ENERGY STAR
Data Center Storage Meeting
SNW Fall 2011

October 13, 2011

Agenda

Time (all EST)	Topic
10:00 AM	Meeting Introduction
10:10 – 11:00	Product Families and Program Scope
11:00 – 11:45	Data Measurement and Monitoring
11:45 AM – 12:45 PM	Ready Idle and Active Mode Reporting
Approx. Noon	Brief Break and Working Lunch (provided)
1:00 – 1:45	Energy Efficient Features
1:45 – 2:15	Power Supplies: Levels, Embedded Equipment
2:15 – 3:00	Remaining topics, meeting summary and closing

Goals and notes

- High-level review and discussion of key topics presented in Draft 2 (as time allows)
- Opportunity for further detail in advance of stakeholders formulating written feedback
- Note: all slides will be posted to ENERGY STAR Data Center Storage website, along with minutes

Introductions

RJ Meyers
EPA, ENERGY STAR
(202) 343-9923
Meyers.Robert@epa.gov

Evan Haines
ICF International
(202) 572-9456
Ehaines@icfi.com

John Clinger
ICF International
(202) 572-9432
Jclinger@icfi.com

Bizhan Zhumagali
ICF International
(202) 572-9448
Bzhumagali@icfi.com

Al Thomason
TBWC, LLC
(503) 708-7881
thomasonw@gmail.com

For remote attendees

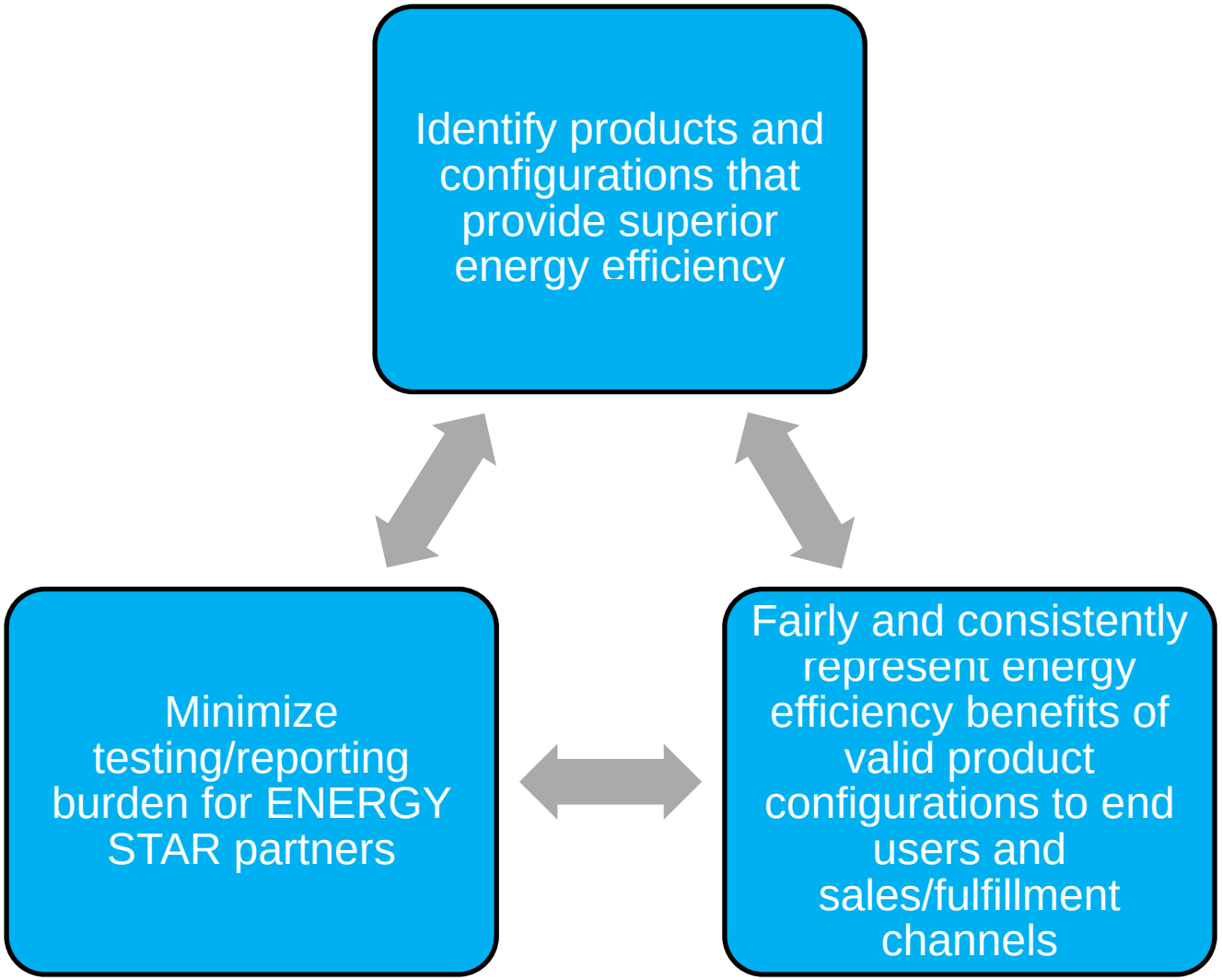
- Audio provided via conference call in:

