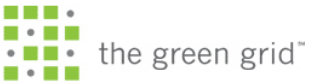


# The Green Grid Feedback to the US EPA on the Draft 1 Version 1.0 ENERGY STAR® for UPS Specification and the Draft 2 Test Method

The Green Grid, a consortium of industry-leading companies, welcomes the opportunity to comment on topics under consideration for the ENERGY STAR for UPS specification.

# Introduction

The Green Grid is a consortium of information technology providers, consumers, and other stakeholders, who seek to improve the energy efficiency of data centers around the globe. The association takes a holistic and comprehensive approach to data center efficiency. Our members include many of the largest UPS companies in the world and we are pleased with the progress that has been made on the proposed standard and look forward to continued cooperation with EPA on the final standard.

# Comments

**Scope –** We suggest that the specification clearly exclude industrial UPSs, Utility & Community Energy System UPSs, Safety & Emergency UPSs, Cable TV UPSs and rectifiers of all types not intended for use as UPSs.

**Product Classes –** We strongly believe that there are three broad categories of UPSs, each optimized for a particular market segment, and each utilized in a different manner, resulting in three distinct load profiles. We further believe that EPA should recognize these product classes in the ENERGY STAR for UPS specification and use them, in conjunction with Input Dependence Characteristics as the basis for all requirements.

The classes are:

- **Consumer UPS** – Defined as all AC output UPSs rated ≤ 1.5 kVA. Typically VFD or VI performance, standby or line interactive topologies, with relatively short runtimes, simple displays and low price points. Consumer UPS are commonly used to protect consumer devices such as desktop computers and related peripherals, and home entertainment devices such as TVs, set top boxes, DVRs, Blu-ray and DVD players.
- **Commercial UPS** – Defined as all AC output UPSs rated > 1.5 kVA to < 10kVA. Typically VI or VFI performance, line interactive or double conversion topologies, with medium runtimes, advanced displays and higher price points. Commercial UPS are commonly used to protect small business and branch office ICT equipment such as servers, network switches and routers, and small storage arrays.
- **Data Center UPS** – Defined as all AC output UPSs rated ≥ 10kVA. Typically VI or VFI performance, line interactive or double conversion topologies, with relatively longer runtimes, advanced displays, more communications options and high price points. Data Center UPS are commonly used to large, installations of ICT equipment such as enterprise servers, networking equipment, and large storage arrays.

**Excluded UPS Product Classes –**

- **Industrial UPS** – Defined as all UPSs designed to directly protect industrial manufacturing processes and operations, in contrast to those UPSs designed to protect ICT equipment as described in “Product Classes” above. Loss of power to industrial process equipment typically results loss of in-process or finished product, costs of scrap or rework, and extra costs needed to return the interrupted process to normal operation. Industrial UPSs are typically packaged in cabinetry that can withstand rougher handling and more abusive environments.
- **Utility & Community Energy System UPS** – Defined as UPSs designed for use as part of the electrical transmission and distribution systems (e.g.: electrical substation or neighborhood level UPSs).
- **Safety & Emergency UPS** – Defined as UPSs designed to comply with specific UL safety standards for safety-related applications such as emergency lighting, operations or egress or medical diagnostic equipment. Standards, such as those that are UL-based

are primarily safety focused, with less importance given to output performance and reliability.

- **Cable TV UPS** – Defined as all UPSs designed to power the cable signal distribution system outside plant equipment connected directly or indirectly to the cable itself. The "cable" may be coaxial cable (metallic wire) type or fiber-optic or wireless (e.g.: "Wi-Fi"). Cable TV UPSs are generally designed for outdoor environments with outputs usually less than 90 volts.

**Usage Profiles and Resultant Average Efficiency Formulas –** Each of the above classes has a different usage profile and hence needs an average efficiency formula which reflects the typical loading for that application. Note that in the formulas below, efficiency at 100% load is really a proxy for loads > 87.5% just as efficiency at 25% load is a proxy for near zero loads.

Specifically:

- **Consumer UPS** – Because consumers are highly cost sensitive and because consumer UPSs generally lack visual load meters, consumers tend to buy the smallest UPS that will support their equipment, resulting in very high average loads when the protected equipment is operational. Conversely, many consumers often turn their protected devices off or put them into low power standby modes, without turning off their UPS, potentially resulting in low UPS loads for significant time periods. In recognition of this dichotomy, we suggest the following weighted average formula for consumer UPSs:

  $$\mathbf{Eff_{AVG} = 0.20 \times Eff|_{25\%} + 0.20 \times Eff|_{50\%} + 0.30 \times Eff|_{75\%} + 0.30 \times Eff|_{100\%}}$$

