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Appliance Standards Awareness Project

May 29, 2015

Mr. Harinder Singh
California Energy Commission
Dockets Office, MS-4
Re: Docket No. 14-AAER-2
1516 Ninth Street
Sacramento, CA 95814-5512

Dear Mr. Singh,

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP) on the Appliance Efficiency Pre-Rulemaking for computers, computer monitors, and signage displays, Docket No. 14-AAER-2. We strongly support the California Energy Commission's (CEC) efforts to develop computer and display standards, which build on the Commission's successful track record establishing standards for other electronic products. The large and cost-effective potential savings from CEC computer and display standards promise energy bill savings for consumers and businesses and significant environmental benefits. The specific standards contained in the Staff Report Final Draft (March 12, 2015) are a good start, but we recommend that CEC consider strengthening each of the draft standards to achieve even larger benefits. We appreciate the opportunity to provide this input to the CEC.

We congratulate CEC on its standards leadership.
Previous CEC standards for electronic products (e.g., external power supplies, TVs, battery chargers) were met more cost-effectively than expected, ahead of schedule, and with no negative impact on the market. California has long provided leadership in energy efficiency standards to the country and the world. California's market size means CEC efficiency standards have far-reaching effects, driving energy-efficiency improvement both within the state and outside of California. CEC standards can create *de facto* national standards, provide a floor for future national regulatory minimums and even influence international markets. We expect that CEC's work on computers and displays will be similarly influential. For computers, CEC's work is especially timely given that the US Department of Energy standards development process is in its early stages.

We strongly support a standard for computers.
The staff report's draft standards are feasible and cost-effective, meeting the criteria for new CEC standards. As we describe below, even stronger standards make sense. Collectively, computers and monitors consume 4 to 6% of California electricity, the most energy of all electronic products throughout California, roughly on par with TVs.[1] While there has been general progress on computer efficiency over the last decade, large savings opportunities remain, and, absent standards, future progress is not guaranteed. There are large energy use differences between form factors (desktops use three to four times the energy of equivalent notebooks, and notebooks use five to ten times the energy of tablets). Even within the same form factor, we see a huge range of efficiency performance: some

[1] http://www.energy.ca.gov/releases/2015_releases/2015-03-12_draft_computer_standards.html

products can use twice as much energy as others delivering very similar functionality. These ranges indicate large potential benefits from minimum standards. In the late 2000s, power-hogging graphics cards were responsible for a large bump in computer energy use, due to lack of power management in idle mode, showing how energy use trends can quickly reverse. We are now seeing "always-on" modes emerge (e.g., Microsoft Xbox One game console's voice standby could be used on computers too) which could also lead to significant increases in energy use if not implemented with efficiency best-practices.

We support the draft standards' performance-based approach which allows each manufacturer flexibility to find their best and most cost-effective compliance pathway. Covering both desktop and laptops as proposed in the staff report also makes good sense. While desktop sales are declining slowly, desktops still represent more than one third of computer sales (not including tablets), and are responsible for more than two-thirds of computer energy use, both in 2015 and projected to 2018. Laptop standards are important because laptops represent the majority of sales and a growing share of computer energy consumption.

We strongly support a standard for computer monitors and signage displays.
These standards are also feasible and cost-effective, and even stronger levels will likely make sense. Although there has been improvement, large saving opportunities remain. Monitors and signage displays of similar size, resolution, and feature sets are available with significant energy use differences.

Digital signage is particularly important as it has proliferated in recent years (10% annual increase in sales). The following trends indicate large and growing energy use in California:

- One-third of all shipments could be greater than 1400 square inches (i.e., unaffected by existing CEC standards). Unlike TVs, signage display installations are in open/commercial spaces with little limitation on how large a display can be.
- Unlike TVs, which may be on 5 hours a day, signage displays are on a majority or even all of the time.
- Signage displays are typically set at high brightness to draw attention from consumers.

