Battery Charger Technical Workshop:

A Forum for Discussing the Draft Battery Charger Test Procedure

November 17, 2005
San Francisco Pacific Energy Center
San Francisco, CA

The California Energy Commission and Pacific Gas and Electric Utility hosted a free workshop on Thursday, November 17 at the San Francisco Pacific Energy Center to discuss a draft energy efficiency battery charger system test procedure currently under development by Ecos Consulting and EPRI Solutions, contractors to the Energy Commission.

At the workshop the battery charger test procedure, efficiency data, and stakeholder comments received to date were presented. Presenters included:

- Steve Blanc – Pacific Gas & Electric: Welcome and Introduction to Energy Programs at PG&E
- John Wilson – California Energy Commission: Overview of the Energy Commission Public Interest Energy Research Program and Mandatory Standards
- David Korn – Cadmus Group: EPA's ENERGY STAR ® Program on Battery Chargers
- Kimberly Herb – Ecos Consulting: Battery Charger Efficiency Introduction
- Suzanne Foster Porter - Ecos Consulting: Battery Charger Test Procedure

Stakeholders at the workshop had the opportunity to provide recommendations and ask questions about the test procedure draft. These comments will inform the final energy efficiency battery charger system test procedure to be released in January 2006.

Full details of the workshop, including presentations given, agenda, and the test procedure are available at www.efficientproducts.org.

Below are comments received at the workshop categorized by subject.

1. ***Policy Landscape – Relationship of Existing Standards and Specifications to Energy Commission Plans for Future Battery Charger Standards***
    A. Stringency
        I. Immediate concerns were raised about the consideration of the concerns of manufacturers in the development of a specification and whether the Energy Commission would

adopt the voluntary ENERGY STAR battery charger specifications which are designed such that only 25% of devices qualify into a mandatory Commission, the result of which would prevent 75% of the market from sales in California.

II. A question was raised about how the scope of CEC battery charging efforts will differ from those of the EPA and ENERGY STAR.

B. Input not heard by the Commission when creating External Power Supply (EPS) standard

I. Some attendees were concerned that industry does not have enough input into policy creation for the External Power Supply Standard. "The last time we gave our input, our concerns were not heard."

2. *Safety Considerations*

A. Concern was raised that consideration might not be given to various types of devices that are bound by certain safety requirements (i.e. devices that, for safety reasons, do not currently qualify for EPS standard). Safety issues need to be considered. 60% to 70% of the products that are currently have on the shelves would not qualify with the new standards, in particular items requiring 4000-volt dielectric strength isolation from the mains. Switching power supplies cannot be used to meet this standard, we must use iron (transformer isolation).

B. In testing items such as phones, secondary lines (phone line) should be connected to analyze for safety concerns.

C. Questions were raised about whether testing would go outside the bounds of UL specifications and whether the testing procedure would include testing batteries not designed to be tested with the battery charger in question (see also Consistency with Existing Standards).

D. One attendee suggested an additional step in which the technician must confirm that the battery under test is recommended for use with the unit under test.

E. Questions arose regarding the dismantling of a device. It was suggested to include safety procedures regarding taking apart the batteries and to add a specific reference to existing safety procedure. Additionally there were questions specifically about dismantling devices with Li-Ion batteries.

3. *Consistency with Existing Standards*

A. Concerns were raised about the lack of reference to IEEE 1625 Livium Standards. The commenter suggested that Ecos Consulting research/ refer to the 2004 Livium Safety standards for concerns about how to declare to the safety issues that are delineated in their research. Manufacturers can "self" declare versus having "third

party" testing. The ability of a manufacturer to self-declare is preferable to third party testing.

B. A commenter noted that there is a huge difference between the size and shape of batteries in how long the rest time should be between tests (USABC Procedures/BCI Procedures). It was noted that rather than specify resting periods, standard IEC recommended temperatures for discharge should be specified.

C. Questions were raised about whether testing would go outside the bounds of UL specifications and whether the testing procedure would include testing batteries not designed to be tested with the battery charger in question (See also Safety Considerations).

D. It was noted that Ecos Consulting should ensure that the test procedure is consistent with existing test procedures developed by the Battery Council International and the United States Advanced Battery Consortium. Additionally, attendees advised that the test procedure should pursue approval of and use exact language from the IEC.

E. The testing should be specific to where it takes place and include global standards, based on where the product is shipped. Within IEC 62301, technicians should know what elements of testing are unnecessary.

F. A number of attendees supported the need to condition batteries as described in IEC standards. (See also General Battery Health/Battery Conditioning)

G. The test procedure should include consideration of the EMC/EMI/FCC standards as well as ANSI (perhaps it's ANSI 22, the commenter was not sure?)