- **Commercial UPS** – Because businesses are cost sensitive and small business/branch office equipment is not as critical as data center equipment, consumers tend to buy the smallest UPS which will support their devices, resulting in very high average loads when the protected equipment is operational. In recognition of this usage pattern, we suggest the following weighted average formula for commercial UPSs:

  $$\mathbf{Eff_{AVG} = 0.00 \times Eff|_{25\%} + 0.30 \times Eff|_{50\%} + 0.40 \times Eff|_{75\%} + 0.30 \times Eff|_{100\%}}$$

- **Data Center UPS** – Data centers of all sizes and criticalities are currently in operation. Low criticality centers generally run non-mission critical applications or support applications that are designed to fail over rapidly to another center. These facilities often have only a single, non-redundant UPS system and operators of such facilities are usually comfortable running their UPSs at loads up to and even above 90%. More critical centers commonly have N+1 UPS systems where N is typically 3 or more, resulting in 75% maximum UPS loading. The most critical facilities, representing < 10% of the market, deploy 2N UPS systems, resulting in 50% maximum UPS loading. While it's true that nearly all datacenters experience significant load growth throughout their lifecycle, energy conscious data center operators tend to maintain a constant level of redundancy during growth periods by turning off un-needed modules or UPSs. The net result is that very few UPSs operate at light loads for significant periods of time. We therefore suggest the following weighted average formula for data center UPSs:

  $$\mathbf{Eff_{AVG} = 0.20 \times Eff|_{25\%} + 0.30 \times Eff|_{50\%} + 0.30 \times Eff|_{75\%} + 0.20 \times Eff|_{100\%}}$$

**Proposed Requirements for Minimum Average Efficiencies –** We agree with EPA's recommendation of different average efficiency requirements for each UPS performance category. However, we strongly disagree with EPA's current proposed requirements of 98% for VFD and 97% for VI categories. According to EPA's own statements, these proposals represent the 80$^{th}$ percentile, not the 75$^{th}$, as should be the case. Also according to EPA's own data set, such high levels would result in no consumer VFD UPSs qualifying for ENERGY STAR. Given the prevalence of these products and the importance of the ENERGY STAR label in the consumer

market, such high VFD requirements may run counter to EPA's efforts to encourage manufacturers to participate in the ENERGY STAR program. Additionally, the proposed VFD requirement would prevent the majority of data center UPSs from qualifying in VFD mode. Similarly the proposed requirements would result in very few qualifying consumer and commercial VI UPSs and no qualifying data center VI UPSs (despite the fact that these UPSs are significantly more efficient than the VFI products that dominate the market). Because we feel that some products of each class and performance category should be able to qualify, we also believe that the proposed VFI requirements are too high as they exclude nearly every consumer VFI UPS.

With the product performance so tightly packed together in some product categories and classes, the requirements should be set to include some safety margin beyond the statistical 25% line. A product that is either "on or just above" the required efficiency level should not be considered as qualifying because manufacturing tolerances may not allow every unit of that model to actually qualify.

Our proposed efficiency requirements are summarized below. They will allow at least some products of each class and performance category to qualify which should result in good participation in the program. While reviewing our proposals, please keep in mind that in the current era of enhanced verification by both EPA and DOE, vendors will likely only submit products that perform well above the requirements, in fear of a marginal product failing a follow up test at a later time.

| | **Minimum Average Efficiency Requirement** | | |
|---|---|---|---|
| **Category** | **Consumer** (≤1.5kVA) | **Commercial** (1.5kVA-10kVA) | **Data Center** (≥10kVA) |
| **VFD** | 97% | | |
| **VI** | 96% | | 95% |
| **VFI** | 0.0099 x ln (S) + 0.80 | | |

**Multimode UPS Testing and Qualification –** We are unable to reach a unanimous position among all member companies regarding the testing and qualification of UPSs capable of operating in multiple normal modes.

The split on this topic has varied over time with a small majority of members supporting the position expressed in our last formal response to EPA, which is that UPSs should only have to be tested, and only be able to qualify, in their most protective normal mode. However a significant minority of members is in disagreement and believes that if a UPS can meet the requirements in any normal mode, then it should qualify. Note: though outside the scope of this reply, several server, storage and networking vendors within The Green grid have expressed concerns in guaranteeing the compatibility of their equipment with eco-mode operation under all modes of failure.

