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Staff Workshop
Computer Monitors and Signage Displays

Art Rosenfeld Hearing Room

April 15, 2015

Harinder Singh
Appliances and Existing Buildings Office
Efficiency Division

Purpose of the Staff Workshop

- To discuss and clarify the scope, definitions, test method, and proposed regulations.
- To discuss energy savings and technical feasibility.
- To allow stakeholder presentations.
- To receive stakeholders comments.

Scope of Proposed Regulations

1601 Scope.

Includes computer monitors and signage displays that are of size greater than 12” and pixel density of greater than 5000 pixels per square inch.

Computer Monitor

Signage Displays

Definitions

1602 Definitions.

"Electronic display" means a display screen with the primary function of displaying visual information from (1) a computer, workstation, or server via one or more inputs (for example, VGA, DVI, HDMI, DisplayPort, IEEE 1394, USB); (2) external storage (for example, USB flash drive, memory card), or (3) a network connection.

"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 greater than or equal to 2.3 megapixels (MP); and,

(3) A color gamut size of at least sRGB as defined by IEC 61966 2-1. Shifts in color space are allowable as long as 99 percent or more of defined sRGB colors are supported.

Definitions

"Display on mode" means the power mode in which the product is activated and is providing one or more of its principal functions. The common terms "active," "in-use," and "normal operation" also describe this mode.

"Display off mode" means the power mode in which the product is connected to a power source but is not providing any display on mode or display sleep mode functions. This mode may persist for an indefinite period. The product may only exit this mode by direct user actuation of a power switch or control. Some products may not have this mode.

"Signage display" is an electronic device typically with a diagonal screen size greater than 12 inches and a pixel density less than or equal to 5,000 pixels/in^2. It is typically marketed as commercial signage for use in areas where it is intended to be viewed by multiple people in non desk-based environments, such as retail or department stores, restaurants, museums, hotels, outdoor venues, airports, conference rooms, or classrooms.

"Display sleep mode" means the power mode the product enters after a period of inactivity, in which a signal from a connected device or an internal stimulus (for example, a timer or occupancy sensor) is received. The product may also enter this mode by virtue of a signal produced by user input. The product must wake on receiving a signal from a connected device, a network, a remote control, and/or an internal stimulus. While the product is in this mode, it is not producing a visible picture, with the possible exception of user-oriented or protective functions such as product information or status displays, or sensor-based functions.

Test Method for Specific Appliances

Section 1604

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

(5) The test method for computer monitors is ENERGY STAR Test Method for Determining Displays Energy Use Version 6.0.

State Standards for Non-Federally Regulated Appliances

Section 1605.3

(5) Computer monitors manufactured on or after January 1, 2017, shall comply with the standards in Table V-5.

Table V-5: Maximum Power Requirements by Modes- Computer Monitors

Diagonal Screen Size in Inches (d)	On Mode in Watts (P_{ON_MAX})	Standby Mode in Watts (P_{SLEEP_MAX})	Off Mode in Watts (P_{OFF_MAX})
d<12	(4.2*r) + (0.04*A) +1.8	1.0	0.5
12”≤d<17”	(4.2*r) + (0.01*A) +3.5	1.0	0.5
17”≤d<23”	(4.2*r) + (0.02*A) +2.2	1.0	0.5
23”≤d<25”	(4.2*r) + (0.04*A) -2.4	1.0	0.5
25”≤d<61”	(4.2*r) + (0.07*A) -10.2	1.0	0.5

r = Screen resolution (megapixels)
A= Viewable screen area (square inches)

State Standards for Non-Federally Regulated Appliances

Section 1605.3

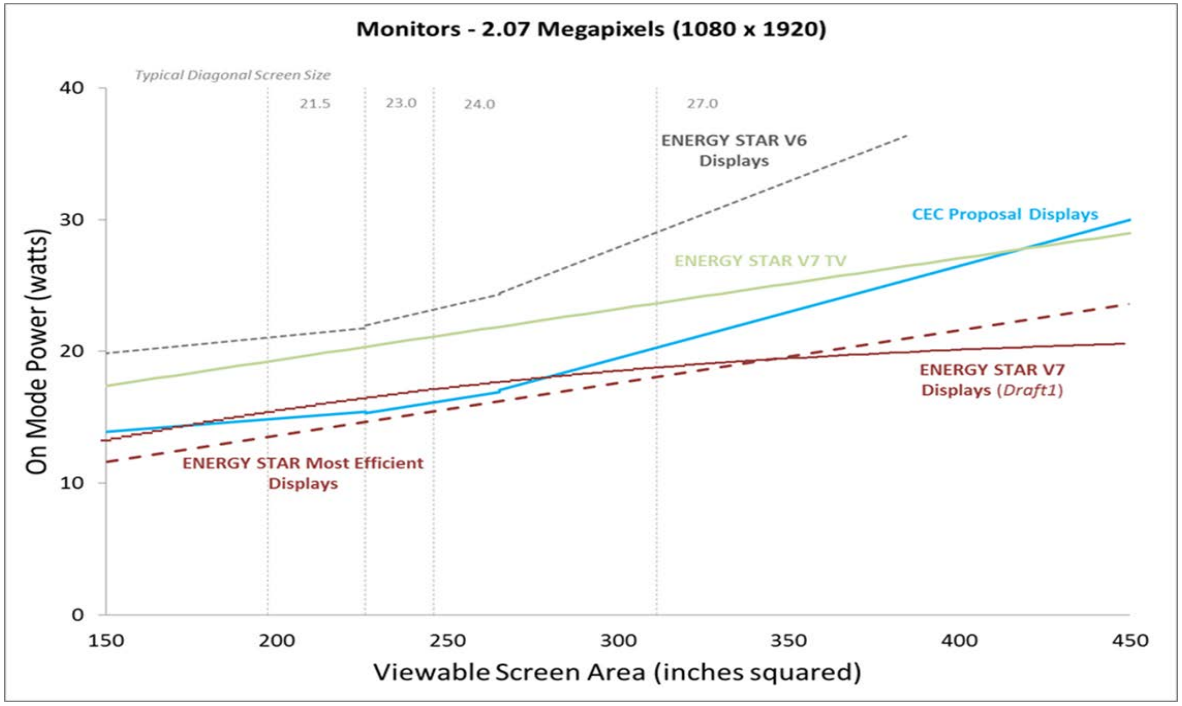
(6) Signage displays manufactured on or after January 1, 2017, shall comply with the standards in Table V-6.