  Call in: +1.877.423.6338 (inside U.S.)
  +1.571.281.2578 (outside the U.S.)
  Code: 436598

- Phone lines will remain on mute during presentations, opened during discussion (*please keep phone lines on mute unless speaking*)

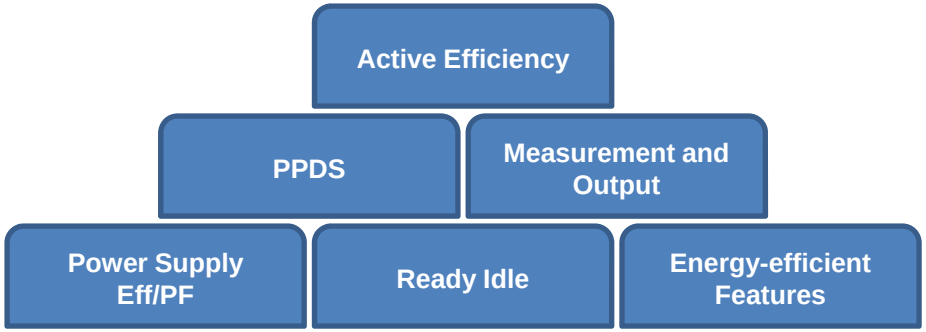
- Please refer to the agenda for approximate discussion timing

Review of ENERGY STAR Goals



Layer Cake

- Building program incrementally
  - Version 1.0
    - **Foundation**: PSUs, Ready Idle
    - **Information**: Standard Reporting, PPDS, Active Efficiency Disclosure
  - Version 2.0+:
    - **Foundation**: PSUs, Ready Idle
    - **Information**: Standard Reporting, PPDS
    - **Active Efficiency Levels**



Time (all EST)	Topic
10:00 AM	*Meeting Introduction*
10:10 – 11:00	**Product Families and Program Scope**
11:00 – 11:45	*Data Measurement and Monitoring*
11:45 AM – 12:45 PM	*Ready Idle and Active Mode Reporting*
Approx. Noon	*Brief Break and Working Lunch (provided)*
1:00 – 1:45	*Energy Efficient Features*
1:45 – 2:15	*Power Supplies: Levels, Embedded Equipment*
2:15 – 3:00	*Remaining topics, meeting summary and closing*

Product family structure

Note: Based on discussions to date and the data available, EPA proposes to proceed with a Product Family structure that "bookends" the systems intended for ENERGY STAR qualification. The "Maximum" and "Minimum" in such an approach refer to the maximum and minimum configurations that the manufacturer intends to sell as ENERGY STAR qualified, not necessarily the maximum or minimum of available configuration options.