There has been general progress on electronic display efficiency, driven in large part by the ENERGY STAR program, TV standards, and availability of light emitting diode (LED) backlighting. However, large savings opportunities remain, and, as with computers, future progress is not guaranteed. We support CEC's proposed approach because it provides no constraint on new functions or features (e.g., higher resolutions are given larger on-mode power budgets). While overall monitor sales are declining slowly, larger high-resolution monitors (the most power consumptive) are increasing sales in the commercial sector. The proliferation of ultra-high definition screens, multiple screen workstations, and the economic recovery indicate increasing shipments in the business sector in the coming years.

We support that standards for computers do not affect active energy use.
For desktops, notebooks and thin clients, the proposed standards cover idle mode (and sleep and off). These are when the computer is not actively used, and many components can be put in a very low power state. The standards generally do not affect active energy use. For workstations and small-scale servers, the proposed standard would be an efficient power supply unit (PSU) which would have no impact on functionality.

A real-world adjustment factor would more accurately estimate energy consumption and the cost-effectiveness of proposed standards.

CEC is underestimating the energy use and savings potential of computers by about 12% (desktops) to 26% (notebooks).[2] CEC should account for real-world energy use in its analysis, even though the current test method used for determining product ratings does not capture this real-world consumption. Capturing real world usage is important from an energy use accounting perspective. Also, some of the energy efficiency measures, such as the power supply, would save additional energy in active mode. Therefore, taking into account real world energy use would more accurately estimate cost-effectiveness.

The desktop proposal can be met mainly with software and should be strengthened.

CEC's proposal for desktops is achievable as demonstrated by Aggios at the public workshop and in their written submittals. It is a good starting point, but we recommend that CEC strengthen it in a number of areas, such as power supply requirements and adders, as suggested by Natural Resources Defense Council (NRDC) and the California Investor Owned Utilities (IOUs). Aggios showed that desktops can meet proposed levels by fully activating power management capabilities already available in computers currently on the market such as C6/C7 states, plus a better power supply, which are very cost effective. Most components already have low-power modes (e.g., C6/C7 states for Intel and AMD CPUs, sleep modes, motherboard efficiency, PSU), but these are often not enabled by manufacturers. Many components, such as graphics cards, hard drive disk (HDD), HDMI port, Peripheral Component Interconnect Express (PCI-E) and others are often kept powered on in long idle, when they could be powered off. Some desktop internal power supplies are still extremely inefficient. For example, testing by Aggios on a randomly selected, currently commercially available HP desktop computer found a power supply which is only 55% efficient in idle, meaning 45% of the computer's energy is wasted in the power supply before it even reaches the motherboard.

We believe that the incremental costs industry has claimed are far too high. For example, they do not consider lower cost options such as a hybrid drive, which stores frequently used information on a small solid-state drive (SSD). This SSD is coupled with a conventionally-sized magnetic HDD for less frequently used information.[3] The recently used information can be seamlessly put on the solid-state drive, like with Apple's "Fusion Drive."[4] Lower incremental cost would be achieved with a smaller SSD like in the Momentus XT.[5] A four GB SSD only costs about $2.[6] These technologies could allow the HDD to turn off most of the time (and therefore even during short idle test). Since SSDs are faster response, most of the time this hybrid drive approach increases performance, which would outweigh the slightly longer latency when a less commonly used piece of information is required (requiring the HDD to turn on). Since a typical desktop HDD consumes approximately 20 kWh per year only on for short idle, and a large SSD consumes only about 1.5 kWh per year, with $0.16 per kWh, this is at least $15 saved over five years. Therefore, even if a significantly larger than 4 GB SSD is required to allow the HDD to be off most of the time when the computer is actively being used, this would still be cost-effective. The current ENERGY STAR test procedure specifies that the hard drive must be spinning in short idle. Therefore, the proposed hybrid drive system would not receive an energy advantage.

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[2] http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/comments_12-AAER-2A/California_IOUs_Standards_Proposal_Addendum_Computers_2014-10-27_TN-73899.pdf

[3] http://www.energy.ca.gov/appliances/2013rulemaking/documents/proposals/12-AAER-2A_Consumer_Electronics/California_IOUs_Standards_Proposal_Computers_UPDATED_2013-08-06_TN-71813.pdf

[4] http://www.anandtech.com/show/6679/a-month-with-apples-fusion-drive

[5] http://www.amazon.com/Seagate-Momentus-Solid-Hybrid-ST95005620AS/dp/B003NSBF32

[6] http://en.wikipedia.org/wiki/Solid-state_drive

Therefore, an exception could be made to reward this efficient technology if the manufacturer could demonstrate that the frequently used information is automatically put on the SSD and the HDD is turned off most of the time under real-world use.

