

**Active Power Comments on Draft ENERGY STAR
Uninterruptible Power Supply Specification Framework**

Thank you for the opportunity to provide the following comments on behalf of Active Power, Inc.

Active Power provides efficient, reliable and green critical power solutions and uninterruptible power supply (UPS) systems to enable business continuity in the event of power disturbances. Founded in 1992, Active Power's flywheel-based UPS systems protect critical operations in data centers, healthcare facilities, manufacturing plants, airports, broadcast stations and governmental agencies. Active Power has deployed more than 2,000 of its flywheels in UPS systems to date with installations in more than 40 countries on six continents, totaling more than 55 million hours of runtime in the field.

Building Block #1: Definitions

General Comments

Active Power agrees with the EPA's intent to use industry-standard definitions where possible. Active Power recommends that EPA turn to the definitions found in the International Electrotechnical Commission (IEC) international standard for UPS, IEC 62040-3, rather than definitions written solely for the Energy Star benchmark.

Active Power does not believe it is necessary to define the various System Topologies. We feel the use of IEC 62040-3 power conditioning delineations is a superior choice that ensures that UPS devices are fairly judged against other systems performing the same function, while also not artificially segregating the market by technology.

If EPA does choose to work from the definitions in the Framework, then Active Power recommends the following minor revisions:

1. The Framework's Definitions include multiple entries where a "battery" is specifically mentioned where Active Power believes a more generic term would be better suited. Active Power advocates replacing references to "battery" with "energy storage mechanism" in the following locations:
 - c.b.2, Line Interactive ("requires a small trickle current to the battery")
 - e.2.2, Line Interactive ("the battery/inverter combination")
 - e.2.3, Double Conversion ("the battery/inverter combination")

Active Power believes replacing these specific references to "battery" with "energy storage mechanism" is more appropriate, as the Framework itself defines both Electrochemical Battery and Rotary (Flywheel) as options under consideration.

2. Re: c.c.2, definition of Rotary (Flywheel): First, Active Power recommends changing the title of this definition to solely "Flywheel". "Rotary" in the UPS context refers to a UPS where an electrical machine is generating the UPS voltage, whereas "flywheel" refers to a type of energy

storage mechanism. Second, Active Power recommends deleting the word “massive” from the first sentence. Flywheels used in the industry vary in size significantly among vendors and models, and not all of them would be considered “massive” compared to each other. Since “massive” itself is undefined and carries negative connotations of weight and size, which we feel to be inaccurate when applied to most flywheels in market, this word should be deleted.

3. In e.1, definition of Normal State, Active Power does not believe this definition adequately captures the power conditioning function of three-phase UPS devices serving the larger (100 kW and above) end of the market. In Active Power’s experience, in every customer deployment power conditioning is at least co-equal to backup power as a customer requirement; indeed, we know of several data center applications where the UPS is in place only to condition utility power, with the customer responding to total outages through alternative mechanisms.

Active Power recommends replacing this definition with (additions in italics):

- Normal State: The operating state in which the load is continuously supplied by the utility, the UPS device is ready and available to provide backup power in the event of a utility power disruption, *and the UPS device is ready and available to condition utility power to remove any power disturbances.*

Comments on Questions for Discussion

Question 3. Active Power agrees that evaluating “eco-mode” strategies is inappropriate at this time. We have seen little evidence of customer demand for this approach once the power conditioning and reliability trade-offs are understood, and to our knowledge very few customers have activated eco-mode even when a model featuring eco-mode was purchased.

Question 4. Active Power recommends the EPA adopt the load levels for testing defined in IEC 62040-3 (currently at 25%/50%/75%/100%), with the addition of one test point at 10% load. Active Power believes these five data points will accurately describe a UPS device’s efficiency across the vast majority of expected load conditions.

Question 5. Active Power does not believe there is an industry-accepted method to measure and quantify power conditioning. Likewise, we do not believe there is a method to “right-size” power conditioning, as that will vary by customer installation. Vendors support varying levels of voltage regulation, frequency regulation, ride-through time, etc. as competitive advantages based on their individual technical capabilities and assessments of customer needs. However, Active Power does believe that some minimum level of power conditioning capability across IEEE disturbances must be defined to ensure that only UPS devices meeting a common baseline are considered for Energy Star certification. IEC 62040-3’s power conditioning framework is a good choice for this baseline.

Question 6. Active Power agrees with the EPA’s concerns related to electrochemical battery storage and disposal as an environmental factor. Given the nascent state of multiple international bodies efforts

on this topic, however, Active Power recommends that this topic not be covered in the initial Energy Star specification, but be included in a later revision when international standards are concluded.