EPA has discussed this bookending approach as well as alternative options for family structures with stakeholders over the months preceding this draft release. The bookending approach provides EPA with well-defined boundaries that delineate product families and assure that energy performance within a family is characterized across a range of system sizes. In addition, the bookending approach supports the assembly of active mode test measurement data, which would provide useful information to the product end-user. EPA continues to welcome stakeholder input on this approach as well as comments and discussions on the merits of alternative approaches.

- Draft 2 noted EPA's intentions to proceed with creating a bookending framework for Data Center Storage product families

Bookends as a family structure

What it is	What it is NOT
Testing of outer bounds of what Partner intends to market as ENERGY STAR qualified	Requirement to test outer bounds of all available configurations in a family
Representative test points to communicate spectrum of results amongst which qualified configurations will fall	Waiver if verification of a “child” configuration shows ENERGY STAR requirements are not met. Partner is responsible for ensuring that intermediate configurations marketed as ENERGY STAR meet all program requirements and criteria.

Testing considerations

- EPA proposed use of the SNIA Emerald™ Power Efficiency Measurement Methodology

- By aligning test methods with the Emerald program, it could allow manufacturers to share data between the programs

Storage proposal

- 3 test points:

310 2) Maximum Configuration: A product configuration that includes the combination of base
311 components that generates the maximum possible power consumption within a product
312 family. [TBD]

313 3) Minimum Configuration: A product configuration that includes the combination of base
314 components that generates the least possible power consumption within a product family.
315 [TBD]

316 4) Typical Configuration: A product configuration that lies between the minimum and maximum
317 configurations and is representative of a product with high volume sales. [TBD]

- To be defined:
  - Common product family attributes
    - key characteristics shared by all family members
    - e.g., drive type

Scope and inclusion of NAS

- The Version 1.0 scope of the program is solidified to cover Online-2, Online-3, and Online-4

384 iii. be comprised of one or more SKUs and be able to be purchased in a single order from a
385 system vendor;
386 iv. be characterized within the SNIA-defined Online 2, 3, or 4 storage taxonomy categories;
387 v. Contain a storage controller within the storage device.

- Further portions of the market may be added to the program, but in future versions

Table 4 - Online Classifications

Attribute	Classification					
	Online 1	Online 2	Online 3	Online 4	Online 5	Online 6
Access Pattern	Random/ Sequential	Random/ Sequential	Random/ Sequential	Random/ Sequential	Random/ Sequential	Random/ Sequential
Connectivity	Not specified	Connected to single or multiple hosts	Network-connected	Network-connected	Network-connected	Network-connected
Consumer/ Component	Yes	No	No	No	No	No
FBA/CKD Support	Optional	Optional	Optional	Optional	Optional	Required
Integrated Storage Controller	Optional	Optional	Required	Required	Required	Required
Maximum Configuration[1]	≥1	≥ 4	≥ 12	> 100	>400	>400
MaxTTFD (t)	t < 80 ms	t < 80 ms	t < 80 ms	t < 80 ms	t < 80 ms	t < 80 ms
No SPOF	Optional	Optional	Optional	Required	Required	Required
Non-Disruptive Serviceability	Optional	Optional	Optional	Optional	Required	Required
Storage Protection	Optional	Optional	Required	Required	Required	Required
User-Accessible Data	Required	Required	Required	Required	Required	Required

NAS

Note: After considering stakeholder feedback on product coverage under the first version of the program, EPA has limited the scope of Version 1.0 to Data Center Storage products falling under the SNIA-defined Online-2, Online-3, and Online-4 storage taxonomy categories.

Some stakeholders raised the prospect of covering Network Attached Storage (NAS) in the scope of the program during development of this Draft 2 document. EPA seeks further stakeholder input on test methodologies appropriate to NAS and how such product fit the requirements structure in this draft.

Other product areas will be considered for future versions of the program.

