



# **ENERGY STAR UNINTERRUPTIBLE POWER SUPPLY SPECIFICATION FRAMEWORK FEBRUARY 16, 2010**

The Green Grid Association, a consortium of industry leading companies welcomes the opportunity to comment on the early framework document under consideration for the ENERGY STAR for Uninterruptable Power Supplies (UPS). Some member companies of The Green Grid Association may be providing additional considerations highlighted by their industry or company's particular perspective. Some members may have also provided their inputs through NEMA.



## INTRODUCTION

A consortium of information technology providers, consumers and other stakeholders, The Green Grid Association seeks to improve the energy efficiency of data centers and business computing ecosystems around the globe. The organization takes a holistic and comprehensive approach to data center efficiency and understands that addressing this challenge requires a high-level view of the entire data center and cooperation among a wide range of industry principals. Participants in The Green Grid include such diverse companies as major server and storage equipment manufacturers, leading infrastructure manufacturers, major software providers, and end-users / data center owners.

## OVERALL

The Green Grid's feedback is referenced against the section numbers listed in the framework document. We applaud the logical approach in the outline and hope to provide additional support to the EPA in the formal process of developing the draft and subsequent specification. We also recognize the need to develop industry wide working groups and forums to assist in the technical development. The Green Grid has indicated and volunteered to support establishing these technical forums to facilitate the specification development.

We believe our response helps to move the EPA forward with a better understanding on how to meet the three stated core objectives for the ENERGY STAR specification.

- (1) to provide purchasers with the means to identify the most energy efficient UPS solutions for their specific end-use application,
- (2) to provide tools and information to designers and managers looking to improve the efficiency of data center operations, and
- (3) to provide uniform efficiency testing conditions and reporting criteria to enable an informed purchase decision and efficiency-oriented comparison of products. EPA will look to harmonize energy efficiency requirements, where appropriate, to minimize the number of competing standards in the marketplace.

## DISCUSSION AND RECOMMENDATIONS

We are encouraged with the EPA's desire to develop an ENERGY STAR specification that is in relative harmony with other industry standards. To that end we encourage EPA to consider framing the bulk of the ENERGY STAR for UPS specification around the yet to be balloted IEC 62040-3 CDV. We feel this is an excellent starting point though you should note in our detailed reply to each framework question The Green Grid has identifies certain areas where the ENERGY STAR specification may desire to extend the IEC framework slightly to ensure enough relevant data is collected and available to better categorize UPS efficiency under normal conditions including idle or no-load.

The Green Grid believes it is time for the industry to move beyond the legacy categorization of UPSs by topology. We prefer to see an adoption of a performance based definition as embodied within the IEC document. The adoption of performance criteria will enable greater latitude for innovation by manufactures which we

believe will lead to improved system-level energy efficiencies with similar and perhaps heightened levels of reliability/availability relative to systems that are available today.

Though not a current component of the framework document The Green Grid recognizes that the EPA is under a great deal of pressure for increased verification of, and accountability for, the use of the ENERGY STAR logo on qualifying products and we want to make certain positions publicly known with regards to third-party testing. In principle we support the concept of calling for a strong specification with clearly defined test parameters to be conducted in qualified test facilities in order to develop a robust data set. However we have some concerns over the potential negative impacts associated with mandatory third-party testing including a general lack of participation in the ENERGY STAR for UPS program.



