



THE GREEN GRID'S RESPONSE TO DRAFT 1 OF THE ENERGY STAR® SPECIFICATION FOR DATA CENTER STORAGE, VERSION 1

The Green Grid appreciates the opportunity to respond to Draft 1 of the ENERGY STAR® Specification for Data Center Storage, Version 1. We recognize, along with the EPA, that this is a multidimensional product category, spanning a wide range of functions, capabilities, capacities and price points. Given the breadth and diversity of this landscape, and the range of configurations possible for each product, The Green Grid recommends that the ENERGY STAR® program approach Version 1 of the Data Center Storage specification with clear focus on specific portions of this product space, rather than attempting to address the entire span. This will allow the program and the industry to identify how to specify and measure improvements for certain product types, before expanding the scope to cover the full range of products. We will offer specific suggestions within this document.



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We would also like to take this opportunity to comment that this Draft 1 specification has left many of the significant measurement approaches and levels undefined. The result is that this version is, in effect, more similar to a revision of the earlier framework document than an initial draft specification. The industry finds it difficult to offer specific comments and recommendations on many areas of this document as a result. However, we also recognize that we will need to partner with EPA to develop a fundamentally sound approach to categorizing and rating storage products. Given the complexity of the product set and the many configurations and mixes of storage devices that can go into a system, we believe that there will be a benefit to developing a step wise, multi-tier strategy for storage systems which begins with a limited, specific set of energy efficiency criteria with a data gathering component on more complex power and performance issue to build the information base needed to build the next tier of criteria. This approach will enable both EPA and the industry to logically progress toward our mutual goal of advancing the ENERGY STAR® program in the IT space in a way that benefits customers and the environment whilst allowing ongoing innovation and product introductions that meet the growing demand for efficient and capable storage products.

These concerns are reinforced by the fundamental nature of the open questions identified in the note boxes; the range of potential answers is quite broad and makes it difficult to envision the content of the next version of the specification. It is our goal to identify the particular areas that raise concerns that the specification may not become specific until too late in the development cycle to allow adequate airing of differing points of view.

The comments that follow correspond to major headings in the Draft 1 Specification.

1. DEFINITIONS

The specification body refers to Storage Products, while its title and focus is exclusively on Data Center Storage products. We feel it is important to ensure that we are addressing only products designed and intended for use in data centers, and not the much broader range of storage products intended for more general purpose use. This distinction is significant: Data Center operations have specific reliability and performance requirements for storage products such as shared/networked access, specific connectivity methods, physical form factors, etc. that can drive packaging, functional design, and system architectural decisions. These factors and considerations, in turn, fundamentally affect product power use profiles. It is important that all definitions of products and product categories remain architecturally neutral, so as not to favor specific vendors nor limit innovations that can yield significant efficiencies.

TGG recommends that the scope of the initial version of the ENERGY STAR® Program Specification for Data Center Storage be limited to products in the Online 2 and 3, and Removable 2 and 3 categories. The Online



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and Removable categories account for the vast majority of data center storage products purchased today. In addition, Classes 2 and 3 in each category, when combined, represent the majority of products purchased, by unit, in these categories. This would allow Version 1 to have measureable impact on energy consumption in data centers while limiting the complexity of the configurations and product types that need to be tested. Given the newness of the measurement methods and interpretations that will be proposed for active load energy consumption, we believe that experience is needed in applying the specification to smaller systems before expanding it to include significantly larger products. As more is understood about the correlation of testing to actual data center performance, and the industry has an opportunity to investigate how similar testing could be applied to other systems, both in these categories and others, future versions of the specification may be able to expand the scope of coverage. (Lines 165-186)

Data Storage Efficiency and Capacity Optimization have both been discussed as means of improving the efficiency of data center storage products. The specifics of intended technologies must be provided, along with objective methods of demonstrating the resulting energy efficiencies, in a timely manner to allow adequate stakeholder review and feedback. This area in particular is associated with many implementation-specific claims, and it is critical that architectural and implementation neutrality be maintained within the specification. Further, TGG would like to point out that many of the techniques used to reduce capacity consumption operate by consuming energy to remove redundant content; in those cases there must be a net positive energy savings over a given period of time rather than just a reduction in capacity in use. Capacity reduction that does not result in a reduction of drives being powered may not actually translate to an energy saving. Initially, the best approach for ENERGY STAR® to take with regards to these types of capabilities is to require their reporting on the product performance data similar to the way power management functions were reported on the server PPD. (Lines 216-224)

While TGG can appreciate the objective of defining requirements across multiple taxonomy categories, it is important that the requirements and related thresholds that will ultimately be defined in this specification recognize the significant differences both between classes in a given category, and between different categories. Specific examples include: RAS and max capacity differences between Online storage classes, and behavioral differences between Removable media and Online products that result in different operational states and energy consumption levels. We recommend that each taxonomy category be reviewed to ensure the criteria are appropriate to the operational and usage characteristics that matter to data center operators. (Lines 228-232)

The discussion of Operational States appears to be more representative of the operation of Servers and Client systems than it does of Data Center Storage systems. As has been previously noted by The Green Grid, Online storage systems are primarily used in configurations where they are shared across multiple servers or clients, and are generally responding to I/O requests from connected application servers, responding to backup requests from connected backup servers, or performing data integrity or capacity optimization activities, all of which require media to be active and processing to be occurring. Customers will only engage multiple operational states where these processes can tolerate extended latency times or where they can be assured that the storage system can manage multiple operational states (with their varied energy use profiles) without causing deterioration in response times and serviceability. Creating specific storage criteria around operational states without considering the need to limit latency and response time impacts will result in the criteria having limited applicability for customer situations. Removable Media storage systems do, in fact, have an inactive state, they only enter this state after executing their primary function across other shared storage systems. This is one of the many instances where the differences between taxonomy categories have notice-

able impact on energy consumption and operational capabilities. (Lines 313-337)

