Natural Resources Defense Council
Appliance Standards Awareness Project
American Council for an Energy-Efficient Economy

December 23, 2014

Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Program
Mailstop EE-2J
1000 Independence Avenue SW
Washington, DC 20585-0121

**RE: Docket Number EERE-2014-BT-TP-0043: Test Procedure, Notice of Proposed Rulemaking for External Power Supplies**

Dear Ms. Edwards:

On October 9, 2014, the U.S. Department of Energy (the Department or DOE) issued a notice of proposed rulemaking (NOPR) to revise its test procedure for external power supplies (EPS). The Natural Resources Defense Council (NRDC), Appliance Standards Awareness Project (ASAP) and American Council for an Energy-Efficient Economy (ACEEE) respectfully submit these comments in response to the Department's proposed changes.

The Natural Resources Defense Council (NRDC) is an international nonprofit environmental organization with more than 1.3 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC has offices in New York City, Washington, D.C., Los Angeles, San Francisco, Chicago, Livingston, Montana, and Beijing. NRDC's top institutional priorities are curbing global warming and creating a clean energy future.  Energy efficiency is the quickest, cleanest, cheapest solutions to global warming and other energy-related problems. Cost-effective energy efficiency standards help to ensure that consumer and commercial products provide the same level of comfort and service using less energy, with benefits for consumers, the environment and the electricity grid. For more than 30 years, NRDC has advocated for stronger federal and state energy efficiency standards for household appliances and commercial products, and for strong implementation and enforcement of these standards, including better test procedures.

ASAP is dedicated to increasing awareness of and support for cost-effective appliance and equipment efficiency standards. Founded in 1999, ASAP is led by a steering committee that includes representatives from energy efficiency organizations, the environmental community, consumer groups, utilities, and state government.

ACEEE, a nonprofit organization, acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors. Since being founded in 1980, ACEEE has continued to advocate for cost-effective new standards on a wide range of products at the state and federal level.

With more than 300 million new EPS shipped annually in the United States, and more than one billion in use in American homes today, EPS collectively consume a lot of energy and are responsible for a significant amount of carbon and other toxic pollution that is harmful to American's health and future prosperity. The 2016 standards will save consumers up to an additional $3.8 billion and cut emissions by nearly another 47 million metric tons of carbon dioxide over 30 years, equivalent to the annual electricity use of 6.5 million homes.

In general, we support and appreciate the Department's effort in advancing this rulemaking. We agree with the Department's proposed revisions to harmonize the test procedure with the latest version of IEC 62301, to add test configurations that can be used to avoid losses caused by testing cables, to clarify which standards apply to which EPS type, and to expand the scope of its sampling plan for Class A EPSs to apply to those that will be subject to standards in 2016.

We have specific comments with regard to the revised indirect EPS definition, the optional testing at 10 percent load condition, the optional recording of power factor, and testing adaptive EPS.

1. **Indirect Operation EPS Definition – We strongly support DOE's proposed revision to the definition of indirect operation EPS.**

EPS are considered "indirect operation" if they cannot be used to operate a consumer product directly. Because indirect operation EPS would be covered by the proposed DOE efficiency standards on battery charger systems, DOE excluded these EPS from the 2016 EPS standards (however indirect Class A EPS are still covered by the 2008 EISA EPS standards). DOE's proposed revision to the definition clarifies that an EPS can only be considered indirect operation if it cannot operate any product directly, not just the product it is shipped with.

This revised definition reduces the risk of a loophole where EPS may be imported or sold as lower efficiency indirect operation EPS but used as direct operation EPS. If an EPS is capable of directly operating an end-use product, there is nothing that prevents consumers from using it with such products, irrespective of which product they were originally sold with. Even more problematic, once an EPS has been imported into the United States and has entered the stream of commerce, it could easily be matched to a variety of end-use products. Thus, an EPS manufacturer may not know or even be able to know which device a given EPS will be sold with, making a standard that differentiates based on the final product the EPS is sold with unenforceable at the point of manufacture or import. Different efficiency requirements for products that provide the same service could lead to a significant loss of energy savings for consumers and the nation.

