SNIA Green Storage

SNIA Emerald™

# SNIA Emerald Specification Updates and Related Programs

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# Agenda

SNIA Emerald™

- Overview
- SNIA Emerald Enterprise System Specification & V5.0 Planned Specification Changes
- SNIA Enterprise Device SpecificationV1.0 - New
- SNIA Green Community – New Opportunities
- SNIA Resources and Contacts

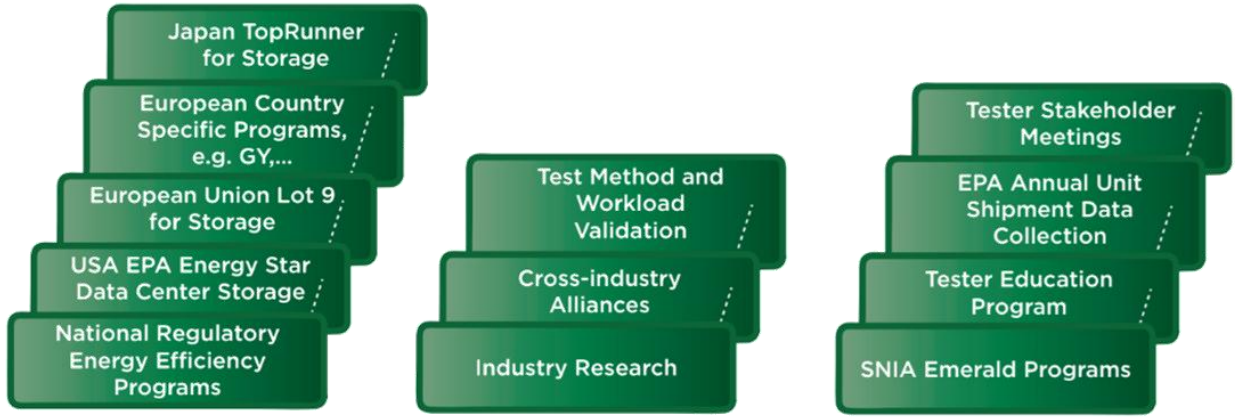
SNIA | Green Storage

# Advancing SNIA Emerald™ Power Measurement Specifications for Regulatory Bodies, Supply Chain with Cross-Industry Collaboration & Alliances

SNIA Emerald™

## Key Activities:

- SNIA Emerald for Enterprise Storage Devices V1.0 Q3 2025 NEW
- SNIA Emerald for Enterprise Storage Systems V5.0 1H2026
- Develop, maintain and publish specifications , JTC1 ISO
- Storage Expertise, for Workloads, Characterization, Metrics
- Cross-Industry Technical Collaboration
- Regional Regulatory Body Metrics, Reporting and Requirements
- Whitepapers, Education, Trends




SNIA Emerald™ | spec | 80 PLUS | energy ENERGY STAR | the green grid enabling data center efficiency | EU Lot 9 | TOP RUNNER PROGRAM JEITA | SNIA Japan™

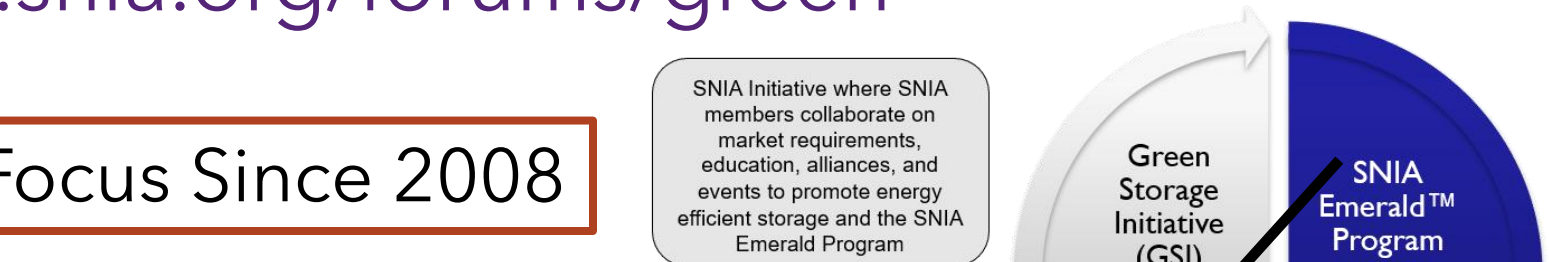
 

SNIA Green Storage A SNIA Community

# Green Storage Initiative (GSI) Mission (Now Community) https://www.snia.org/forums/green

## Focus Since 2008

SNIA Initiative where SNIA members collaborate on market requirements, education, alliances, and events to promote energy efficient storage and the SNIA Emerald Program




