DOCKETED

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Public Meeting
Computers, Computer Monitors, and Signage Displays

Art Rosenfeld Hearing Room

October 10, 2016

Leah Mohney
Supervisor
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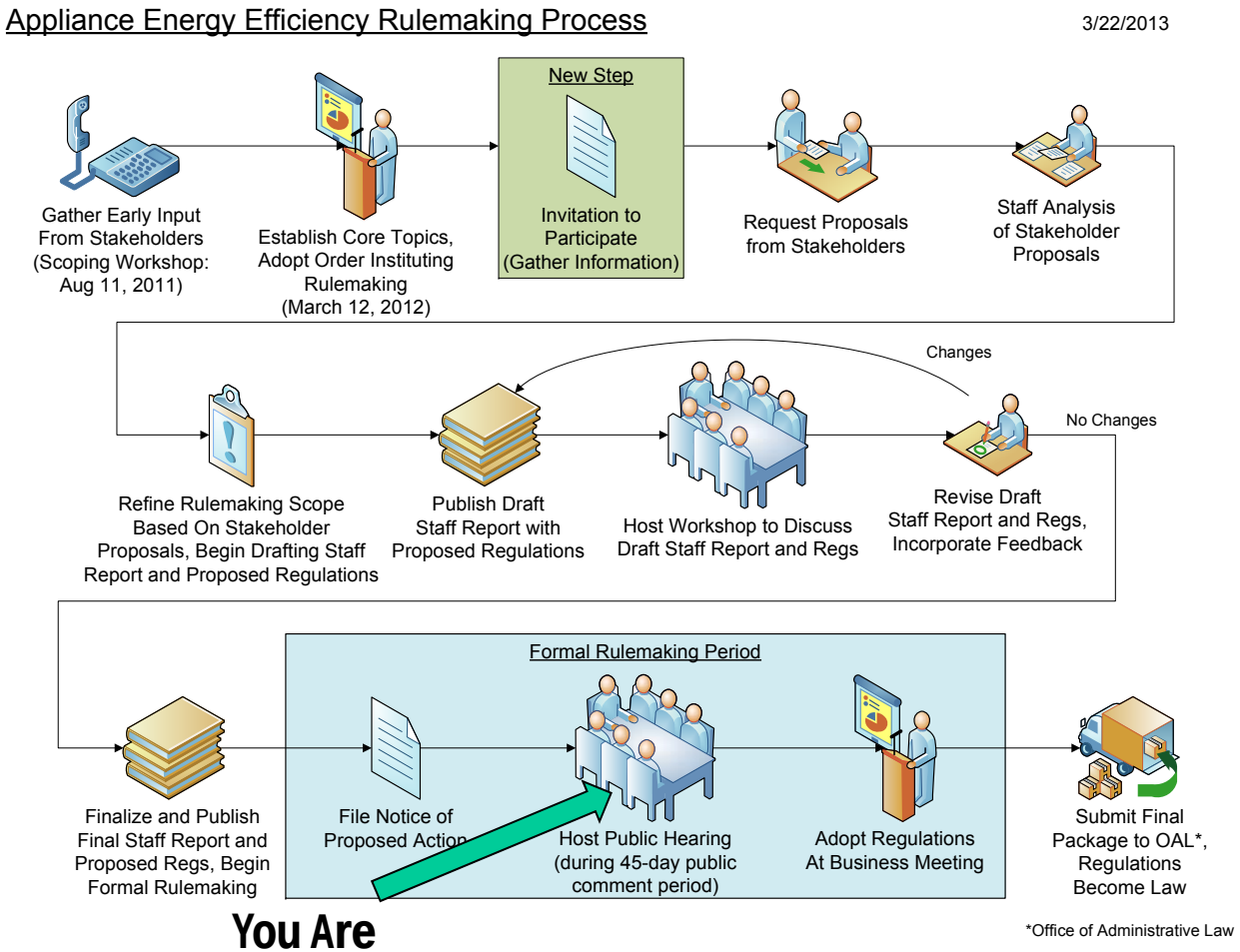
Agenda

Time	Topic
10:00 a.m.	Opening Remarks
10:10 a.m.	Staff's Computer Monitor Presentation
10:40 a.m.	Stakeholder Comments
Noon	Break
1:00 p.m.	Staff's Computer Presentation
1:45 p.m.	Stakeholder Comments
4:00 p.m.	Adjourn

History of the Rulemaking

- March 14, 2012: Energy Commission issued an order instituting rulemaking
- March 25, 2013: Energy Commission released an invitation to participate to collect data on potential efficiency standards
- June 13, 2013: Energy Commission released an invitation to submit proposals to identify proposed efficiency standards
- March 12, 2015: Energy Commission released staff report on proposed efficiency standards for computers and displays
- April 15, 2015: Energy Commission conducted a workshop on the staff report for computers and displays
- June and September 2015: Stakeholders held workshops on the proposed efficiency standards for computers and displays
- March 30, 2016: Energy Commission releases revised staff report on proposed efficiency standards for computers and displays
- September 9, 2016 Energy Commission releases ISOR, NOPA and Proposed Regulatory Language and Final Staff Report for Computers and Monitors
- September 14, 2016 released Initial Study Negative Declaration for Computers Computer Monitors and Signage Displays
- October 10, 2016 Lead Commissioner Meeting Initial Study and Negative Declaration 45 Day comment period

Public Participation



Initial Study and proposed Negative Declaration

- The proposed negative declaration discusses the environmental impacts of adopting the proposed standards for Computers, Computer Monitors, and Signage Displays.
- The proposed regulations will result in reduction of 0.731 million metric tons of CO_2 equivalent and combined 524.5 tons of criteria air pollutant.
- The study shows no adverse environmental impacts.

Written comment period for negative declaration ends on October 24, 2016 at 5:00 PM (PDT).

Document Availability

- Proposed Negative Declaration and regulations for Computers, Computer Monitors, and Signage Displays are available on the Energy Commission's website:

  https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=16-AAER-02.