- Network attached storage raised again by stakeholders as an area for ENERGY STAR coverage
- EPA understands from related discussions that it will be challenging to develop and agree on an appropriate test method

NAS

- EPA will proceed with development of Version 1.0 and will incorporate NAS if it can fit into a reasonable specification development timeline.
  - Spring 2012

- Options:
  - Follow developments and integrate with Version 1.0 (if timing allows)
  - Encourage continued development with reference in “Considerations for Future Specification Revisions” section. Inclusion in v2.0.

Other data center storage types

- Blade storage
  - EPA has longer-term interest in capturing blade storage in the ENERGY STAR program
  - Level of testing complexity, and limits of available data, suggests evaluation in future versions of the program (similar to ENERGY STAR Computer Servers)

- Server-based storage
  - Computer server used in place of a controller
  - “Controller-server” requires high capacity to amortize server overhead enough to compete with standard storage products
  - … but might produce a more efficient solution in cases where a server and storage product would be purchased separately
  - EPA proposes to leave such server-based storage products outside of the Version 1.0 scope, to be considered in future versions of the program.

Next steps

- Evaluate comments
- Agree on a product family structure for testing
- Communicate refinements to representative testing structure
- Set approach for NAS in V1.0 – evaluate now or establish intent for next version

Topic	
Identify product family structure	
Refine bounds for tested configurations in bookend structure	
Approach for NAS	
Finalize family structure	

Product Families and Program Scope

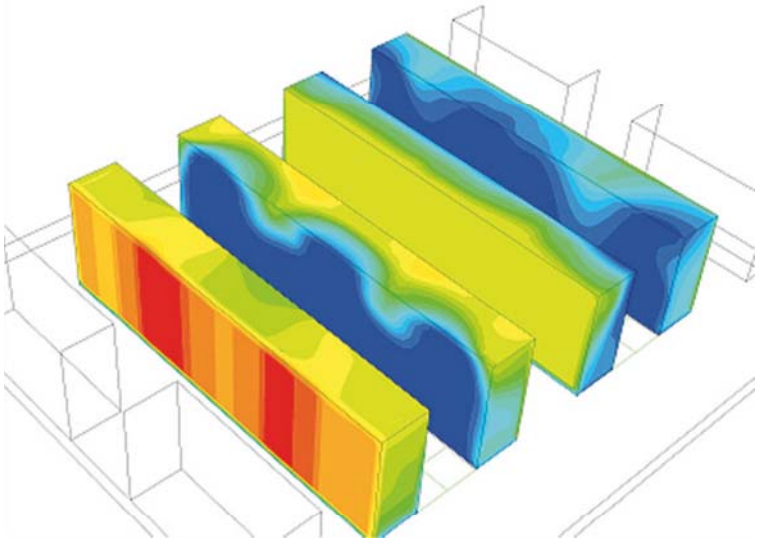
Discussion

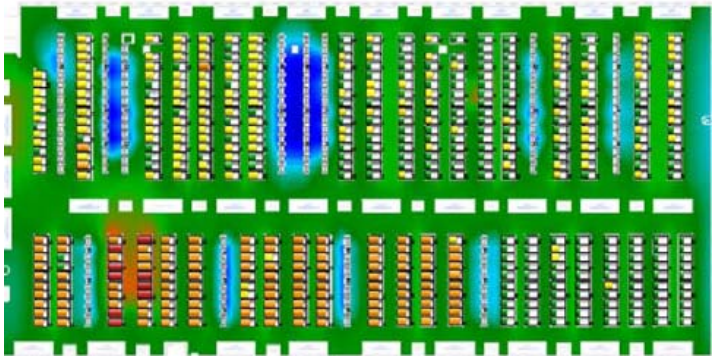
Time (all EST)	Topic
10:00 AM	*Meeting Introduction*
10:10 – 11:00	*Product Families and Program Scope*
11:00 – 11:45	**Data Measurement and Monitoring**
11:45 AM – 12:45 PM	*Ready Idle and Active Mode Reporting*
Approx. Noon	*Brief Break and Working Lunch (provided)*
1:00 – 1:45	*Energy Efficient Features*
1:45 – 2:15	*Power Supplies: Levels, Embedded Equipment*
2:15 – 3:00	*Remaining topics, meeting summary and closing*

