



# **Storage Systems Can Now Get ENERGY STAR Labels and Why You Should Care**

**Dennis Martin  
President, Demartek**

# 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](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](http://www.demartek.com/TestLab)



 **SNIA Emerald™**  
RECOGNIZED TESTER

# Do You Have a Green Data Center?

BY DIANE ALBER



# Home vs. Data Center

## ► Electric Power Usage Comparison

### □ Home

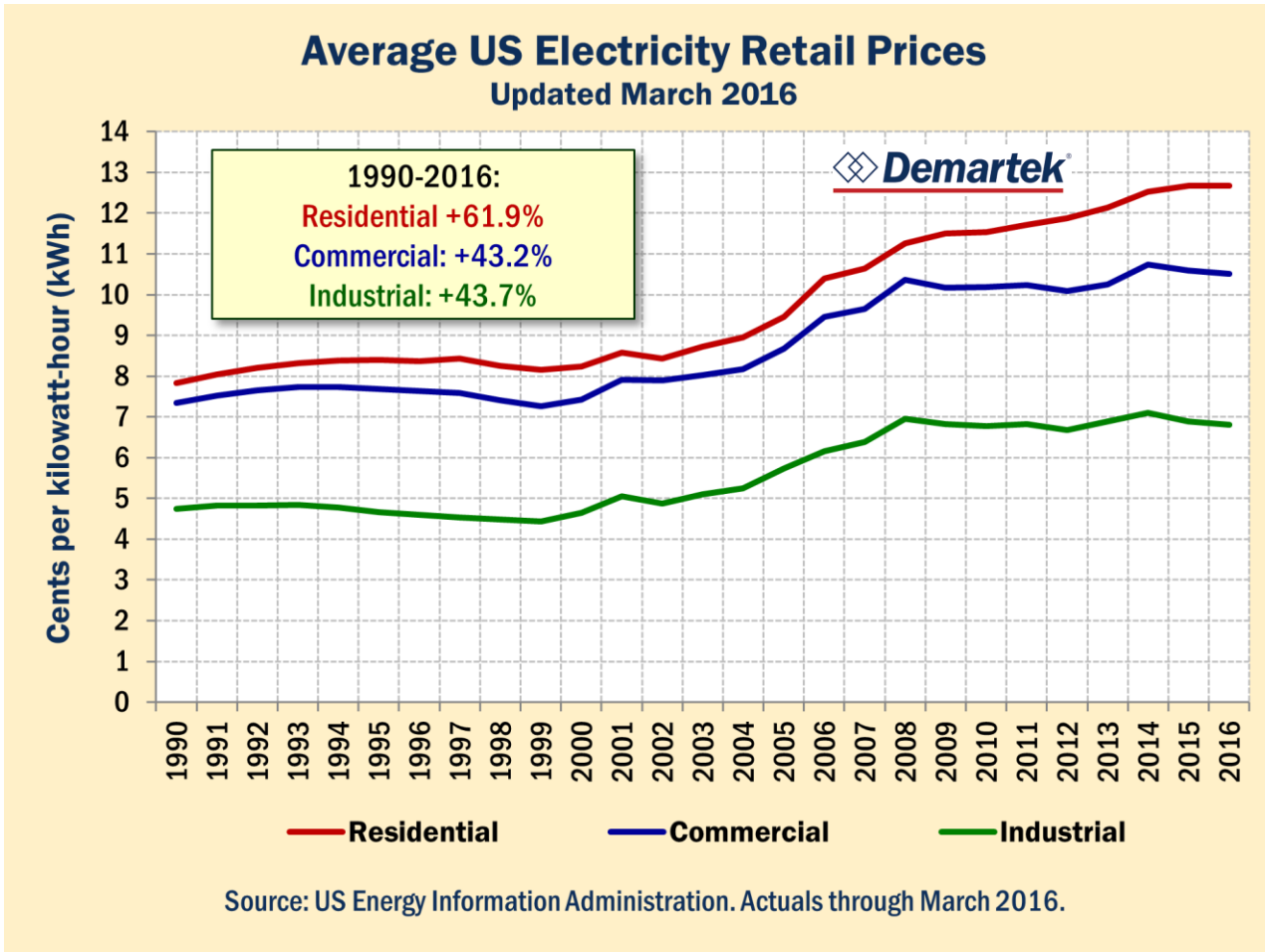
- Install more power-efficient devices
- Devices usually have one power supply
- Some devices always on
- Turn off devices when not in use

### □ 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
- ❑  $PUE = \frac{\text{Total Facility Energy}}{\text{IT Equipment Energy}}$        $DCiE = \frac{1}{PUE}$
- ❑ 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.