- Copies of rulemaking documents can also be obtained by contacting staff.

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Negative Declaration for Computers, Computer Monitors and Signage Displays

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Written Comments

Comments are due on or before October 24, 2016, 5:00 PM (PDT).

- You can electronically upload your comments on the following
- link: http://www.energy.ca.gov/appliances/2016-AAER-2/prerulemaking/
- Or send a hard copy to:

California Energy Commission
Dockets Office, MS-4
Re: Docket No. 16-AAER-2
1516 Ninth Street
Sacramento, CA 95814-5512

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Please include Docket No. 16-AAER-2 in the subject line.

If you need assistance commenting, please contact the Public Adviser's Office at: 800-822-6228 or PublicAdviser@energy.ca.gov

Questions

Public Meeting
Computers, Computer Monitors, and Signage Displays

Art Rosenfeld Hearing Room

October 10, 2016

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Computer Monitors, Displays, and Battery Chargers Agenda

- Overview of the Proposed Regulations
- Technical Feasibility
- Energy Savings and Cost-effectiveness
- Statewide Energy Savings
- Stakeholder Comments and Clarifying Questions

PROPOSED REGULATIONS

Battery Charger System

Changes to Section 1601 (w) Scope:

An exception is provided for the following battery charger systems:

1601 (w) (7) battery charger systems that are contained completely within a larger product and that:

(a) provide power for data storage or for continuity within volatile cache or memory systems;

(b) maintain information for system use; and

(c) the battery is not capable of powering full operation of the product when AC mains power is removed.

Section 1601(v). Scope

Added **Computers, computer monitors,** to the existing televisions, and consumer audio and video equipment.

Definitions (Section 1602)

"**Computer monitor**" means an analog or digital device **of size greater than or equal to 17 inches and less than or equal to 61 inches, that has a pixel density of greater than 5000 pixels per square inch, and that is** designed primarily for the display of computer generated signals for viewing by one person in a desk-based environment. A computer monitor is composed of a display screen and associated electronics.

A computer monitor does not include:

(1) Displays with integrated or replaceable batteries designed to support primary operation without AC mains or external DC power, (e.g., electronic readers, mobile phones, portable tablets, battery-powered digital picture frames).

(2) A television or a signage display.

Definitions (Section 1602)

"**Enhanced-performance display (EPD)"** means a computer monitor that has all of the following features and functionalities:

(1) A **contrast ratio of at least 60:1** measured at a horizontal viewing angle of at least 85º, with or without a screen cover glass;

(2) A **native resolution equal to or greater than 2.3 megapixels** (MP); and

(3) **A color gamut size of at least sRGB** as defined by *IEC 61966-2.1:1999*. Shifts in color space are allowable as long as 99 percent or more of defined sRGB colors are supported.

Definitions (Section 1602)

"**Gaming monitor**" means a computer monitor that is **capable of adjusting the monitor refresh rate with the frame rate of the video content**, **and supports a continuously variable refresh rate** ranging across a factor **of at least 1.75 times** the minimum supported (for example a variable refresh rate of at least 40Hz to 70Hz if the minimum supported refresh rate is 40Hz); the monitor may include an incremental hardware-based assistance.

"**Keyboard, video, and mouse (KVM)"** or "**keyboard, mouse, and monitor (KMM)"** means a computer monitor that is designed to be used in a server rack for use solely in a data center.

"**Organic light-emitting diode (OLED) monitor**" means a monitor in which the emissive electroluminescent layer of the light-emitting diode is a film of organic compound that emits light in response to an electric current.

Definitions (Section 1602)

"Computer monitor sleep mode" means a low-power mode in which the computer monitor provides one or more non-primary protective functions or continuous functions.

"Computer monitor off mode" means the computer monitor is connected to a power source, produces no visual information, and cannot be switched into any other mode with a remote control unit, an internal signal, or an external signal.

"Native resolution" means the physically present number and size of pixels in a display panel.

"Monitor screen area" means the viewable screen area of the computer monitor, calculated by multiplying the viewable image width by the viewable image height. For curved screens, the measurements shall be made along the curvature on the face of the screen rather than along a straight line or chord.

Definitions (Section 1602)

"Professional signage display" means an electronic display that is:

- Composed of an area greater than 1,400 square inches;
- Composed of two or more display panels, each with a diagonal size greater than 12 inches;
- Designed to be operated by an external data controller; and
- Designed and marketed for viewing by multiple people in a non-desk-based environment. Examples of such environments include stadiums, airports, and convention centers.

"Signage display" means an analog or digital device designed primarily for the display of computer-generated signals that is not marketed for use as a computer monitor or a television.

Test Procedure (Section 1604)

(2) The test method for televisions and signage displays manufactured on or after April 24, 2014 is 10 C.F.R. Sections 430.23(h) (Appendix H to Subpart B of part 430).

(4) The test method for computer monitors is the ENERGY STAR Program Requirements for Displays, Final Test Method (September 2015), with the following modifications:

(A) On mode measurements shall be made using the IEC **62087: 2011** and computer monitor sleep mode and computer monitor off mode measurements shall be made using the IEC 62301:2011, as specified in the ENERGY STAR Program Requirements for Displays, Final Test Method (September 2015).

Test Procedure (Section 1604)

(B) A computer monitor shall be tested as required by the test procedure only for each of the following:

1. On mode power consumption.
2. Sleep mode power consumption.
3. Off mode power consumption.

(C) Product features and functions not specifically addressed by the test method shall be turned off or disconnected. Built-in speakers shall be muted or turned down to their lowest volume setting for the on mode power consumption test.

(D) Before starting the test procedure for measuring on mode power consumption, any feature unrelated to the display of images (for example USB hubs, webcams, speakers, LAN connections, and SD card readers) shall be turned off.

Proposed Regulations: Computer Monitors

(4) Computer monitors. Computer monitors manufactured on or after July 1, 2019, shall comply with all of the following:

(A) Comply with the maximum on-mode standards in Table V-4.

