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

| Topic                                    | Duration |
|------------------------------------------|----------|
| 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.  |
| Next Steps                               | 5 min.   |
| 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

1. International Coordination
2. Open Specification for Revisions (as necessary)
3. Energy & Environmental Analysis
4. Stakeholder Notification
5. Test Methodology Development (as necessary)
6. Market, Industry & Design Research
7. Release Draft Specification
8. Subsequent Drafts with Interim Decision Memos (as necessary)
9. Post Drafts and Stakeholder Comments to Web Site
10. Final Decision Memorandum
11. Specification Takes Effect
12. Manufacturers Join Program as Partners and Begin Labeling Products
13. Monitor Market Penetration
14. Officially Launch Specification with Industry and Stakeholders
15. Finalize Specification
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

Source: High Performance Buildings: Data Centers Uninterruptible Power Supplies (UPS), EPRI, 2005 by EPRI and Ecos Consulting
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

Source: High Performance Buildings: Data Centers Uninterruptible Power Supplies (UPS), EPRI and Ecos Consulting, 2005
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

Efficiency

Load/Utilization

25% 50% 75% 100%

Typical UPS  ENERGY STAR Objectives
Example: Server PSU Efficiency

230V Server Power Supplies - Efficiency Vs. Load

Source: Historical Desktop & Server Power Supply Efficiency (2004 – 2009) by EPRI
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) |

*Based on 2009 Frost and Sullivan report*
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

| Scope               | IEC-62040                  | CSA-C318                  |
|---------------------|----------------------------|---------------------------|
| 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?
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

Andrew Fanara, US EPA
Fanara.Andrew@epa.gov // 206.553.6377
Kathleen Vokes, US EPA
Vokes.Kathleen@epa.gov // 202.343.9019
Sarah Medepalli, ICF International
smedepalli@icfi.com // 202.862.1268
Steve Pantano, ICF International
spantano@icfi.com // 202.862.1551

Please address questions and comments to UPS@energystar.gov
Visit the ENERGY STAR UPS Web page at www.energystar.gov/NewSpecs