Table V-6: Maximum Power Requirements by Mode – Signage Displays

Screen Size (Area A in Inches Squared)	On Mode (W)	Standby Mode (W)	Minimum Power factor for (P ≥100W)
d<1400”	(0.12*A) +25	1	0.9
Where A is a viewable screen area (Square Inches)			

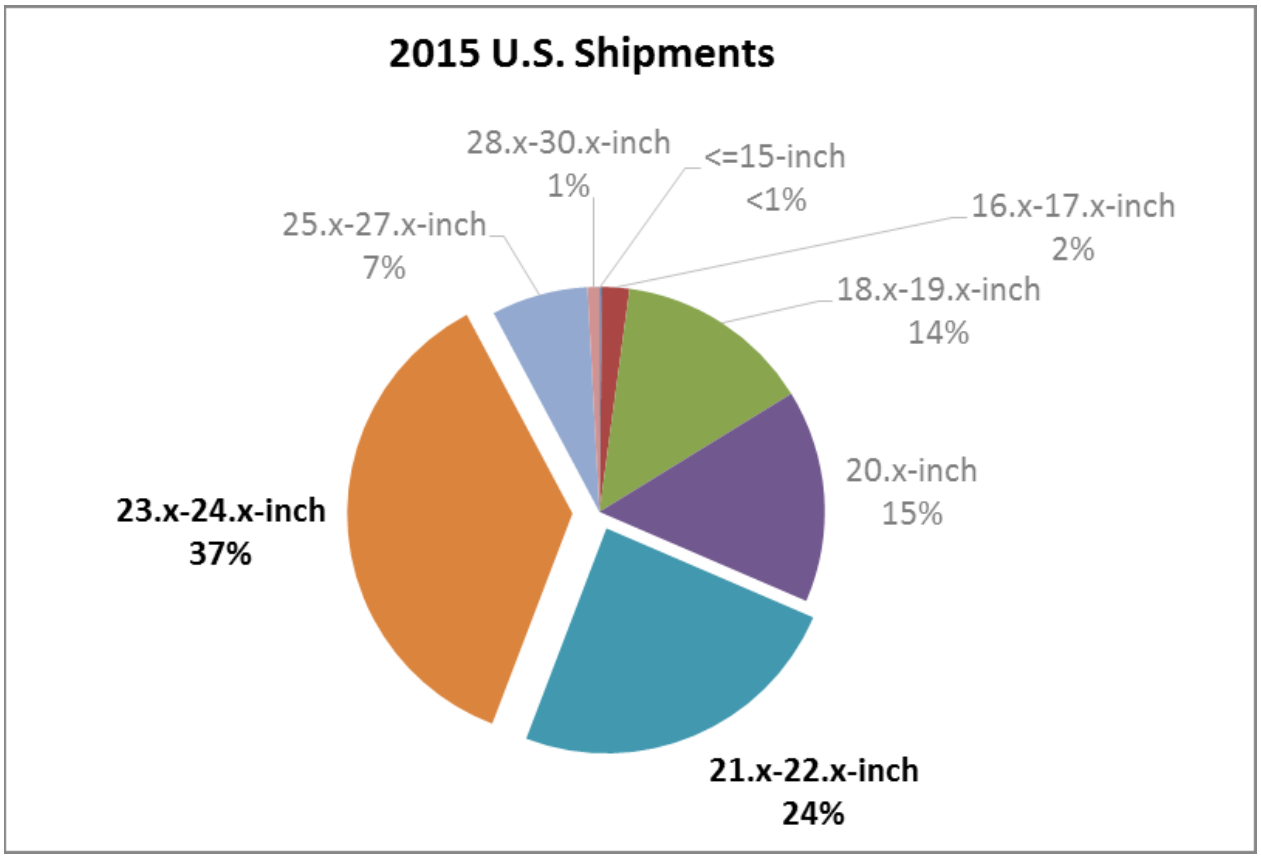
Comparison: Proposed CEC Standard and Energy Star Specifications

CEC proposal for monitors and displays compares with ENERGY STAR Version 6 and Version 7 for 2.07 mega pixels (MP) computer monitors. ENERGY STAR Version 7 proposed an asymptotic line that flattens out at large screen sizes.



