SNIA DSI '16 DATA STORAGE INNOVATION CONFERENCE
Innovation in Storage Products, Services, and Solutions
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Storage Systems Can Now Get ENERGY STAR Labels and Why You Should Care

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Agenda

- About Demartek
- Energy Efficiency in the Home and in Data Centers
- Power Supplies
- SNIA Emerald Specification
- EPA ENERGY STAR Data Center Storage
- Demartek Experience Running Emerald/EPA Tests
- Demartek Free Resources

Demartek Video

Click to view this one minute video
(available in 720p and 1080p)

Demartek YouTube Channel:
http://www.youtube.com/user/Demartek/videos

http://www.demartek.com/Demartek_Video_Library.html

About Demartek

- Industry Analysis and ISO 17025 accredited test lab
- Lab includes enterprise servers, networking & storage (DAS, NAS, SAN, 10 / 25 / 40 / 100GbE, 32GFC)
- We prefer to run real-world applications to test servers and storage solutions (databases, Hadoop, etc.)
- Demartek is an EPA-recognized test lab for ***ENERGY STAR Data Center Storage*** testing
- Website: www.demartek.com/TestLab

Do You Have a Green Data Center?

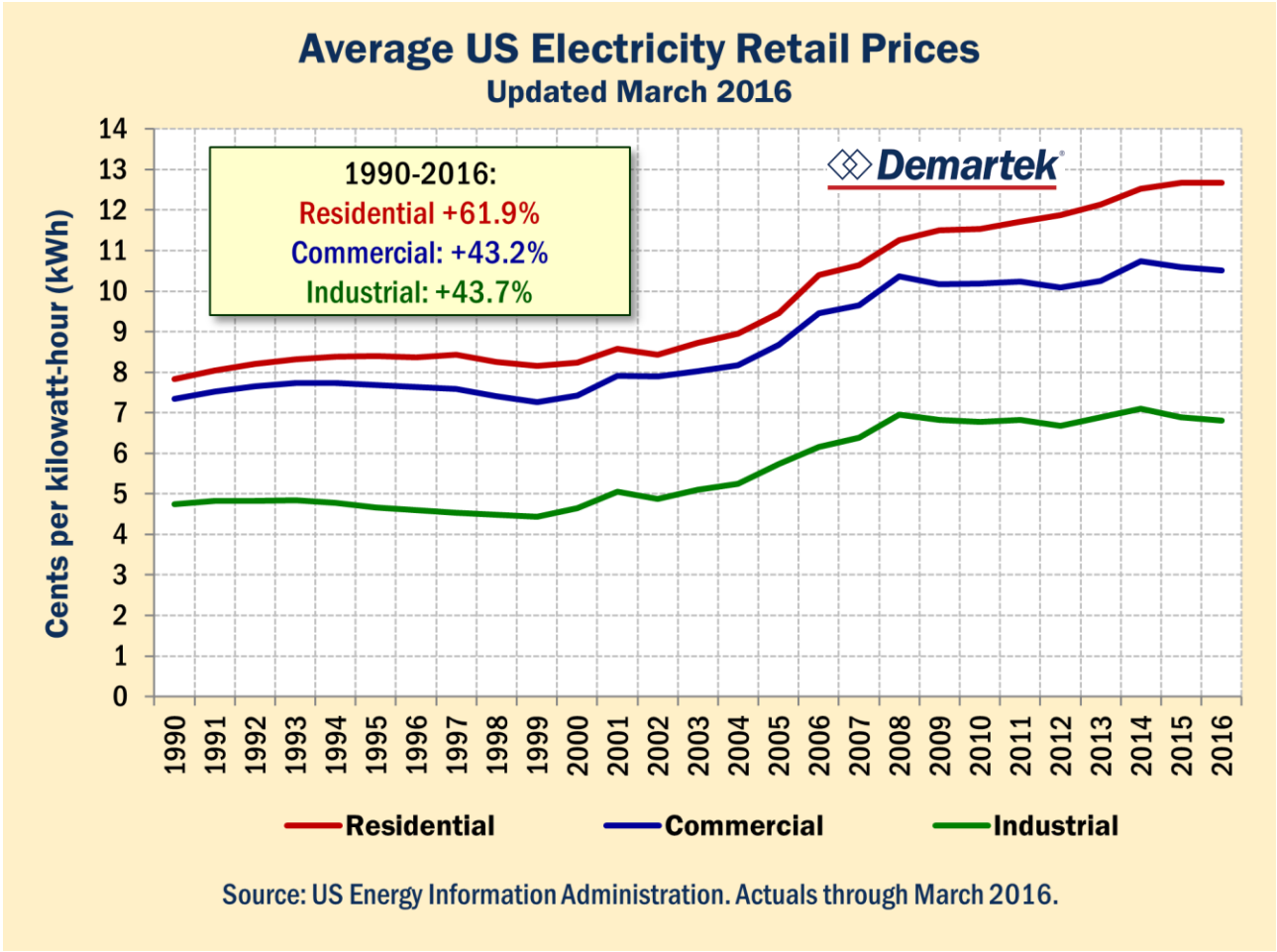
Home vs. Data Center

► Electric Power Usage Comparison

- Home
  - Install more power-efficient devices
  - Devices usually have one power supply
  - Some devices always on
  - Turn off devices when not in use
- Data Center