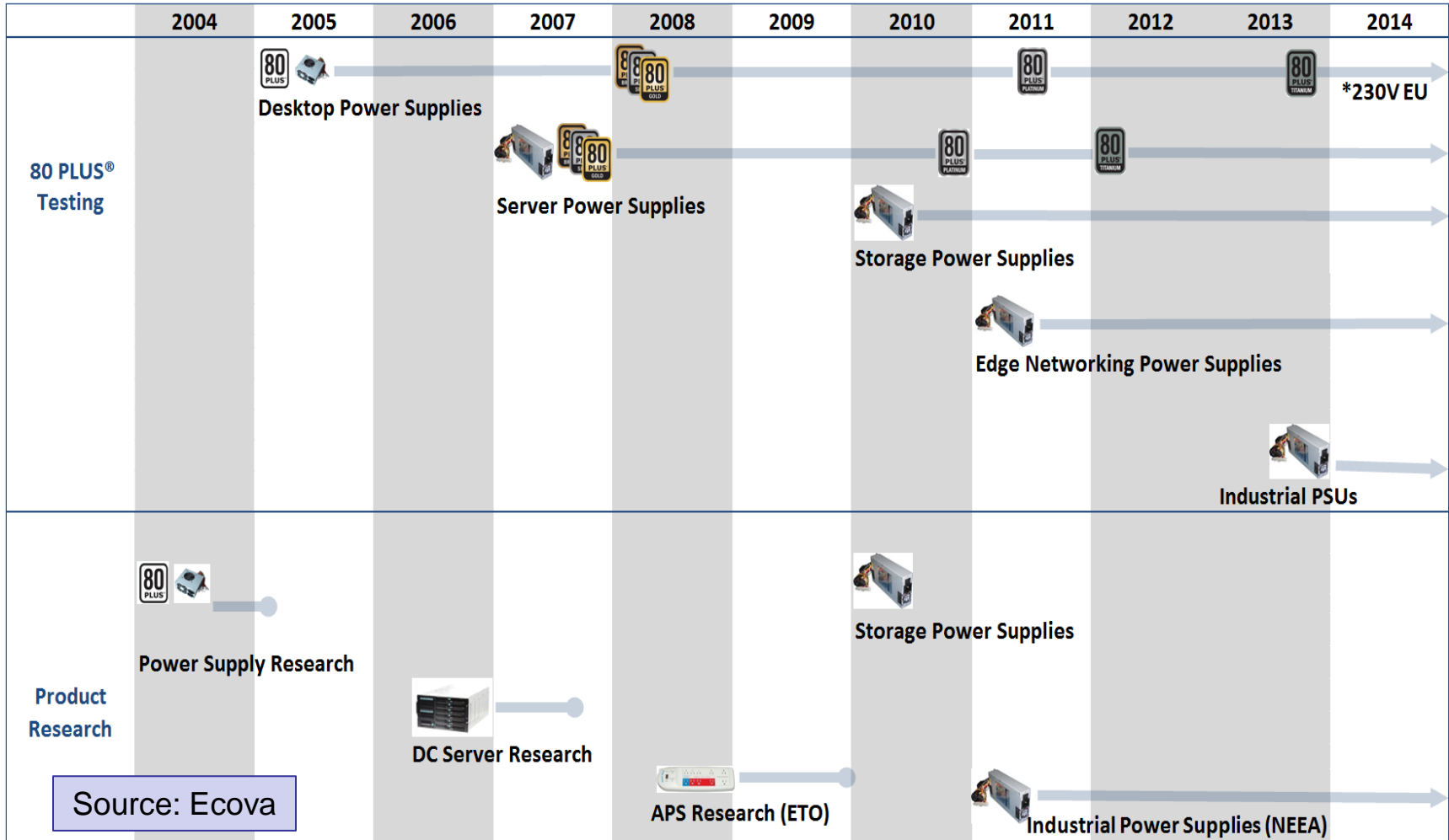
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# 80 PLUS

- ❑ 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



Source: Ecova

# 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.

- ❑ 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, known as the ***SNIA Emerald Power Efficiency Measurement Specification***
- ❑ Website: <http://snia.org/emerald>

# SNIA Emerald™ Taxonomy



	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



- ❑ **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.

