



Comments of the
INFORMATION TECHNOLOGY INDUSTRY COUNCIL
to the
CALIFORNIA ENERGY COMMISSION
regarding
Battery Charging Specification

PROPOSED AMENDMENTS TO APPLIANCE EFFICIENCY REGULATIONS
CALIFORNIA CODE OF REGULATIONS, TITLE 20, SECTIONS 1601
THROUGH 1607 CALIFORNIA ENERGY COMMISSION

Docket Number 11-AAER-2

October 19, 2011

ITI welcomes the opportunity to comment on the amendments to the appliance efficiency regulations with regards to devices containing a battery charger. We appreciate the willingness of the California Energy Commission (CEC) to review an alternative testing method that would entail isolating the battery charging circuit and accommodate multifunction IT equipment where battery functions merely support the primary operations of the system. We realize that until such a test procedure can be proven, the existing test methods are to be used to evaluate the battery systems including those multifunction devices.

As noted previously, multi-function devices are highly integrated, manage the battery subsystem and conduct their primary function when plugged into an AC source. Specifically, many of these devices – smart phones, tablet computers, etc. – will wake up, manage the battery and conduct auxiliary functions while connected to the AC outlet. An assessment of the energy consumption of these systems may result in higher energy measurements than what would be anticipated by

the simple addition of the two circuits.¹ For example, the integration might include intelligence to prevent overcharging, or total discharge of the battery to ensure functional restart of the system. The error between the battery capacity and discharge can be upwards of 10 percent for small batteries. This can lead to a partial assessment of the battery capacity, resulting in inaccurate test results and the disqualification of otherwise eligible products.

Off Power on Mobile Computers

ITI noted the energy consumption in the off mode can be significant in a number of these mobile computing devices. The publically available data collected by the EPA to determine ENERGY STAR® for Computers v5.0 provides standby/Off state (without the battery) data on over 300 notebooks. Note that although technology has improved, the scope of products was limited and did not include those devices that primarily ran on battery power. The population of just notebook computers indicates that some devices were over 2W in off mode without the battery. Battery functions would be additive to these levels. It does not appear as though this data was taken into account during the limit setting analysis.

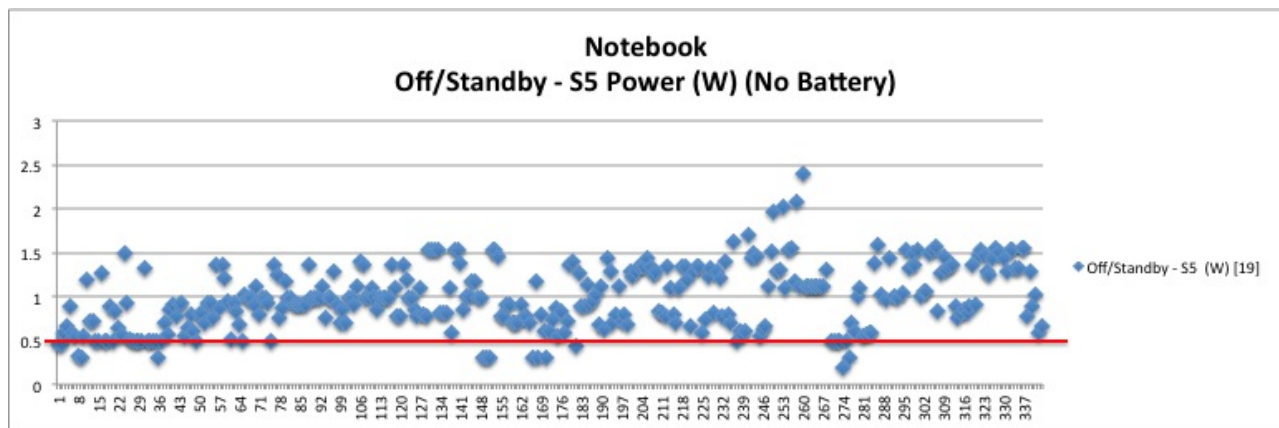


Fig 1. ENERGY STAR® v5 S5 source data (computer “standby/off”: system is plugged in with battery removed).

