



ENERGY STAR®

Uninterruptible Power Supplies Draft Version 2.0 and Version 1.1 Webinar

April 13, 2017





Webinar Details

- Webinar slides and related materials will be available on the Uninterruptible Power Supplies Product Development Web page:
 - www.energystar.gov/revisedspecs
 - Follow link to “Version 3.0 is in Development” under “Uninterruptible Power Supplies”
- Audio provided via teleconference:
 - Call in:** +1 (877) 423-6338 (U.S.)
+1 (571) 281-2578 (International)
 - Code:** 198-920 #
 - Phone lines will remain open during discussion
 - Please mute line unless speaking
 - Press *6 to mute and *6 to un-mute your line



Webinar Agenda

1. Introductions and Recap of ENERGY STAR Process
2. Version 1.1
 - Definitions and sampling requirement harmonization
 - New DOE test method and impacts on efficiency
3. Version 2.0
 - Ac-output efficiency requirements
 - Dc-output categorization and testing
 - Test Method Revision
 - Other issues
4. Timeline and Open Discussion



Introductions

Time	Topic
12:00–12:05	Introductions and Specification Development Recap
12:05–12:30	Version 1.1
12:30–1:30	Version 2.0
1:30–2:00	Timeline and Open Discussion



Introductions

Ryan Fogle

U.S. Environmental Protection Agency

Matt Malinowski

ICF

Ben Hill

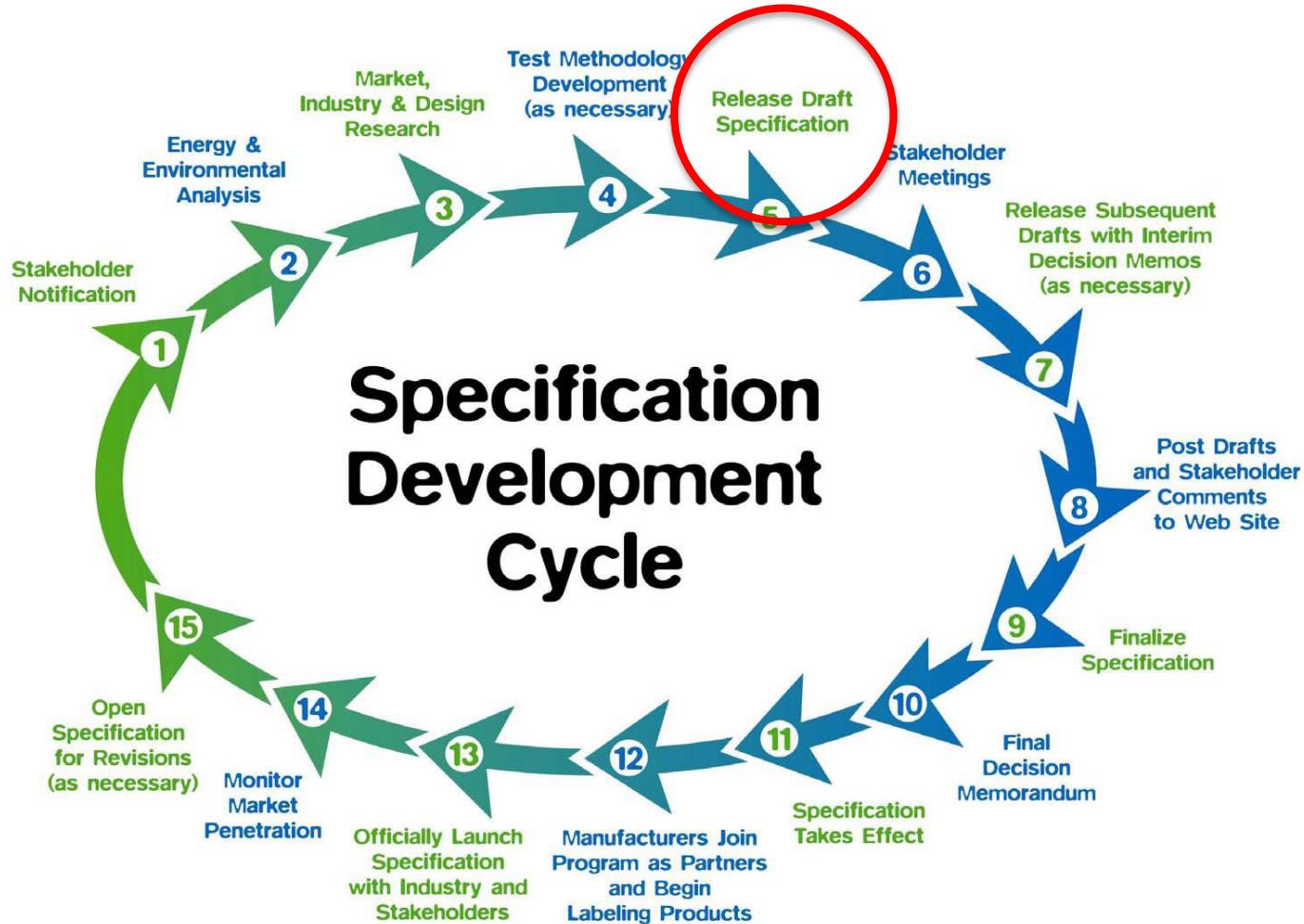
ICF



ENERGY STAR Guiding Principles

- ENERGY STAR criteria are designed to balance these foundational principles, including:
 - Significant energy and/or water savings
 - Product performance maintained or enhanced
 - Purchasers can recover investment in increased efficiency within a reasonable time period
 - Efficiency can be achieved without proprietary technology
 - Energy/water consumption can be measured and verified with testing
 - Label provides meaningful differentiation

ENERGY STAR Specification Development Process





Major Drivers

- **Timing**
 - Version 1.0 went into effect in August 2012
- **Market Penetration**
 - Estimated market penetration is high
- **Regulatory Activity**
 - DOE test method required for covered products.



Objectives for Version 2.0 Specification

- **Increase energy efficiency and differentiation in the market.**
 - Increase the efficiency score for UPS products.
 - Propose removing the metering incentive.
- **Consider amendments to the ENERGY STAR Test Method**
 - Incorporate DOE test method in the specification, for those appropriate products.
 - Complete minor test method updates to reduce some testing burden.



Version 1.1 Specification