Building Block #2: Eligible Product Categories

General Comments

1. Active Power strongly believes that UPS devices should be evaluated based on function, not topology. Active Power recommends that the EPA adopt the performance classifications (VFI, VI, VFD, etc.) from IEC 62040-3 rather than topology-based benchmarks.
2. Active Power has no insight or knowledge of the proper categorization of UPS devices for the smaller end of the market. For larger systems serving data centers, Active Power recommends dividing the market into three meaningful categories:
 - 100 kVA – 300 kVA – This range encompasses most small data centers.
 - 300 kVA – 1000 kVA – This range encompasses both large data centers run by individual enterprises as well as sections of very large data centers run by network service providers and dedicated hosting operators. (These sections are physically proximate but have distinct utility feeds, power distribution including UPS devices, generator backup facilities, and other infrastructure such as cooling.)
 - 1000 kVA and larger – This range describes the very largest of the enterprise data center category.

Comments on Questions for Discussion

Question 1. Active Power recommends three classification criteria:

1. IEC 62040-3 performance classification, as discussed above;
2. UPS power rating, in the ranges discussed above;
3. Voltage. Active Power also recommends that the EPA create categories distinguishing low-voltage (600V and below) from medium-voltage UPS devices. EPA efficiency benchmarks may vary with different voltages within low voltage (120V-60Hz, 208V-60Hz, 230V-50Hz, 208/120V-60Hz, 400/230V-50Hz, 415/240V-60Hz, 480/277V-60Hz, 600/346V-60Hz, etc.)

Question 2. Active Power believes the biggest opportunity for energy savings is to be found in the three range segments described above (100-300 kVA, 300-1000 kVA, 1000+ kVA). While EPRI estimates that these devices account for only about 9% of US UPS stock, Active Power estimates 100 kVA+ devices account for over half of the total energy supported by UPS devices in the US, due to the vastly larger average size of these systems. Further, since sub-20 kVA devices tend to be standby UPS providing back up power only, they are already very efficient with presumably smaller gains to be made. By contrast,

the efficiency of data center UPS devices providing power conditioning may vary widely by load and topology, offering tremendous opportunity for efficiency gains through Energy Star.

Building Block #3: Energy Efficiency Criteria and Test Procedures

Comments on Questions for Discussion

Questions 1 and 2. Active Power recommends that the Energy Star specification should address only normal mode. In Active Power's experience, UPS devices typically spend 99% of their time in normal mode, with less than 1% in stored energy and bypass modes combined. While energy consumption is generally highest in stored energy mode and lowest in bypass, their relative (in)efficiency in either of these modes will be dwarfed by the (in)efficiency during normal mode.

Question 3. In Active Power's experience, oversizing for partial loads is almost exclusively caused by end user design requirements for planned growth or redundancy/reliability. Active Power does not believe it is appropriate for EPA to weigh in on these customer decisions. Active Power recommends publishing the full efficiency curves across loads (10%/25%/50%/75%/100%) to assist customers with understanding the efficiency impacts of partial loads and their growth or redundancy requirements.

Question 4. Active Power recommends Energy Star address modularity and scaling with two connected approaches: 1) through publication of the full efficiency curve for each product, and 2) through separate Energy Star testing and certification of each size step in a modular product as a separate product. (That is, a modular product with 250 kVA, 500 kVA, and 750 kVA options would have an Energy Star certification and efficiency curve for each.) This approach would allow a customer looking for a modular solution to account for growth to analyze the efficiency of various steps in their growth plan on a consistent basis

Questions 5 and 6. Active Power recommends that Energy Star should follow the test procedures in IEC 62040-3, with one additional test point for efficiency at 10% load conducted using the same procedures as the other load points.

Question 7. In Active Power's experience, loading for large (100 kVA+) UPS devices range from a low of 10% on a sustained basis up through 80-90%. Typically, devices are deployed intended to operate at 40-45% (2N), 60-65% (N+1), or above 80% (no redundancy). Within each of these, the actual loads may be significantly lower as the UPS device may be over-sized due to staged growth of the IT load.

Component and hardware differences for redundant operation vary by manufacturer. In Active Power's case, our system is highly modular, with growth in 300 kVA increments, from 300 kVA to 1200 kVA. For each increment, the customer need only add another 300 kVA flywheel energy storage cabinet to common components for input/output and system control. We offer product options for a redundant flywheel energy storage cabinet in an N+1 configuration. This enables our UPS device to remain in operation supporting the customer load in case of a complete failure (or bypass due to maintenance) of one flywheel cabinet. For customers wishing redundancy at the UPS device level (e.g. two separate 600

kVA systems), no additional hardware is required from Active Power; typically additional switchgear or power distribution equipment is required.

Question 8. In Active Power's experience, while value added resellers are an important part of the sales and installation process for data center UPS devices, they are a negligible factor in efficiency of UPS devices. In no case does Active Power permit VARs to modify the UPS system, nor is Active Power aware of any manufacturer that does permit this. Qualification of the UPS device for Energy Star should be solely the manufacturer's responsibility.

Building Block #4: Information and Management Requirements

Active Power agrees generally with the EPA's approach to information and management, and believes that most 100 kW+ UPS devices for data centers should be able to provide the information discussed in one or more open methods (i.e., SNMP or ModBUS).