DOCKETED

Docket Number:	14-AAER-02
Project Title:	Computer, Computer Monitors, and Electronic Displays
TN #:	211724
Document Title:	California Investor Owned Utilities Comments: Response to CEC Final Draft Proposal_Addendum for Power Supply Efficiency and Power Factor
Description:	N/A
Filer:	System
Organization:	California Investor Owned Utilities
Submitter Role:	Public
Submission Date:	6/3/2016 5:37:50 PM
Docketed Date:	6/6/2016

Comment Received From: California Investor Owned Utilities
Submitted On: 6/3/2016
Docket Number: 14-AAER-02

Response to CEC Final Draft Proposal_Addendum for Power Supply Efficiency and Power Factor

Additional submitted attachment is included below.

Computers

Codes and Standards Enhancement (CASE) Initiative
For PY 2016: Title 20 Standards Development

Response to Final Draft CEC Staff Report,
Revised Analysis for **Computers**
Addendum regarding Power Supply Efficiency & Power Factor

Docket #14-AAER-2

May 31, 2016

Prepared for:

PACIFIC GAS & ELECTRIC COMPANY

SOUTHERN CALIFORNIA EDISON

SAN DIEGO GAS AND ELECTRIC

SOUTHERN CALIFORNIA GAS COMPANY

Prepared by:
Nate Dewart, ENERGY SOLUTIONS
Peter May-Ostendorp, XERGY CONSULTING
Vojin Zivojnovic, AGGIOS
Davorin Mista, AGGIOS

This report was prepared by the California Statewide Investor-Owned Utilities Codes and Standards Program and funded by the California utility customers under the auspices of the California Public Utilities Commission.

Acknowledgements

The content of this document was developed with technical contributions from Pierre Delforge, NRDC.

1 Intro

The content below is an additional analysis in support of the CASE Team's recommendation for power supply efficiency requirement submitted on May 23rd in response to CEC's Final Draft Staff Report for Computers. Also include is the recommendation for power factor previously submitted, for reference.

2 Power Supply Requirements

2.1 Power Supply Efficiency

Summary: We recommend CEC sets power supply efficiency requirements of 80 PLUS Bronze (at a minimum for the 20% and 50% load points) for all desktop computers required to meet overall TEC requirements and not just those high-end desktops, workstations, and small-scale servers exempted from TEC requirements. Inclusion of power supply efficiency requirements ensures energy savings in real-world use and active mode, not just in lab testing at minimum idle conditions. For gaming computers, which are responsible for as much as 20 percent of computer energy use, 80 PLUS Bronze could save an extra 20 percent energy in real-world use. Most computers would also be able to reduce power demand in active modes, saving energy and limiting demand impacts.

Discussion:
CEC's current proposal does not set efficiency requirements for desktop power supplies for the vast majority of systems (although it does for TEC-exempt high-performance desktops, workstations, or small-scale servers). Rather it is focused on ensuring low power in idle modes. CEC's underlying rationale seems to be that power supply efficiency will likely be one of the options for manufacturers to reduce idle load and therefore achieve TEC limits, as most desktops typically idle between 2% and 10% of PSU rated output, and therefore 80 PLUS should not also be required. Assuming that this approach for compliance was implemented, reducing energy waste in active modes would not be guaranteed; high efficiency at low load or idle conditions is not necessarily predictive of efficiency and energy savings in active mode. For example, a non-80 PLUS power supply and an 80 PLUS Gold power supply could have the same efficiency at 5% load (hypothetical idle load point), but very different efficiencies in active mode.[1]

The absence of PSU efficiency requirements at higher loads is particularly problematic for computers that spend a lot of time in active mode, such as gaming computers which represent 2% of sales but 20% of overall computer energy use. According to Mills[2], the majority of gaming computers' energy consumption comes from active mode (over 90%), but the same is likely true of

---

[1] See testing conducted by EPRI and Ecova (2016) and submitted to this docket, available at http://docketpublic.energy.ca.gov/PublicDocuments/14-AAER-02/TN210102_20160130T110353_Douglas_McIlvoy_Comments_Results_from_laboratory_testing_for_th.pdf.