Time	Topic
12:00–12:05	Introductions and Specification Development Recap
12:05–12:30	Version 1.1
12:30–1:30	Version 2.0
1:30–2:00	Timeline and Open Discussion



New Federal Test Method

- Test procedure in 10 CFR 430 Subpart B Appendix Y effective June 12, 2017.
 - Covers UPSs capable of operating at 115 V and 60 Hz that use NEMA 1-15P or 5-15P plug.
- All currently certified products may remain on the ENERGY STAR certified products list until V2.0 takes effect.
 - Products within DOE scope tested to ENERGY STAR test method before June 12 will remain certified to V1.1, but will require retesting for V2.0.
 - Not yet certified UPSs within the DOE scope may wish to certify to ENERGY STAR using the DOE UPS Final Rule to avoid retesting should they meet the V2.0 eligibility criteria when it takes effect.



Version 1.1 Specification

- Definitions harmonized with DOE (10 CFR 430 Subpart B Appendix Y)
 - Input dependencies: re-worded and more specific
 - Reference test load: required power factor specified – nothing functionally different from Version 1.0
 - UUT: includes battery for products within scope of DOE
- Retained the UPS definition to allow products outside the scope of Appendix Y to remain within the ENERGY STAR scope.
- Sampling requirements
 - DOE sampling requirements (10 CFR 429.11) added as an option (Section 4.2)



Version 1.1 Specification

- DOE Test Method

- Added as an option for products within scope: “UPSs capable of operating at 115V and 60 Hz that use NEMA 1-15P or 5-15P plug” (rated output power ≤ 1875 W)

- Efficiency Impacts

- DOE test method requires battery connection during testing
- Battery connection reduces efficiency by 0.1-0.3 percentage points*, accounted for in revised Ac-output efficiency requirements

Table 4: Ac-output UPS Minimum Average Efficiency Requirement for UPSs tested to 10 CFR 430 Subpart B Appendix Y

Minimum Average Efficiency Requirement ($Eff_{AVG\ MIN}$), Where:			
• P is the Rated Output Power in watts (W), and			
• ln is the natural logarithm.			
Rated Output Power	Input Dependency Characteristic		
	VFD	VI	VFI
$P \leq 1500$ W	0.964		$0.0099 \times \ln(P) + 0.812$
1500 W < $P \leq 1875$ W	0.967	0.964	

*Determined via comparative analysis of ENERGY STAR and CEC datasets



Version 2.0

Time	Topic
12:00–12:05	Introductions and Specification Development Recap
12:05–12:30	Version 1.1
12:30–1:30	Version 2.0
1:30–2:00	Timeline and Open Discussion



Proposed Draft 1, V2.0 Criteria

Version 1.0 Requirements:

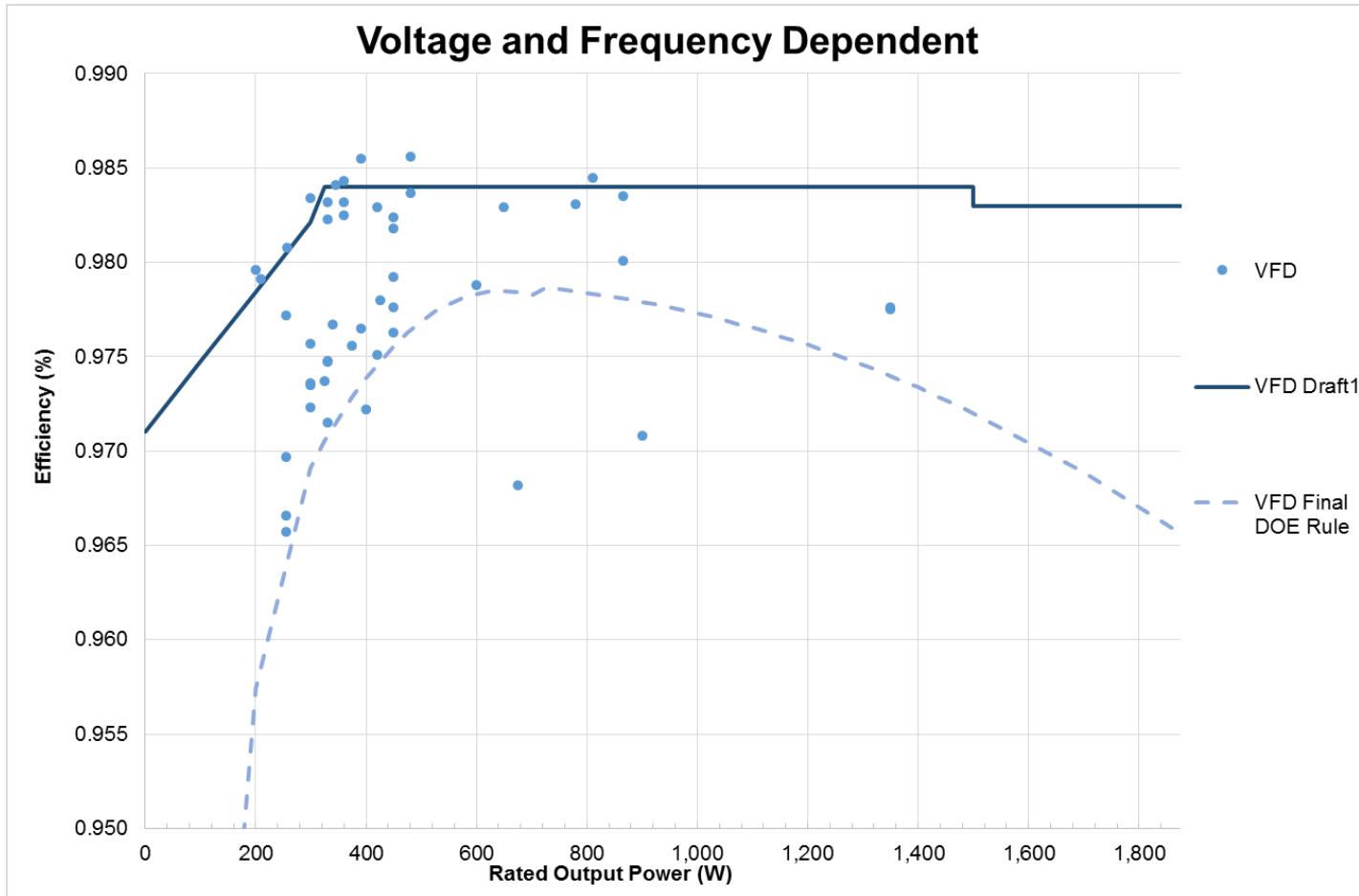
Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), Where:			
<ul style="list-style-type: none"> • P is the Rated Output Power in watts (W), and • \ln is the natural logarithm. 			
Rated Output Power	Input Dependency Characteristic		
	VFD	VI	VFI
$P \leq 1500\text{ W}$	0.967		$0.0099 \times \ln(P) + 0.815$
$1500\text{ W} < P \leq 10,000\text{ W}$	0.970	0.967	
$P > 10,000\text{ W}$	0.970	0.950	$0.0099 \times \ln(P) + 0.805$

Version 2.0 Requirements:

Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), Where:			
<ul style="list-style-type: none"> • P is the Rated Output Power in watts (W), • E_{MOD} is an allowance of 0.004 for Modular UPSs applicable in the commercial 1500–10,000 W range, and • \ln is the natural logarithm. 			
Rated Output Power	Input Dependency Characteristic		
	VFD	VI	VFI
$P \leq 300\text{ W}$	$3.7 \times 10^{-5} \times P + 0.971$	0.985	$0.012 \times \ln(P) + 0.825$
$300\text{ W} < P \leq 1500\text{ W}$	0.984		
$1500\text{ W} < P \leq 10,000\text{ W}$	$0.983 - E_{MOD}$	$0.983 - E_{MOD}$	$0.016 \times \ln(P) + 0.797 - E_{MOD}$
$P > 10,000\text{ W}$	0.920	0.940	$0.0059 \times \ln(P) + 0.890$