SNIA program to promote usage by vendors and test labs of the SNIA Emerald Test Specification and for IT professionals to reference energy usage metrics for storage vendor products to aide storage system procurement planning and optimization of IT storage operations

SNIA Emerald™

- Japan TopRunner for Storage
- European Country Specific Programs, e.g. GY,...
- European Union Lot 9 for Storage
- USA EPA Energy Star Data Center Storage
- National Regulatory Energy Efficiency Programs

- Test Method and Workload Validation
- Cross-industry Alliances
- Industry Research

- Tester Stakeholder Meetings
- EPA Annual Unit Shipment Data Collection
- Tester Education Program
- SNIA Emerald Programs

SNIA committee of technical storage system experts defining storage system energy measurement methodology, energy usage-related metrics, technical specifications, and best practices

SNIA Emerald™

SNIA Emerald™ Power Efficiency Measurement Specification for Enterprise Storage Systems
ISO/IEC 24091 – Information Technology – Power Efficiency Measurement Specification for Data Center Storage

**New for 2023:**
Storage Device-Level Power Efficiency Measurement Specification

SNIA Green Storage A SNIA Community

# Current Work Items from the Program of Work

**Green Storage TWG ROADMAP- 2025**
Approximate and subject to change
Update 07-17-2025

| # | Events | CY2025 Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | CY 2026 Q1 | Q2 | Q3 | Q4 | CY2027 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SNIA-GTWG F2F<br>Invite EPA to concall | | | | | | | | | | | | | ▽ SNIA Member vSymposium Jan '26 | | | | |
| 2 | EPA-SNIA Industry Meetings | | | | | | | | ...as needed... | | | | | ▽ DCS Stakeholder Meeting | | | | |
| 3 | ENERGY STAR Data Analysis (on file submittals) | | | | | | | | | | | | | ▽ V2.0/2.1 data analysis | | | | |
| 4 | Emerald Measurement Spec v5.0<br>CTS lite replacement for Vdbench<br>Update to Spec Strorage 2020 | | | | | | | | ▽ Spec V5.0 (internal draft) | | ▽ Spev V5.0 Public review | | | ▽ Sbmit for SNIA Approval | | ▽ Publication | | |
| 5 | ISO version of Emerald 5.0 (tentative) | | | | | | | | | | | | | | | | ▽ Submit to ISO | |
| 6 | Storage Device Level Power Efficiency Measurement | | | | | | | ▽ Spec V1.0 Public review SNIA Approval | | | ▽ Publication | | | | | | | |
| 7 | Futures | | | | | | | | | | | | | | | | | |
| | Memory attached persistent storage | | Investigate and make recommendations | | | | | | | | | | | | | | | |
| | Test methodologies for capacity optimization, data protection, etc. (impact on performance, energy consumption) | | | | | | | | | | | | | | | | | |
| | Energy measurement for large / new distributed systems; consider small scale measurement as system indicator | | | | | | | | | | | | | | | | | |
| | Collaborate w/ other Servers, Switch | | SW-defined, Hyperconverged configs | | | | | | | | | | | | | | | |
| | Cloud data centers | | Data caching, remote VS local, hybrid, etc. How to actually measure the energy efficiency? | | | | | | | | | | | | | | | |
| | Object storage | | Is market large enough? Is growing, e.g. S3. Plug-ins available SPEC Storage 2020 | | | | | | | | | | | | | | | |
| | ESTAR, ITI/ TGG (incl 80PLUS, Digital EU), EU Lot 9, ASHRAE, SPEC-Storage/Power, SNIA-Jpn TopRunner, ISO, | | | | | | | | | | | | | | | | | |
| 8 | Partner Collaboration/Tracking | | | | | | | | | | | | | | | | | |