It is our understanding that the vast majority of the UPS industry manufactures currently providing products to the data center community who may be interested in pursuing the ENERGY STAR rating already have in-house test equipment, ISO procedures, third-party verification of test equipment calibration, and frequent test oversight and verification by third-party labs, consulting engineers, and large end-user customers. Further many of the UPS units supplied to the data center industry are physically large, heavy, available in numerous configurations, have extensive set-up requirements, require extensive support equipment including DC plants to simulate batteries under various states of charge, precision programmable load-banks, switch-gear, and a host of system-level skilled technicians to ensure smooth operation of the test program. Often due to system-level complexity and customer/consulting engineer requirements the test process may take three to five business days with the off-hours used for system stabilization

Therefore we encourage the EPA to consider alternate solutions to address compliance and verification testing. It is our recommendation that we explore this subject together with the manufactures, large end-users, and consulting engineering firms as part of developing the formal ENERGY STAR specification. The Green Grid would like to see a specification developed that encourages the largest number of UPS manufactures to participate with minimal cost penalties. This may include a plan whereby manufactures provide the EPA with annual test facility certification from recognized ISO auditing firms and/or safety agencies such as CSA, ETL, etc.

## EPA ENERGY STAR® FOR UPS FRAMEWORK QUESTIONS / DISCUSSION POINTS

### BUILDING BLOCK #1: DEFINITIONS

*At this time The Green Grid believes all definitions should come from IEC 62040-3 CDV however we reserve the right to amend this position upon review of the final balloted standard. We do believe it is time to move away from the use of topologies as a means of segmenting UPSs. We support the use of Performance classifications (VFI, VI, VFD, etc.) and feel they should be used instead of topologies. Definitions of topologies should be omitted.*

*However The Green Grid wishes to note that this specification is still in draft format. The document is subject to further revision. There is the potential that the final version may not be acceptable to Green Grid. We highly recommend the US EPA hold off on releasing a final ENERGY STAR® for UPS specification incorporating reference to the IEC 62040-3 CDV specification until it is ratified and enough time has been made available for the industry to understand the nuances of the final document.*

**Questions for Discussion:**

1. Are there any other sources that the EPA should review for variations of, or additions to, this list of definitions? *See above*

2. 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? Normal mode should only be defined as the highest performance classification (defined as the operating characteristics that provide the highest degree of protection / fault isolation for the connected load) available in a product. Alternatively, a product should have to pass testing in all normal modes that it supports. Note: Green Grid encourages the EPA to standardize all testing and reporting requirements on any submitted product on that mode of operation that by default will provide the highest degree of fault protection / isolation as years of industry data indicates this is the single mode of operation that the vast majority of data center operators will select. Those with multiple normal modes shall be tested in that mode which provides the highest degree of protection.*

3. 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. *We agree that measuring ECO mode testing should not be required. All testing and requirements should be in the highest performance mode (as defined in IEC 62040-3) that a given UPS supports. As part of the data collection process test data for alternate (eco-mode) modes of operation may be gathered under similar test criteria and made available on a voluntary basis.*

4. 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 (sic) *Testing should only be nominal mains input with balanced resistive load at 25, 50, 75 and 100% to align with IEC62040-3 CDV plus 0 and 10% to cover catcher and 2N applications. Input power factor data should be collected at the same time. For a higher degree of granularity in reporting power curves we would consider testing to include 0, 10, 25, 35, (37.5 instead?), 50, 75, and 100% of load using a resistive load. We believe testing should only be conducted with a resistive load as complex loading conditions are very difficult to verify and obtain consistent results.*

5. 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? *The IEC performance classifications 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? *The right amount of power conditioning depends on the customer’s requirements, the application, and the loads to be protected. The UPS industry provides numerous types and sizes of products with varying degrees of power conditioning to best meet the customer’s specific needs.*

6. 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? *This subject will be dealt with by IEC62040-4. Energy Star should align with that when it is published (2-3 years). We*



do not believe waste or life-cycle issues are best served within ENERGY STAR as there are several other global efforts to address this and may be a bit premature to this effort.