[2] Mills N. and Mills E., "Taming the Energy Use of Gaming Computers", June 2015.

other desktops that experience heavier active workloads, such as non-workstation desktops that are used for graphics/video editing, scientific/financial analysis.

Table 1 illustrates the estimated real-world energy use of a CEC-compliant desktop computer with an 80 PLUS Bronze power supply and a non-80 PLUS power supply. Both power supplies have the same efficiency at low loads like idle, but the 80-PLUS Bronze power supply has a higher efficiency in active mode (based on differences between a 70% efficient conventional PSU and typical 80 PLUS Bronze units at similar load points). Using the gaming computer duty cycle defined in Mills, the computer uses about 20 percent more annual energy with the non-80-PLUS power supply. This example is based on an aggressive active usage pattern, but any desktop computer will reduce its power draw by about 5 to 15% in active operation by incorporating 80 PLUS Bronze power supplies over non-80 PLUS designs. This illustrates the importance of maintaining active mode efficiency requirements.

Table 1: CEC Compliant Gaming Computer TEC Impact from PSU Active Mode Efficiency

Mode		**Time per Day (h)**	**DC Power (W)**	**PSU Load (%)**	**80 PLUS Bronze TEC (kWh/yr)**	**Non-80 PLUS TEC (kWh/yr)**
Active	Gaming	4.4	200	67%	378	459
	Web browsing	2	25	8%	24	26
	Video streaming	1.6	25	8%	19	21
Short Idle		1	8	3%	4	4
Long Idle		3	6	2%	9	9
Sleep		6	1	0%	4	4
Off		6	0.3	0%	1	1
				Total	**441**	**525 (+20%)**

80 PLUS Bronze is undeniably technologically feasible and available. There are over 2,100 certified models listed in the 80 PLUS program's online database to date.[3] Manufacturers have been incorporating power supplies with efficiencies largely equivalent to 80 PLUS Bronze in desktops sold into the European Union since 2013 due to ErP regulations. Due to market transformation progress over the past decade, the incremental cost associated with 80 PLUS Bronze is estimated to be very low. Estimates from power supply component experts submitted during CEC's 2013 invitation to participate on computers and displays suggested that bill of materials for 80 PLUS Bronze might increase by about $0.25 (GTLC 2013). We conservatively estimate this might add an additional $1.00 to retail prices, meaning that a desktop like the one modeled in Table 1 would achieve benefit-cost ratios well over 50.

We therefore strongly recommend requiring 80 PLUS Bronze efficiency levels, at least for the 20% and 50% load requirements, which are the most important to realistic active loading requirements; the 100% load point could be omitted for the purpose of the standard.

2.2 Power Factor

We recommend CEC require power factor greater than or equal to 0.8 at 20% and 50% load, the same load points as for efficiency requirements so that they can be tested together to minimize testing burden. If CEC chooses not to set 20% and 50% efficiency requirements, we recommend power factor requirements at the short and long idle load points, so that power factor can be tested at the same time as short and long idle. Power factor correction in low power modes such as sleep and off is important too, but we are not recommending it in this standard because this could potentially be done more effectively through a horizontal standard that comprehensively addresses these low power modes.

Non-power-factor-corrected computers can have a power factor of 0.75 or lower in active mode (Fortenberry 2006), and recent testing conducted by EPRI and Ecova shows PF can be less than 0.5 at low load (EPRI and Ecova 2016). We estimate that correcting desktop PSU power factors to 0.9 in idle mode would save up to an additional 46 GWh/yr statewide (about 2 kWh/yr per desktop) on the consumer side of the meter, with additional savings on the utility side of the meter. While distribution-level savings cannot be counted as direct customer benefits, they add up and represent real energy losses, unnecessary generation capacity, and GHG emissions.

Our analysis shows that most 80 PLUS power supplies could easily pass the proposed power factor requirements, and since the 80 PLUS program already requires power factor correction for certification, the cost of implementation is effectively bundled with the incremental cost of 80 PLUS Bronze (less than $1, as noted in the section above). At less than $1, the combined 80 PLUS Bronze efficiency and power factor requirements should be highly cost-effective.

[3] http://www.plugloadsolutions.com/80PlusPowerSupplies.aspx.