This data unfortunately, is without the battery. Battery functions and intelligent system controls are additive to the S5 levels.

Challenges for <50Whr mobile IT devices

As a result of these integrated and intelligent functions, the CEC’s proposed limits are extremely challenging:

¹ In some devices, the battery cannot be easily removed from the system in order to conduct necessary tests to identify the residual value.

Table W-2
Standards for Small Battery Charger Systems

<u>Performance Parameter</u>	<u>Standard</u>
<u>Maximum 24 hour charge and maintenance energy (Wh)</u> <u>(E_b = capacity of all batteries in ports and N = number of charger ports)</u>	<p><u>For E_b of 2.5 Wh or less:</u> <u>16 x N</u></p> <p><u>For E_b greater than 2.5 Wh and less than or equal to 100 Wh:</u> <u>12 x N + 1.6E_b</u></p> <p><u>For E_b greater than 100 Wh and less than or equal to 1000 Wh:</u> <u>22 x N + 1.5E_b</u></p> <p><u>For E_b greater than 1000 Wh:</u> <u>36.4 x N + 1.486E_b</u></p>
<u>Maintenance Mode Power and No Battery Mode Power (W)</u> <u>(E_b = capacity of all batteries in ports and N = number of charger ports)</u>	<p><u>The sum of maintenance mode power and no battery mode power must be less than or equal to:</u></p> <p><u>1x N + 0.0021x E_b Watts</u></p>

Fig.2 CEC proposed limits for small battery chargers, 10/7/2011

The challenges are particularly difficult for devices whose battery capacity is ≤ 50 Whrs. Mobile computing devices provide functional capabilities (e.g. system interrupts, phone calls, notices, etc.), battery management (e.g. charge protection, monitoring, etc.) and battery charging when necessary while under AC load. These contribute to fixed losses beyond the compensation of the multiplier. Specialized modes to decouple the battery will take several years to implement. The additional test modes to isolate the battery may also cause a decrease in battery life in typical use conditions.

For very small battery capacity devices (e.g., <20 Whrs) the multipliers for the 24hr test and maintenance_off power limits will simply be insufficient to compensate for the aforementioned losses. Even though these small devices may be highly-efficient and use the most efficient battery technologies, they would fail or become un-manufacturable (marginal) to those limits. Typical manufacturing processes must use $>5\%$ (depending on the test) margin to specifications to ensure coverage for test and manufacturing hardware variations. Therefore, data points with less than 5% margin to limits are likely to fail manufacturing tests and substantially increase the cost of the remaining passing units.

Many very small battery capacity devices are being designed to be supported by USB connections. These devices use a single USB connection to provide machine-to-machine synchronization (i.e., “sync”), battery charging, and provide energy to operate the device. USB specification is an international standard, is required for interoperability and maintains a fixed voltage level of 5v. Adopting this standard causes multiple voltage conversions instead of customized voltage levels. This level of convenience and efficiency causes additional fixed energy losses due to the multiple voltage conversions. Coupled with fixed losses in the AC to

5V DC converter, USB power capable units may not be able to meet either the maintenance mode or 24hr test limits since the scalar to the battery capacity (Eb) does not compensate for the fixed losses.

As noted by the CEC on the four mobile system data points in the CEC database and the four units in the DOE data base, the 1.6 multiplier was expected to contain extra margin for devices using advanced battery chemistries after accounting for battery charging and maintenance. Though the systems in the CEC and DOE data sets did pass, one was very marginal. The sample size was insufficient to highlight inherent technology sensitivities in the population. Given the fixed losses mentioned and the large database of systems with off power of >1W, it is clear the multipliers would not be able to compensate for fixed losses across the range of devices. The example calculations in fig. 3 demonstrate the discrepancy between the proposed multiplier and underlying technologies with these multi-function, integrated devices.