[1] https://www1.eere.energy.gov/buildings/appliance_standards/pdfs/cce_faq.pdf

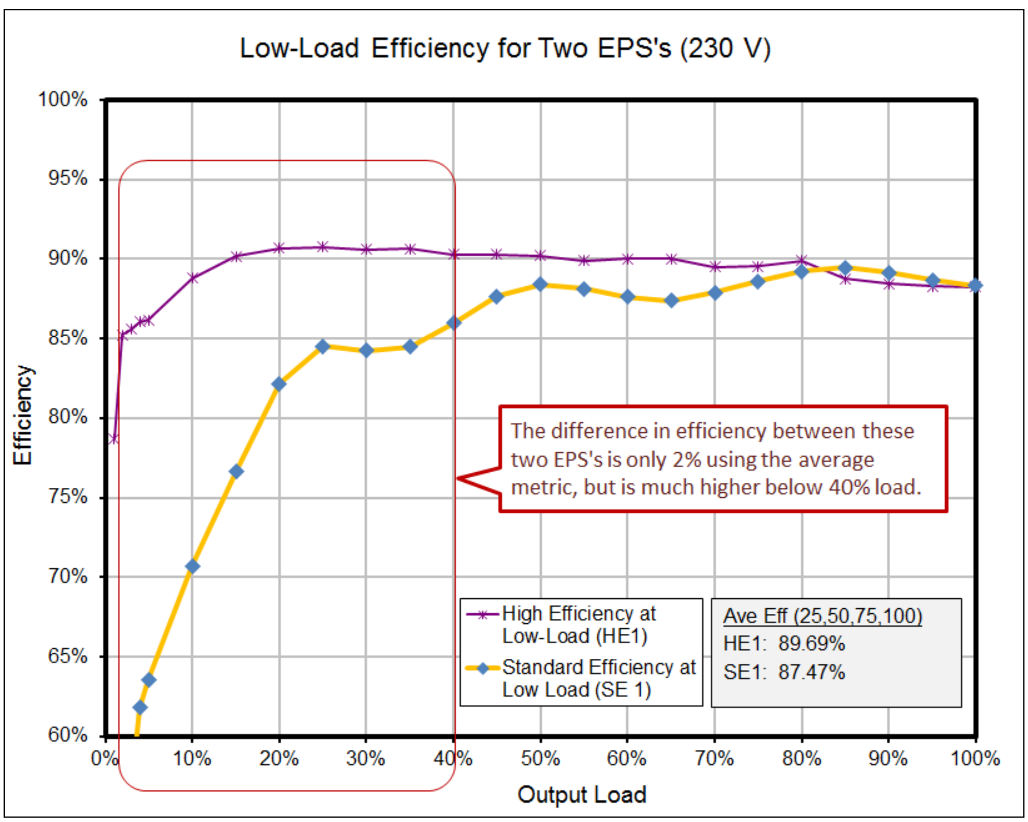
Indirect operation EPS that are capable of directly operating end-use products share the same functional requirements and use the same technology as direct operation EPS. They will be broadly available in the market due to the 2016 standards.

It is important to keep as broad a scope of coverage as the statute allows to ensure the energy savings and health and environmental benefits from the 2016 standards are effectively realized.

2. **Optional Testing at 10% Load Condition – We strongly support DOE's proposal to create a new test condition at 10% load and urge DOE to make it mandatory for EPS with 50 W or higher rated power in order to collect sufficient data.**

The EPS Average Efficiency metric calculates the arithmetic average efficiency at 25, 50, 75 and 100 percent of rated power. It does not capture efficiency below 25% load, which is a common operating point for many electronic devices (e.g. laptop computers). Many electronic devices operate most, or a significant portion, of the time, below 25% load. Laptop computers for example spend the majority of their time in the 10 to 20 percent range. Battery charger systems, such as cell phones, even when designed to primarily charge above 25%, taper output current when the battery reaches 90 percent charge, causing the load on the EPS to drop into its low-load zone. And the low-load zone can be a frequently occurring charging condition as consumers typically leave their phones plugged in until fully charged and frequently top them off.

The figure below illustrates the importance of measuring low-load efficiency. The two EPS on the chart have similar efficiency using the standard metric (approximately **2%** average efficiency difference), but 18 percentage points (**20%**) difference in efficiency at 10% load:



SE1 is a computer manufacturer EPS rated level V. HE1 is a Power Integrations reference design.
Due to the diluting effect of the 4-point average formula, and as illustrated on this chart, a 10% load measurement is important not just for devices operating in a narrow range around 10% load, but also for all devices operating a significant amount of time below 50% load.