# SNIA Emerald Enterprise System V4 & 5 Updates

# SNIA Emerald V5.0 Enterprise System Work

## Completed Work

Completed: SNIA Emerald 5.0 planning since 2023

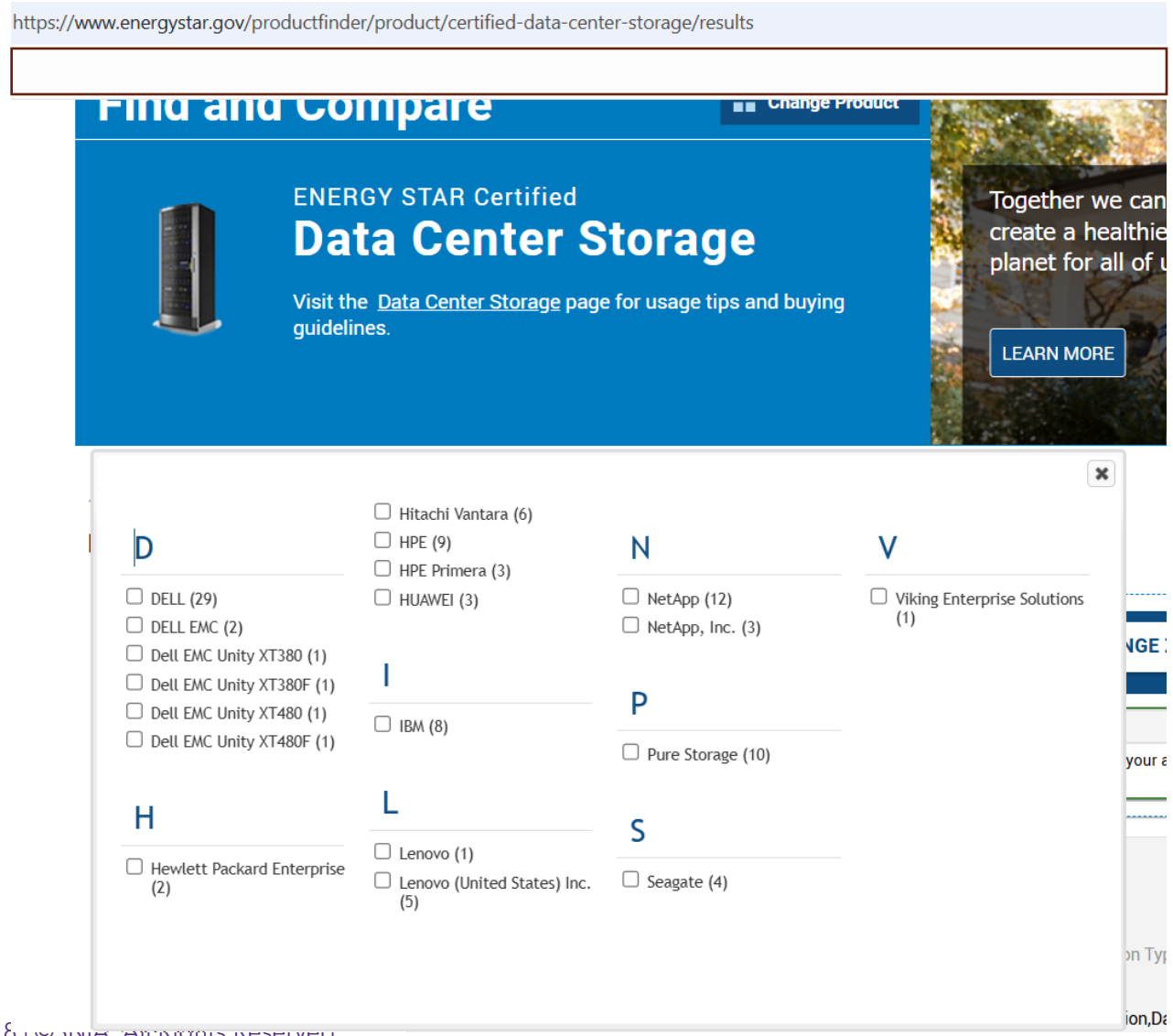
- **DONE**: Block IO workload tool replacement
  - vdBench → Calypso Test Suite
- **DONE:** File IO workload tool replacement
  - SPEC SFS 2014 → SPEC Storage Solution 2020 ; new workload e.g. AI
- TGG Alliance / EU Lot 9 regulations, EU other
- Data Analysis and Recommendations – SNIA-J for TopRunner.
- Working ETSI and CNIS
- EPA Data Analysis DCS 2.1

## WIP Plans thru 2026

- Complete SNIA Emerald 5.0 development
  - Modernizing tools and workloads a priority
- TGG Alliance / EU Lot 9 regulations
- EPA DCS Unit Shipment Report for 2023, 2024, will do 2025
- Industry Stakeholder Meetings EPA
- Tester Community Training for new SNIA Emerald V5.0 tools
- ISO submission

# USA EPA Energy Star Data Center Storage v2.0 Test Reports, based on SNIA Emerald v4




2025: 104 Test Reports 9 Vendors
2024: 71 Test Reports 9 Vendors
2023: 57 Test Reports 8 Vendors

EPA Energy Star Program:

- Focus is systems with sellable SKU
- Block IO and File IO
- Vendor voluntary participation
- Results independent certification
- US Gov procurement priority

- Focus does not include composable systems, in-house proprietary designs, or consumer products.