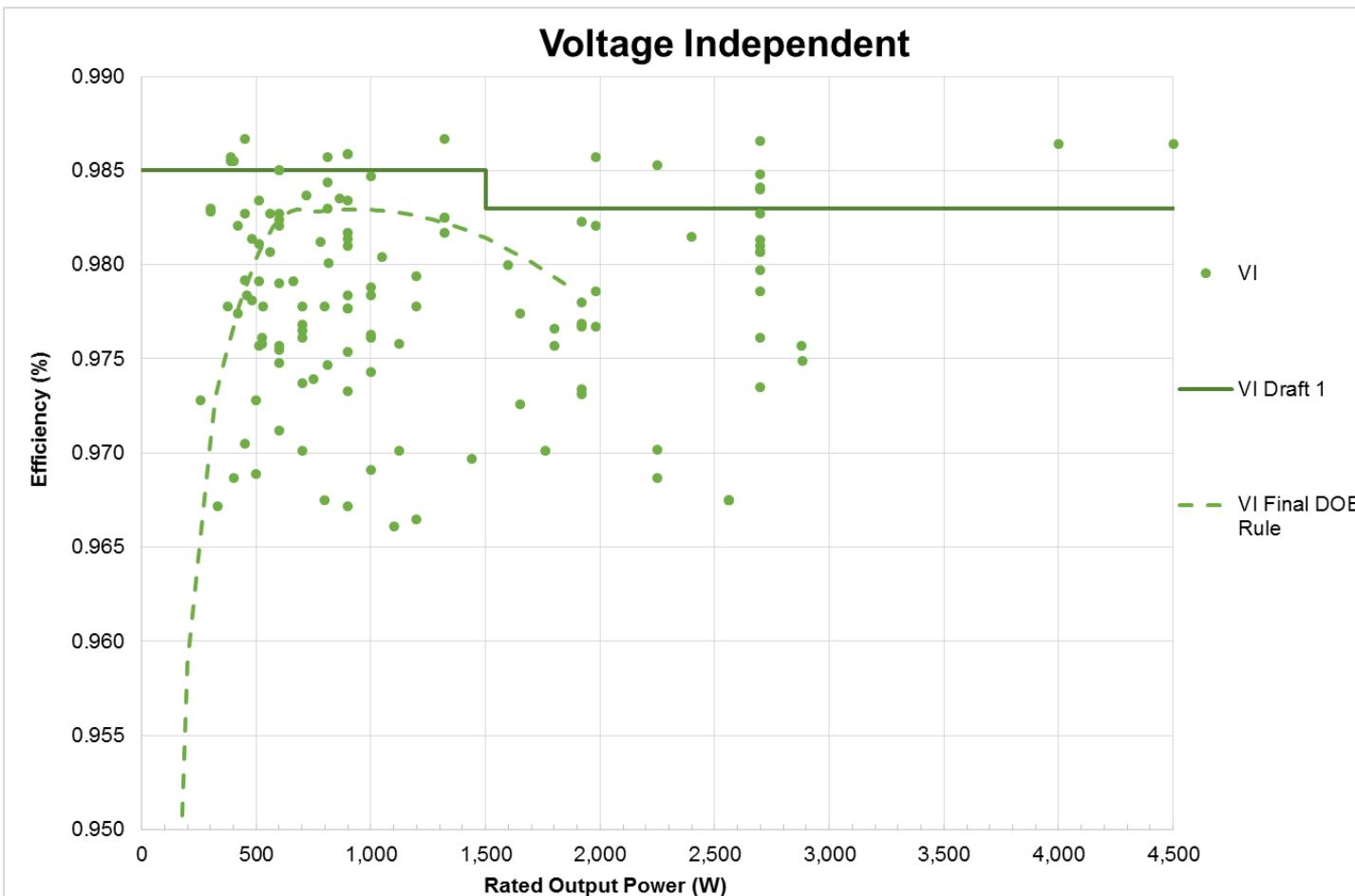
Revised Ac-output Efficiency Requirements - VFD



- Linear requirement for UPSs rated below 300 W ensures full range of models captured