  - Install more power-efficient devices
  - Devices usually have redundant power supplies
  - Most devices always on
  - Achieve 99.999% uptime

Home and Data Center have divergent requirements with respect to electric power consumption

Electric Price Trends



Yearly average increase,
1990-2016:

Res. 1.87%

Com. 1.39%

Ind. 1.40%

Prices tend to be above average in New England, the middle Atlantic States, California, Alaska and Hawaii.

Prices can fluctuate during different times of day.

Data Center Trends

- Nearly three million data centers in the USA today
  - Source: National Resources Defense Council (NRDC)
- Data center equipment is becoming more dense
  - New server designs with more processors and memory per rack unit
  - Increasing use of 2.5-inch drives for storage
- Increases in density of equipment in racks have implications for cooling, noise, arrangement of equipment and relationship to the power company

Data Center Power: PUE and DCiE

► Developed by the Green Grid

- PUE = Power Usage Effectiveness
- DCiE = Data Center infrastructure Effectiveness
- $PUE = \frac{Total\ Facility\ Energy}{IT\ Equipment\ Energy}$ $\qquad DCiE = \frac{1}{PUE}$
- The ideal PUE is 1.0, but very difficult to achieve
  - A PUE of 2.0 means that for every 2 watts of power delivered to the data center, 1 watt reaches the computing equipment
- These metrics are for the entire data center, not individual devices