# GSI Work in Support of SNIA Emerald Specifications

## GSI Alliances and Cross Industry Work

Technology and Testing

- SPEC (SFS), Oracle (Vdbench (SPC community)), SPEC (power meters), S-FLOW, 80 Plus Ecova/EPRI (power supply testing), Calypso Testers, Quarch

Policy

- The Green Grid (+Digital Europe) (EU, EU country level pgms)
- SNIA-J (Japan)

Industry Regulatory

- EPA Energy Star (USA)
- TopRunner (Japan) (via SNIA-J)
- EU Lot 9 ( via TGG → Digital Europe), Blue Angel,
- *** ETSI, CNIA others

International Standards

- SC39 / ITS 39

Alliance work being investigated

- New OCP, Expanded SPEC

## GSI/GreenTWG Cross-SNIA Group Collaboration

- S3 TWG/CMSI
  - Solid state storage taxonomy
  - S3 Test Methods/data collection
- SFF TA TWG (future? )
  - EDSFF: Enterprise and Datacenter Standard Form Factor

# Key SNIA Projects

- (Green Community and Green TWG) SNIA Emerald - power/efficiency: system, device
- (CMSI and SSS TWG) PTS and IO Capture
- Redfish/Swordfish instrumentation
- IOTTA repository
- SDC
- Data, Network Storage Community - time to time webinar

# SNIA Emerald Enterprise Drive V1.0 Updates

# Why Enterprise Device Specification

- Hypervisor work (custom OEM build), Supply chain work
- Future Device type proliferation and packaging , e.g. DPU
- Future architectures non-CPU related
- Cost of testing for large, distributed systems, inability test
- Extension of SNIA subject matter experts in SNIA TWG(s)
- ** Client testing well understood with existing work by many system vendors and tool, workloads, consumer market driven

# SNIA Emerald Enterprise Device Work

## Accomplishments

- SDLPEM Taxonomy and Test Methods
  - Both HDD and Solid State
- Specification Writing
- Extensive Testing and Scripting
  - Tool automation for install
  - Tool for deep dive analysis at the granular level
  - Tool integration for
- V1.0 Just Approved to become SNIA Architecture

## WIP Plans

- Regulatory interests
- Alliances interests
- Tester Community Training for new SNIA Emerald Device V1.0 tools
- Documentation, tester kits with supplemental how to materials, pricing, etc
- V1.1 requirement gathering
- Decision on whether to make ISO
- Additional workloads