Arguments in support of the majority position include:

- All UPSs of a given topology (e.g.: double conversion) would have to qualify in the same mode of operation (e.g.: VFI), ensuring that efficiency comparisons done by potential customers of any sophistication will be evaluating the same mode of operation.
- Minimal qualification testing is required (i.e.: 1 mode = 1 test)

- Verification testing is shortened and simplified which keeps time and costs down, avoids misunderstandings about which modes a product is supposed to qualify in, and eliminates the need to educate verification bodies about how to change operating modes.
- UPS operators lack sufficient data to judge whether or not a less protective mode is safe for their equipment. Current generation ICT equipment no longer complies with the ITIC/CBEMA curves and ICT equipment vendors do not publish adequate information on the subject to ensure compatibility between a UPS with a given dynamic performance curve and a given set of devices. Even if such a comparison were possible, performing this evaluation on an ongoing basis, every time new equipment is connected to the UPS would be impractical.
- History shows that operators tend to exclusively use the most protective mode that a UPS offers. Where loads exist that are compatible lower performance UPSs (e.g.: VI or VFD), UPSs which exclusively offer the required mode are purchased, commonly resulting in significant, permanent cost savings.

Arguments in support of the minority position include:

- UPSs with lesser protective, high efficiency modes should be able to make customers aware of the presence of these modes and their associated performance levels.
- Highly sophisticated customers will understand the meanings of terminology like VFD, VI and VFI and will be able to make appropriate comparisons.
- UPSs that can qualify in any mode, even if that mode is not the most protective mode supported by the product, should be allowed to qualify.

Regardless of the final decision, we feel that vendors should be able to include, at their sole discretion, efficiency data for multiple modes of operation on the PPDS, provided that the data is gathered in accordance the relevant EPA and IEC specifications and methods.

**Power Factor Requirements –** We suggest that UPS input power factor requirements be omitted from the version 1.0 specification for the following reasons:

- Inadequate data exists to support the establishment of appropriate requirements.
- Highly efficient UPSs with low power factor could get disqualified and yet less efficient UPSs with higher power factor could qualify, even though they save less energy overall.
- UPS input power factor has only a minimal impact on the losses of the power distribution network.

If input power factor requirements are established, we would prefer that the same weighting factors we proposed above for efficiency be used to develop a single power factor requirement for each product class.

**Measurement and Reporting Requirements –**

- We suggest that measurement and reporting requirements be omitted from the version 1.0 specification. If they are included, they should only apply to Data Center UPSs and be limited to parameters that are commonly measured by these UPSs such as output voltage, current, frequency, and power.
- Output energy metering should not be required as it is not commonly implemented in UPSs and we feel that output switchgear, PDUs and rackmount PDUs are all more accurate locations to collect data necessary for accurate calculation of PUE.
- Additionally we believe that because data center UPSs are frequently deployed as multiple units operating in parallel, it would be more cost effective to install a single meter on the collective output bus rather than to essentially purchase meters for each UPS.

- We also believe that temperature reporting should not be required as there is no standard location for it to be measured in UPSs (unlike servers that measure inlet air temperatures, many UPSs only measure battery temperatures or critical component temperatures which are only indirectly related to the surrounding environment).
- Finally, if there are any measurement and reporting requirements, we recommend that these be based on open or published standards determined by the current best practices in the market.

**PPDS Requirements and Format –** We think that the PPDS should be a small, similarly formatted, subset of the information required by IEC 62040-3 Table D.1, retaining only the information necessary to describe the UPS's electrical performance and ratings in sufficient detail as to allow easy identification and performance comparisons of similar products. We look forward to commenting on EPA's draft UPS PPDS in the near future.

**LCA Requirements –** The process of performing comparable Life Cycle Assessments on UPS systems will remain immature until after the publication and implementation of IEC 62040-4. Therefore, we believe that LCA requirements should be omitted from the version 1.0 specification.

**Potential Overlap with DOE Battery Charger Regulations –** Because the purposes, scopes, jurisdictions, life cycles and test methods of the EPA and DOE programs vary so greatly, we believe that there should be no references made in the ENERGY STAR UPS version 1.0 specification to the DOE Battery Charger regulations.

**Modular UPS Testing –** We recommend that modular UPSs need to be tested only at vendor specified minimum and maximum configurations, at N+ 0 redundancies, and that all intermediate configurations of the system would be deemed to qualify, upon the qualification of the minimum and maximum specified configurations.

**Timeline –** While we appreciate the change in the target effective date from July 1, 2011 to September 1, 2011, we still feel that this is insufficient time to properly develop the specification and test method, to get AB's and CB's ready, to get our in house labs accredited and to actually measure and qualify products. At this time, January 1, 2012 seems like a more realistic target, given all that remains to be done. Additionally, we request that EPA investigate ways to delay the effective date of the program by 90 or 120 days after the publication of the final specification and test method. We will use this time to qualify our products and in return EPA will have a list of qualified products at launch.

## Conclusion

This document is a consensus document that was subject to peer review and comment within the more than 200 member companies of the Green Grid. We firmly recommend that EPA implement different weighted average formulas for each product class and that the proposed requirements for each performance category should be lowered to foster participation in the program. We look forward to working further with EPA on the ENERGY STAR for UPS specification.