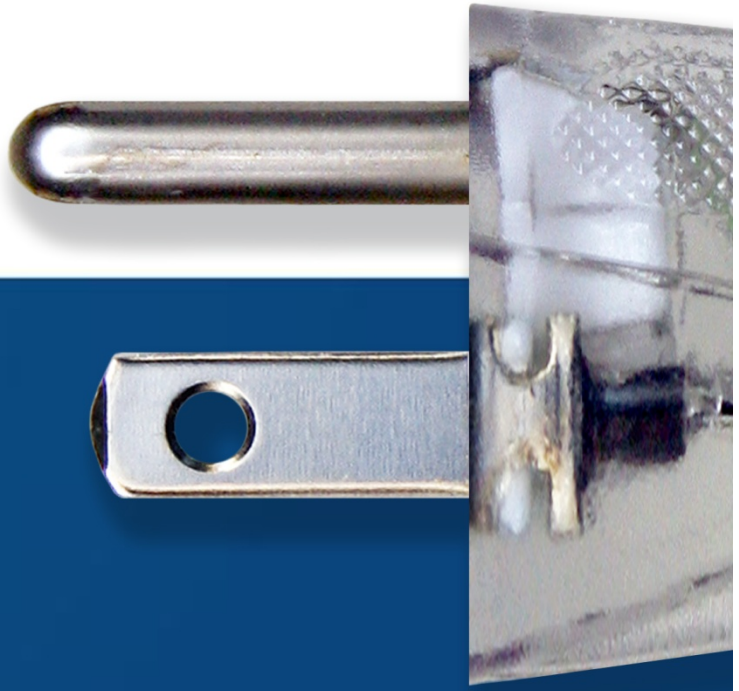
U.S. DOE EPS Efficiency Proposal



Rich Fassler, Power Integrations
European Code of Conduct Meeting
September 13, 2012

DOE March 2012 EPS/BCS NOPR

- Tightens efficiency & expands the range of current EISA2007 limits
  - Class A expanded to seven EPS product classifications
  - Adds multiple output, low voltage and high power classes
  - Distinction between EPS “direct” and “indirect” operation
- Roman numeral VI marking

Product Class	Product Class Description	
B	DC Output, Basic-Voltage	2.5 W (0-10.25 W)
		18 W (10.25-39 W)
		60 W (39-90 W)
		120 W (91-250 W)
C	DC Output, Low-Voltage	
D	AC Output, Basic-Voltage	
E	AC Output, Low-Voltage	
X	Multiple-Voltage	
H	High-Power	
N	Indirect Operation	

(Source: U.S. DoE March 2012 BCS EPS NOPR)

AC-DC Proposed Efficiency Requirements

- Product Classes B, C, H

AC-DC, Basic-Voltage External Power Supply		
Nameplate Output Power (P_{out})	**Minimum Average Efficiency in Active Mode** *(expressed as a decimal)*	**Maximum Power in No-Load Mode [W]**
0 to ≤ 1 watt	≥ 0.5 * P_{out} + 0.16	≤ 0.100
> 1 to ≤ 49 watts	≥ 0.071 * ln(P_{out}) - 0.0014 * P_{out} +0.67	≤ 0.100
> 49 watts to ≤ 250 watts	≥ 0.880	≤ 0.210
> 250 watts	≥ 0.875	≤ 0.500
AC-DC, Low-Voltage External Power Supply		
Nameplate Output Power (P_{out})	**Minimum Average Efficiency in Active Mode** *(expressed as a decimal)*	**Maximum Power in No-Load Mode [W]**
0 to ≤ 1 watt	≥ 0.517 * P_{out} + 0.087	≤ 0.100
> 1 to ≤ 49 watts	≥ 0.0834 * ln(P_{out}) - 0.0014 * P_{out} + 0.609	≤ 0.100
> 49 watts to ≤ 250 watts	≥ 0.870	≤ 0.210
> 250 watts	≥ 0.875	≤ 0.500

Classes D, E, H

Max No-Load (W)