Inlet air temperature and sampling requirements

- Real-time access to thermal information at the device holds promise to optimize cooling of the overall datacenter

- Integrated measurement capability in ENERGY STAR equipment adds this capability “out of the box”





Inlet air temperature and sampling requirements

- EPA wishes to revisit feedback regarding the complexities of requirements for integrated inlet air temperature measurements in storage equipment
  - Unique considerations by product type
  - Implementation timeframe
  - Cost implications to customer
  - Actionable (while cost-effective) level of accuracy

Power measurement and output

- Requirements in Draft 1 maintained in Draft 2

558 3.8.1 Data Elements: All Data Center Storage products shall be capable of measuring and reporting the
559 following data elements:

560 i. Input Power, in watts. Input power measurements must be reported with accuracy of less
561 than or equal to 5% of the actual value for measurements greater than 200 W, through the
562 full range of operation. For measurements less than or equal to 200 W, the accuracy must
563 be less than or equal to 10 W times the number of installed PSUs; and

575 3.8.3 Sampling Requirements:

576 i. *Input power*: Input power and processor utilization measurements must be collected at a
577 rate of ≥ 1 measurement every 10 seconds. A rolling average, encompassing a period of
578 no more than 30 seconds, must be reported at a frequency of greater than or equal to once
579 every 10 seconds.

Next steps

- Complete revisions to data measurement and output by next draft

Topic	
Inclusion of Input Power	✓
Inclusion of Inlet Air Temp	
Reporting Implementation	✓
Sampling Requirements	