4. *Concerns about the Broadness of the Battery Charger Test Procedure*

A. One attendee wondered if the test procedure had been developed such that it can be generalized for application on any device with battery chargers? (is Ecos trying to develop it such that it could be used with UPSs, emergency egress lighting, electric vehicle charging, etc.?)

B. Concerns were raised about developing a test procedure, and possibly standards, that bind future products because they are based on current technology. The commenter suggested that the test procedure should be different for different products. Perhaps, the commenter suggested, there are some so different that they deserve different test procedures. He said that if the intent is to allow consumers to decide between products in the same category that it may not make sense to utilize a test procedure that groups all categories together.

C. Because this will likely lead to mandatory standards, an attendee said it should be more specific to products and cannot generalize.

The commenter wondered what the point is of trying to use one test procedure for devices that are not compared to one another.

5. *Multi-function Devices*

A. There were discussions about chargers imbedded with other functions, i.e., radio/charger or phone with a base containing a clock, etc. One commenter sought clarification on how the battery-charging circuitry is separate from the functionality of the device. He said that when charging the battery, you're not using the functionality of the device. Concern was expressed that in multi-function devices that the on/off switch on the base unit does not disable additional functions of the unit.

B. Consideration should be given to the type of product the battery eventually powers.

6. *General Battery Health/Battery Conditioning*

A. A number of attendees supported the need to condition batteries as described in IEC standards (See also comments on standards consistency)

B. In addition to conditioning the battery, many felt it was important to determine how close the battery was to its rated capacity. Some had suggested that the battery not be more than 1% less than its rated capacity. This raised the question about whether a battery that tests at less than its full capacity is suffering from "bad health" or "bad marketing" and some wondered if one can still use capacity as denominator in an efficiency metric. Determining the overall health of a battery is especially important in lead acid batteries and in battery charging systems that do not come with batteries.

C. Questions arose as to *requirements* of the condition of the battery before testing. It was expressed that one should not simply assume that a battery is in good health and ideal condition before testing and that the test procedure should call out the need to ensure that the battery included as part of the system is as close as possible to its rated capacity.

D. One attendee suggested that the battery should be stable within 2% of previous discharge.

7. *Test Procedure Details*

A. <u>Test Procedure Overall</u>

I. An attendee wanted clarification on the general nature of the test as to whether it was more of a snapshot in time, or whether the intent is to represent cumulative consumption over a period of time.

II. Someone asked what the procedure would be if the capacity of the battery is not available. He then suggested that the test procedure should include

language about what to do if the rated capacity of the batter is unavailable. Specifically he suggested stating "if available" in step 1 of #8.

III. Steps 1-10 in the section on reporting requirements should be connected or reference with step 1 of Table A.

IV. Attendees wanted to know how the people making the standards would be measuring the devices? At one second intervals versus one minute? How it was measured should be documented.

V. One attendee commented that there seemed to be three features, each of which might be tested separately:
   a. Stand by power and maintenance test
   b. Battery charger interaction (check functionality)
   c. Power conversion efficiency test

VI. Another attendee stated that not all would agree that dividing out these three features would be best for all applications. The commenter replied that he did not want to include power conversion efficiency in the test and that manufacturers should be allowed to choose where they want to save energy.

VII. Someone raised the question as to whether it was important to include power factor on devices that are prevalent in the residential sector.

B. Standby/No Battery Mode

I. A question was raised about how exactly no battery mode is different from standby mode and might they be the same in some products.

II. One commenter requested that we add to the definitions the differences for Standby versus No- Battery modes.

III. A commenter was concerned about testing a battery charger in "no battery mode" because in separating the power supply from battery charging system, it would no longer represents a battery charging system.

IV. There was a question about why power factor in no battery mode was important?

C. Discharge Rates

I. There was a discussion about the use of the 0.2 C discharge rated for all devices and battery types instead of using industry standards that vary by device. Some thought it should vary by device, various battery manufacturers said that 0.2 C for a discharge rate is fine and that the standard focuses more importance on the end-of-discharge cutoff voltages.

D. Rest Period

I. Manufacturer should be allowed to determine how long the battery rests in between each test.

II. A commenter noted that there is a huge difference between the size and shape of batteries in how long the rest time should be between tests (USABC Procedures/ BCI Procedures). It was noted that rather than specify resting periods, standard IEC-recommended temperatures for discharge should be specified. (See also comments on standards consistency)

III. There were questions about how long a battery should be allowed to rest as well as the impact of the resting period after discharge.

