



SNIA Emerald Specification is an established building block for regulatory agencies to define data center storage energy policies.

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Within the European Union, the annual energy consumption related to servers directly is expected to be 48 terawatt hours (TWh) in 2030, which increases to 75 TWh when the annual energy consumption related to infrastructure (e.g. cooling systems and uninterruptible power supply systems) is also included. The annual energy consumption of data storage products is expected to be 30 TWh in 2030, 47 TWh when infrastructure is also included. The preparatory study shows that use-phase energy consumption by servers and data storage products can be significantly reduced. (*See Footnote 1)

To enable national regulatory agencies around the world with data center storage energy efficiency metrics and policies, the Storage Networking Industry Association (SNIA) has been working diligently for more than a decade through its Green Storage Initiative (GSI) to establish the SNIA Emerald Power Efficiency Measurement Specification. The specification encompasses networked storage systems for block IO and file-system IO data communications, which represents the vast majority of storage systems deployed in data centers. The specification is comprehensive, vendor product neutral, and has been in use since 2013. One of the next steps SNIA is taking is to seek International Organization for Standardization (ISO/IEC JTC 1) recognition.

Companies with data centers, understandably, have become more careful about the type of equipment they deploy. As well as better performance and added capacity, they are demanding lower power consumption. SNIA in its early industry analysis concluded that the

maximum energy consumption profiles for power planning was not adequate to determine energy usage operations on average daily/weekly/monthly basis. This led SNIA to move beyond vendor specific product spec sheets and vendor specific energy calculators to determine which equipment models and specific configuration are optimal in terms of energy efficiency.

SNIA worked across industry with all the storage manufacturers to create energy metrics that allow IT planners to compare a range of possible solutions. An objective, metric-based approach enables planners to select the mode of storage usage and data protection that accomplishes business goals accompanied by understanding energy consumption trade-offs. In addition, it encourages vendors to produce more energy efficient products.

The SNIA Emerald Power Efficiency Measurement Specification details rigorous test methodology based on industry proven tools for the measurement of the power efficiency of storage systems under typical data center conditions. It covers block storage, file storage and will soon provide a uniform way to measure solid state, converged storage, and object storage. It offers a standardized method to assess the energy efficiency of commercial storage products in both active and idle states of operation. It has evolved a detailed taxonomy to classify storage products in terms of operational profiles and supported features. Test definition and execution rules are carefully laid out to ensure adherence to the standard.

The U.S. Environmental Protection Agency (EPA) Data Center Storage Energy Star Program references the SNIA Emerald Specification. It provides an industry voluntary participation program to receive and post test reports for storage equipment under the umbrella of the Energy Star Data Center Storage (DCS) specification. DCS metrics and measurements are performed according to the SNIA Emerald specification and include some additional EPA test criteria, system component ratings and requirements.

The US EPA program has close to 200 storage product test reports publicly posted for block IO and most recently file IO. The repository of reports provides an industry view of vendor products, models, and their energy efficiency metrics, and serves as a quick reference for an apples-to-apples comparisons on energy metrics between many vendors storage products.

Towards a Global Standard

Since configuring and measuring data center storage is capital, time, and resource intensive, SNIA has adhered to its objective to create a single test methodology, in essence a building block, for all national regulatory bodies to reference. As a building block, it enables national bodies to establish any additional criteria for testing, measurement, and configurations that meet geographic preferences and priorities. The national body should have confidence that the SNIA Emerald test methods are proven, fair, and sound, to avoid a national body expending limited resources on a multi-year effort to establish a similar test method.

The SNIA Emerald Specification is recognized by several national bodies in one form or form or another, in different stages of industry program rollout including the U.S. EPA Energy Star program, Europe's EU LOT 9 program, and the Japanese Top Runner program. SNIA

recognizes that many national bodies prefer to reference an ISO/IEC specification instead of an industry body specification. With that requirement in mind, SNIA will be submitting SNIA emerald V3.0.3 to the ISO/IEC JTC 1 PAS process.

SNIA is a well-established global forum for storage specification work which invites the participation of all vendors. As such, specific to data center storage, its members who have been involved in the SNIA Green Storage Initiative and SNIA Emerald Specification development represent more than 90% of all shipped storage units and capacity.

SNIA Green Storage Initiative also undertakes the task of training test engineers and independent test labs on the proper use of the Emerald specification to ensure it is implemented with uniform results. SNIA records and posts its training materials for public use. SNIA also hosts an annual stakeholders meeting with the EPA to further advance the Energy Star Program. SNIA has met several times with the Japan Ministry responsible for the Top Runner Program to align timetables for future reference of the SNIA Emerald Specification. SNIA in collaboration with The Green Grid and Digital Europe has made many recommendations for the EU Lot 9 specification work.

The SNIA Green Storage objectives with the SNIA Emerald specification include the following:

- A single worldwide test methodology that can serve as the foundational building block for any/all national energy policies and programs
- A vendor agnostic test that is fair across storage architectures and configurations
- Using test tools and methods known to be sound, precise, and non-disputable
- Using test tools that are not costly, that otherwise could be a barrier to entry for startups introducing innovative storage solutions
- A test specification that leverages best practices, know-how, and established programs, instead of reinventing the wheel
- A commitment to the industry to train certifying bodies, independent test and measurement labs, and vendor test teams on how to perform SNIA Emerald tests repeatedly with accurate results.

The SNIA Emerald Specification is steadily evolving to keep pace with storage component and system innovation. Storage engineers and architects continue to meet as part of the SNIA Technical Work Group working on next version of the specification, analyze test results posted to public agencies, and support the global testing community. SNIA encourages all storage vendors to participate in its stakeholder meetings and training. Additionally, we encourage storage vendors to work in our community to accelerate the rate of new specification development and validate test methods/tools.

For more information:

Visit: <https://www.snia.org/emerald>

To review US EPA Energy Star storage system test reports, visit

<https://www.energystar.gov/productfinder/product/certified-data-center-storage/results>

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1. *(Reference: Regulation (EU) No 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardisation, amending Council Directives 89/686/EEC and 93/15/EEC and Directives 94/9/EC, 94/25/EC, 95/16/EC, 97/23/EC, 98/34/EC, 2004/22/EC, 2007/23/EC, 2009/23/EC and 2009/105/EC of the European Parliament and of the Council and repealing Council Decision 87/95/EEC and Decision No 1673/2006/EC of the European Parliament and of the Council (OJ L 316, 14.11.2012, p. 12).*