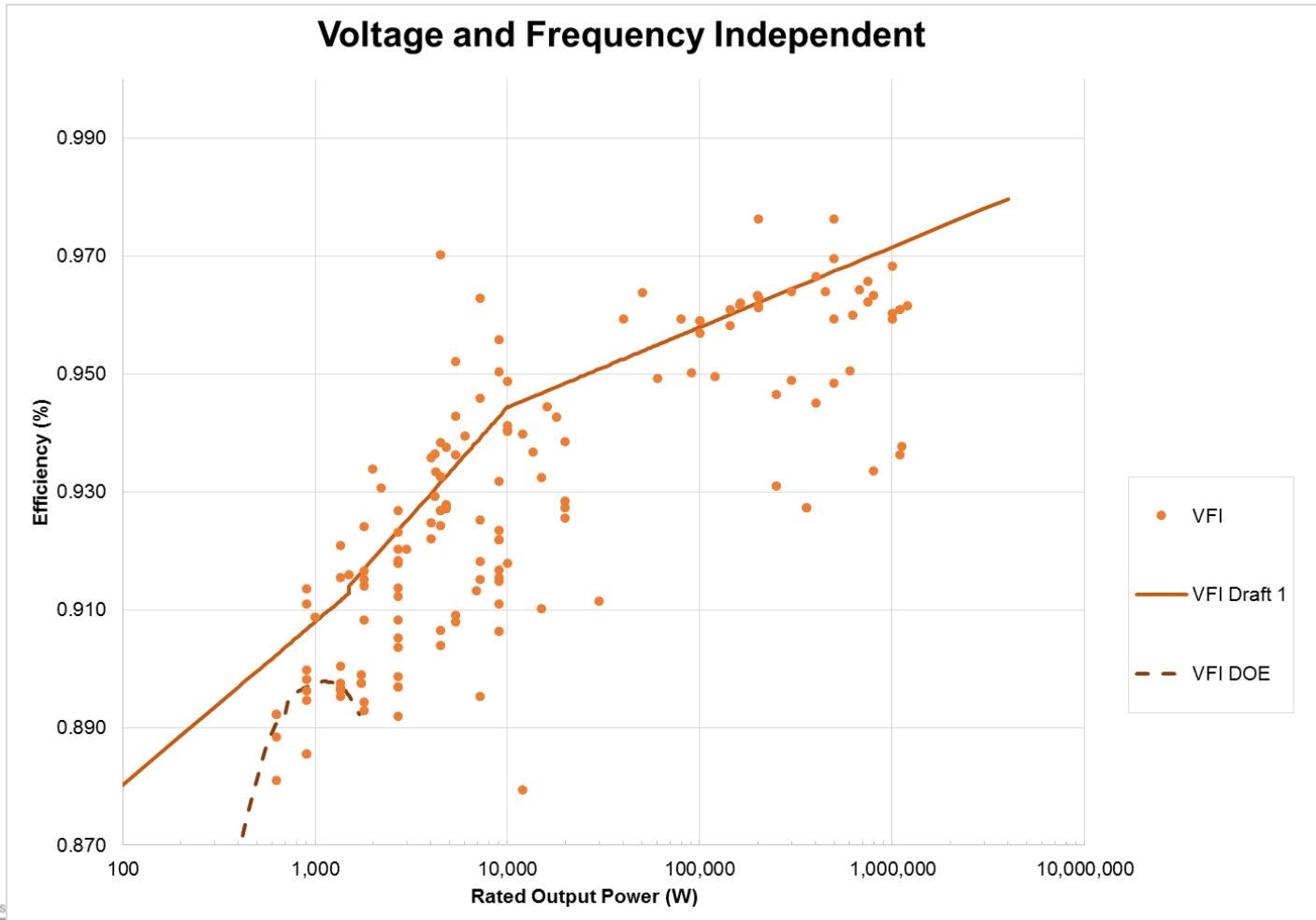


Revised Ac-output Efficiency Requirements - VI



- Stringent DOE level requires ENERGY STAR consumer requirements to be near market-best
- Limited market information for datacenter VI models (2 products on QPL)