(B) Comply with at least one of the following requirements:

1. Consume less than or equal to 0.7 watt in sleep mode and less than or equal to 0.5 watt in off mode;
2. or Consume less than or equal to 1.2 watts in sleep mode and off mode power combined.

(C) Be shipped with a screen luminance less than or equal to 200 cd/m^2 ± 35 percent. A manufacturer may ship with additional features enabled, even if they were turned off in testing.

(D) Computer monitors with touch screen capability are allowed an additional 1 watt allowance per mode in on, sleep, and off modes.

Proposed Regulations: Computer Monitors

Table V-4

Power Consumption Standards for Computer Monitors

	Diagonal Screen Size (d) in Inches	Maximum Computer Monitor On Mode Power Consumption in Watts
Resolution ≤ 5 MP	17”≤d≤20”	[(6.0*r) + (0.025*A) + 3.7] * applicable adders in Table V-5
	20”<d<23”	[(4.2*r) + (0.02*A) + 2.2] * Applicable adders in Table V-5
	23”≤d<25”	[(4.2*r) + (0.04*A) – 2.4] * applicable adders in Table V-5
	25”≤d<30”	[(4.2*r) + (0.07*A) – 10.2] * applicable adder in Table V-5
	30”≤d≤61”	[(6.0*r) + (0.1*A) – 14.5] * applicable adders in Table V-5
Resolution > 5.0 MP	17”≤d≤20”	[25 + (0.025*A) +3.7] * applicable adders in Table V-5
	20”<d<23”	[25 + (0.02*A) +2.2] * applicable adders in Table V-5
	23”≤d<25”	[25 + (0.04*A) – 2.4] * applicable adders in Table V-5
	25”≤d<30”	[25 + (0.07*A) – 10.2] * applicable multipliers in Table V-5
	30”≤d≤61”	[25 + (0.1*A) – 14.5] * applicable adders in Table V-5

Proposed Regulations: Computer Monitors

(E) Manufacturers shall apply no more than one applicable adder from Table V-5 to determine the maximum on-mode wattage.

Table V-5

List of Potentially Applicable Adders

Computer Monitor Type	Models manufactured on or after July 1, 2019, and before January 1, 2021	Models manufactured on or after January 1, 2021
Enhanced Performance Display with a color gamut support of 32.9% of CIELUV or greater (99% or more of defined sRGB colors)	30%	20%
Enhanced Performance Display with a color gamut support of 38.4% of CIELUV or greater (99% or more of defined Adobe RGB colors)	75%	60%
Gaming Monitors without incremental hardware-based assistance	30%	20%
Gaming Monitors with incremental hardware-based assistance	35%	35%
OLED monitor	30%	20%
Curved monitor	30%	20%

Proposed Regulations: Computer Monitors

(F) EXCEPTIONS to Section 1605.3(v)(4): The following computer monitors are not required to comply with Section 1605.3(v)(4) but shall comply with the test procedures in Section 1604(v)(4), the certification requirements in Section 1606, and the marking requirements in Section 1607:

1. Keyboard, video, and monitor (KVM).
2. Keyboard, mouse, and monitor (KMM).
3. Computer monitors that are classified for use as medical devices by the United States Food and Drug Administration.
4. Very high performance monitors.

Proposed Regulations: Computer Monitors

Table X Data Submittal Requirements

	Appliance	Required Information	Permissible Answers
V	Computer Monitors	Technology Type	CCCFL, LED, OLED, Quantum Dots
		Monitor Type	Computer Monitor, EPD sRGB, EPD Adobe RGB, OLED, Gaming Monitor w/ Incremental Hardware, Gaming Monitor w/o Incremental hardware, "Keyboard, Video, Mouse," "Keyboard, Mouse, Monitor," Very High Performance
		Viewable Screen area (square inches)	
		Screen size (diagonal inches)	
		Automatic Brightness Control	True/False
		Automatic Brightness Control Enabled when Shipped	True/False
		Screen Luminance (Candelas Per Square Meter)	
		Native Resolution (megapixels)	
		Power Consumed in Computer Monitor On Mode (watts)	
		Power Consumed in Computer Monitor Sleep Mode (watts)	
		Power Consumed in Computer Monitor Off Mode (watts)	
		Touch Screen	True/False
		Color Gamut	32.9% of CIELUV or greater, (99% or more of defined sRGB colors), 38.4% of CIELUV or greater (99% or more of defined Adobe RGB colors), Less than 32.9% of CIELUV

Proposed Regulations: Signage Displays

1. Televisions and Signage Displays. All televisions and signage displays manufactured on or after the effective dates shall meet the requirements shown in Table V-~~2~~3.

2. In addition, televisions and signage displays manufactured on or after January 1, 2011 shall meet the requirements shown in Sections 1605.3(v)(3)(A) and 1605.3(v)(3)(B) and 1605.3(v)(3)(C) of this Article.

   A. A television or signage display shall automatically enter TV standby-passive mode or standby-active mode after a maximum of 15 minutes without video or audio input on the selected input mode.

   B. A television or signage display shall enter TV standby-passive mode when turned off by remote or integrated button/switch.

   C. The peak luminance of the product in “home” mode, or in the default mode as shipped, shall not be less than 65% of the peak luminance of the “retail” mode, or the brightest selectable preset mode, of the product.

Proposed Regulations: Signage Displays

Table V-~~2~~3
Standards for Televisions and Signage Displays

Effective Date	Screen Size (area A in square inches)	Maximum TV and Signage Display Standby-passive Mode Power Usage (watts)	Maximum On Mode Power Usage (P in Watts)	Minimum Power Factor for (P ≥ 100W)
January 1, 2006	All	3 W	No standard	No standard
January 1, 2011	A < 1400	1W	P ≤ 0.20 x A + 32	0.9
January 1, 2013	A < 1400	1W	P ≤ 0.12 X A + 25	0.9

Professional signage displays are exempt.

