

## **APC by Schneider Electric Comments on the Version 1.0 ENERGY STAR® Uninterruptible Power Supply (UPS) Specification Framework Document**

Thank you for allowing APC by Schneider Electric to provide input into the ENERGY STAR UPS specification development process.

APC by Schneider Electric, a global leader in critical power and cooling services, provides industry leading products, software and systems for home, office, data center and factory floor applications. Through its unparalleled commitment to innovation, APC delivers pioneering, energy efficient solutions for critical technology and industrial applications. In 2007, Schneider Electric acquired APC and combined it with MGE UPS Systems to form Schneider Electric's Critical Power & Cooling Services Business Unit, which recorded 2008 revenue of €2.6 billion (including APC-MGE sales of \$3.7 billion) and employed 12,000 people worldwide. APC solutions include uninterruptible power supplies (UPS), precision cooling units, racks, physical security and design and management software.

### **Comments on Building Block #1: Definitions**

**Q: Are there any other sources that the EPA should review for variations of, or additions to, this list of definitions? Are there alternate versions of the operational state definitions above, that EPA should consider? Are there other operational states specific to UPS that need to be defined in this specification?**

A: Given EPA's desire to make use of existing definitions that are generally accepted by industry, APC suggests that EPA rely solely on the established definitions of relevant terms contained in the Committee Draft for Vote (CDV) of IEC 62040-3, Ed.2.0: Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements, dated January 15, 2010.

Furthermore, we suggest that EPA refrain from using topology based nomenclature and categorizations where ever possible (e.g.: Passive Standby, Line Interactive and Double Conversion), in favor of using the system of performance classifications defined in section 5.3.4 of the IEC 62040-3 CDV (e.g.: lowest performance = Voltage and Frequency Dependent – VFD, medium performance = Voltage Independent – VI, and highest performance = Voltage and Frequency Independent – VFI).

The performance classification system has been utilized by the European Commission's Code of Conduct on Energy Efficiency and Quality of AC Uninterruptible Power Systems (UPS), with great success since its inception in 2006. It is also used in the IEC 62040-3 CDV which establishes minimum allowed efficiencies for all UPSs, worldwide.

In addition to ensuring consistency with these other UPS efficiency standards, by adopting the performance classification system, the ENERGY STAR UPS specification would enjoy the benefit of not requiring an update as new UPS topologies emerge into the market.

After properly classifying UPSs, the next most important definition is that of the “normal mode” of UPS operation, defined in section 3.2.11 of the IEC 62040-3 CDV. Because a typical UPS spends nearly the entirety of its operating life in a normal mode of operation, we recommend that operational efficiency in the UPS’s highest performance normal mode must form the backbone of the ENERGY STAR UPS specification.

**Q: EPA is aware of an “eco-mode” in certain Line Interactive and Double Conversion UPS products that trades off power conditioning for higher levels of efficiency. It is EPA’s understanding that “eco-mode” is not often actuated by end-users because of a real or perceived risk that the UPS reliability is diminished. EPA intends at this time to require UPS energy performance to be evaluated without the aid of any “eco-mode” strategies, but would like to request stakeholder feedback on various “eco-modes” to understand if and how they may be referenced in the ENERGY STAR program.**

A: So called, “Eco modes” are simply normal modes of operation that allow a UPS to operate at a lesser performance classification in return for higher electrical efficiency. While the presence of these modes should not necessarily be excluded from recognition on the proposed Power and Performance Data Sheet, they subject the protected load to significant additional risk, and are therefore infrequently used by those operators that understand them. Because they are seldom used, they should not be required by, nor should their performance be documented as part of conformance with, the ENERGY STAR UPS specification, lest the less sophisticated customer be lured in by the higher efficiency they promise without being made fully aware of the risks they present.

**Q: Are standard load conditions (such as 30% or 70%) used in the industry for the evaluation of UPS efficiency? What load conditions are data center operators most interested in when selecting the most efficient UPS solution for their data center? What load conditions are most applicable to home or small office UPS buyers?**

A: With regard to standard load conditions, both the Code of Conduct and the IEC 62040-3 CDV require certain minimum balanced resistive load efficiencies at 25, 50, 75 and 100% load. However, APC recognizes that performance at loadings below 25% is relevant for both large and small UPSs. We therefore recommend that requirements for maximum loss at 0% load and minimum efficiency at 10% load be included in the ENERGY STAR UPS specification.

**Q: EPA is interested in understanding the relationship between various means of UPS power conditioning and energy efficiency. Is there an industry-accepted method to measure and quantify power conditioning? If so, is there a way to “right-size” the amount of power conditioning to match the needs of a particular application in order to maximize energy efficiency?**

A: Power conditioning performance is included in the performance classification system referenced above. Selecting the appropriate performance classification for a given UPS application requires a thorough understanding of the power disturbance immunity of the protected loads along with the importance of continuity of those loads, and the cost and environmental sensitivities of the customer. Only with all of those in mind can an informed decision be made regarding trading off load protection for increased energy efficiency.

