UPS Webinar: Draft Test Procedure Review
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Outline

1. Introduction
   – Meeting objectives
   – Background

2. UPS Test Procedure Review

3. What’s Next?

4. General Comments

5. Contacts and Resources
Introduction: Meeting Objectives

1. Feedback on draft test procedure
2. Examine specification development timeline
3. Take general comments or concerns relevant to UPS spec development
Introduction: Why ENERGY STAR?

• UPS Energy Savings Potential is High
  – 550 to 710 million kWh/year in the US
  – Majority in small capacity devices
  – But per-unit savings greater in high capacity

• Data center energy demands increasing
  – Double every ~5 years
  – UPS critical for efficiency

• Potential for Cost Savings
  – Approximately 2 – 3 years ROI
  – Varies by product size
Introduction: Why ENERGY STAR (cont’d)

- Pre-existing efficiency trend
  - Customer demand drives efficiency
  - ENERGY STAR can help:

<table>
<thead>
<tr>
<th>Introduce Uniformity</th>
<th>Performance vs. Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>• UPS efficiency testing, reporting</td>
<td>• Help datacenter customers make tradeoffs</td>
</tr>
<tr>
<td>• Aid customers in comparisons</td>
<td>• Possibly develop sizing guidance</td>
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UPS Test Procedure Review
ENERGY STAR UPS Draft Test Method: Overview

• Based on Int’l Electrotechnical Commission (IEC) Standards
• Use to assemble a dataset in support of a future ENERGY STAR specification for UPS
  – Dataset assembly for 8 weeks: from Dec. 2010 to Feb. 2011
  – Test method may be revised before use for qualification

EPA welcomes comment on the test method from both perspectives:
• Making comparisons between models for specification development
• Clearly addressing full range of UPSs for qualification
ENERGY STAR UPS Draft Test
Method: Applicability

• Eligible Products:
  – Single-phase and three-phase UPS for home, office, and datacenter use
  – Static and Rotary UPSs
  – AC-output and DC-output UPSs

• Intended to provide a complete assessment of UPS efficiency during typical use with an IT load
DOE Battery Charger Test Method

- The U.S. Department of Energy (DOE) recently proposed a test method for battery chargers.
  - To evaluate energy savings for battery charging component of consumer UPSs.
  - Measures energy consumption during charging and maintenance (float) modes of charger, with no load connected.
- EPA is proposing to use its draft test method (based on IEC 62040-3) to evaluate UPS energy consumption
  - Takes into account normal mode, loading, etc.

EPA welcomes comments on this proposal.
ENERGY STAR UPS Draft Test Method: Definitions

- Definitions sourced from:
  - Draft IEC 62040-3 Ed. 2.0
  - Stakeholder comments
  - IEC 88528-11
  - Framework Document

- Definitions divided into several sections:
  - Product Types
  - Operational Modes
  - Power
  - Redundancy
  - Topologies
  - Other
Energy Saver Mode (such as “Eco-Mode”)

- Energy Saver modes meet the definition of Normal Mode in IEC 62040-3 Ed. 2.0.
- EPA proposes to compare efficiency in each mode that meets the definition, including Energy Saver modes.

EPA welcomes comments on this proposal.
ENERGY STAR UPS Draft Test Method: Definitions (cont’d)

• UPS Topologies and Types (static versus rotary)
  – Only used to classify UPSs during data analysis.
  – EPA intends to use technology-agnostic approach.

• Topologies not listed are considered subtypes of the listed topologies.
  – E.g., “delta-conversion” considered line-interactive

EPA welcomes comments on this proposal.
ENERGY STAR UPS Draft Test Method: Definitions (cont’d)

• Unit Under Test
  – Includes not only UPS, but also any accessories to meet test voltage conditions.
  – Establishes a common set of output and input characteristics to enable comparisons between models.

EPA welcomes comments on this proposal.
ENERGY STAR UPS Draft Test Method: Test Setup

- EPA proposes to categorize UPSs by number of phases:
  - Consumer/small office
  - Datacenter UPSs
- Alternatively, EPA is also considering using output power (per IEC 62040-3)

EPA welcomes comments on this proposal.
ENERGY STAR UPS Draft Test Method: Test Setup (cont’d)

• Input Power Requirements Single-Phase

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<th>Voltage</th>
<th>Voltage Tolerance</th>
<th>THD</th>
<th>Freq.</th>
<th>Freq. Tolerance</th>
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<td>50Hz/60 Hz</td>
<td>+/- 1.0 %</td>
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</table>

• And Three-Phase products

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<thead>
<tr>
<th>Market</th>
<th>Voltage</th>
<th>Voltage Tolerance</th>
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<th>Freq.</th>
<th>Freq. Tolerance</th>
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<td>50Hz</td>
<td>+/- 1.0 %</td>
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</table>
ENERGY STAR UPS Draft Test Method: Test Setup (cont’d)

• Typical UPS operating voltages
  – European output voltage proposed for three-phase UPS testing to promote more efficient operation.
  – Input or output accessories should be used with UPSs not designed to meet the specified conditions.

  This is in contrast with IEC 62040-3 and some stakeholder comments, which suggest testing at the UPS design input voltage. EPA welcomes comment on the pros and cons of this approach.