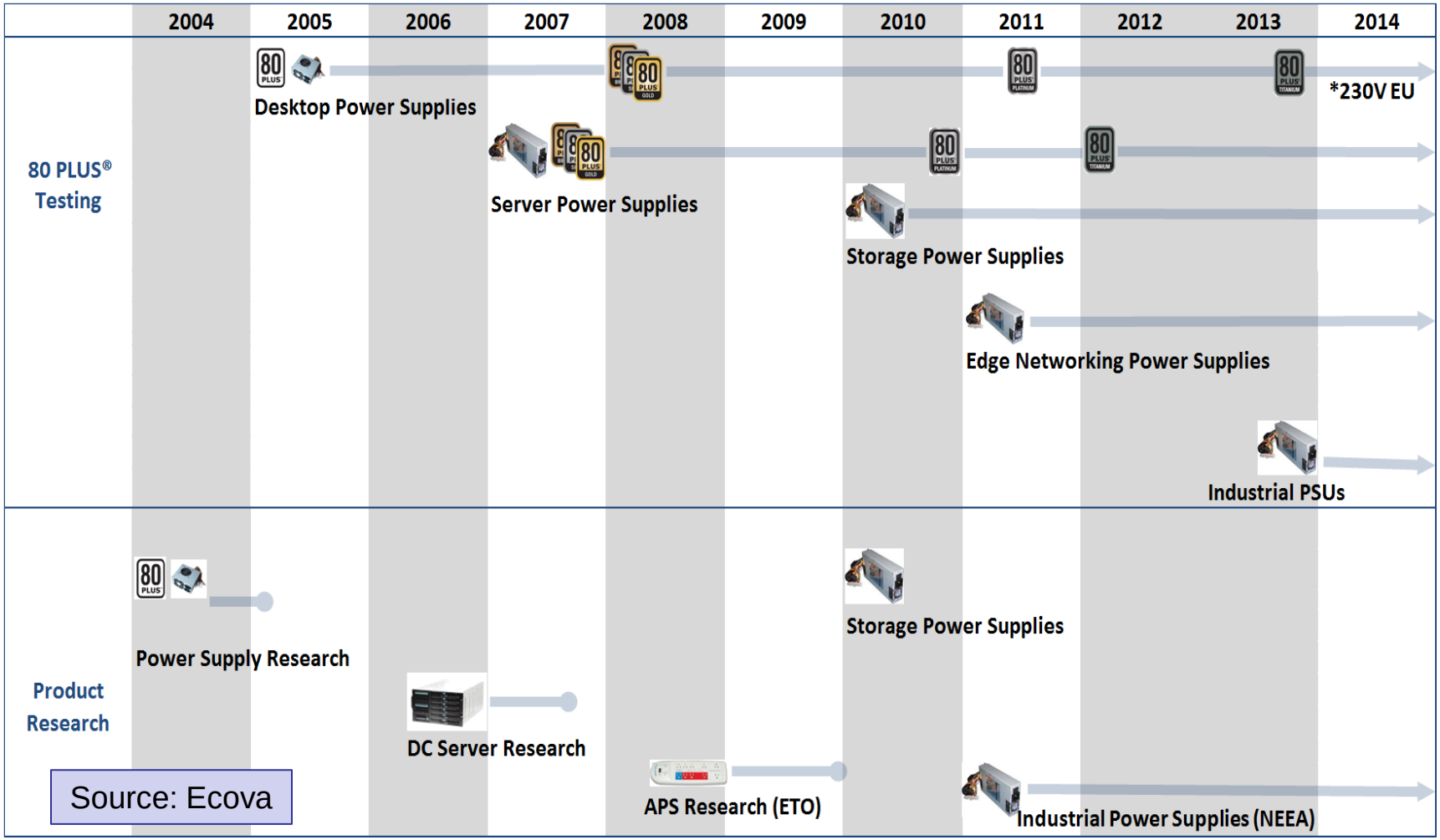
Power Supply Efficiency

- Power supply efficiency measure how efficiently power is delivered from the “wall power” to the components inside a computing device such as a server or storage system.
  - A 60% efficient power supply will draw 1000 watts from the grid in order to deliver 600 watts to the components inside the computer or storage system. The other 400 watts would be wasted as heat.
  - Higher efficiency power supplies waste less energy, are cooler and quieter, resulting in lower OPEX
- Reducing OPEX is increasingly important.

80 PLUS

- Started in 2004
- A voluntary certification program
- Certifies that power supplies are at least 80% efficient at 20%, 50% and 100% of rated load.
- Power factor of 0.9 or greater at 100% load
- Measured at 115v and 230v

80 PLUS History



80 PLUS Ratings

	115v Internal Non-Redundant				230v Internal Redundant			
% of Rated Load	10%	20%	50%	100%	10%	20%	50%	100%
80 PLUS	—	80%	80%	80% PFC.90	—	—	—	—
80 PLUS Bronze	—	82%	85% PFC .90	82%	—	81%	85% PFC .90	81%
80 PLUS Silver	—	85%	88% PFC .90	85%	—	85%	89% PFC .90	85%
80 PLUS Gold	—	87%	90% PFC .90	87%	—	88%	92% PFC .90	88%
80 PLUS Platinum	—	90%	92% PFC .95	89%	—	90%	94% PFC .90	91%
80 PLUS Titanium	90%	92% PFC .95	94%	90%	90%	94% PFC .95	96%	91%

These are of particular interest to us

Efficient Voltages

- Many of today's power supplies are rated for a range of voltages, such as 100v – 240v or sometimes broader.
  - Applies to many consumer and enterprise devices and systems
- These power supplies are more efficient at 230v or 240v than they are at 115v or 120v.
- Demartek's lab runs 80% of its racks at 230v/240v and 20% of its racks at 115v/120v.