**Q: Given the environmental impact of electrochemical battery production and disposal, what environmental programs or best practices should be considered for inclusion in the ENERGY STAR specification?**

A: Given the numerous existing environmental regulations and recycling programs already in place in much of the world (e.g.: RoHS, Reach, etc.) and because the IEC has just begun work on an environmental standard for UPSs (62040-4), we feel that it would be best to omit any specific environmental requirements from Version 1 of the ENERGY STAR UPS specification, pending the release of the IEC standard.

### **Comments on Building Block #2: Eligible Product Categories**

**Q: Aside from output rating, what are some other means of segmenting the UPS market? Would market segmentation by input power phase (single- versus three-phase) more effectively classify devices according to end-use application?**

A: Because the feature set, form factor, performance and cost of UPSs are tailored to needs of specific markets and applications, we believe that products should be segmented in the ENERGY STAR UPS specification by intended application. While we recognize that the analysis of test data will ultimately determine the final categorizations, we recommend that UPSs should be categorized by performance classification, output power rating and output voltage rating. We further recommend, consistent with IEC 62040-3 CDV, that input and output phase quantity not be a basis for categorization lest too many categories get created or products with unusual configurations (e.g.: 3 phase input, single phase output) be excluded.

**Q: Given the wide variations in topology, base technology, and load range for UPS devices, which portions of the market provide the biggest opportunity for energy savings?**

A: Determining which portions of the market represent the best opportunity for energy savings is difficult. Small UPSs are sold in the highest volumes but tend to be of lower performance classifications (e.g.: VFD and VI) which are inherently more efficient. Large UPSs on the other hand are sold in much lower volumes but are typically lower efficiency VFI designs. Therefore we agree that all types and sizes of UPSs be included in the ENERGY STAR UPS specification.

**Q: Are there any upcoming technologies or product types in development which are not included in this document and should be considered for inclusion in this ENERGY STAR specification?**

A: By making the ENERGY STAR UPS specification performance classification based, rather than topology based, EPA would guarantee that future technologies are inherently included in the specification. We therefore strongly recommend this approach.

**Comments on Building Block #3: Energy Efficiency Criteria and Test Procedures**

**Q: Which operational states (e.g., stored energy, normal, bypass) should EPA address in the specification? In which states(s) might the highest energy savings be achieved?**

A: As stated above, because nearly all UPSs spend >99.9% of their entire operating life in their most protective normal mode of operation, optimization of this mode represents the best opportunity for energy savings and must therefore be the primary basis for ENERGY STAR requirements. For small UPSs used as master power switches for groups of equipment, power consumption when plugged in with the output off may be worth investigating, but is unlikely to be a large opportunity for energy savings.

**Q: For various types or classes of UPS, what is the typical breakdown of energy consumption across operational states and how often is the UPS expected to operate in each state?**

A: Modes other than normal, such as stored energy mode and bypass mode total less than 0.1% of the operating hours of a typical UPS and are therefore inconsequential energy savings opportunities.

**Q: Research indicates that UPSs designed for partial loads are typically oversized. What requirements can be put in place to avoid over sizing and improve energy efficiency?**

A: Over sized UPSs are selected or specified for numerous reasons including: hedging against or in anticipation of future load growth, derating for increased reliability and achievement of greater stored energy mode runtimes with internal batteries. Given that all of these are valid motivations, rather than seeking to prevent over sizing, we recommend that the ENERGY STAR UPS specification minimize the adverse efficiency impacts of the practice by requiring high performance at partial loadings.

**Q: How can ENERGY STAR address the concept of modularity and scaling in UPS?**

A: Modular UPSs represent a significant and growing portion of the total UPS market and therefore must be included in the first version of the ENERGY STAR UPS

specification. While testing of modular UPSs is more challenging than fixed configuration products, we believe that a “Product Family” approach is appropriate wherein a small configuration and a large configuration can be tested and when demonstrated to pass, all intermediate configurations can also be deemed to pass.

**Q: Are there any additional power consumption or efficiency test procedures that should be considered for reference in the ENERGY STAR specification? Do the test procedures listed above accurately quantify UPS energy efficiency? Are any performance or energy efficiency criteria missing from existing test procedures that should be addressed by an ENERGY STAR test procedure?**

A: Because it is most representative of the way the vast majority of UPSs in mature markets spend nearly the entirety of their operating hours, efficiency testing in the highest available performance mode, with nominal voltage and frequency input and balanced resistive load output, in line with the procedure in the IEC 62040-3 CDV, extended to include 0 and 10% load and recording input power factor data at each load point is the most meaningful testing method. For products that can operate at multiple voltages and frequencies, a single representative voltage/frequency pair should be used for ENERGY STAR qualification. If testing at multiple voltage/frequency pairs is required all efforts should be made to select the fewest possible pairs that deliver the necessary performance data.