Product Families afford the industry a necessary tool for managing the combination of reporting requirements for the ENERGY STAR® program and the configuration complexity inherent in all categories of storage product. Appropriate effort must be focused on a mutually agreeable definition. The Green Grid looks forward to working with the EPA and other industry bodies such as the SNIA to develop such a definition. (Lines 370-384)



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2. ENERGY EFFICIENCY CRITERIA

There are several significant differences between server and storage power supplies, including, but not limited to, the use of custom designs instead of “off the shelf” units, the more prevalent use of the PSU fan to cool the enclosure, not just the supply, and the greater prevalence of multi-output power supplies. This draft specification provides no insight into how the ENERGY STAR® Program intends to address these differences, if at all. The Green Grid suggests that the EPA work with it, EPRI and SNIA, and any other appropriate organizations, to assess the current state of single and multi-output supplies used in data center storage products. The goal of this survey would be to assess the current distribution of power supply efficiency and power supply configurations (single vs. multi-volt, fan for power supply or enclosure cooling, integrated UPS) in the marketplace. The resulting information would provide the data needed for EPA to set its power supply efficiency criteria for storage systems and determine what configuration based factors needed to be included in the criteria. The data will enable EPA to set criteria that will encourage improvements in storage power supply efficiency while taking into account the current marketplace conditions of power supply efficiency.(Lines 477-510)

Active State and Idle State Efficiency Criteria are completely undefined in this draft. Even though this is an initial draft, and the exact nature and level of the goal criteria are not expected to be fully refined, it is difficult for the industry to respond to the lack of definition in these sections. The Green Grid would recommends that the EPA consider Active State metrics that reflect the functional/design focus of each category of data center storage product included in the scope of the specification so that purchasers can be certain that they are comparing products designed for use in their chosen type of application. Similarly, if an Idle State metric is identified, it should adequately account for the differences in features, and functions, including RAS capabilities of the different types of products included in the scope, again to assist purchasers in identifying appropriate products. (Lines 511-524))

Power Management functions are a server and client concept that do not have an analogue in most data center storage products. While products in some taxonomy categories can achieve power savings by turning off drives when not in use (Removable Media) or spinning down unused disks (Near Online, for example), Online products must be able to respond within a maximum period of time that does not allow the use of such techniques. Products in this category can only save power by reducing drive counts via techniques such as compression or de-duplication, or by storing data on lower speed devices. Most techniques seen in the market today are specific to either a particular implementation or to a particular category of storage. TGG recommends that this is an area in which we would like to work with the EPA and other industry organizations to identify the existing techniques that can initially be reported as the basis for defining architecturally neutral approaches to reducing power draw for various categories of data center storage products in future versions of the specification. (Lines 525-530)

While The Green Grid recognizes the potential contribution of Energy Efficient Ethernet, particularly for storage products having multiple Ethernet interfaces, the industry does not believe it is appropriate to incorporate it into the specification at this time. The actual standard is not yet fully ratified by the standards bodies, and is not yet available from multiple sources, or in sufficient quantities to make it generally available for inclusion as a required element in the ENERGY STAR® specification. (Lines 531-537)

3. STANDARD INFORMATION REPORTING REQUIREMENTS



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Given the ongoing changes being made to the qualification and verification procedures that will apply to data center storage, as well as the lack of detail provided as to the nature of the measurements that will be included in the specification, it is not practical to make meaningful, specific comments on the PPDS at this time. We do, however want to note some general recommendations based on the IT industry's experience with the data submission processes used for servers and clients. Today's processes for those products require the use of two separate forms having significant overlap in content and, at the same time, significant differences in formatting. This process results in substantial duplication of effort or significant risk of incorrect filings due to the need to restructure and reformat replicated data. We would urge a dialog with stakeholders in an effort to improve the process for accuracy and ease of use. We also wish to reemphasize the importance of Family reporting as a means of providing purchasers of data center storage with easily understood information on the configurations of qualified products, given the large number permutations possible within the energy consumption envelope. In addition, given the configuration permutations possible with storage products, TGG urges the EPA to accept PPDS submissions for product families rather than individual product configurations. (Lines 539-575)

4. STANDARD PERFORMANCE DATA MEASUREMENT AND OUTPUT REQUIREMENTS

Data center storage products available on the market today do not natively provide either real time inlet temperature or input power readings. While the latter can be obtained through the use of third-party Intelligent Power Distribution Units (IPDUs), the frequency of the readings provided do not approach those stated in this draft. The specific requirements identified in the draft will require significant development by the industry, both in modifications to PSUs or other hardware to integrate the components needed to enable this reporting directly from the storage systems, and in the development of software to report this information into the existing data reporting systems utilized by the server systems.

The Green Grid is very concerned that the sampling and reporting rates proposed for servers in the Tier 2, Draft 1, which we expect will be the basis for the storage system data reporting requirements, are unworkable. The collection and averaging frequencies collect an inordinate amount of data and report it on a time frame which is not representative of the response times in a data center. Data center operators may look at their temperature and power profiles on frequencies of ten or fifteen minutes. In an environment which often has thousands of individual data points, anything more frequent is focused more on the "noise" within the system than on any meaningful trend in data that requires a response or action by the data center operator. In addition, generating and collecting that data requires significant IT support with little or no value to the operation of the data center. We encourage EPA to recognize that the intent of power and thermal reporting is to gather operational data that can be used to manage the data center and set reasonable, workable requirements for data collection and reporting. (Lines 577-608)