Example:

Stage	Efficiency@load	Impact on Multiplier (1.+)
AC to DC	80%	0.20
5V USB	90%	0.10
Battery chging	80%	0.20
Eb_discharged	90%	0.10
S5 w/o battery	-0.5W	0.25 for 50Whr
Manufacturing	95%	0.05
-----		1+ 0.90

Fig 3. Technology efficiency accounting and multiplier impact

Accounting for some of the best manufacturable efficiency levels achievable, the 1.6 multiplier is insufficient. The implied requirement to the industry is ‘increase the efficiency by 25%’ over the state of the art today and makes that a mandatory across all devices.” As seen with the ENERGY STAR® for Computers v5.0 source data (Fig. 1), meeting the efficiency targets in Fig 3 across all designs will already be difficult. Getting an additional 25% will not be feasible, even with the advances since the ENERGY STAR for Computers v5.0 data collection.

Sample of systems <50Whr

Even with efficiency allocations listed above, some of the systems listed below will not pass (will need to be redesigned).

Battery Capacity (Whr)	24 Hour Mfg Limit (Whr)	24 Hour Measuremt (Whr)	24 Hour Result (P/F)	No-Battery Mfg Limit (W)	No-Battery Measuremt (W)	No-Battery Result (Pass/Fail)	Maintn Mfg Limit (W)	Maintn Measuremt (W)	Maintn Result (P/F)	Combined No-Batt & Maintn Mfg Limit (W)	Combined No-Batt & Maint Calc (W)	Combined No-Batt & Maintn Result (P/F)
23	46.3	41.11	PASS	0.28	0.25	PASS	0.47	0.5	PASS	.99	0.75	PASS
5.18	19.27	35.79	FAIL	0.28	0.03	PASS	0.47	0.982	FAIL	.96	1.012	FAIL
10.3	27.05	54.44	FAIL	0.28	0.08	PASS	0.47	1.53	FAIL	.97	1.61	FAIL
40	72.2	65.52	PASS	0.28	0.239	PASS	0.47	0.834	FAIL	1.03	1.073	FAIL
5.18	19.37	31.22	FAIL	0.28	0.03	PASS	0.47	0.943	FAIL	.96	0.973	FAIL

Data from tests conducted by ITI member companies, 2011

To accommodate the fixed losses we recommend increasing the offset for devices with $E_b \leq 50\text{Whr}$. Though this may provide slightly more margin to smaller battery devices, the resultant reduction in plug load is consistent with the energy saving behavior advocated by the objectives of the regulation.

Test	Limit	Comments
<i>50Whr < Devices ≤ 100Whr</i>		
24 hr test	$(12 * N) + 1.6E_b$	E_b =battery capacity; N=ports
Maintenance + Off	1.20	
<i>Devices ≤ 50Whr</i>		
24 hr test	$20 + 1.6E_b$	fixed loss
Maintenance + Off	1.20	fixed loss/advantages low E_b

Please note that with these limits, the industry is still challenged to aggressively improve the energy efficiency across the technologies and parameters identified. However, the compromise proposal would at least address the majority of fixed losses for small battery devices.

Labeling

Given that the forthcoming regulation will amount to a mandatory market requirement, a label will not differentiate between products and will therefore be superfluous to consumer purchasing decisions. Moreover, the process of labeling product is not environmentally- nor cost-neutral. Rather, adding labels to products prolongs the manufacturing process, typically requires additional tools and parts to accomplish the task, and increases the energy consumed to produce a product that otherwise would comply with the regulation. Finally, the labeling requirement will be preempted by the forthcoming label associated with the Department of Energy's testing regulation. Therefore, we request that the CEC reconsider the decision to require placing a label directly on covered products, and allow manufacturers to place compliance statements and related information in product documentation.

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