## BUILDING BLOCK #2: ELIGIBLE PRODUCT CATEGORIES

### Questions for Discussion:

1. Aside from output rating, what are some other means of segmenting the UPS market? *The data could be segmented by performance classification, cord connected (pluggable) vs. hardwired; form factor (rack vs. tower), as well as internal battery vs. expandable battery. We are not certain that any of these factors will affect efficiency but would be interested in exploring the data for any potential correlations.*

Would market segmentation by input power phase (single- versus three-phase) more effectively classify devices according to end-use application? *Segmenting by output power rating is better than by phases. The product variants are very complex: 1:1, 3:3, 3:1, 2:2, 1:2, etc. There may be some variation in efficiency depending upon the intended application or market use such as consumer level versus business, industrial, or medical.*

2. 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? *Hard to say; we believe there may be more potential with small UPSs than big but most small are highly efficient already. Consumer products under 1.5 kVA may have the largest potential for improvement due in large part to the lack of knowledge of end users who may be misapplying them as giant power strips unaware of standby losses. However we are not convinced that the EPRI/CEC reference report dated 2005 with source data from 2004 and older vintage UPS equipment is still relevant. Many manufactures have made two or even three turnovers in their product offerings and technology. The Green Grid recommends the EPA conduct another market survey to better understand the dynamics of the market we will experience in 2011.*

3. 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? *Eliminating topologies from the spec entirely and focusing on performance classifications solves this problem.*

*We recommend the following power ranges for segmenting the products, each by IEC Performance Criteria.*

0 to <1.5 kVA
≥1.5 kVA to <5 kVA
≥5 kVA to <10 kVA
≥10 kVA to <20 kVA
≥20 kVA to <40 kVA
≥40 kVA to <200 kVA
≥200 kVA

*Note: there is also a consideration within the IEC community for an expanded range below 5 kVA. If the test parameters remain the same this amounts to no more than additional segmentation of the reported data. In all likelihood there will be little impact on those units in the ≥ 1.5 kVA to < 5 kVA.*

Rated Load (kVA)				
≥0.3 to <0.8	≥0.8 to <1.5	≥1.5 to <3.5	≥3.5 to <5.0	≥5.0



**BUILDING BLOCK #3: ENERGY EFFICIENCY CRITERIA AND TEST PROCEDURES****Questions for Discussion:**

1. Which operational states (e.g., stored energy, normal, bypass) should EPA address in the specification? *Because a UPS spends 99.9% of its life in normal mode, only normal mode should be addressed.*

In which states(s) might the highest energy savings be achieved? *Normal mode is used the most so it represents the best opportunity for savings*

2. 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? *For all classes of products, when the output is on, the unit is in normal mode > 99% of the time. For small UPSs which can be used as master on/off switches, the output may be off > 66% of the time (eg: only on 8 hrs per day only on business days) hence the requirement for testing at 0 load. Standby losses are often not understood. The consumer may think turning off the desktop, monitor, printer, and accessories is saving 200 watts (which it is) but doesn't realize the idle UPS could be burning 25 watts or more at idle. Note – consumer grade UPSs have battery chargers that may be on all the time regardless of the state of the output On/Off switch. This may relate to future DOE Battery Charger specifications. In addition the master On/Off switch may not be totally “off”.*

3. 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? *Over sizing can't be avoided. On small systems over sizing is used as a way to get more runtime. On large systems over sizing is seen as a means to achieve reliability and prevent outgrowing the UPS. Therefore, the best thing to do is require high performance at light loads. Ideally a UPS will provide nearly flat-line efficiency across the operating range of 10 to 100%. If so the discussion of over sizing goes away.*

4. How can ENERGY STAR address the concept of modularity and scaling in UPS? *Modularity, defined as changing capacity by adding or removing components from a frame vs. paralleling entire systems, will be difficult to deal with. We suggest testing a fully populated frame and then getting no load losses with 1-n modules installed. With this data, the performance of any possible configuration can be derived. These derived readings could then be compared with appropriate limits to determine which configurations of a modular system qualify.*

5. Are there any additional power consumption or efficiency test procedures that should be considered for reference in the ENERGY STAR specification? *Input powered, output off is relevant for small UPSs.*