Regulatory Proposal

Proposed standards are based on the ENERGY STAR version 6.0 framework. Standards are based on the **on mode, sleep mode, and off mode** energy consumption of the unit.

ENERGY STAR version 7.0 specifications requires **Total Energy Consumption** of the unit. Proposed standard levels are similar to ENERGY STAR version 7.0 levels.

As of July, 2016, about 20% of the total monitor market already meets the proposed standards.

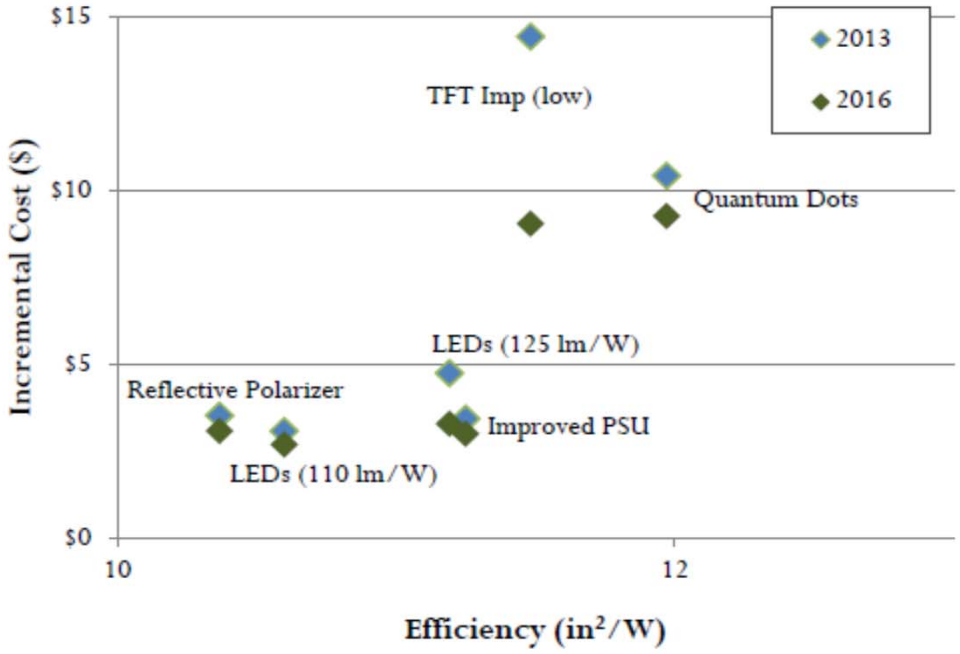
About 80% of the monitors in the market **meet the proposed sleep and off mode** power requirements.

Technical Feasibility

Efficiency can be achieved by using the following available technologies:

- Higher efficiency LED backlights,
- Reflective polarized films,
- Higher transmittance screen technologies,
- Efficient power supplies, and
- Emerging technologies.

Computer Monitor Cost and Efficiency Improvements Over Time



Incremental cost by efficiency measure showing the decrease in incremental cost from 2013 to 2016 for the 22" screen size.

Computer Monitor Power Consumption

On mode power consumption is weighted average based on the shipment and size weighted average consumption.

Unit	On (Watts)	Standby (Watts)	Off (Watts)	Annual Unit Energy (kWh/year)
Non Qualifying	26.16	0.35	0.27	60.58
Qualifying	13.90	0.30	0.21	32.83

Life Cycle Cost and Per Unit Savings

The computer monitor estimated design life of seven years is based on the Fraunhofer and Navigant study.

Staff analyzed technically feasible and cost effective strategies for life cycle cost estimates. Analysis of the current data shows most strategies to be cost effective and feasible and would result in significant energy savings for computer monitors.

Unit	Life-Cycle Cost (Present Value Dollars)	Life-Cycle Benefits (Present Dollar Value)	Life Cycle Dollar Savings
Design Life	Average Incremental Cost per unit	Estimated Energy Savings per unit	=$31.08-$5.00
7 years	$5.00	$31.08	$26.08

Statewide Energy Savings Estimates

Proposed standards would result in significant statewide energy savings. First-year statewide savings and total statewide savings after stock turnover are provided in the table below.

First Year Statewide Energy Savings	Total Statewide Energy Savings After the Stock Turnover	Total Statewide Savings over the life cycle after stock turnover
First Year Sales* Unit Energy Savings X Electricity Rate	Baseline Consumption-Total Energy Consumption after the Stock Turnover	Dollar Savings/Unit*Existing Stock
3.6 million * 32.93* 0.16¢ =$15.38 million	**1527 -831 = 696 GWh/year**	**$26.08 * 25.2 million units = $657 million**

Greenhouse Gas Savings	**0.218 million metric ton**

Signage Display

Digital signage displays are covered under the existing television standards.

Market data shows that not all manufacturers have been compliant with the existing standards for signage displays.

Clarification to definition and harmonizing current definition with industry-accepted definition, the expectation is that there will be greater compliance with existing standards.

Comment Process

Comments are due on or before October 24, 2016, 5:00 PM (PDT).

You can electronically upload your comments on the following link: http://www.energy.ca.gov/appliances/2016-AAER-2/prerulemaking/.

or

Send a hard copy to:

California Energy Commission
Dockets Office, MS-4
Re: Docket No. 16-AAER-2
1516 Ninth Street
Sacramento, CA 95814-5512

or

Send a digital copy to: docket@energy.ca.us.

Please include Docket No. 16-AAER-2 in the subject line.

Questions

Computers

Public Meeting on Proposed Negative Declaration and Express Terms

Art Rosenfeld Hearing Room

California Energy Commission

October 10, 2016

Soheila Pasha
Appliances and Outreach and Education Office
Efficiency Division

Soheila.Pasha@energy.ca.gov / 916-657-1002

Agenda

- Overview
- Proposed Standards for Computers
- Technical Feasibility
- Energy Savings and Cost-effectiveness
- Stakeholders Comments and Clarifying Questions

Overview

Purpose of Public Meeting

- Staff will clarify the scope of the proposed Negative Declaration and for Computers, Computer Monitors, and Signage Displays as well as Regulations for Computers.