# CTSLite - ctslite.com

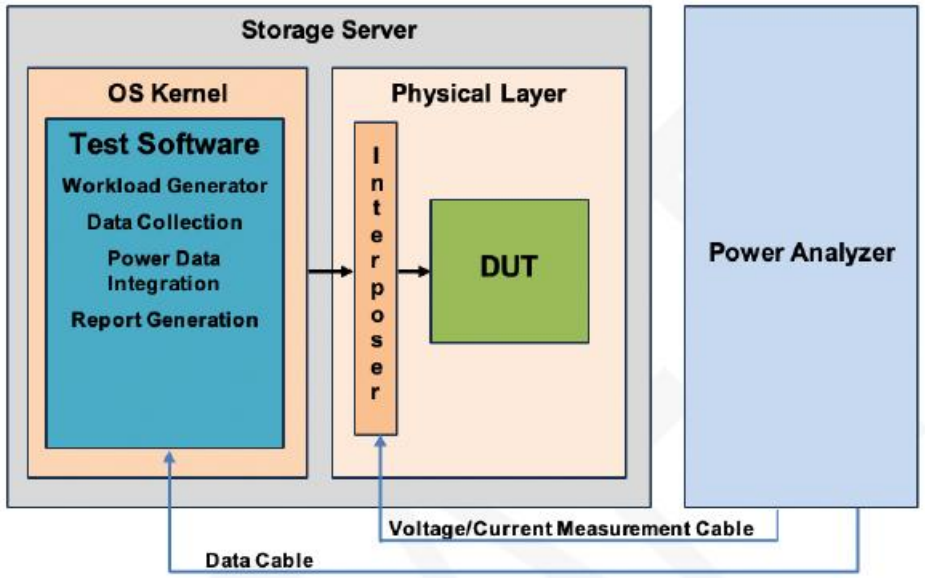



Figure 1. CTS Lite/Quarch - Power Efficiency Measurement

Figure 3. Quarch Interposer Board & Ribbon Cable

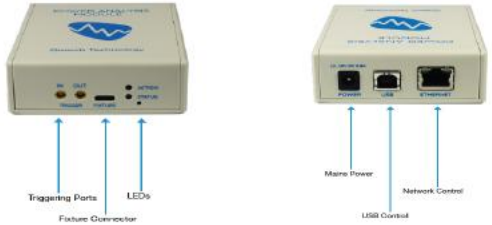



Figure 4. Quarch PAM

# Green Community

# Green Community Opportunities

- Since SNIA membership model from Forums/Initatives to free to join Community, a large influx of members have joined
  - However, nothing has been started yet
  - Current GS Community, remnant of Initiative , focused on SNIA Emerald success, for Tester Community, Specification timelines, and Alliances
- **Tonight**, a Birds of a Feather session on other orgs expanding their performance specs to include power measurement
  - **This Monday, 7PM-8PM** , San Thomas & Lawrence Meeting Rooms
- In the near future, Zoom meeting to discuss synergistic focus areas and starting separate meetings outside of the GreenTWG
  - SNIA whitepapers, research, alliances
  - ***Will take active volunteers to do work – there is no we/they ; we is they***

# Industry Landscape/Trends

- sustainability, performance, power/efficiency
  - by device, by storage, by IT, by geo/political location, by entire data center
- performance by device, system, application - longstanding industry approach
- different advancements in technology in points in time, shift the max performance bottleneck between processor/compute, network/interconnect, and data/storage
- inhouse tools, open source tools, a few tools for a fee; a few industry association programs
  - industry association programs take resources - for spec, for testing, for self/3rd party audit, challenge
  - comprehensive, fair, reflective of the deployed environment, not too expensive,
- consumers
  - customers/CIO, design/architect engineers,  regulatory bodies

# Green Storage Community – from a SWOT analysis

***Strengths***

- - SNIA Emerald system program for power efficiency, leveraging workload IO performance tools from Oracle, SPEC, Calypso Systems ; recognized worldwide and cross referenced by regulatory bodies
- - IOTTA as a longstanding repository of traces
- - events and webinar programs for papers to be presented
- - individual members from large companies who are deep into test tools, device/system characteristics that participate in other industry groups know the pros and cons of the various tools, understand device/system behavior (but are typically unable to participate/lead inside of SNIA due to pressures to deliver performance related work for ongoing employer revenue streams)
- - SNIA TWG process, industry association structure to write specs and protect IP through RAND, and create ISO variants of SNIA architecture

***Opportunities***

- IOTTA traces become de facto workloads for performance benchmarking

- SNIA Emerald Device specification for supply chain uptake and potential regulatory uptake

- Alliances by the dozen

- Cross-company CTO commitment to establish new baseline performance program inside SNIA, instead of one-trick industry/technology groups

# Key Industry Organization/Project Targets/Challenges From the SWOT work that can Feed into new Community

- Too many organizations to list
  - Following the buzzword of where is the workload, the advanced research, the concentration of companies that already are convened and collaborating
    - sustainability, performance, power/efficiency
    - by device, by storage, by IT, by geo/political location, by entire data center
    - performance by device, system, application - longstanding industry approach
- Reality Check
  - **SNIA Alliances require alliance program managers**
  - **New SNIA work require several companies "serious" beyond the bright idea in a BoF**
  - SNIA attractiveness to rehost an existing program into SNIA
- Industry Overlap with SNIA Work
  - Regulatory bodies that don't provide SNIA a direct seat at the table
    - Europe, Japan, China
  - Synthetic workloads and representative reference workloads with many party agreements, vs raw IO traces ; any in-house methods that are tailored to revenue streams and vendor unique architectures/technology

# Resources

Who to contact for additional information

- GS Community Chair, Wayne M. Adams, waynemadams@gmail.com
- GS SNIA Emerald Program Manager, David Thiel, emerald@snia.org

SNIA Emerald Tester Community and Training

- www.sniaemerald.com

GreenTWG Co-chairs

- Don Goddard, NetApp
- Carlos Pratt, Ultrastratech

Technology Companies/Test Related Tools

- Don Capps – SPEC Storage 2020 and future roadmap, file workloads
- Eden Kim- Calypso Testers, CTSLite – both Device and System
- Andy Norrie – Quarch PAM Boards/Modules for Enterprise Device Testing
- SPEC - Power Measurement Meters for SNI Emerald System Testing

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