SNIA Emerald™

- The SNIA Emerald™ program provides storage system power usage and efficiency information to the public.
  - Part of the Green Storage Initiative (GSI)
- It uses a well-defined test procedure to provide performance/watt and capacity/watt results for storage systems, knowns as the ***SNIA Emerald Power Efficiency Measurement Specification***
- Website: http://snia.org/emerald

SNIA Emerald™ Taxonomy

SNIA Emerald™

	Online	Near Online	Removable Media Library	Virtual Media Library
Consumer / Component	Online 1*	Near Online 1*	Removable 1	Virtual 1
Low-end	Online 2	Near Online 2	Removable 2	Virtual 2
Mid-range	Online 3	Near Online 3	Removable 3	Virtual 3
	Online 4	—	—	—
High-end	Online 5	Near Online 5	Removable 5	Virtual 5
Mainframe	Online 6	Near Online 6	Removable 6	Virtual 6

* Online 1 and Near Online 1 are not covered in the current version of the ENERGY STAR specification.

SNIA Emerald™ Taxonomy

SNIA Emerald™

- **Online:** storage systems that can consistently retrieve the first data of a data block within 80ms (milliseconds), generally disk-based.
- **Near Online:** not as fast as online but can support random and sequential I/O.
- **Removable Media:** tape libraries and optical juke boxes.
- **Virtual Media Library:** can meet the 80ms time to first data. Generally disk-based for sequential I/O.

SNIA Emerald™ Tests

- VDBENCH is used as the disk I/O workload generator. VDBENCH is maintained by Oracle Corp.
- The scripts for the workloads include:
  - Pre-fill Test (phase)
  - SUT Conditioning Test (12 hours of run time)
  - Active Test
  - Ready Idle Test
  - Capacity Optimization Method (COM) Test
- Power meters and temperature sensors are required.
  - Power meter list taken from SPEC power benchmark

SNIA Emerald™ Metrics

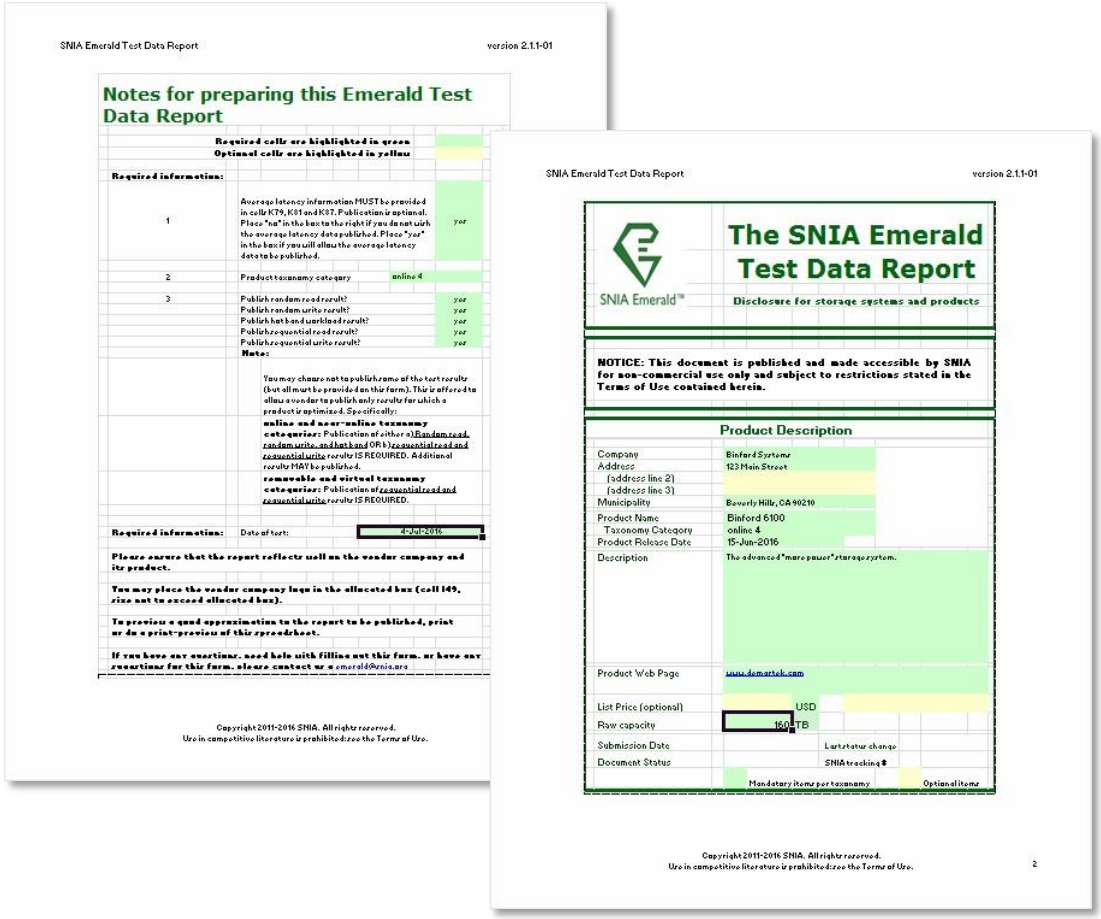
- Hot band workload – IOPS/watt
- Random Read workload – IOPS/watt
- Random Write workload – IOPS/watt
- Sequential Read workload – MBPS/watt
- Sequential Write workload – MBPS/watt
- Achieve the best performance/watt results while maintaining < 20ms latency
- Capacity/watt (idle)
- Pass the COM (capacity optimization) tests