- Allow Commissioner to receive comments on the proposed Negative Declaration and Regulations.

Why Adopt Standards

- Computers and monitors use an average of about 1.7 to 2.9 percent of electricity consumption in the residential sector and 7 percent of electricity consumption in the commercial sector for a total of 5,610 GWh/yr.
- The proposed standards are an opportunity to save energy without changing the core functions of the machine.
- The combined net direct savings in the state are expected to be about $3.5 billion cumulatively from 2018 to 2030, or $350 million per year once the product stock has fully turned over.
- The proposed standards are expected to reduce greenhouse gas emission by about 0.513 million metric tons equivalent (MMTCO2e) annually.

Proposed Standards for Computers

Scope (Section 1601)

The scope of the regulations is defined by section 1601, and is further refined by the definitions in section 1602.

In Scope	Not In Scope
Desktop Computers	Tablets
Notebook Computers	Game Consoles
Small-Scale Servers	Televisions
Workstations	Large-Scale Servers
Thin-Client Computers	Industrial Computers
	Small Computer Devices with screen area of 20 $(in)^2$ or less

Definitions (Section 1602)

- The initial set of definitions were taken from the ENERGYSTAR Specification Version 6.1.
- New terms are added or small modifications were made to the definitions to reduce the language to necessity and to better clarify products that are included and excluded from the scope or to make a distinction between similar devices.
  - Example: “Primary storage” means the largest capacity non-volatile storage device present in the system.
- The definitions used in the standards describe product types, modes of operation, design capabilities, and small volume manufacturers.

Definitions (Section 1602)

- "Expandability score" means the results of a calculation designed to estimate a computer's power supply capacity based on the power draw if each interface present in the system were operated at their designed maximum voltage and current.
- "High expandability computer" means a computer with any of the following:

  (1) An expandability score of more than 690;

  (2) If the computer is manufactured before January 1, 2020, a power supply of 600 watts or greater and a discrete or integrated graphics with a frame buffer bandwidth of 400 gigabytes per second (GB/s) or greater; or

  (3) If the computer is manufactured on or after January 1, 2020, a power supply of 600 watts or greater and a discrete or integrated graphics with frame buffer bandwidth of 600 gigabytes per second (GB/s) or greater.
- "Small computer device" means a computer system with an integrated and primary display that has a screen area of 20 square inches or less.

Definitions (Section 1602)

- "Limited capability operating system" means an operating system that performs basic operations and that does not:
  - (1) Have automatic power management features;
  - (2) Support USB devices;
  - (3) Have Graphical User Interface (GUI); or
  - (4) Support multiple user profiles or distinguish between users.

- "Sleep mode" means a low-power mode that the computer enters automatically after a period of inactivity or by manual selection. A computer with sleep capability can quickly "wake" in response to network connections or user interface devices with a latency of less than or equal to five seconds from initiation of the wake event to the system becoming fully usable, including rendering of display. For systems where ACPI standards are applicable, sleep mode is ACPI System Level S3 (suspend to RAM) state. Some computers utilize an alternative sleep mode to ACPI S3.

Test Procedure (Section 1604)

- Staff proposes to utilize the "ENERGY STAR Test Method for Computers, Rev. March 2016" with the modification to not alter hard-disk spinning from the default as shipped. It uses the ENERGY STAR Specification version 6.1 for annual energy use calculations.

- Computers manufactured before 7/1/2021 use "Conventional" or "Full Capability" mode weighting if they meet the criteria.

- Computers manufactured on or after 7/1/2021 only use "Conventional" mode weighting.

Test Procedure (Section 1604)

- Expandability score is calculated as 100 plus the sum of each port's score multiplied by the number of such ports.
- A computer monitor used in the testing of computers shall have a native resolution of 1920x1080 pixels and use progressive scanning. The computer operating system shall be set to operate at the same resolution and progressive scanning. Computers with integrated display use integrated display's native resolution.
- Choose the display connection based on the following order:
  1. Hybrid graphics
  2. Discrete graphics GPU
  3. Integrated graphics GPU
  4. Connector ports: Display port, HDMI, DVI, VGA, Other

Test Procedure (Section 1604)

- Sleep mode power is measured between 30 to 31 minutes following the long-idle mode with no alterations or user activity on the system under test.

- The power factor of a computer, at 50% load and during long-idle, is determined by the following test procedure:

  "Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies Revision 6.7"

- To provide the data as required for the section 1606, select the configuration that has the greatest allowable energy consumption and yields the greatest annual energy consumption.

Performance Requirements (Section 1605.3)

- All computers, except Small-Scale servers, rack-mounted workstations, and computers that are shipped (per purchaser's request) without an operating system or with a limited capability operating system, are required to:
  - transition displays into sleep mode after 15 minutes or less of user inactivity.
  - transition system into a sleep mode after 30 minutes or less of user inactivity.
- Sleep mode is either S3 state as described in ACPI or an alternative sleep mode with a maximum power limit.

Performance Requirements (Section 1605.3)

Alternative Sleep Mode Power Limits:

Computer Type	Maximum Sleep Power Consumption (watts)
Workstations, Mobile Workstations, High Expandability Computers, Small-Scale Servers	10 + 0.03 * C where C is the system memory capacity in gigabytes minus 32 gigabytes. If C is less than zero, use zero for the value of C.
Desktop Computers, Thin Clients, Mobile Gaming Systems	5 + 0.03 * C where C is the system memory capacity in gigabytes minus 32 gigabytes. If C is less than zero, use zero for the value of C.
Notebook Computers, Portable All-In-Ones	2.5 + 0.03 * C where C is the system memory capacity in gigabytes minus 16 gigabytes. If C is less than zero, use zero for the value of C. If a discrete graphics GPU is present in the system, the maximum power consumption limit shall be increased by an additional 2 watts.