6. Do the test procedures listed above accurately quantify UPS energy efficiency? *The IEC test procedures do.*  
Are any performance or energy efficiency criteria missing from existing test procedures that should be addressed by an ENERGY STAR test procedure? *Resistive load efficiency and input power factor should be sufficient.*

7. What are the typical loading ranges for different categories of UPSs? *Very small UPSs (<500VA) are frequently heavily loaded (80-100%) Very large UPS in non redundant configs are seldom loaded above 80% and in redundant configurations they are rarely loaded above 40%.*

Are there any component or hardware differences for devices intended for redundant operation? *Parallel capable and Modular systems are often used in redundant deployments.*

8. What role does the Value Added Reseller (VAR) play in the UPS market (e.g., number of sales or % of total sales)? *VARs are the predominant sales channel to the small and medium business customer as well as many local, state, and federal government agencies.*

What system configuration modifications are typically provided by VARs and how do they impact the UPS efficiency? *Outside of basic power levels, form factor, and possible management interfaces the VARs provide little to no additional configuration services. Some VARs provide installation services for rack mounted UPS systems including connecting ex-*



ternal battery packs and PDUs. However these are typically manufacturer recommended configurations that will have been tested under the ENERGY STAR program. Installing contractors and commissioning services are more likely to enable/disable any specific circuits that would impact energy efficiency especially those like ECO-Mode.

#### **BUILDING BLOCK #4: INFORMATION AND MANAGEMENT REQUIREMENTS**

##### **Questions for Discussion:**

1. What, if any, aspects of the Standard Information Reporting or Data Measurement and Output requirements for Servers are not relevant to UPS devices? *TBD*

Do any existing UPS standards approximate the ENERGY STAR requirements as described above? *Measurement and communication capabilities vary greatly based on the size and intended use of the UPS. If requirements exist in this area, they must recognize this fact. Low cost UPSs may have little reporting capabilities other than input power status, operating mode, battery state, and impending loss of output due to diminished battery capacity. As UPS grow in size and/or application complexity requirements drive UPS solutions with a higher performance (fault isolation/protection) mode they tend to gain increased monitoring and reporting capabilities. However there are no universal requirements within the industry today that define a superset of real-time analytical data.*

*In UPS modules of >200 kVA it is common to a higher degree of capability. Depending upon the manufacturer of the device there may be sufficient data to extrapolate an efficiency measurement and report it via the manufacture's native/optional communications port. As noted elsewhere there are no industry standards in this area either for data reporting or the communication pathway, NIC, MODBUS®, BACnet, CAN bus, etc.*

2. What is the typical performance data measurement, reporting, and output capability of a data center UPS? *There isn't broad agreement on what should be measured or how accurately anything is measured. Be advised that the typical accuracy of instrumentation within a UPS is sufficient for intended internal purposes but not designed to be substituted for a high-precision test instrument.*

Are there industry trends towards the inclusion of more robust reporting capabilities? *Green Grid is seeking to achieve industry consensus upon one or more standards but it will be years in coming.*

3. What additional information specific to UPS should be included on a Power and Performance Data Sheet? *TBD, we would like to see greater alignment with the recommendations within IEC 62040-3. The Green Grid will work closely with EPA to develop an initial framework for a UPS Power and Performance Data Sheet.*

4. 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? *Large systems typically offer SNMP and/or Modbus options which allow data propagation to 3rd party software. Exactly what is measured, accuracy, and format are not well standardized.*

5. How is utilization defined for UPSs? UPSs have both real and apparent power limits. *The higher of either of these is how 'utilized' a UPS is.*

What utilization information would be helpful to managers for procuring the proper equipment for use in their data centers? *With the goal of nearly flat-line high-efficiency across the power curve from 10 or 15% of rated power to at least 85% of capacity the end user will not be significantly concerned with utilization until they are close to maxing out the available capacity of their installed system. In larger module UPSs, typically over 200*



*kVA, this type of information is made available to the end user in one or more data formats. However this has little bearing on the initial selection process.*