Computer Monitor Shipments

Computer Monitor Market Distribution by Screen Size

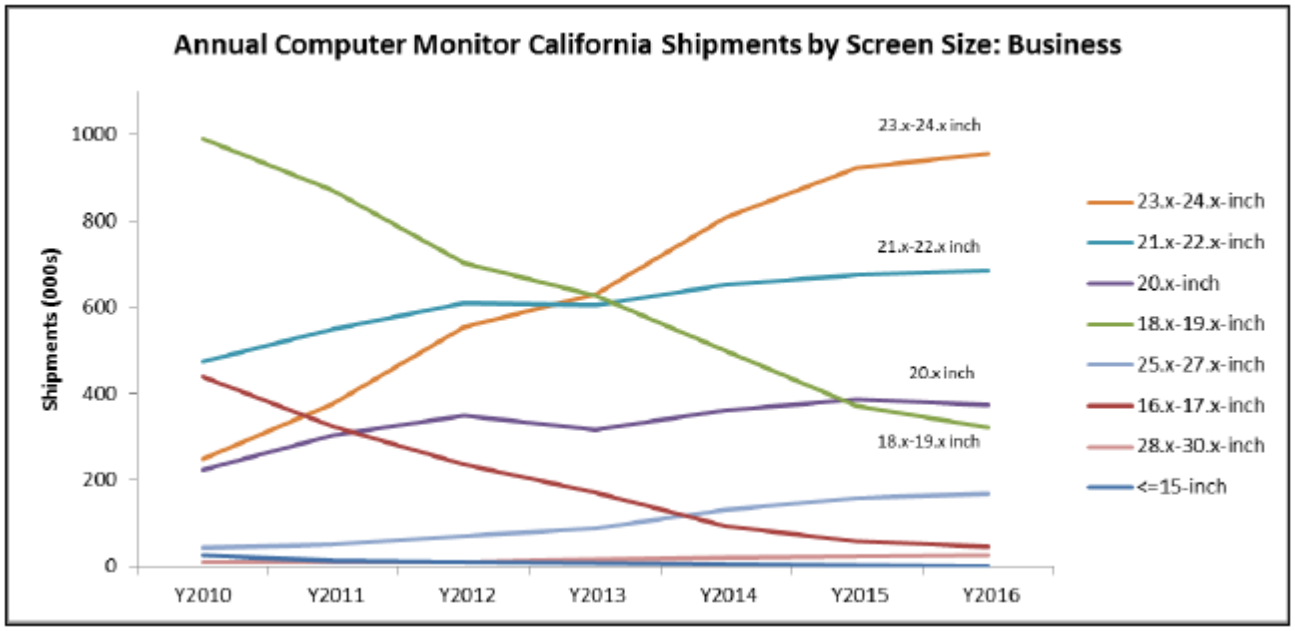


Screen size of 21”-24” make about 60% of the U.S. market.

LED Backlighting: Shipments

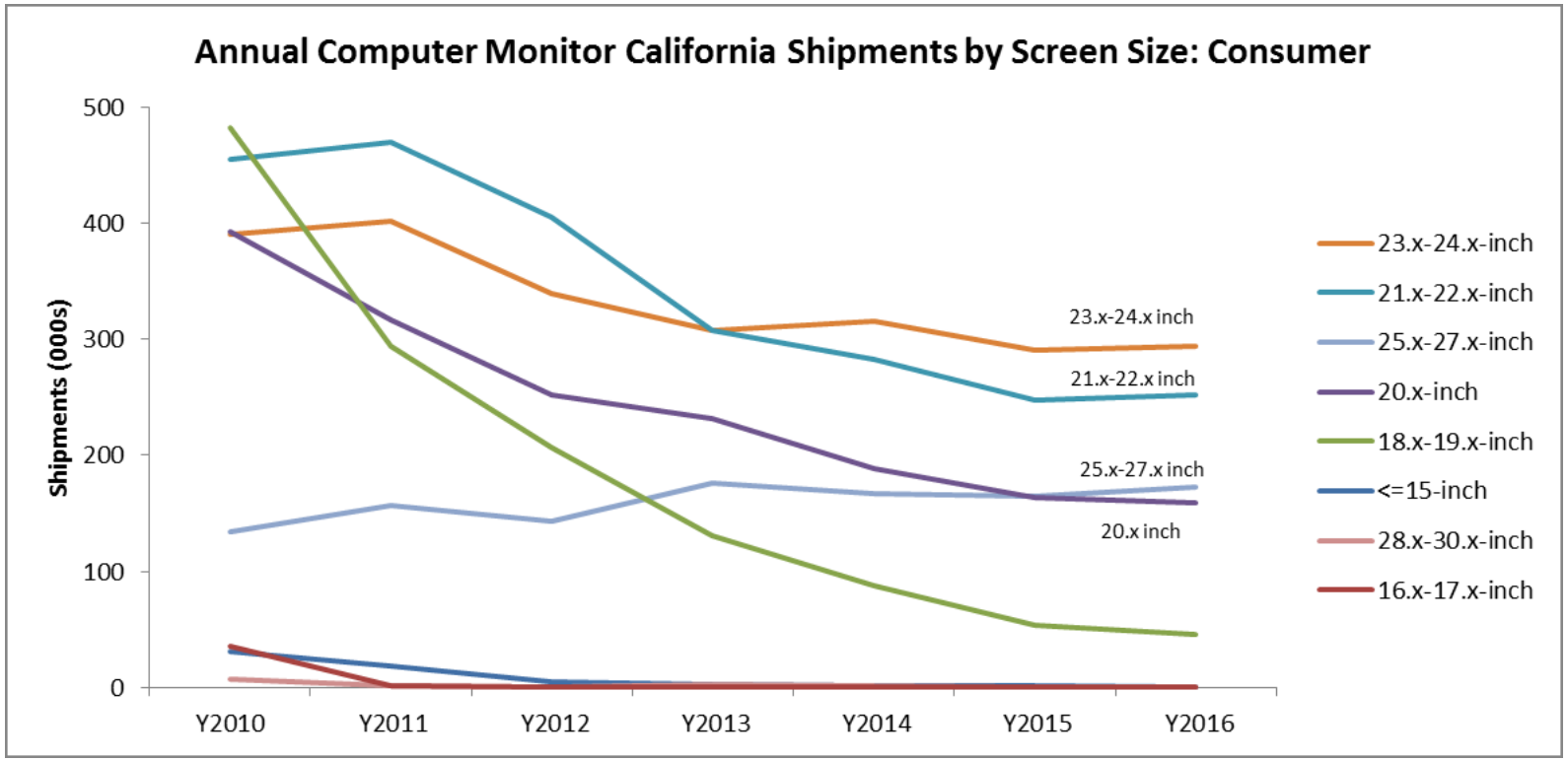
- In 2012, 86% of computer monitor models shipped had LEDs as backlight. About 92% of signage display models shipped in 2012 had LEDs as backlights.
- Shipment data for 2014-2015 shows that all computer monitor and signage display shipments have LEDs as backlights.