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# 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 Test Data Report version 2.1.1-01

### Notes for preparing this Emerald Test Data Report

Required calls are highlighted in green  
Optional calls are highlighted in yellow

Required information:		
1	Average latency information MUST be provided in cells K79, K81 and K82. Publication is optional. Place "yes" in the box to the right if you do not wish the average latency data published. Place "yes" in the box if you will allow the average latency data to be published.	yes
2	Product taxonomy category	online-4
3	Publish random read result? yes Publish random write result? yes Publish sequential read result? yes Publish sequential write result? yes	yes

**Note:**  
You may choose not to publish any of the test results (but all must be provided on this form). This is offered to allow a vendor to publish only results for which a product is optimized. Specifically:  
**online and near-online taxonomy categories:** Publication of other (0) randomized, sequential write results IS REQUIRED. Additional results MUST be published.  
**removable and virtual taxonomy categories:** Publication of sequential read and sequential write results IS REQUIRED.

Required information: Date of test: 4-Jun-2016

Please ensure that the report reflects well on the vendor company and its product.

You may place the vendor company logo in the allocated box (cell I49, size not to exceed allocated box).

In previous and approximation to the report to be published, print or do a print-preview of this spreadsheet.

If you have any questions, need help with filling out this form, or have any questions for this form, please contact us at [emerald@snia.org](mailto:emerald@snia.org)

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SNIA Emerald Test Data Report version 2.1.1-01

## The SNIA Emerald Test Data Report

SNIA Emerald™ Disclosure for storage systems and products

**NOTICE: This document is published and made accessible by SNIA for non-commercial use only and subject to restrictions stated in the Terms of Use contained herein.**

### Product Description

Company	Emford Systems
Address	123 Main Street
Address line 2	
Address line 3	
Municipality	Beavertown Hills, GA 30216
Product Name	Emford 6100
Taxonomy Category	online-4
Product Release Date	15-Jun-2016
Description	The advanced "near-poser" storage system.
Product Web Page	<a href="http://www.demartek.com">www.demartek.com</a>
List Price (optional)	USD
Raw capacity	160 TB
Submission Date	Last status change
Document Status	SNIA tracking #
	Mandatory Home port taxonomy
	Optional Home

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# 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>

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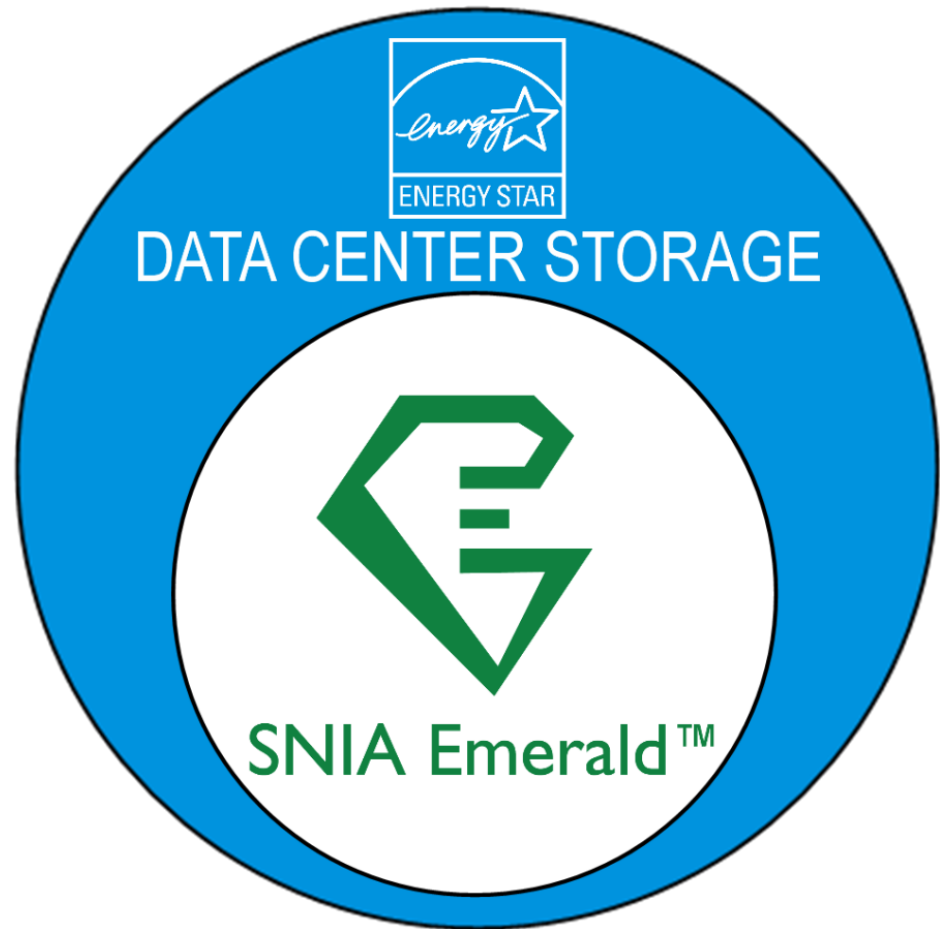
# EPA ENERGY STAR