- 0.210
- 0.500

- 0.210
- 0.500

Note: Low-voltage EPS defined as < 6 volts and • 550 mA output

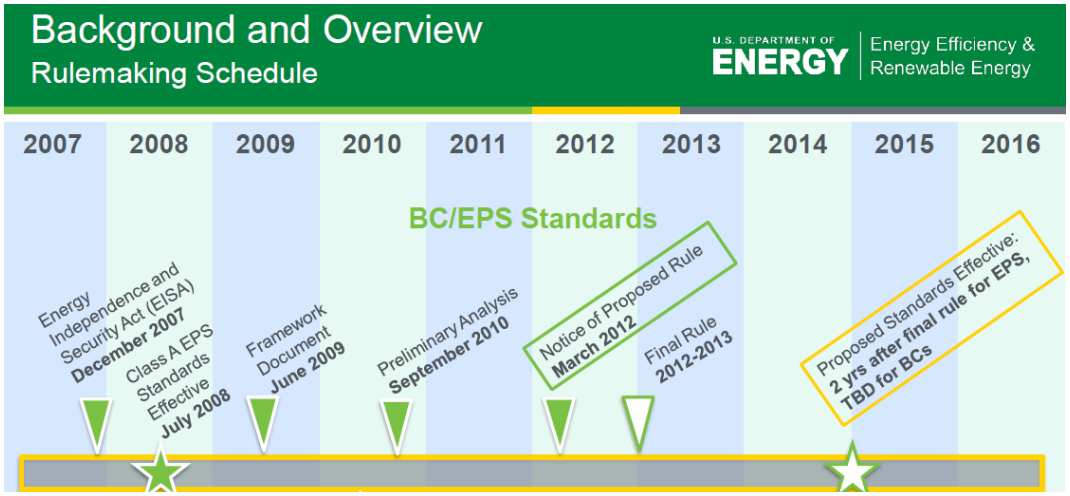
Comparing 2012 NOPR with Ecodesign Tier 2

§ NOPR proposes tighter active mode efficiency and no-load power consumption (Classes B,C)

Nameplate Output Power (Pno)	U.S. DoE March 2012 NOPR (Proposed)	EC Ecodesign Directive Tier 2 (In effect – 2011)
	Active Mode Efficiency (Ave.)	**Active Mode Efficiency (Ave.)**
1 W (standard voltage)	**66%**	62%
1 W (low voltage)	**60.4%**	56.4%
5 W (standard voltage)	**77.7%**	72.3%
5 W (low voltage)	**73.6%**	68.2%
20 W (standard voltage)	**85.5%**	81%
60 W (standard voltage)	**88.0%**	87.0%
	No-load power consumption	**No-load power consumption**
< 50 W	• **0.1 W**	• 0.3 W
• 50 to • 250 W	• **0.210 W**	• 0.5 W

May Stakeholder Meeting Observations

- Rulemaking Schedule calls for 2015 EPS effective date
  - Strong desire by some stakeholders to have BCS rule effective in 2013 to pre-empt CA standard



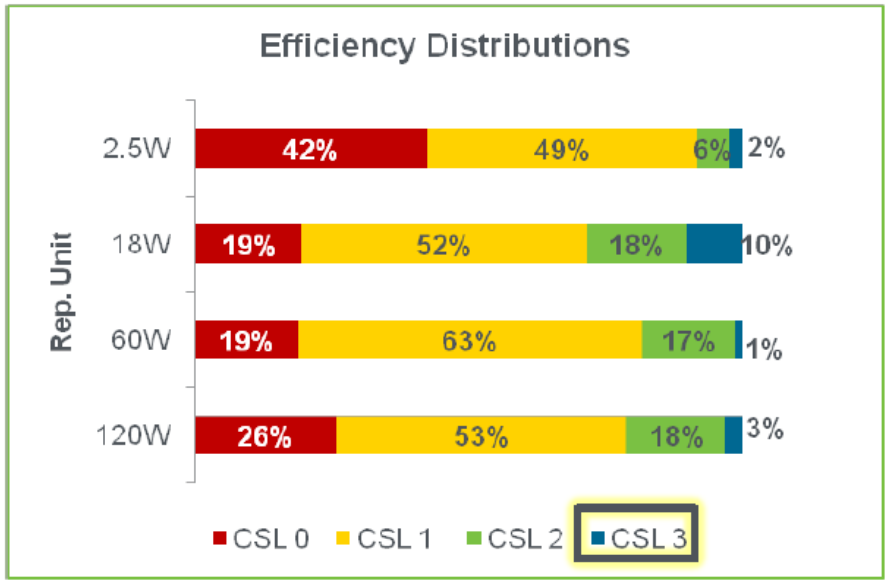
Source: DOE May 2012 stakeholder meeting presentation

- Review of indirect operation definition to prevent “gaming” the standard to override EPS requirements?
  - Increase operational time delay from 5 seconds to ?

May Stakeholder Meeting Observations

§ Possible relaxation of active mode efficiency requirements?

CSL	Reference
0	EISA 2007
1	Energy Star 2.0
2	Intermediate
3	Best in Market
4	Max Tech