Computer Monitor Shipments



Annual Computer Monitor California Shipments by Screen Size.
IOUs CASE report data shows 23.x – 24.x are the monitor size is rapidly growing size

Computer Monitor Shipments



Annual Computer Monitor California Shipments by Screen Size.
CASE report data shows decline in shipments across most sizes.

Estimated Computer Monitor Stock

	US Stock	CA Stock*
Residential	**97,000,000**	**12,687,600**
Commercial	**64,787,000**	**8,474,140**
Total	**161,787,000**	**21,161,740**

Estimated residential computer monitor stock is based on the 2014 Fraunhofer study.

Estimated commercial computer monitor stock is based on the 2009 Navigant study.

Annual Duty Cycle Computer Monitor

	On (hour/Year)	Sleep (hour/year)	Off (hour/year)
Residential	1,533	4,453	2,774
Commercial	2,483	5,043	1,234
Shipment Weighted Average	2,232	4,887	1,640

Annual duty cycle data for residential computer monitors usage is based on the 2014 Fraunhofer study.

Annual duty cycle data for commercial computer monitor is based on the 2009 Navigant study.

Computer Monitor Energy Consumption

	On (Watts)	Standby (Watts)	Off (Watts)	Annual Unit Energy (kWh/yr)
Non Qualifying	26.16	0.35	0.27	60.58
Qualifying	13.95	0.30	0.21	32.93

Life Cycle Cost and Per Unit Savings

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

Staff conducted research and evaluated various technically feasible cost effective strategies for life cycle cost estimates provided in the IOUs CASE study. Analysis of the current data shows most strategies to be cost effective and feasible and would result in significant energy savings for computer monitors.

Design Life	Life-Cycle Cost per Unit (Present Value Dollars)	Life-Cycle Benefits per Unit (Present Dollar Value)	Life Cycle Per Unit Dollar Savings
	Average Incremental Cost per unit	**Estimated Energy Savings per unit**	**=$26.54-$5.00**
6 years	**$5.00**	**$26.54**	**$21.54**

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 Based on 2017 Sales	Total Statewide Energy Savings After the Stock Turnover KWh/Year	Total Statewide Savings over the life cycle after stock turnover
First Year Sales X Electricity Rate 3.6 million * 32.93* 0.16¢ =$15.93 million	Current Energy Consumption-Energy Consumption after the Stock Turnover 585 GWh	Dollar savings per unit over the life cycle * Existing stock = $21.54 * 21.2 million units = $457 million

Technical Feasibility

- Back light unit in the average size computer monitor consumes 45-60 percent of the power.
- Improving back light unit lamp efficacy by using efficient LEDs or more efficacious LEDs would produce the same amount of backlight with fewer LEDs and less power consumption.
- Improving LED efficiency 110 lumens-150 lumens will significantly improve the efficiency of the back light unit. IOUs data shows an estimated 8% to 30% energy savings with a moderate increase in cost.

Technical Feasibility

- Higher Liquid Crystal Display Panel Transmissivity: Higher panel transmittance can be achieved by optimizing pixel design.
- Transmittance of panel functional layers can be improved by using color filters, polarizers, and reflective polarizing films. Reflective polarized films recycle polarized light and increase the panel transmittance. Improvements in the transmittance would result in requiring less light from back light unit and improve the efficiency of the computer monitor.

Technical Feasibility

- Power supply improvements: Use of efficient power supply will significantly improve the efficiency of the computer monitors.
- USB-powered monitor: video and power over one single USB will save energy.

Technical Feasibility

Limit Screen Brightness

- Screen brightness in default mode has a significant impact on back light unit power consumption.
- Reducing the default brightness to 200 nits (candelas per square meter) results in 15% reduction in power consumption with zero incremental cost.