The benefits of high efficiency at low load may vary depending on end-use devices. Some devices may operate the EPS mostly at 100% load, in which case low-load efficiency would bring little benefits. For other devices, such as laptops, low-load is responsible for the vast majority of energy consumption. Continuing to ignore this test condition would be ignoring the reality of EPS usage and energy saving opportunities.

The additional testing burden for 10% load is very low: it only requires one additional measurement using the same test setup, taking a matter of minutes at most.

DOE's proposal to make this test condition optional will likely result in very limited data. In order to capture significant and representative data, **we urge DOE to make 10% load testing mandatory, at least for all EPS with 50 W or higher output power rating.** Our proposed 50 watt threshold would capture EPS that use the most power and may present the highest energy saving opportunities at low load.

Some industry stakeholders expressed concerns about testing being a first step toward regulation—there is no reason to believe that this will be the case until data is available to assess the costs and benefits of regulation. This additional test condition is critical to inform industry priorities, stakeholder advocacy, and DOE decisions in the future.

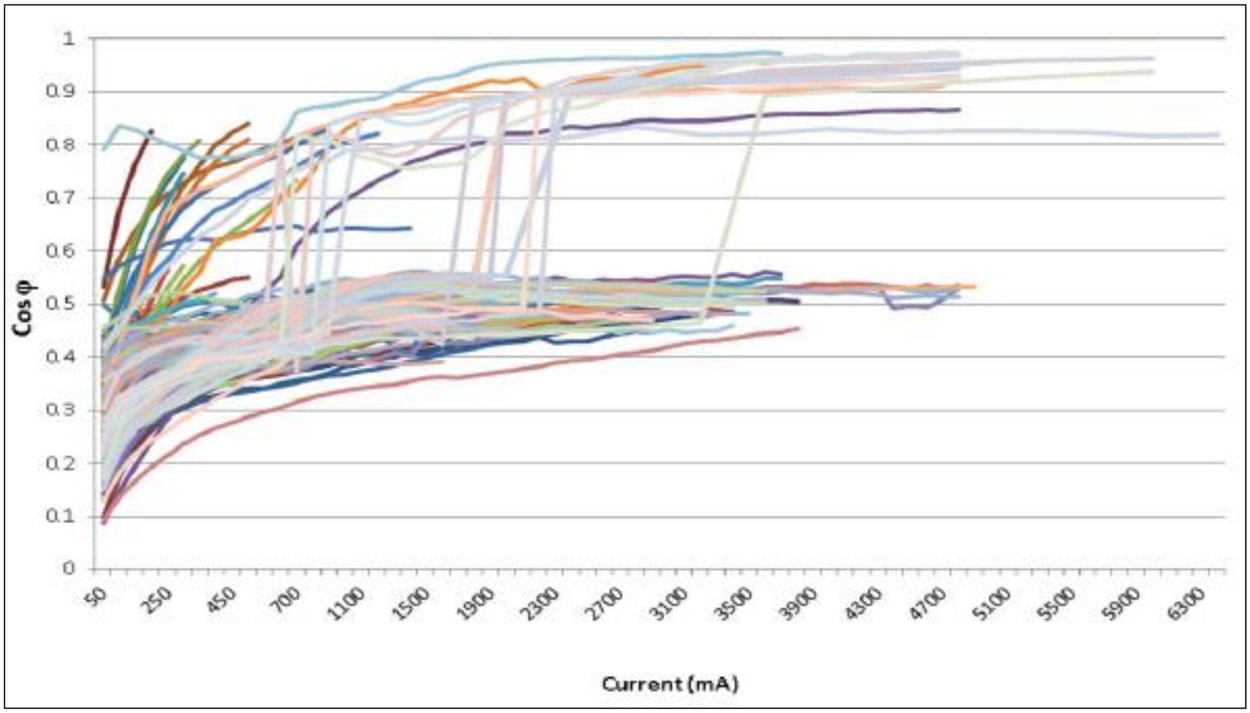
3. **Optional Recording of Power Factor – We strongly support DOE's proposal to record power factor at each test condition, and urge DOE to make it mandatory for EPS with 50 W or higher rated power in order to collect sufficient data.**

Power factor (PF) is a measure of current quality. Most efficient power supplies use switch mode designs that draw current in short spikes which often bear no relation to the voltage waveform, resulting in a low power factor if uncorrected[1]. Devices with low power factor have proportionately higher AC current draw, which increases the resistive losses in the building wiring, and increase the amount of electricity generation required for a given load.