Data Measurement and Monitoring

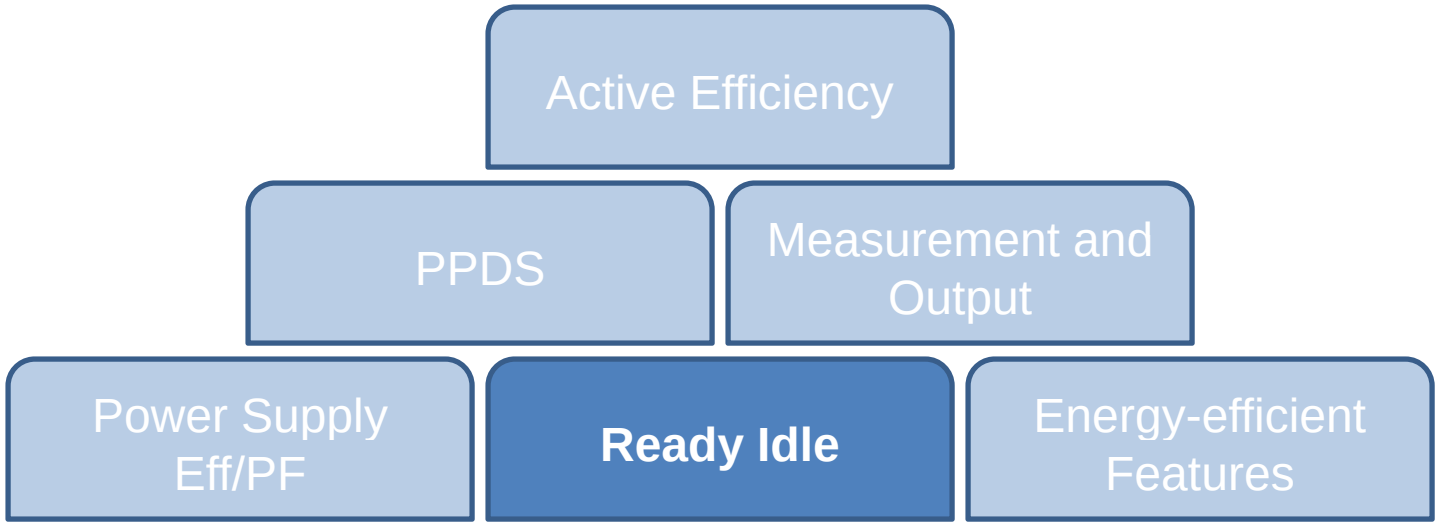
Discussion

Time (all EST)	Topic
10:00 AM	*Meeting Introduction*
10:10 – 11:00	*Product Families and Program Scope*
11:00 – 11:45	*Data Measurement and Monitoring*
11:45 AM – 12:45 PM	**Ready Idle and Active Mode Reporting**
Approx. Noon	**Brief Break and Working Lunch (provided)**
1:00 – 1:45	*Energy Efficient Features*
1:45 – 2:15	*Power Supplies: Levels, Embedded Equipment*
2:15 – 3:00	*Remaining topics, meeting summary and closing*

Ready Idle

- Include baseline levels for Ready Idle in Version 1.0

- A building block of energy-efficient platform



Benefits and challenges

Benefits	Challenges and questions
Identifies differences between drive technologies	
Ready Idle is … ready	Applicability to deployed equipment activity
Identifies efficiencies (or inefficiencies) in overhead	

Possible approaches

- Base + Adder
  - **Base**: A single (or scaled) allowance for all products in a category
  - **Adder**: an additional allowance associated with a feature that provides a user (or an operational) efficiency benefit that cannot be shown through the primary Base evaluation
    - Examples: Wake on LAN, Energy Efficient Ethernet
    - Considerations: adds complexity, challenge to utilities when evaluating incentive structures

- Modules
  - Evaluate different pieces of device separately, sum to the whole

Active State

Note: This approach mirrors the proposed approach to active power measurement in the ENERGY STAR Computer Server v2.0 development process and requires (1) that a Data Center Storage product be evaluated using a predetermined active state testing methodology, with results to be publically disclosed via the ENERGY STAR program as part of the Power and Performance Datasheet, and (2) that a Data Center Storage product also provide an energy-efficient platform by meeting or exceeding pass/fail levels and requirements in other areas.

EPA is pursuing this approach to active state evaluation to encourage further testing for energy efficiency of Data Center Storage products. Data generated through this testing will allow EPA to set efficiency levels for active state energy consumption in future versions of the specification. This reporting approach also assists manufacturers in differentiating their products via energy efficiency. Efficiency data is measured and disclosed in a consistent manner and is provided along with the hardware and software characteristics of each system.

As referenced in Section 4.1, EPA proposed use of the *SNIA Emerald™ Power Efficiency Measurement Specification, Version 1.0 (23 August 2011)*, as the basis of Active State evaluation and data disclosure.

- Draft 2 requires active efficiency disclosure for Version 1.0
  - Allows program to build critical mass of data for future evaluation
  - Customers know to look for efficiency information as part of their purchase decision
  - Sets stage for requirements in future versions of the ENERGY STAR program

Considerations

- Robust product family structure still critical
  - Disclosed information appropriately broad to give customers an idea of where their configuration falls, while not requiring excessive testing and burden to manufacturer

- Configuration details tied closely to results.
  - Improper (or missing) context → misinterpreted results

Next steps

- Work through remaining considerations in family structure
- Consider challenges and opportunities to use Ready Idle

Topic	
Family Structure	
Ready Idle Considerations and Implications	
Levels	

Ready Idle and Active Mode Reporting

Discussion

Time (all EST)	Topic
10:00 AM	*Meeting Introduction*
10:10 – 11:00	*Product Families and Program Scope*
11:00 – 11:45	*Data Measurement and Monitoring*
11:45 AM – 12:45 PM	*Ready Idle and Active Mode Reporting*
Approx. Noon	*Brief Break and Working Lunch (provided)*
1:00 – 1:45	**Energy Efficient Features**
1:45 – 2:15	*Power Supplies: Levels, Embedded Equipment*
2:15 – 3:00	*Remaining topics, meeting summary and closing*

Energy efficient features

Note: EPA is interested developing the energy savings associated with COMs and proposes to include them as part of the qualification criteria. EPA seeks stakeholder feedback on how often these COMs are deployed to consumers and the impacts on manufacturers associated with providing these features.