Technical Feasibility

Reducing default screen brightness by using automatic brightness control. Automatic brightness control for computer monitors relies on three basic components:

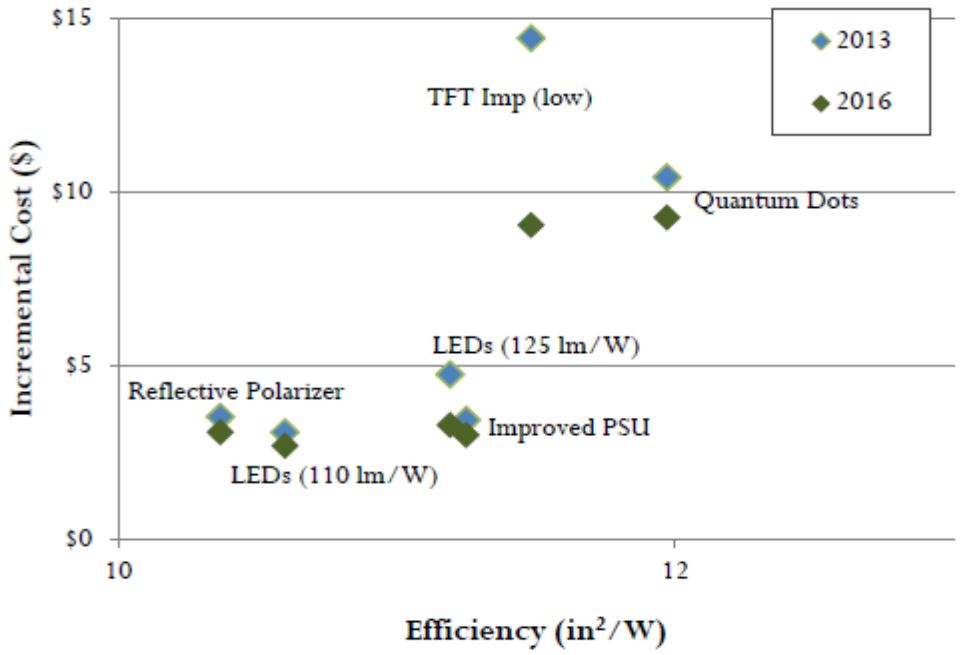
- The ability of a display to dim its backlight.
- An ambient light sensor that measures lighting levels.
- The software to interpret the light levels and translate them to a particular display brightness.

Technical Feasibility

Other pathways to meet the proposed standards are to use emerging technologies approach:

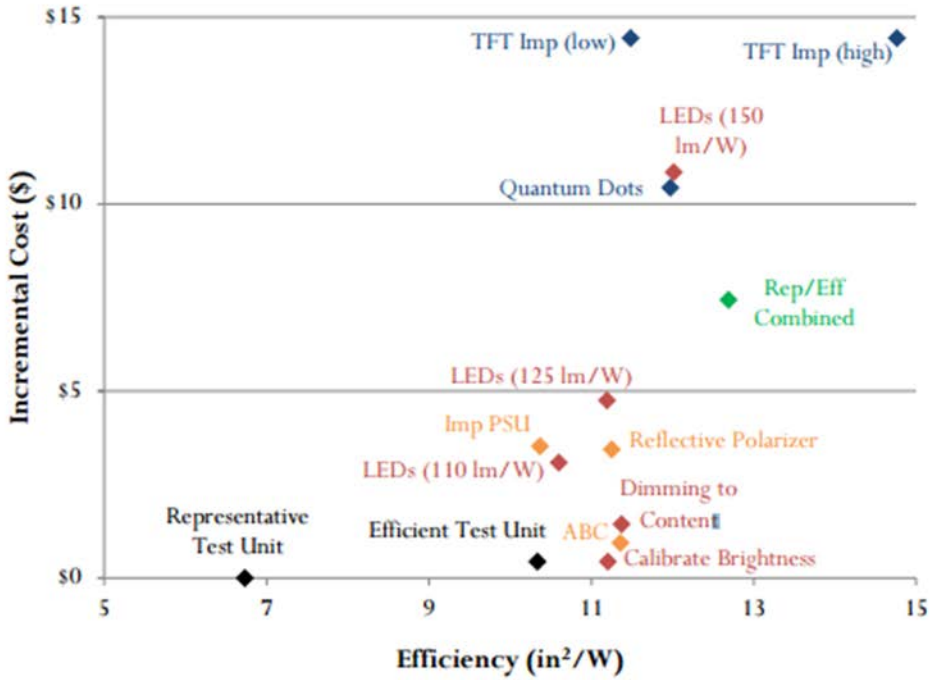
- Use of quantum dots technology that is currently offered by multiple suppliers.
- Use of organic light emitting diodes that do not require a backlight or light filters.

