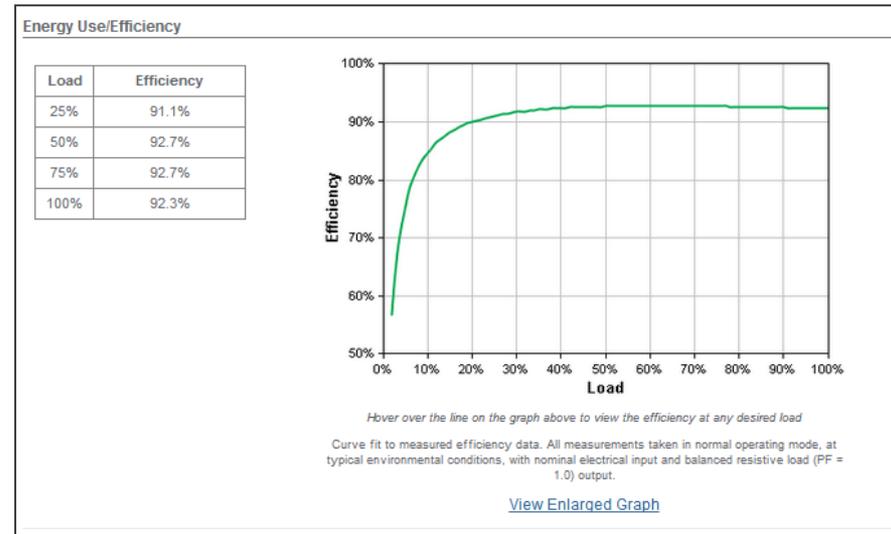
Output Power/ Configuration	Input Dependency	Report Data From this Test Configuration?
Minimum	Lowest	Reported for ALL MODELS

Using the QPX



Continued:

- Separate fields for reported and tested values
 - Allow manufacturers consistency for marketing/other reporting
 - Reported values should be submitted even if they are the same as the calculated values



Reporting Requirements



- Manufacturers are required to report information for the Power and Performance Data Sheet to EPA-recognized certification bodies
- Applies to Data Center Products
- Current ENERGY STAR Program Example: *Computer Servers*

ENERGY STAR® Power and Performance Data Sheet
Dell PowerEdge R210 featuring the 250W 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-SO
Power Supply Output Rating ¹ (watts)	250
Minimum and Maximum # of Power Supplies	1
Input Power Range (AC or DC)	100-240VAC
Power Supply Efficiency at Specified Loadings ²	74.15% @10%, 82.6% @20%, 86.0% @50%, 85.8% @100%
Power Supply Power Factor at Specified Loadings ³	0.96 @10%, 0.98 @20%, 0.99 @50%, 0.99 @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

1. Power supply information is for a single power supply only.
2. Available operating systems as shipped configurations from the factory.
3. Minimum as shipped configuration is installed SD 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		
I/O Devices	2 integrated 1 Gb NICs	2	
Power Supply Number and Redundancy Configuration	1		
Management Controller or Service Processor Installed?	Yes		



Reporting Requirements



A successful QPX test submission using the UPS web service will be a pre-requisite for CB recognition.

CBs shall report the following data to EPA which includes both tested and verified data and manufacturer provided information:

- General Characteristics
- Electrical Characteristics
- ENERGY STAR Efficiency Values
- Metering and Communications
- Energy Storage Device
- Physical Dimensions
- Recycling and Environmental Information

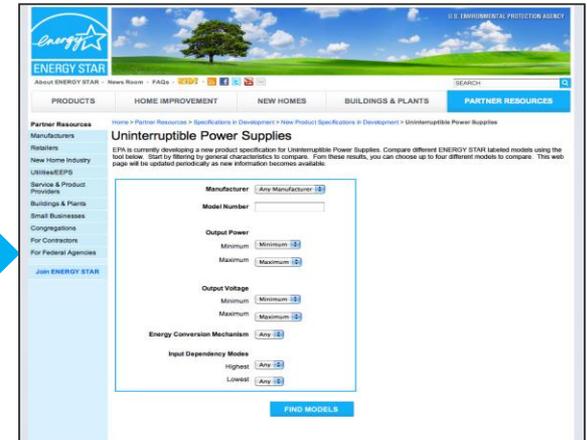
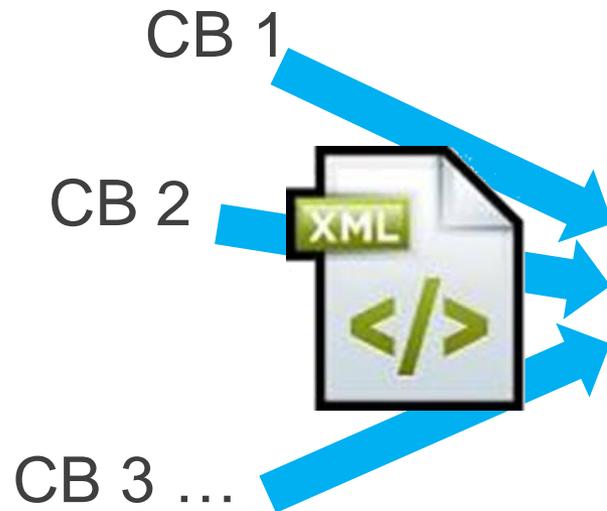
Fields are specified in the data reporting template (QPX)

PPDS Data Submission



Qualified Product Exchange (QPX)
EPA-recognized certification
bodies submit data for PPDS

Power and Performance Data Sheet Widget
Aggregated data for online display



**CBs coordinate with
manufacturers to
obtain necessary data.**

Test Method Q & A



- 1 Introduction
- 2 Evaluating UPSs for Certification
- 3 Reporting Requirements and Data Submission
- 4 **Test Method Q & A**
- 5 Next Steps and Questions

Test Method Q&A



- The line is now open to receive any questions related to the test method.

Next Steps and Questions



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Contact Information



Please send all questions to:

- Certification: certification@energystar.gov
- Technical Assistance: ups@energystar.gov

Eamon Monahan

EPA ENERGY STAR Program

Monahan.Eamon@epa.gov

RJ Meyers

EPA ENERGY STAR Program

Meyers.Robert@epa.gov

References and Resources

- Certification Body Resources (including application form):
www.energystar.gov/CBresources
- ENERGY STAR UPS specification development:
Go to www.energystar.gov/NewSpecs and Click on
“Uninterruptible Power Supplies”