In all cases, the ability to disconnect the energy storage subsystem, as is allowed by the IEC 62040-3 CDV test procedure, must be maintained. Because the steady state energy flow into the energy storage subsystem must be insignificant, data collected in this mode is representative of the long term performance of the product. This concession is appropriate in light of the repeatability, test time and test expense reduction benefits it provides.

As mentioned above, because of the master power switch scenario, it might be worth collecting input power data with nominal input voltage and frequency applied, with the output off for smaller systems. If this procedure is adopted, care must be taken to ensure that the energy storage subsystem is fully ‘charged’ during this test or disconnection of the subsystem must also be permitted during this test.

**Q: What are the typical loading ranges for different categories of UPSs? Are there any component or hardware differences for devices intended for redundant operation?**

A: Because all UPSs can be used in redundant configurations, and because of over sizing, there really aren’t any typical load ranges for UPSs beyond stating that very few ever operate a full load for extended periods of time. Consequently efficiency at all loadings is relevant and needs to be the central theme of the ENERGY STAR UPS specification.

UPSs intended for parallel operation often have additional communication and interface components but the majority of the power train is identical, so special test procedures and requirements for parallel capable UPSs are unnecessary.

**Q: What role does the Value Added Reseller (VAR) play in the UPS market (e.g., number of sales or % of total sales)? What system configuration modifications are typically provided by VARs and how do they impact the UPS efficiency?**

A: Distributors, Resellers and VARs are involved with the majority of UPS sales and installations. However, due to the lack of interchangeable components across UPS models, the configuration changes they make seldom have an adverse impact on the energy efficiency of the UPSs.

#### **Comments on Building Block #4: Information and Management Requirements**

**Q: What, if any, aspects of the Standard Information Reporting or Data Measurement and Output requirements for Servers are not relevant to UPS devices? Do any existing UPS standards approximate the ENERGY STAR requirements as described above? What is the typical performance data measurement, reporting, and output capability of a data center UPS? Are there industry trends towards the inclusion of more robust reporting capabilities? Do UPS devices have the ability to measure and self-report operational characteristics (e.g., power consumption, load utilization, temperature) in an open, accessible format when interfacing with a third-party management software?**

A: Unlike servers, there is very little commonality in what UPSs typically measure or how they communicate. The simplest UPSs may not communicate at all. Slightly more sophisticated UPSs communicate their operating mode (on line/on battery) via contact closures. Still more sophisticated UPSs will communicate their operating mode, battery state of charge/health, expected runtime, input and output voltage, frequency and percentage output load over serial or USB connections via vendor proprietary or industry standard protocols. Data center class UPSs frequently have standard features or option cards which provide SNMP or Modbus RTU interfaces, both of which are intended to interface into 3<sup>rd</sup> party data center management products. Even in large UPSs however it is rare to measure and report input and output energy or even inlet temperature as such data is not operationally required for the UPS to function.

Additionally the accuracy, precision and update rate of UPS measurements are frequently not the equivalent of stand alone metering products, and may not be sufficient to provide meaningful data to data center operators.

While there is some work underway within The Green Grid to move UPSs and other data center infrastructure equipment toward a standardized set of measurements, reported via the CIM protocol, this work is still in it's infancy and it will be many years before it is broadly available in shipping products. Consequently, we recommend that

there be few if any Information and Measurement requirements in version 1 of the ENERGY STAR UPS specification and that any such requirements be dependent upon the size and intended use of the UPSs.

**Q: What additional information specific to UPS should be included on a Power and Performance Data Sheet?**

A: The Power and Performance Data Sheet should rely heavily upon the data that manufacturer's already collect and report via the IEC 62040-3 CDV's Technical Data Sheet and Test Report.

**Q: How is utilization defined for UPSs? What utilization information would be helpful to managers for procuring the proper equipment for use in their data centers?**

A: Utilization is the higher of percent output real power (W) or percentage output apparent power (VA). It can be evaluated for the output as a whole or on a per phase basis.

**Conclusion**

Thank you again for allowing APC by Schneider Electric to provide input into the ENERGY STAR UPS specification. We look forward to working closely with EPA on this important work.

Please contact Jim Spitaels via email at [jspitael@apcc.com](mailto:jspitael@apcc.com) with any questions or concerns you may have regarding our responses.