Computer Monitor Cost and Efficiency Improvements Over Time



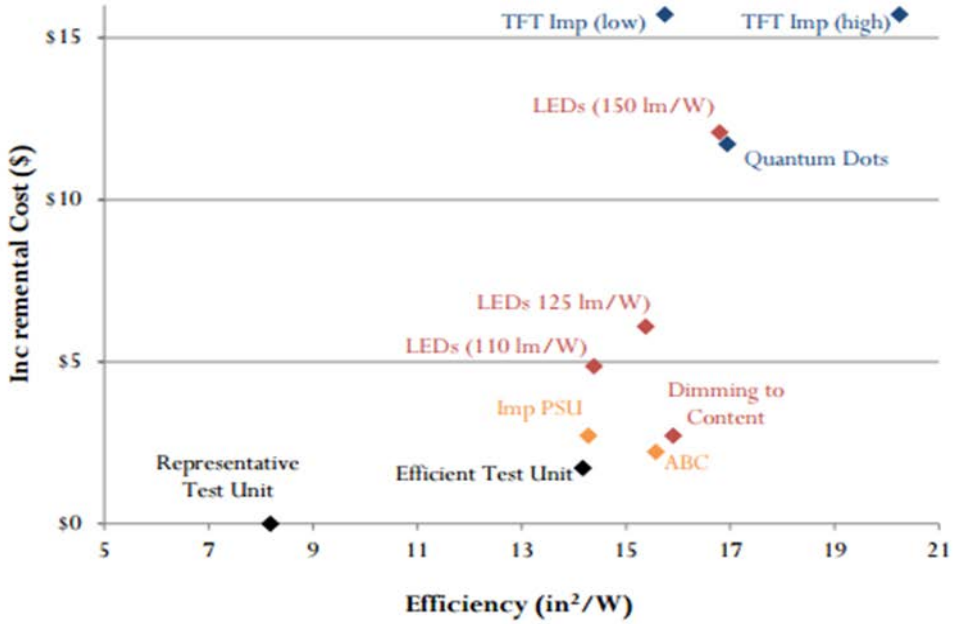
Incremental cost by efficiency measure showing the decrease in incremental cost from 2013 to 2016 for the 22” screen size.

Computer Monitor Efficiency vs Incremental Cost



22” computer display incremental consumer cost in 2013 shown as a function of efficiency for both test units as well as several maximum technology scenarios.

Computer Monitor Efficiency vs Incremental Cost



27" computer display incremental consumer cost in 2013 shown as a function of efficiency for both test units as well as several maximum technology scenarios.

Signage Display

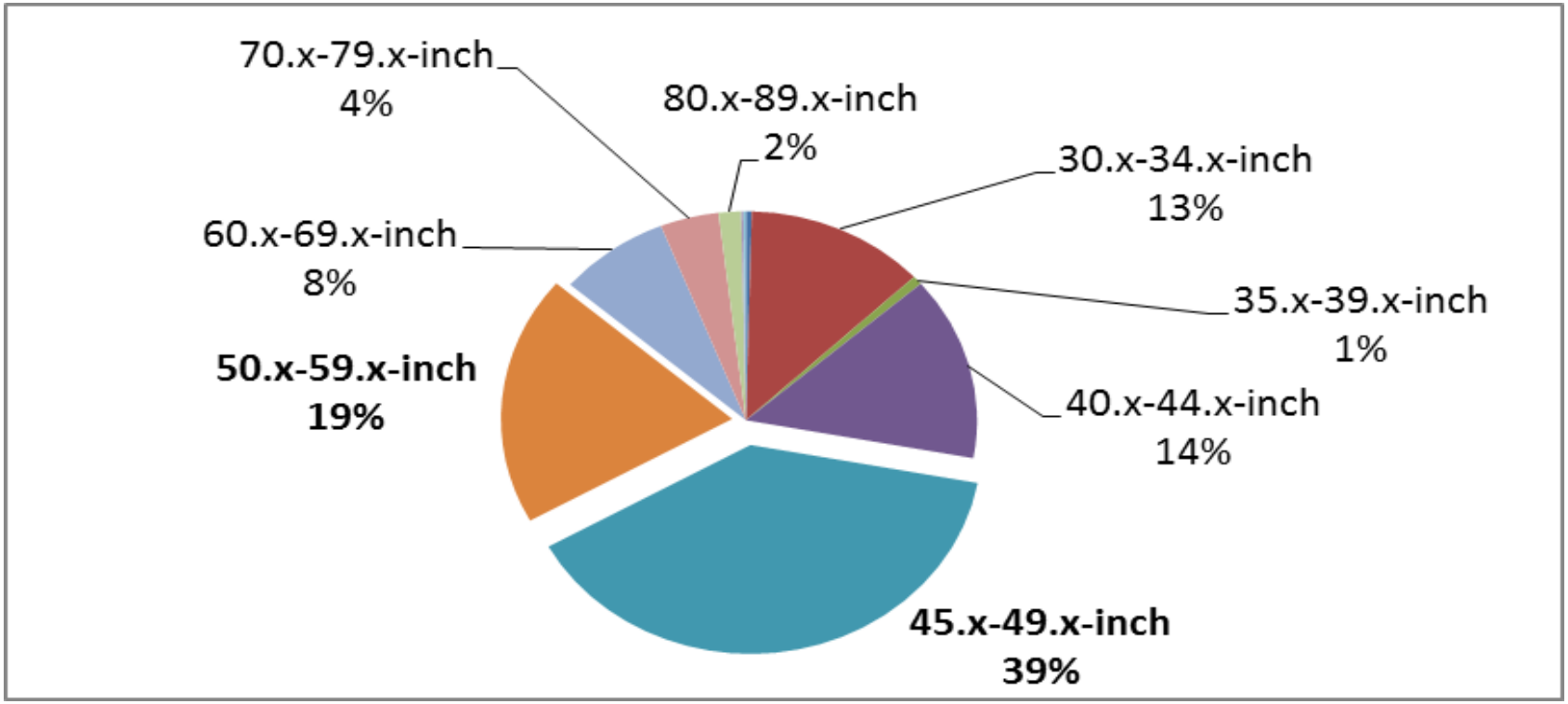
Signage Display

Digital signage displays are covered under the existing television standards.