The notebook proposal can easily be met and should be strengthened.
The draft standards for notebooks would save very little if any energy. It would be a missed opportunity for energy savings in notebooks. For instance, mobile phones, tablets and some notebooks (Apple laptops) optimize power at the millisecond level ("sleep between keystrokes") instead of the 15-min level used in most laptop computers. This approach helps these Apple laptops to be far more efficient than the CEC proposal, e.g. the MacBook Pro is 78% lower annual energy use than proposed CEC limit. See NRDC and IOU comments for further details.

The monitor proposal should be strengthened as well.
Currently available monitor models of every major screen size and resolution are able to meet the proposed levels using cost-effective, off-the-shelf technologies.
We recommend that the CEC proposal be improved and strengthened in a number of areas such as:

- Reduction in resolution adder after a certain threshold resolution;
- Continuous on-mode power line similar to ENERGY STAR V7 Draft 1;
- Lower standby mode requirements given the current market; and
- Power management requirements.

Technical improvements which could be implemented to meet stronger efficiency standards include greater LED efficacy, use of a reflective polarizing film, greater power supply efficiency, setting default brightness dimmer than brightest setting, and employing automatic brightness control and other dimming strategies to reduce light output smartly.

The signage display proposal is particularly weak because existing TVs easily meet it and more efficiency is cost-effective with the high duty cycle of signage.

Technical improvements for displays are similar to those for monitors. However, with the greater duty cycle of signage displays, greater energy efficiency would be cost-effective. Signage display energy use is growing and will likely eclipse TVs on a statewide basis. IOU tear-down analysis indicates design options to meet the standard are off-the-shelf technologies and cost-effective.

The signage displays >1400 square inches (diagonal ~57 inch) are not covered in the CEC proposal. Greater than 60 inch displays make up approximately 14% of signage displays sales. If we conservatively assume that these are the only ones exempted the standard and that the energy savings is based on monitors just slightly greater than 1400 square inches, approximately 21% of the energy savings would be lost by the exemption. However, it is more realistic to assume that manufacturers will favor the exempted size such that the 20% of monitors that are currently 50 to 60 inch would no longer be covered (that is the manufacturers would change the typically 55 inch displays to greater than 57 inch displays). In this case, 51% of the energy use would be lost by the exemption. Even though it is not likely that all of the 50 to 60 inch category would become exempt, half of the energy savings lost overall by the exemption is a reasonable estimate for two reasons: 1) the energy savings of monitors significantly greater than 60 inches would be larger than the 60 inch monitors we currently have data for, and 2) there has been a tendency towards larger displays, so more products would be exempt in the future. Therefore, we strongly recommend that CEC cover these larger signage displays.

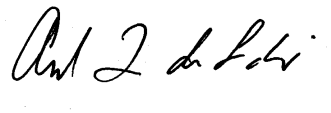
We recommend that the signage display draft standard be strengthened in a number of areas such as:

- Aligning with the ENERGY STAR on-mode power approach by including a luminance factor to account for the brightness, and;
- Aligning with the ENERGY STAR on-mode power approach that flattens out at the largest screen areas.

Regarding that last point, very large displays, like digital billboards, use a more efficient technology. In this case, each pixel typically has four colored LEDs.[7] The four LEDs can produce any color, so they do not need an LCD to filter the light. Furthermore, it can implement pixel-by-pixel dimming, saving much more energy. This much greater efficiency is another piece of evidence for larger displays requiring less power per area. Furthermore, there has been significant technical progress since the TV standard took effect. Therefore, the curved IOU proposal is more reasonable than CEC's linear proposal.

Overall, the standards contained in the staff report for computers, monitors, and signage displays would save a significant amount of energy, but more energy could be saved cost effectively. Thank you for considering these comments.

Sincerely,



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[7] http://www.vegasledscreens.com/faq/48-what-is-a-led-screen.html