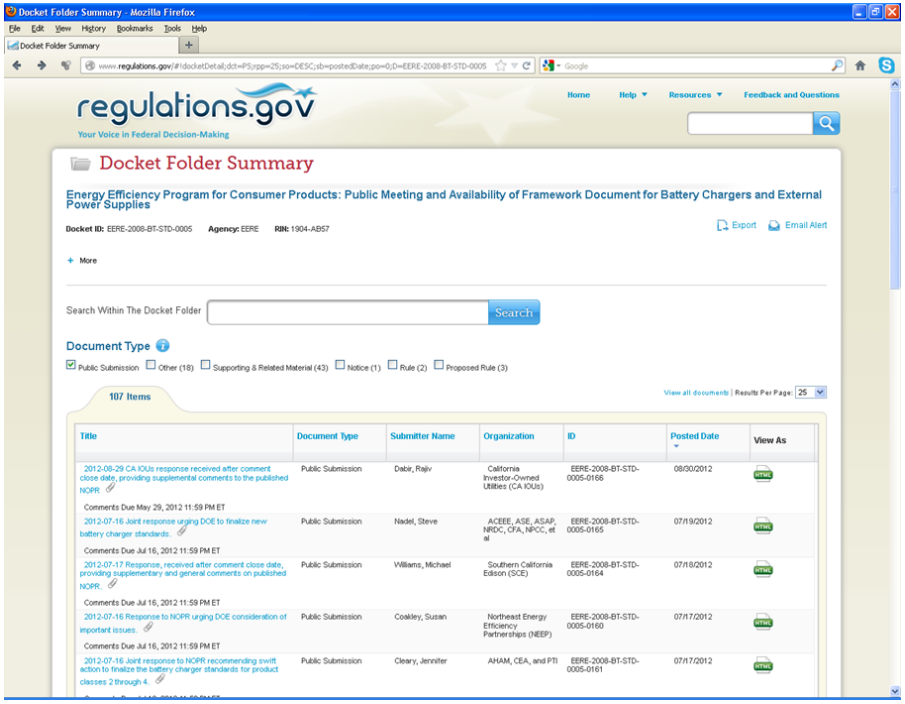


Source: DOE May 2012 stakeholder meeting presentation

CSL = Candidate Standard Level used in EPS characterization – include efficiency and no-load equations

Sept 4, 2012 Status - DOE EPS/BCS Standard

- Review of stakeholder comments continues (>70)



- Hope to finalize standard by year end with Jan 2015 effective date
  - Any additional analysis required could cause delay

For More Information

- DOE EPS/BCS Program Manager
  - Jeremy Dommu; Email: jeremy.dommu@ee.doe.gov, PH: 202-586-9870
- Link to the DOE EPS/BCS webpage (NOPR & TSD):
  - http://www1.eere.energy.gov/buildings/appliance_standards/residential/battery_external_nopr.html
- Link to May 2012 meeting slides
  - http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/bceps_nopr_public_meeting_slides.pdf
- Link to stakeholder comments page:
  - http://www.regulations.gov/#!docketDetail;dct=PS;rpp=25;po=0;D=EERE-2008-BT-STD-0005

Backup Slides

Direct vs. Indirect EPS Operation

- Direct Operation EPS – EPS that can operate consumer product that isn't a battery charger without assistance of the battery
- Indirect Operation EPS – EPS that can't operate a consumer product that isn't a battery charger without assistance of a battery determined by the following:
  - 1) Charge battery in app via EPS
  - 2) Disconnect EPS, turn app on, record time to operational (5 s incr.)
  - 3) Operate app until battery discharged
  - 4) Attach EPS to app, record time to become operational (5 s incr.)
  - If time recorded in 4) is • time recorded in 2) plus 5s, then Direct Operation EPS

Major EPS Specs/Standards Comparison

	EC CoC v4, EC ErP Tier 2 (2011), China YD/T 1591-2009[5], ENERGY STAR EPS v2,		EISA 2007
	Standard Voltage PS[3]	Low Voltage PS[3]	
Nameplate Output Power (Pno)	Minimum Average Efficiency, Active Mode	Minimum Average Efficiency, Active Mode	Minimum Average Efficiency, Active Mode
• 1 watt	• 0.480 * Pno + 0.140	• 0.497 * Pno + 0.067	0.5* Pno
> 1 to • 49 watts	• [0.0626 * Ln (Pno)] + 0.622	• [0.0750 * Ln (Pno)] + 0.561	
> 1 to • 51 watts	• [0.0626 * Ln (Pno)] + 0.622 *(EcoDesign only)*		• [0.09 * Ln (Pno)] + 0.5
> 49 watts	• 0.870	• 0.860	
> 51 watts	• 0.870 *(EcoDesign only)*		• 0.850
	No-Load Power[1, 2, 4]	No-Load Power[2, 4]	No-Load Power
< 50 watts	0.3 watts / 0.15 watts	0.3 watts / 0.15 watts	0.5 watts
• 50 to • 250 watts	0.5 watts	0.5 watts	0.5 watts

Notes:

1. AC-AC is • 0.5 W for all power levels, 2. CoC and YD/T - No-load spec for mobile handheld battery powered apps = < 0.15 W, 3. Standard voltage power supply excludes low voltage power supplies which are defined as < 6 volts and • 550 mA, 4. For Ecodesign, power levels are • 51 watts and > 51 watts, 5. YD/T standard covers only EPS with USB output of 5 V, 500mA to 1500 MA.