Revised Ac-output Efficiency Requirements - VFI

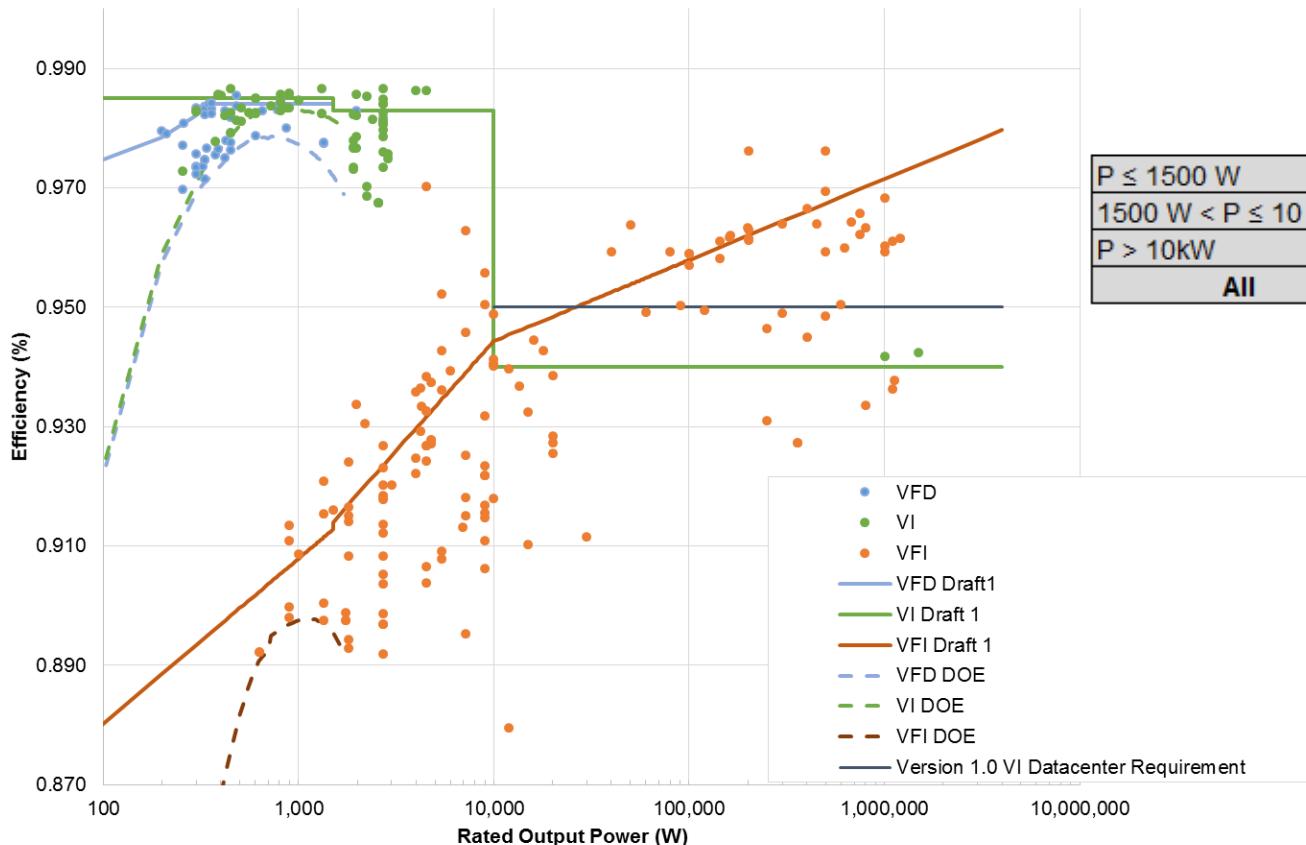




Version 2.0

Revised Ac-output Efficiency Requirements – with DOE Standard

Ac Models in Lowest Input Dependency Mode



	DRAFT Pass Rate			
	VFD	VI	VFI	All
$P \leq 1500 \text{ W}$	26%	32%	33%	29%
$1500 \text{ W} < P \leq 10 \text{ kW}$	0%	24%	29%	27%
$P > 10\text{kW}$		100%	23%	25%
All	25%	30%	27%	27%

Note: For those products covered by the DOE test method, the efficiency was reduced by 0.1 percentage point to account for the battery connection.



Version 2.0

Revised Ac-output Efficiency Requirements - Savings

	Avg. Unit Energy Consumption of Standard Unit (kWh/yr)	Average Unit Energy Consumption at Proposed ENERGY STAR Level (kWh/yr)	Model-Weighted Avg. Per-Unit Annual Energy Savings (kWh/yr)	Model-Weighted Avg. Per Unit Annual Electricity Cost Savings (US\$)	National Annual Energy Savings as Stock Replaced from Current MP to 100% MP (TWh/yr)	National Annual Carbon Dioxide Savings as Stock Replaced from Current MP to 100% MP (MMTCO ₂ e/yr)
Shipment Weighted Average	1023	738	286	\$30		
Total					8.5	6.0



Revised Ac-output Efficiency Requirements – Commercial Modular Allowance

- Modular UPSs rated 1,500 W – 10,000 W may use 0.004 efficiency allowance (E_{MOD}) to qualify.
- Modular models provide end-users unique added value and increased efficiency not reflected in test procedure.
- E_{MOD} allows models across all rated output power ranges to be represented in Version 2.0 QPL.



Revised Ac-output Efficiency Requirements – Datacenter Communications and Metering Allowance

- Propose to remove metering allowance in Draft 1, V2.0.
 - 1 percentage point efficiency incentive in Version 1.0.
 - Removed in Draft 1 Version 2.0 – metering no longer needed as these features appear to be widespread.



Connected Functionality

- Several ENERGY STAR product categories include optional Connected criteria (demand response, remote management, consumption reporting, etc.).
- EPA requests feedback on possible inclusion of Connected criteria for the UPS Version 2.0 specification, specifically on the following questions:
 - Is there stakeholder benefit in defining connected functionality for UPS products?
 - Are utilities interested in connected functionality in UPS products? Is there more significant interest in consumer products compared with commercial products or vice versa?
 - Are UPS a good fit for demand response programs?
 - Is there a way to cycle off the load for moments and save energy without threatening performance?
 - Is there potential to incorporate diagnostics support within any connected criteria that would provide utility to the end user?



Dc-output updates

- **Low-Voltage vs. High-Voltage Products.**
 - Maintained the same efficiency requirements for both types of products, due to products having comparable efficiency.