SNIA Emerald™ Output

Output is a multi-page spreadsheet that combines the technical performance data, power measurements, and information about the model under test.

Some data fields are mandatory and some are optional.

Must understand difference between GB and GiB.



SNIA Emerald™ RTP

- SNIA has developed the SNIA Emerald Recognized Tester Program (RTP)
- Organizations can become recognized testers by demonstrating knowledge of and proficiency with the SNIA Emerald test specification. An on-site audit is required.

September 16, 2014: Demartek is the first official SNIA Emerald Recognized Test Lab

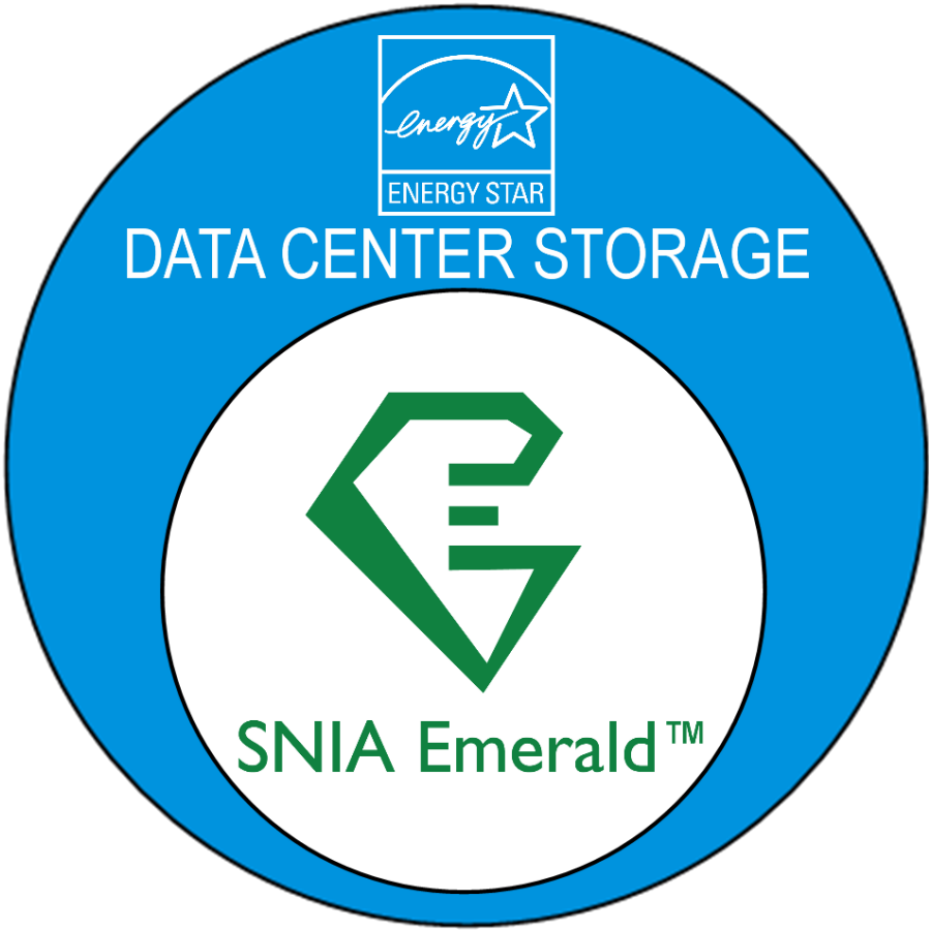
http://www.snia.org/emerald/rtp-overview