IOUs market survey shows that not all manufacturers have been compliant with the existing standards for signage displays.

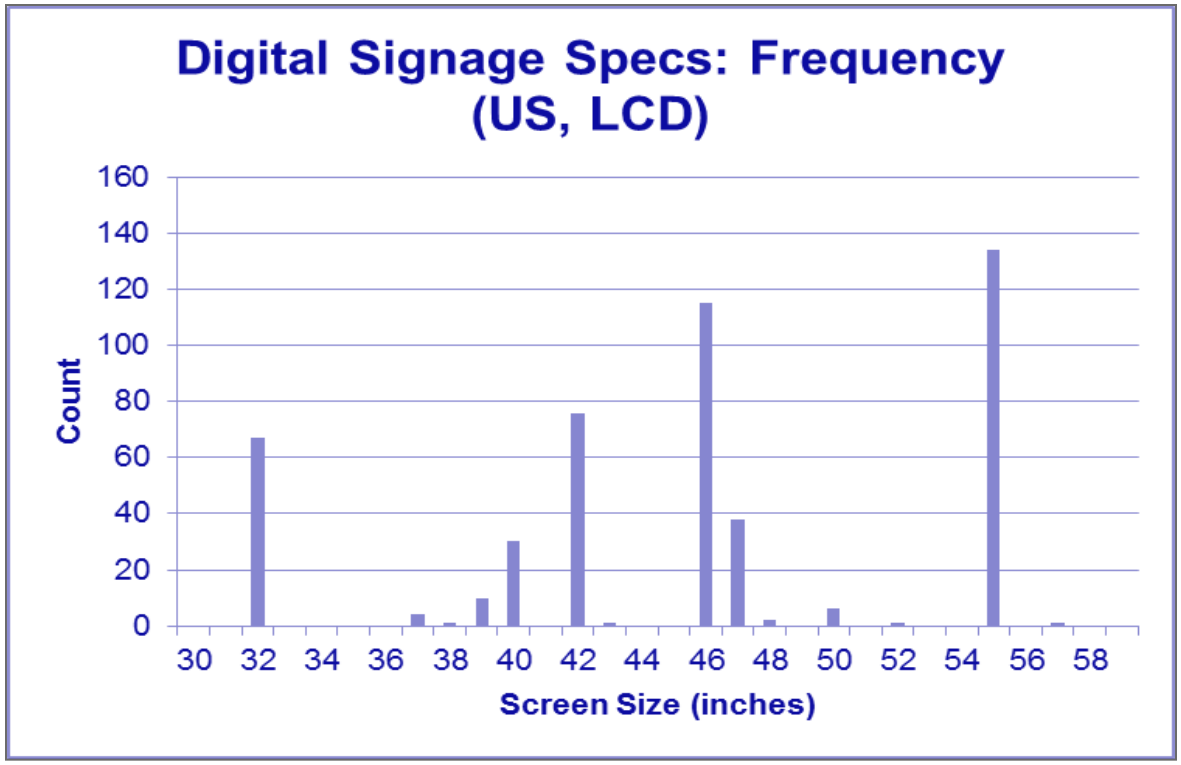
Clarification to definition and harmonizing CEC definition with industry-accepted definition, the expectation is that there will be greater compliance with existing standards.

Signage Display Shipments



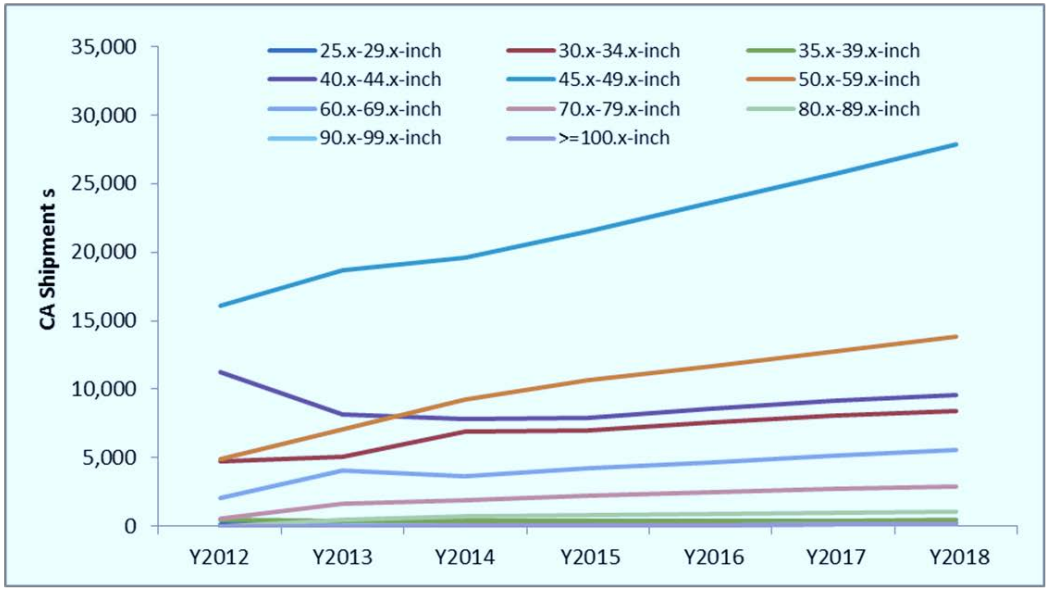
Most shipped size of signage displays are 45.x – 49.x.