Voltage	Application	Test Method	Loading Assumption	Efficiency requirement*
≤ 60V	Telecom	ATIS-0600015.2009 and ATIS-0600015.04.2010	Unchanged from V1.0, average of 30%-80% (per ATIS)	} 0.955
> 60V	Datacenter	IEC 62040-5-3:2016	Aligned with Ac-output loading assumptions for VFI, 0%, 25%, 50%, 75%, and 100% (per IEC)	

*unchanged from V1.0



Revised Test Method – Version 2.0

- New, separate reference for high-voltage Dc-Output UPSs: IEC62040-5-3 Annex F.
 - Designed for data center products; telecom products will continue to use the ATIS test method.
- Specified “as-shipped” configuration – harmonized with DOE.
 - B) The UUT shall be tested in “as-shipped” configuration, with the following exceptions:
 - 1) All DC output ports(s) of the UUT must remain unloaded during testing
 - 2) Any feature unrelated to maintaining the energy storage system at full charge or delivery of load power (e.g., LCD display) shall be switched off. If it is not possible to switch such features off, they shall be set to their lowest power-consuming mode during the test.
 - 3) If the UPS takes and physically separate connectors or cables not required for maintaining the energy storage system at full charge or delivery of load power but associated with other features (such as serial or USB connections, Ethernet, etc.), these connectors or cables shall be left disconnected during the test.
 - 4) Any manual on-off switches specifically associated with maintaining the energy storage system at full charge or delivery of load power shall be switched on for the duration of the test.



Revised Test Method – Version 2.0

- Thermal stabilization only required when testing at 100% reference test load.
 - B) Steady-state: The UPS and load shall have been operated for a sufficient length of time to reach thermal stability. Allow the UUT to stabilize for 125% of the manufacturer-specified stabilization time, as instructed in Appendix J of IEC 62040-3, Ed. 2.0. During the final 20 minutes of the stabilization period, **at each loading point**, perform the following steady-state check, in which the difference between the two efficiency calculations shall be less than one percent:



- B) Steady-state: The UPS and load shall have been operated for a sufficient length of time to reach thermal stability. Allow the UUT to stabilize for 125% of the manufacturer-specified stabilization time, as instructed in Appendix J of IEC 62040-3, Ed. 2.0. During the final 20 minutes of the stabilization period, **at the 100% loading point**, perform the following steady-state check, in which the difference between the two efficiency calculations shall be less than one percent:
- Removed the outdated Power and Performance Data Sheet (PPDS) requirement.



VI Loading Assumptions

- A stakeholder has proposed that 100% test load should be weighted in loading assumptions for datacenter VI (>10,000 W).
 - Unchanged in Version 2.0 Draft 1; update will require supporting data.

Table 1: Ac-output UPS Loading Assumptions for Calculating Average Efficiency

Rated Output Power, P , in watts (W)	Input Dependency Characteristic	Proportion of Time Spent at Specified Proportion of Reference Test Load, $t_{n\%}$			
		25%	50%	75%	100%
$P \leq 1500 \text{ W}$	VFD	0.2	0.2	0.3	0.3
	VI or VFI	0	0.3	0.4	0.3
$1500 \text{ W} < P \leq 10,000 \text{ W}$	VFD, VI, or VFI	0	0.3	0.4	0.3
$P > 10,000 \text{ W}$	VFD, VI, or VFI	0.25	0.5	0.25	0



Multiple-normal-mode Loading Assumptions

Products with 3 active modes

- ECEEE Ecodesign report* recommends the average efficiency calculation below for models with 3 active modes.

$$Eff_{AVG} = 0.30 \times Eff_{VFI} + 0.55 \times Eff_{VI} + 0.15 \times Eff_{VFD}$$

- Report references analysis of 60 UPSs with 3 active modes.
 - No products on ENERGY STAR QPL are listed as having 3 active modes.
- Feedback requested on prevalence and utility of such products.



Diesel Coupled Rotary Generators

Natural Gas Fired Generators

- EPA has noted that there are increasing numbers of products with natural-gas fired generators.
- EPA is interested in the following:
 - Further information regarding the market for diesel coupled rotary UPS products.
 - If the use cases for diesel and natural gas coupled rotary products differ?

Solar Energy Back-Up

- EPA is interested in the viability of solar energy back-up products, in particular:
 - Growth or potential growth of the market.
 - Specific challenges to the expansion of this market.
 - How the use case of a UPS with a solar energy back-up differs from natural gas or diesel back-up products.



Other Proposed Edits to V2.0

- **Rounding language (Section 3.1):**
 - Language and calculations consistent with other ENERGY STAR specifications and DOE test procedure.
- **Standard Information Reporting Requirements (Section 3.5)**
 - EPA proposes removing the Standard Information Reporting Requirements.
 - No longer needed due to the transition to a richer dataset interface.