E. Charge time

I. *General Questions*

a. A question was raised as to the inclusion of charging elements that may be part of the maintenance mode.

b. One attendee asked if one of the objectives of the test procedure development was to shorten the time compared to the EPA test procedure.

c. One attendee suggested that the initial charge times and the "tested" charge times should be mirrored, i.e., 16 hours or 24 hours.

d. One attendee noted that there might be a skew based on how much time a device spends in each mode. He said that one could always extend the maintenance ratio and you've captured the charge time. These numbers, he noted, can then be used with duty cycle estimates.

e. One attendee asked if the objective was to get 4 hours of maintenance to highlight devices that are the 'losers' with respect to maintenance. He suggested that we might want a separate maintenance mode measurement of 4 hours.

II. *Charge Time Too Short*

a. There were a number of concerns about only performing the test over a 16 hour time period. Some devices, some suggested, would likely not have completed a charging cycle in that amount of time. Some attendees suggested increasing the test period to 24 hours.

b. A number of attendees suggested that to ensure a fully charged battery, it must be charged for a minimum of 24 hours. One suggested that the "bulk charge" test be avoided entirely. He suggested that the test start with a fully charged

battery to measure mostly the maintenance and no-battery tests.

c. One attendee commented that the procedure could suggest 24 hours but if the manufacturer agrees to a time that is less then it could be changed.

d. An attendee commented that the intent is to make sure the battery is fully charged.

e. An attendee commented that the test procedure assumes an anticipated use pattern by setting a 16-hour charge period. He asked why shorter periods could not be used.

f. An attendee commented that you couldn't be sure that the battery reached its rated capacity within 16 hours. Some types of batteries require longer periods to actually reach full charge, so that maintenance mode would be underrepresented or not present at all in the energy calculation. He suggested either a 24-hour period or some way to separate the maintenance mode measurement.

F. Testing at multiple voltages

I. An attendee commented that the description of how to test battery-charging systems that can charge multiple batteries of various types was confusing. He suggested that it be described electrically.

II. A number of attendees were concerned that if devices worked at more than one frequency and voltage, that efficiency testing would be required at all those frequencies and voltages – even those that would not be used in California.

III. One attendee asked, if the test included a variety of multi-voltage permutations, could one use the measurements to generate a weighted average? The attendee noted that the EPA test procedure allows for an option to use a weighted average of the products. He suggested that perhaps general-purpose batteries should be separated out from specific battery packs.

G. Cooling

I. One attendee sought clarification about the use of external cooling of the unit under test.

H. Maximum and Minimum Capacity Tests

I. An attendee wanted to know what difference one hoped to capture by testing maximum and minimum batteries, instead of just maximum.

8. *Field Conditions vs. Lab Conditions*

A. Considerations of consumer behavior

I. A comment was made that a statement about how consumers treat batteries should be included to address the effects of consumer behavior, if only to acknowledge that they exist. The commenter suggested that Ecos Consulting include factors that might better represent real world scenarios.

B. Duty Cycles and Loads

I. An attendee questioned how well the test procedure would capture product differences that require different loads based on assumptions about the way in the battery will ultimately be used by the product it is intended to power.

II. Concerns were expressed about how well the test procedure will include considerations for devices that may never reach a fully charged state, such as cordless phones; how will it take into consideration standby and maintenance modes?

III. Concerns were expressed about the ramifications of not considering the load of the devices. These loads may influence the design of the battery charging system, i.e. the charger-battery system may not operating under conditions for which it was designed, and the measured efficiency may therefore be significantly lower (or higher) than the system operating at the conditions for which it was designed.

9. *EPA-California Energy Commission coordination*

A. Sharing data

I. A question was raised about how Ecos Consulting will partner with Cadmus to share data to avoid duplication of efforts.

10. *General Comments/Questions*

I. Some attendees expressed appreciation for the inclusion of industry concerns in the development of the test procedure.

II. Attendees asked if they could have access to data on their specific product and that any other product specific data not otherwise be shared.

III. Ecos Consulting was encouraged to consider the marketing rationale that supports decisions on which batteries to sell with a device.

IV. An attendee asked that manufacturer names be removed from charts before any become publicly available.

V. Different sized batteries are offered as accessories. How would accessory batteries be covered under a battery charging test procedure and possible specification?

VI. An attendee asked if the test was measuring *efficiencies* at one-minute intervals (rather than voltage and current or power levels). They were concerned that the efficiency might bounce around a lot and wondered whether one would take the optimal efficiency measurement over a one-minute interval.

VII. Comparing the products on the basis of battery voltage instead of battery capacity is preferable once this process moves to a standard.