Signage Display Shipments



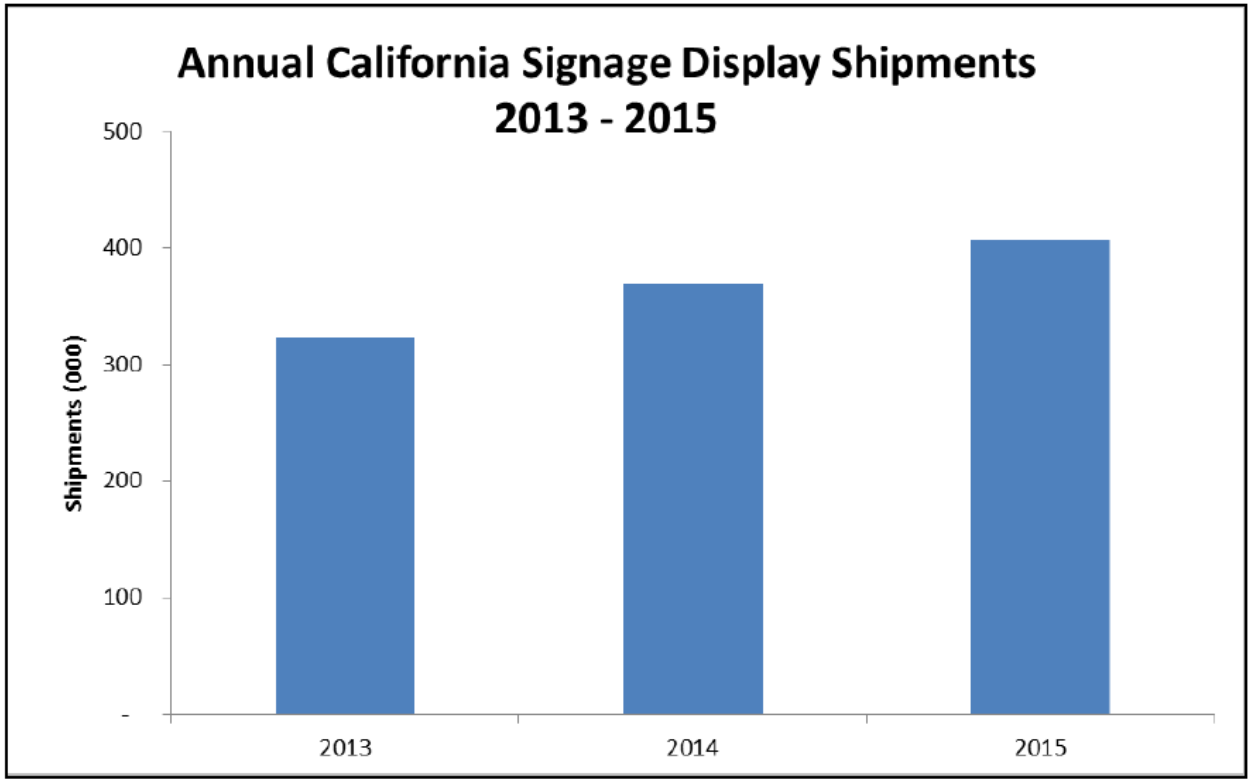
Favorite screen sizes within bins: 32”, 42”, 46”, and 55”.

Signage Display Shipments



Most popular size is 45.x – 49.x and second most popular size is 50.x – 59.x.

Signage Display Shipments



Above bar graph shows increase in the sales of signage display units.

Signage Display Stock

Stock = Annual Shipments X Equipment Lifetime

Estimated Shipments = 60K

Estimated Lifetime = 7.5 years

Estimated CA Stock = 450,000

Signage Display Duty Cycle

Many signage displays promote themselves as being able to withstand “heavy” usage for commercial applications capable of a duty cycle of 24/7 operation.

Some signage displays may run 24 hours a day in applications such as hospitals, hospitality, and transportation, other commercial applications may not require around the clock operation.

Signage Display Duty Cycle

On (hours/year)	Sleep (hours/year)
6,570	2,190

Assumed Daily Duty Cycle

- On: 18 hours
- Sleep: 6 hours

Assumed Days in Operation: 365

Energy Consumption

Units	On Mode Power consumption (W)	Sleep Mode Power consumption (W)	Unit Energy Consumption (kWh/year)
Non Qualifying	178	0.92	1174
Qualifying	92	0.35	608

Analysis of the available data shows that non-compliant units use approximately 1174 kWh/year and compliant units use 608 kWh/year. Proposed clarification to the signage display definition would result in full compliance and significant energy savings.

Comments and Questions

Comment Process

Comments are due on or before May 15, 2015.

You can electronically upload your comments on the following link: http://www.energy.ca.gov/appliances/2014-AAER-2/prerulemaking/.

or

Send a hard copy to:

California Energy Commission
Dockets Office, MS-4
Re: Docket No. 15-AAER-1
1516 Ninth Street
Sacramento, CA 95814-5512

or

Send a digital copy to: docket@energy.state.ca.us.
Please include Docket No. 14-AAER-2 in the subject line.

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