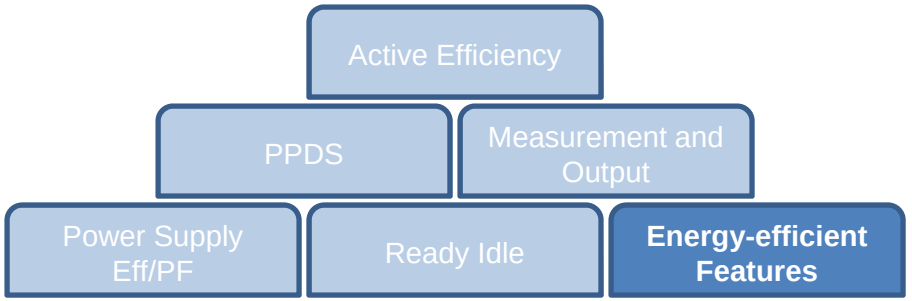
3.6.2 To qualify for ENERGY STAR, a Data Center Storage product must be shipped with [TBD—a designated number] of the following end user configurable / selectable features listed in Table 4. For consideration, the feature must be enabled by default upon shipment.

Table 4: Configurable Energy Efficiency Features

Feature	Implementation
Deep Sleep Mode	TBD
Allow for unallocated storage elements to be placed into a power-down state.	TBD
COM: Thin Provisioning	TBD
COM: Data Deduplication	TBD
COM: Compression	TBD
COM: Delta Snapshots	TBD

Energy efficient features

- Efficiency checklist as another foundation building block



- As with Ready Idle, not a panacea
  - Balance between pursuit of encouraging advanced features while not leaving behind otherwise efficient storage platforms

Note: EPA is interested developing the energy savings associated with COMs and proposes to include them as part of the qualification criteria. EPA seeks stakeholder feedback on how often these COMs are deployed to consumers and the impacts on manufacturers associated with providing these features.

3.6.2 To qualify for ENERGY STAR, a Data Center Storage product must be shipped with [TBD—a designated number] of the following end user configurable / selectable features listed in Table 4. For consideration, the feature must be enabled by default upon shipment.

Table 4: Configurable Energy Efficiency Features

Feature	Implementation
Deep Sleep Mode	TBD
Allow for unallocated storage elements to be placed into a power-down state.	TBD
COM: Thin Provisioning	TBD
COM: Data Deduplication	TBD
COM: Compression	TBD
COM: Delta Snapshots	TBD

Capacity optimizing methods

- Draft 2 proposal
  - Establish a list of eligible COMs, of which a set minimum number must be available to the customer and enabled on shipment:

Deep Sleep Mode
Allow for unallocated storage elements to be placed into a power-down state
COM: Thin Provisioning
COM: Data Deduplication
COM: Compression
COM: Delta Snapshots

  - Others?

Other features

- Adaptive cooling
  - e.g., Variable Speed Fans
- Parity RAID
  - Proposal: A storage product must offer a form of Parity RAID in addition to other RAID levels it may support

Considerations for COMs

- Price premium
- Demand – current and latent
- Impacts and fit with current market
- COM list and threshold

Next steps

- Review COM proposal
- Review additional proposals for additional features to incentivize

Topic	
Inclusion of Adaptive Cooling	
Inclusion of Parity RAID	
COM list contents	
COM list threshold	
Finalize feature list	

Energy efficient features

Discussion

Time (all EST)	Topic
10:00 AM	*Meeting Introduction*
10:10 – 11:00	*Product Families and Program Scope*
11:00 – 11:45	*Data Measurement and Monitoring*
11:45 AM – 12:45 PM	*Ready Idle and Active Mode Reporting*
Approx. Noon	*Brief Break and Working Lunch (provided)*
1:00 – 1:45	*Energy Efficient Features*
1:45 – 2:15	**Power Supplies: Levels, Embedded Equipment**
2:15 – 3:00	*Remaining topics, meeting summary and closing*