- ❑ 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

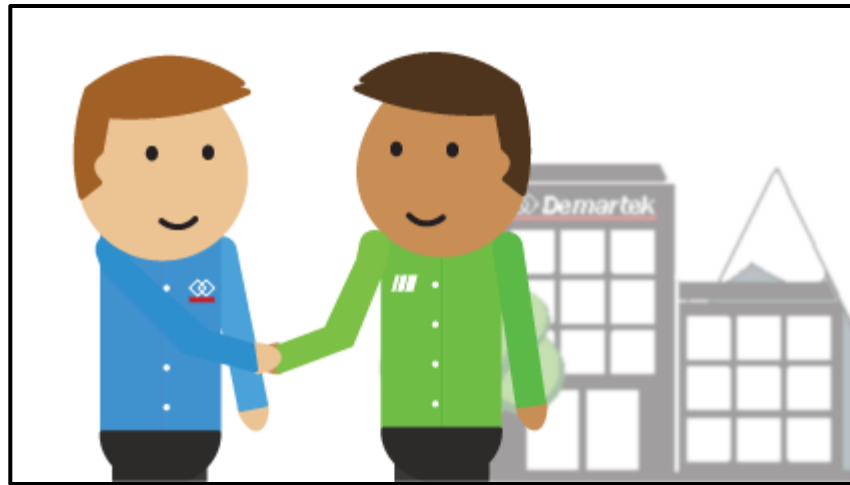


- ❑ EPA ENERGY STAR Data Center Storage uses the SNIA Emerald test specification.
  - ❑ EPA adds requirement for tight voltage variations and total harmonic distortion (THD) measurements.
  - ❑ EPA requires temperature and humidity measurements.
  - ❑ EPA requires 80PLUS Silver equivalent or better power 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](http://www.snia.org/emerald/EPA_Reporting)

# Demartek Free Resources

- ❑ Demartek SSD Deployment Guide  
[www.demartek.com/Demartek\\_SSD\\_Deployment\\_Guide.html](http://www.demartek.com/Demartek_SSD_Deployment_Guide.html)
- ❑ Demartek Video Library  
[www.demartek.com/Demartek\\_Video\\_Library.html](http://www.demartek.com/Demartek_Video_Library.html)
- ❑ Demartek FC Zone  
[www.demartek.com/FC](http://www.demartek.com/FC)
- ❑ Demartek iSCSI Zone  
[www.demartek.com/iSCSI](http://www.demartek.com/iSCSI)
- ❑ Demartek SSD Zone  
[www.demartek.com/SSD](http://www.demartek.com/SSD)

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

# Storage Interface Comparison



The banner features the Demartek logo in the top right corner. Below it, a row of icons represents various storage interfaces: nvm EXPRESS, SERIAL ATA, SUPER SPEED USB, Fibre Channel over Ethernet, 12Gb/s Serial Attached SCSI, Fibre Channel, INFINIBAND, and Ethernet. The central text reads "STORAGE INTERFACE COMPARISON". Below this, there is a button with a play icon and the text "INTERACTIVE PDF". Underneath the button, it says "Download the Demartek Storage Networking Interface Comparison Interactive PDF (PDF, 12.3 MB)".

- ❑ Downloadable interactive PDF version now available
- ❑ Search engine: “storage interface comparison”
- ❑ [www.demartek.com/Demartek\\_Interface\\_Comparison.html](http://www.demartek.com/Demartek_Interface_Comparison.html)

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# Thank You!



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