Performance Requirements (Section 1605.3)

- Small-scale servers, high expandability computers, mobile workstations, and workstations must be manufactured with an 80 plus Gold level power supply and energy efficient Ethernet.

- Notebooks, desktops, thin-clients, mobile gaming systems, and portable all-in-ones must meet specified total energy consumption and power factor targets.

- Total energy consumption target for desktops, mobile gaming systems, and thin clients is implemented in two tiers.

Performance Requirements (Section 1605.3)

Computer Type	For models manufactured on or after January 1, 2019, and before July 1, 2021, the measured annual energy consumption shall be less than or equal to the values below	For models manufactured on or after July 1, 2021, the measured annual energy consumption shall be less than or equal to the values below.
Desktop Computers, mobile gaming systems, and thin clients with an ES of 250 or less	50 kWh/yr + applicable adders in Table V-8	50 kWh/yr + applicable adders in Table V-8
Desktop Computers, mobile gaming systems, and thin clients with an ES of more than 250 but no more than 425	80 kWh/yr + applicable adders in Table V-8	60 kWh/yr + applicable adders in Table V-8
Desktop Computers, mobile gaming systems, and thin clients with an ES of more than 425 but no more than 690	100 kWh/yr + applicable adders in Table V-8	75 kWh/yr + applicable adders in Table V-8
Notebook computers and portable all-in-ones	30 kWh/yr + applicable adders in Table V-8	30 kWh/yr + applicable adders in Table V-8
Minimum power factor of a computer power supply that is not a federally-regulated external power supply	0.9 measured at full load	0.9 measured at full load

Table V-8 (Adders)

Function	Desktop Computer, Mobile Gaming System, and Thin Client Adder (kWh/yr)	Notebook Computers and Portable All-In-One Adder (kWh/yr)
System Memory	4 + 0.15 * C where C is the capacity in GB.	4 + 0.15 * C where C is the capacity in GB.
Energy Efficient Ethernet	0.9	0.9
Storage device other than primary storage device	3.5-inch Drive: 26 2.5-inch Drive: 4.5 Solid-State Drive (SSD): 0.5 Solid-State Hybrid Drive (SSHD): 1.0 Other: 26 per storage device	2.6 per storage device

Table V-8 (continued)

Function	Desktop Computer, Mobile Gaming System, and Thin Client Adder (kWh/yr)	Notebook Computers and Portable All-In-One Adder (kWh/yr)
First Discrete Graphics GPU (on or after January 1, 2019 and before July 1, 2021) Where "B" is frame buffer bandwidth measured in GB/s	58.6*tanh(0.0038*B-0.137)+26.8	29.3*tanh(0.0038*B-0.137)+13.4
First Discrete Graphics GPU (on or after July 1, 2021) Where "B" is frame buffer bandwidth measured in GB/s	29.4*tanh(0.008*B-0.03)+11+(0.011*B)	14.7*tanh(0.008*B-0.03)+5.5+(0.0055*B)
Additional Discrete Graphics GPU	11 per unit	5.5 per unit

Table V-8 (continued)

Function	Desktop Computer, Mobile Gaming System, and Thin Client Adder (kWh/yr)	Notebook Computers and Portable All-In-One Adder (kWh/yr)
High bandwidth system memory, where "S" is system memory bandwidth measured in GB/s. This adder does not apply to a computer that meets any of the following criteria: 1) Expandability score includes a credit for 4-channel memory. 2) System memory bandwidth is less than 134 GB/s. 3) Majority of system memory capacity (in gigabytes) has a bandwith less than 134 GB/s and either: a) Has an integrated display with a resolution of 9 megapixels or less; or b) Does not have an integrated display. 4) Uses an adder for a first discrete graphics GPU.	22.78*tanh[0.006*(S-70)+0.15]-12.33	9.11*tanh[0.006*(S-70)+0.15]-4.45

Reporting Requirements (Section 1606)

- Products manufactured on or after the effective dates must certify their compliance with the standards with the Energy Commission.