Other Proposed Edits to V2.0

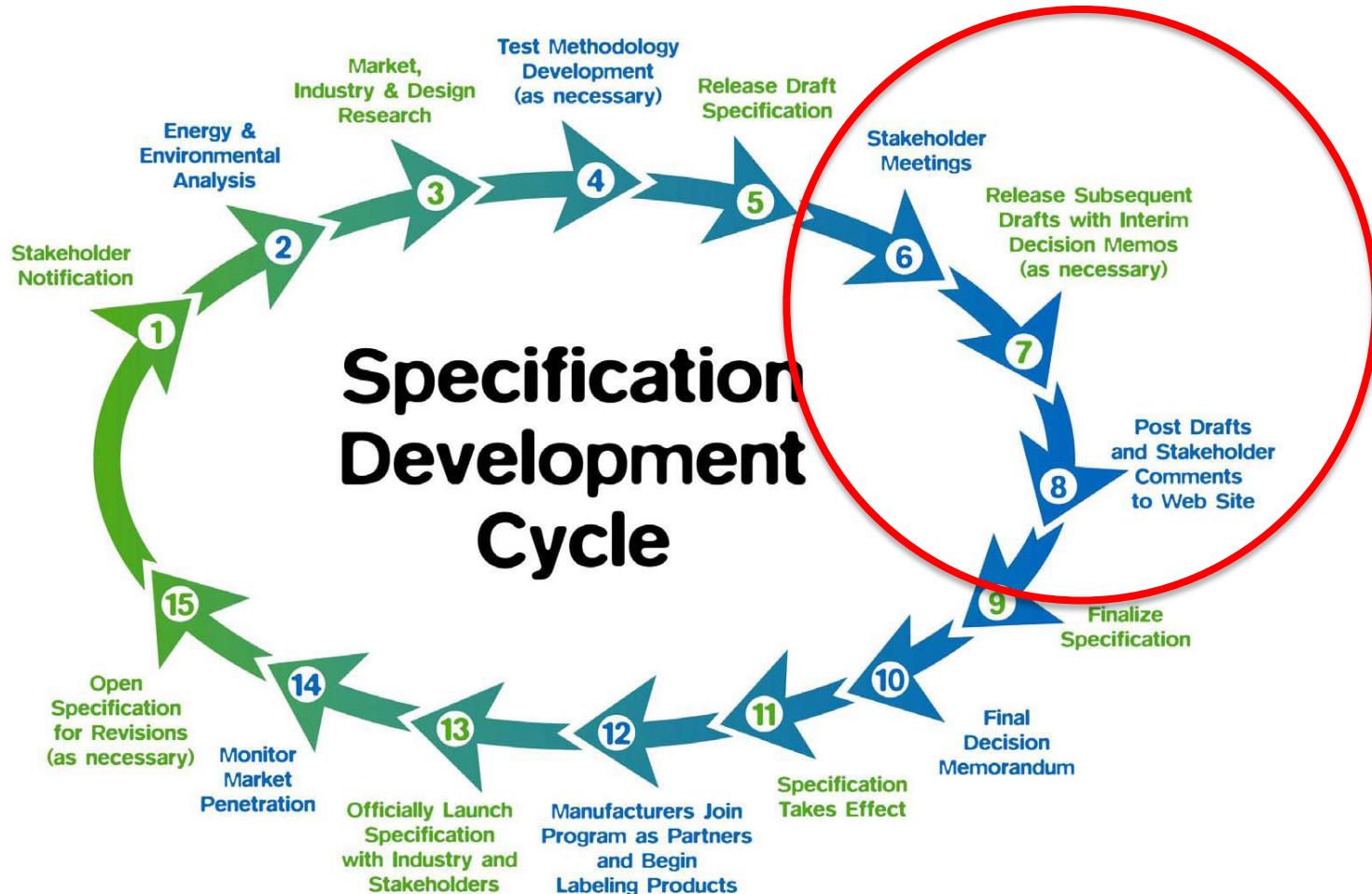
- **Recycling:**
 - Not mandatory in Version 1.0, although there was a reporting requirement included.
 - Only 36% of products have a URL for manufacturer battery take-back program listed.
 - EPA exploring the option to highlight information on lead-acid battery recycling, including why, how, and where to recycle.
 - Would like to assess stakeholder interest in helping with this initiative and further suggestions on how ENERGY STAR can help promote recycling.



Timeline and Open Discussion

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ENERGY STAR Specification Development Process





Timeline

- Q2/Q3 2017: Final Version 1.1/ Draft 2 Version 2.0
- Q3/Q4 2017: Finalize Test Method Revision and additional drafts, as necessary
- Q2/Q3 2018: Version 2.0 Effective



Final Questions or Comments



Written Comment Submission

Please send any data and written feedback on the discussion document to ups@energystar.gov no later than **April 28, 2017**

Unless marked as confidential, comments will be posted on the Uninterruptible Power Supplies Version 1.1/2.0 product development pages at www.energystar.gov/products/spec/uninterruptible_power_supplies_specification_version_1_0_pd

and www.energystar.gov/products/spec/uninterruptible_power_supplies_specification_version_2_0_pd

also accessible through www.energystar.gov/revisedspecs



Thank You!

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