Power supply efficiency and power factor

- Draft 2 levels correspond to CSCI/80 PLUS Silver

- Update to reference most recent measurement methodology, version 6.5
  - Specific language in test method related to storage power supplies
  - Available at www.efficientpowersupplies.org

Further power supply review

- Stakeholders approached EPA during development of Draft 2 with offer to further investigate presence of power supplies in the storage market

- EPA is supportive of this initiative and will monitor activities and evaluate provided information prior to finalizing requirements

Embedded equipment

- Stakeholders raised the topic of “embedded,” non-storage equipment, often built by third-parties, included as part of the storage product; examples include embedded notebook computers, displays, and network switches.
  - Power supply requirements
    - EPA may be open to targeted exemption for such power supplies from the efficiency and power factor requirements in this section, provided it cannot be used to exclude power supplies servicing the primary components of the Data Center Storage product (e.g., controller, drawers).
    - EPA welcomes proposals from stakeholders on language to this effect.

- ENERGY STAR
  - EPA is also considering a requirement that all equipment in a storage system that falls under the scope of another applicable ENERGY STAR specification (e.g. computers, servers) also be ENERGY STAR qualified.

Next steps

- Stakeholders encouraged to suggest language that captures power supplies servicing embedded non-storage hardware

Topic	
Evaluate results of stakeholder PSU inquiry	
Establish final PSU limits	
Evaluate any stakeholder-proposed language regarding power supplies servicing embedded non-storage hardware	

Power supplies

Discussion

Time (all EST)	Topic
10:00 AM	*Meeting Introduction*
10:10 – 11:00	*Product Families and Program Scope*
11:00 – 11:45	*Data Measurement and Monitoring*
11:45 AM – 12:45 PM	*Ready Idle and Active Mode Reporting*
Approx. Noon	*Brief Break and Working Lunch (provided)*
1:00 – 1:45	*Energy Efficient Features*
1:45 – 2:15	*Power Supplies: Levels, Embedded Equipment*
2:15 – 3:00	**Remaining topics, meeting summary and closing**

Power modeling presale tool

Note: To promote consideration of energy efficiency issues among the other purchase decision points, and encourage existing stakeholder efforts, EPA has added the Power Modeling Presale tool requirement.

- EPA's goal is to have power modeling presale tools available for all qualified storage systems
  - Need to find way to make available to all purchasers (through quote?)
  - How sales channels have access

- Possible clarifications initially recommended by stakeholders
  - Change "public" to "available to purchasers in pre-sale cycle" or similar
  - Change performance element from a power cap to an error band

Planned effective date

Table 6: Specification Effective Date

Effective Date
March 2012 (preliminary)

Note: EPA is proceeding with a goal to complete development of the Version 1.0 Data Center Storage program by early 2012. As a reminder, the Data Center Storage program, as a new ENERGY STAR program area, would go into effect immediately upon finalization of specification development.

- EPA intends to hold a call focused on the Third-party Certification/Verification program as applies to Data Center Storage

References and resources

- ENERGY STAR Data Center Storage specification revision:

  www.energystar.gov/NewSpecs

  – Select “Data Center Storage”

Reminder

Written comments on Draft 2 due to EPA no later than November 4th, 2011. storage@energystar.gov

Thank you!

RJ Meyers
EPA, ENERGY STAR
(202) 343-9923
Meyers.Robert@epa.gov

Evan Haines
ICF International
(202) 572-9456
Ehaines@icfi.com

John Clinger
ICF International
(202) 572-9432
Jclinger@icfi.com

Bizhan Zhumagali
ICF International
(202) 572-9448
Bzhumagali@icfi.com

Al Thomason
TBWC, LLC
(503) 708-7881
thomasonw@gmail.com