A 2012 study found that the power factors of the majority of the power supplies of electronic devices were in the 0.3 – 0.55 range over much of their operating range.

[1] IEA: Power Factor Correction: An Energy Efficiency Perspective, http://standby.iea-4e.org/files/otherfiles/0000/0041/AGO_G3A_PowerFactorCorrection_FINAL_2011_0617-M.pdf

Power factor (cosine of phase angle) vs. load:[2]




**A device with a PF of 0.4 draws 2.5 times the current compared to an ideal load with a PF of 1**, which means that building wiring losses could be 6.25 times higher than the ideal case.[3]
A 2011 Asia Pacific Partnership - Ecos Consulting paper[4] estimated the savings potential from power factor correction to be 2.1% in residential settings and 11% in commercial settings. The paper estimates that roughly half of these savings, and more than half in commercial settings, occur on the customer-side of the meter, the other part on the utility side.

Only customer-side savings may be counted towards cost-effectiveness for an individual consumer. However, losses on the utility side increase the cost of electricity for consumers as a whole, and therefore should be counted in cost-effectiveness calculations. The entire savings accrue societal benefits in the form of reduced air and climate pollution. Even if consumer benefits of power factor correction are not cost-effective by themselves for some EPS, they may be cost-effective bundled with other energy-saving requirements such as low-load efficiency.

The additional testing burden for power factor is negligible: power factor measurement is readily available on test equipment and just needs to be reported along with efficiency.

DOE's proposal to make power factor measurement optional will likely result in very limited data. In order to capture significant and representative data, **we urge DOE to make power factor measurement and reporting mandatory, at least for all EPS with 50 W or higher output power rating.** Our proposed 50 watt

[2] GeSI-ITU 2012: An Energy-Aware Survey on ICT Device Power Supplies http://www.itu.int/dms_pub/itu-t/oth/4B/01/T4B010000070001PDFE.pdf.
[3] *Ibid*.
[4] Power Factor Correction: An Energy Efficiency Perspective, http://standby.iea-4e.org/files/otherfiles/0000/0041/AGO_G3A_PowerFactorCorrection_FINAL_2011_0617-M.pdf

threshold would capture EPS that use the most power and may present the highest energy saving opportunities from improved power factor.

Measurement of power factor is a critical first step to inform industry priorities, stakeholder advocacy, and DOE decisions in the future.

4. **Testing Adaptive EPS – We support DOE's proposal to test adaptive EPS at both the highest and the lowest output voltage, and recommend that DOE clarifies that EPS must meet standards requirements at both voltages.**

Adaptive EPS are capable of adjusting output voltage depending on battery charge level. This is typically used for "fast charging" phones and other electronics. Increasing the voltage allows increasing charging power while staying within allowable current limits of USB connectors and cords. This is different from "smart charging" protocols which vary current but do not need communication with the EPS.

It is important to note that measurement values at the highest voltage do not necessarily represent efficiency of the EPS as used in the field. This is because adaptive charging protocols can use different voltages for each of the four load points. The best way to test the efficiency of an EPS as used is to test it as part of a Battery Charger System test.

However we support DOE's proposal to test EPS at both the highest and lowest output voltages, because it is a simple way to measure what are likely the upper and lower bounds of the efficiency range of EPS at each load point in communicating and non-communicating modes.

We urge DOE to clarify that adaptive EPS must meet applicable standards requirements at both voltages, including if the EPS is classified as low-voltage in non-communicating mode, and as basic voltage in communicating mode. This is important to ensure that EPS operating in communicating mode meet the requirements applicable to other EPS operating at the same voltage in non-communicating mode, avoiding a potential loophole and a loss of energy savings.

Thank you for the opportunity to comment on this rulemaking.

Respectfully submitted,

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