• DC-Output UPSs
  – Same input voltage as AC UPSs
  – 380 VDC output
ENERGY STAR UPS Draft Test Method: Efficiency Test

- Proposed Loading Points:
  - Test at 100%, 75%, 50%, 40%, 30%, 20%, 10%, and 0% of the reference test load.

- Differ from IEC 62040-3 and data collected to date (at 100%, 75%, 50%, and 25% of load).

EPA welcomes comment on whether the proposed test conditions allow for an assessment of the practical efficiency range.
• Measurement at 0% intended to limit energy losses due to underutilized UPSs.
  – Maintain chemical batteries with the output inverter turned off, in a “standby” or “hibernate” mode.
  – Also, limit battery maintenance losses.

EPA welcomes comment on the best way to test that batteries are being maintained in this mode. For example:
• Monitoring the status display of the UPS,
• Momentarily connecting the batteries to measure current, or
• Momentarily connecting a test load to mimic the batteries.
• The efficiency test shall be repeated in case of:
  – **Energy Saver Modes**: repeated for each mode that meets definition of Normal Mode.
  – **Parallel EPSs with Scalable Output Power**: repeated at min. and max. configurations.

EPA welcomes comment whether repeating the efficiency tests as described above allows for comparisons:
• Between desired efficiency and reliability, and
• Between performance of parallel and non-parallel units.
ENERGY STAR UPS Draft Test Method: Overload Test

• Measuring Time in Overload
  – Overload handling allows a facility manager to use a UPS closer to 100% load where the efficiency is highest.
  – Proposed overload test based on section 6.4.2.10.1 of IEC 62040-3: Testing of manufacturer’s overload claims.
  – Test at 125%, 150%, 200% of the reference test load and any other conditions desired.

EPA welcomes comment on the benefits of overload testing and performing such tests safely.
Data Input Form

- Data Input Form
- Accompanied Test Method
  - Assemble a dataset in order to evaluate efficiency in the market.
  - Includes both test results and product characteristics.
  - Finalized data input form will be distributed following comment period.

EPA welcomes comment on all aspects of the data input form.
Dataset Parameters

- Proposed Parameters Include:
  - Electrical input and output characteristics
  - Characteristics of energy storage device
  - Energy efficiency
  - Other general characteristics

EPA welcomes comment on striking the right balance between
- Imposing minimal burden, and
- Assembling the data necessary to make effective comparisons and set an energy efficiency specification.
Dataset Parameters (cont’d)

- Stakeholders commented that testing is burdensome, and that some data (tested to initial version of IEC 62040-3) already exists
  - EPA will collaborate with stakeholders to build a large dataset.
  - EPA encourages stakeholders to both:
    - Generate new data in accordance with final Data Input Form (to be released in December).
    - Submit existing data, even if generated under different loading points/conditions (using provided data input form).
Dataset Parameters (cont’d)

- Output conditioning characterized using the metrics in IEC 62040-3:
  - Voltage and frequency dependence (VFI, VI, VFD)
  - Voltage waveform characteristic (sinusoidal: yes/no)
  - Dynamic output performance (similar to of ITI-CBEMA curve).

EPA welcomes comment on whether this characterization sufficiently captures users’ performance concerns.
Data Input: Additional Environmental Considerations

- EPA also seeks to identify efficient UPSs that deliver additional environmental benefits:
  - Battery recycling
  - Longer lifetimes through maintenance/warranties
  - Lower air-conditioning burden

- Some stakeholders have commented that these benefits should not/need not be accounted for in an ENERGY STAR specification.
  - E.g., IEC 62040-4, under development, deals with these issues.

EPA welcomes input on additional environmental considerations and how best to address them.
Real-Time Power Measurement and Reporting

- EPA is interested in real-time reporting for all datacenter products.
  - Stakeholders have commented that parallel efforts are currently under way.
  - E.g., Modbus, SNMP

EPA welcomes input on how it can best:
- Promote an industry-standard real-time reporting protocol, or
- Use the ENERGY STAR specification to standardize divergent protocols.
What’s Next?

- Refine test procedure
- Develop Power Performance Data Sheet (PPDS) and Real-Time Power Measurement and Reporting
- Coordinate education
  - Data center operators, purchasing authorities
  - Encourage adoption of more efficient systems, practices

- Use data to understand UPS market
  - Energy consumption of small, medium, large systems
  - Quantify tradeoffs between reliability and efficiency
  - Performance, hardware characteristics
  - Special features
    - kWh reporting, Eco-Mode, overload, etc.
What’s Next? (cont’d)

• December:
  – Receive feedback on test procedure (12/8/10)
  – Publish final test procedure (12/17/10)
  – Begin dataset development

• February:
  – Finish dataset development (2/4/11)
  – Begin spec draft process

• March – June:
  – Draft revisions
  – Stakeholder input/meetings

• July:
  – Publish final specification (7/15/11)
  – Effective immediately

2011 Dates are Tentative
Open Comment

• EPA would now like to open up the line for any general comments from stakeholders.
References and Resources

- Energy Star UPS specification development
  http://www.energystar.gov/index.cfm?c=new_specs.uninterruptible_power_supplies

- Energy Star Data Center energy efficiency initiatives
  http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency
Thank You!

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