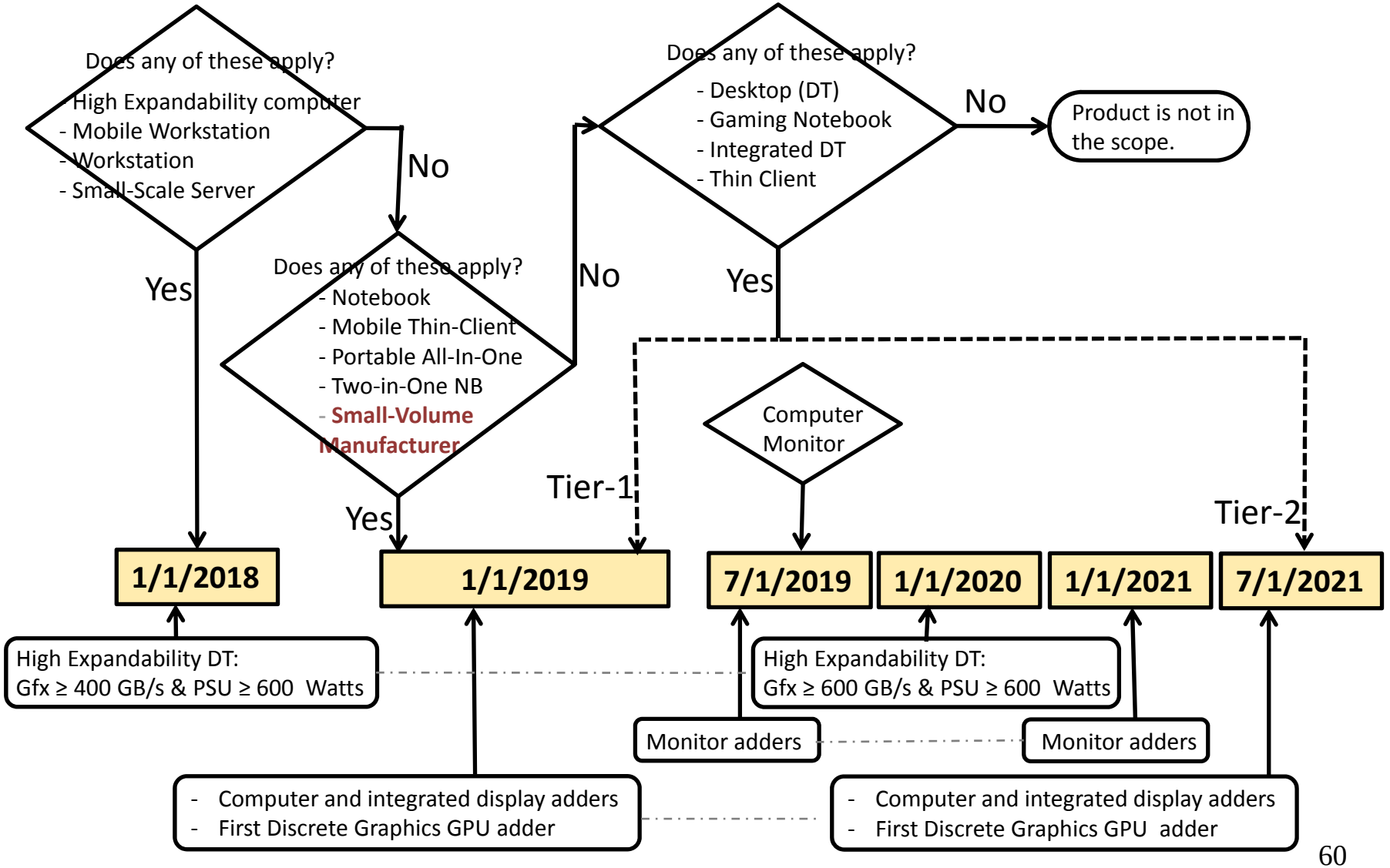
- The data collected is the minimum necessary to:
  - Determine compliance and identify the product.
  - Use for data collection regarding future rulemakings.

- There is no proposal for any additional labeling or marking requirements other than the general requirements that the model number, manufacturer, and date of manufacture be permanently and legibly placed on the product.

Data Reporting (Section 1606)

- Computer Type
- Operating System Type
- Operating System (Provide the operating system used during testing to calculate energy consumption.)
- Core Speed (gigahertz)
- Number of Cores
- Number of 3.5” hard-disk drives and Others (other than primary storage)
- Number of 2.5” hard-disk drives (other than primary storage)
- Number of solid-state drives (other than primary storage)
- Number of hybrid solid-state drives (other than primary storage)
- AC Adapter Size (watts) (notebook computers only)
- Total Battery Capacity (watt-hours) (notebook computers only)
- Discrete graphics processing unit(s) present in system
- First Discrete Graphics Frame Buffer Bandwidth (rounded to nearest gigabyte per second)

Effective Dates



Limited Exemptions

- Manufacturers with total annual gross revenue of $2M or less who assemble and sell the computers at the same location can certify themselves as “Small Volume Manufacturers” (SVM).
- If a SVM no longer meets any of the requirements, they have to remove themselves from the database as a SVM within 90 days.
- If a SVM manufactures 40 units or less of a basic model of computers, these units are exempted from complying with most of the proposed standards, with the exception of power management.
- If a SVM manufactures more than 40 units of a basic model, those units must fully comply.
- Basic models have the same chassis, power supply, motherboard, and expandability score.

Limited Exemptions

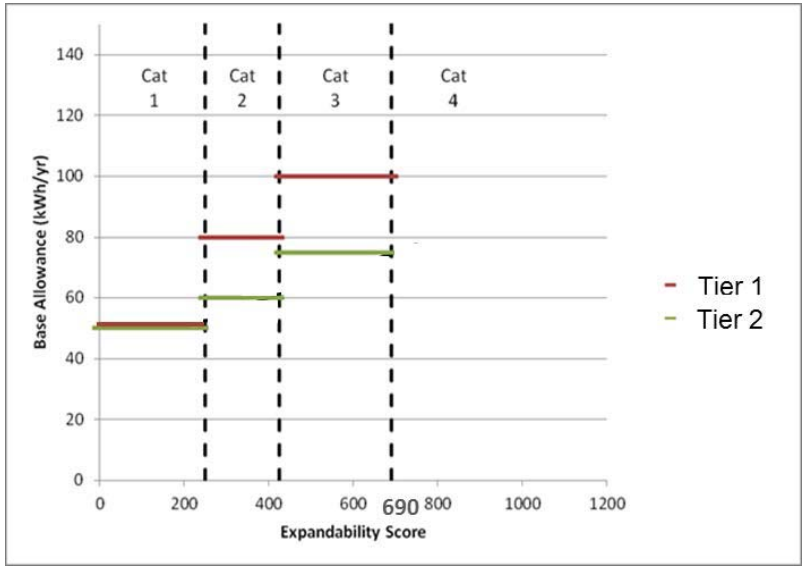
- Desktop computers and thin clients assembled before July 1, 2021, entirely from parts manufactured before September 1, 2018, are exempted from complying with most of the proposed standards, with the exception of power management.