EPA ENERGY STAR

- The US Environmental Protection Agency (EPA) has defined the ENERGY STAR program to encourage energy efficiency with a wide variety of consumer and business products.
- Electronics and Office Equipment programs include:
  - Computers
  - Data Center Storage
  - Displays
  - Enterprise Servers
  - Small Network Equipment
  - Uninterruptible Power Supplies
- Future programs include
  - Large Network Equipment

EPA ENERGY STAR Data Center Storage and SNIA Emerald

- EPA ENERGY STAR Data Center Storage Specification 1.1 uses the SNIA Emerald Power Efficiency Measurement Specification 2.1.1

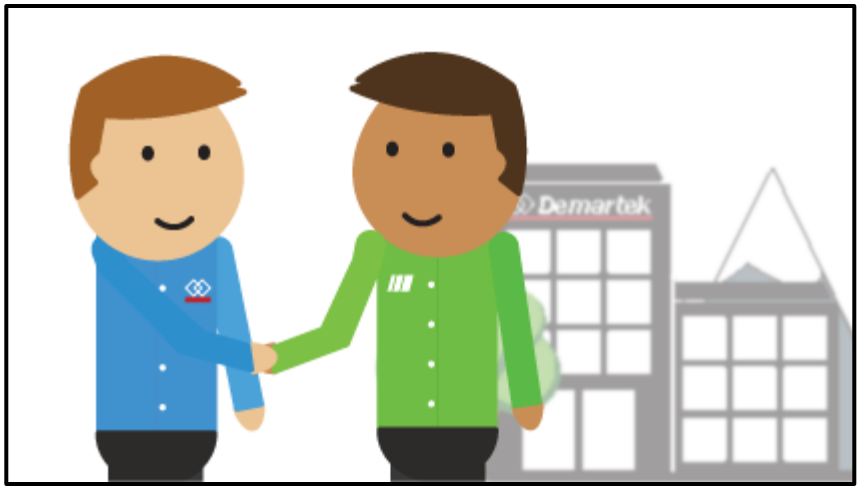


EPA ENERGY STAR Data Center Storage Testing

- EPA ENERGY STAR Data Center Storage uses the SNIA Emerald test specification.
  - EPA adds requirement for tight voltage variations and total harmonic distortion (THD) measurements.
  - EPA requires temperature and humidity measurements.
  - EPA requires 80PLUS Silver equivalent or better power supplies in the storage systems under test.
  - EPA has slightly different COMs requirements.
- EPA-recognized testers must be ISO 17025 accredited test labs
- Submissions for EPA can be tested or modeled.

Demartek Video on Emerald/EPA Testing

- Demartek created a video that provides the details of the EPA ENERGY STAR Data Center Storage specification.



Includes information for product vendors to get started with EPA ENERGY STAR

Additional Demartek Presentation

- Demartek has a separate presentation that provides a detailed comparison between SNIA Emerald and EPA ENERGY STAR Data Center Storage
- Demartek also works with product vendors to complete the large amount of marketing product data required for the EPA submissions.

EPA ENERGY STAR Data Center Storage

- EPA ENERGY STAR Data Center Storage certified products: https://data.energystar.gov/Government/ENERGY-STAR-Certified-Data-Center-Storage/gqtf-hp7x

- EPA Product Shipment Data
  - SNIA has been appointed as the Storage Shipment Data Aggregator by the EPA http://www.snia.org/emerald/EPA_Reporting

Demartek Free Resources

- Demartek SSD Deployment Guide
  www.demartek.com/Demartek_SSD_Deployment_Guide.html
- Demartek Video Library
  www.demartek.com/Demartek_Video_Library.html
- Demartek FC Zone
  www.demartek.com/FC
- Demartek iSCSI Zone
  www.demartek.com/iSCSI
- Demartek SSD Zone
  www.demartek.com/SSD

Performance reports, Deployment Guides and commentary available for free download.

Storage Interface Comparison

- Downloadable interactive PDF version now available
- Search engine: “storage interface comparison”
- www.demartek.com/Demartek_Interface_Comparison.html

Thank You!

Demartek

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