Technical Feasibility

Technical Feasibility: Expandability Score Desktops, Mobile Gaming Systems, Thin Clients

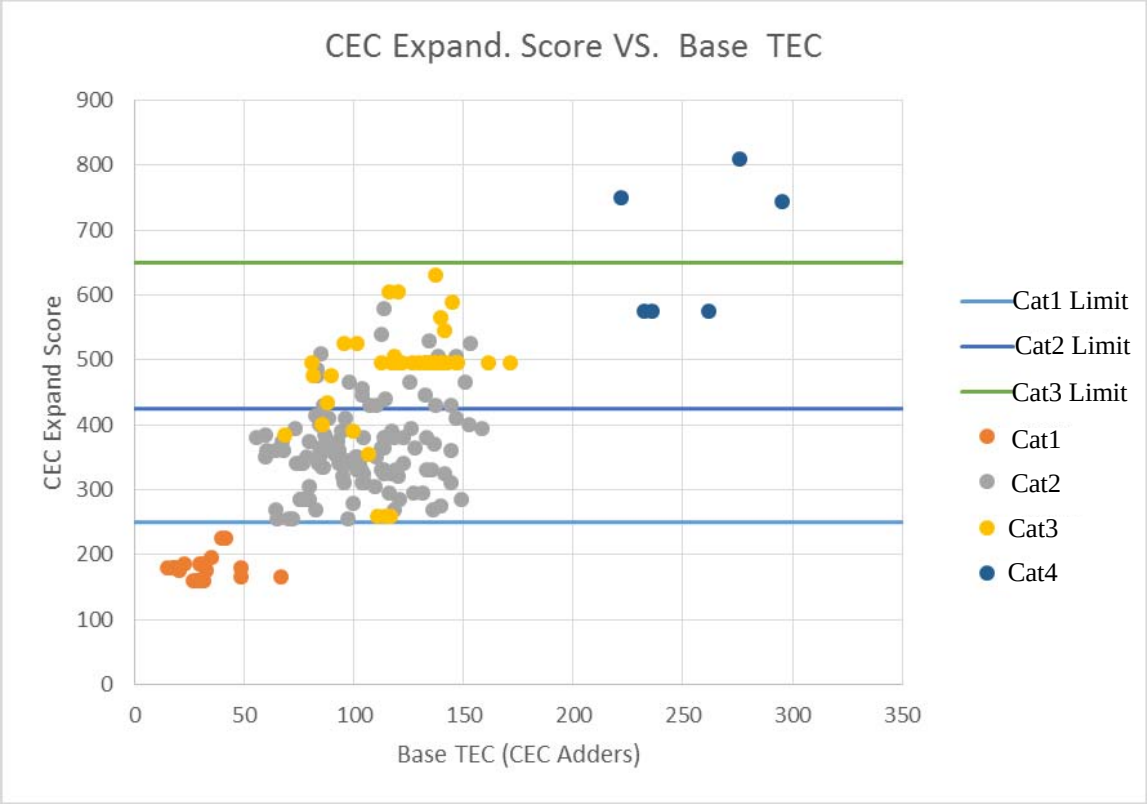
- Only applies to desktop computers
- Emulates power supply sizing
- Calculated based on the type and number of interfaces and ports
- The base energy consumption limit is directly related to the expandability score
- There are additional energy allowance for Adders

Base TEC limits for desktops



Technical Feasibility: Expandability Score Desktops, Mobile Gaming Systems, Thin Clients

- Measured TEC Versus Expandability Score for Desktop Computers



Source: Information Technology Industry (ITI)

Technical Feasibility Notebooks

- Proposed total energy consumption limit consists of a base energy plus energy allowance for Adders.
- Notebooks are far more efficient than other computer types due to constrains on real estate space, battery life, and heat dissipation.
- More than 70 percent of models certified to the Energy Star version 6.0 specification meet the proposed standards for notebooks as of November 2014.

Technical Feasibility
Small-Scale Servers and Workstations

- There is no limit for the total energy consumption.
- Two hardware implications are required: 80+ Gold power supply and High efficiency Ethernet
  - No negative affect to the functionality.
  - Both are widely available and used in products even today.

- Power management required (except for small-scale servers)
  - Sleep power limit for alternative sleep mode.

Energy Savings and Costs

Energy Savings and Cost Effectiveness Tier-1

Product Type	Average Energy Use Baseline (kWh/yr)	Average Energy Use – Compliant (kWh/yr)	Design Life (yr)	Life Cycle Savings (kWh/yr)	Life Cycle Savings ($)	Incremental Cost ($)
Desktop	143.2	88.73	5	272.4	$43.58	$9.55
Notebook	33.4	29.8	4	14.4	$2.30	$1.00
Small-Scale Server	302.0	278.0	5	120	$19.20	$13.00
Workstation	469.3	431.9	5	187	$29.92	$13.00

Energy Savings and Cost Effectiveness Tier-2

Product Type	Average Energy Use Baseline (kWh/yr)	Average Energy Use – Compliant (kWh/yr)	Design Life (yr)	Life Cycle Savings (kWh/yr)	Life Cycle Savings ($)	Incremental Cost ($)
Desktop	143.2	70.21	5	365	$58.39	$14.00
Notebook	33.4	29.8	4	14.4	$2.30	$1.00
Small-Scale Server	302.0	278.0	5	120	$19.20	$13.00
Workstation	469.3	431.9	5	187	$29.92	$13.00

Statewide Energy Savings
First Year and Stock Turnover Savings

Product Type	Unit Savings (kWh/yr)	Unit Sales (millions)	Unit Stock (millions)	1 year Sales Savings (GWh/yr)	Stock Savings (GWh/yr)
Desktop	72.99	4.12	20.91	300.72	1,526.22
Notebook	3.60	5.83	23.12	20.99	83.23
Small-Scale Server	24.00	0.06	0.30	1.44	7.20
Workstation	37.40	0.106	0.53	3.97	19.82
Total	137.99	10.12	44.86	327.12	1,636.47

Comment Process

Comments are due on or before October 24, 2016, 5:00 PM (PDT).

You can electronically upload your comments on the following link: http://www.energy.ca.gov/appliances/2016-AAER-2/prerulemaking/

Or send a hard copy to:

California Energy Commission
Dockets Office, MS-4
Re: Docket No. 16-AAER-2
1516 Ninth Street
Sacramento, CA 95814-5512

Or send a digital copy to: docket@energy.ca.us.

Please include Docket No. 16-AAER-2 in the subject line.

If you need assistance commenting, please contact the Public Adviser's Office at: 800-822-6228 or PublicAdviser@energy.ca.gov