

# Results of Invitation to Participate: Displays

2013 Appliance Efficiency Rulemaking  
California Energy Commission

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# Agenda

- ❑ Purpose
- ❑ Information Requested
- ❑ Responses
  - ❑ Product Lifetime
  - ❑ Duty Cycle
  - ❑ Market Data
  - ❑ Modal Power
  - ❑ Components & Energy-Saving Tech
  - ❑ Costs
- ❑ Next Steps



# Purpose

- ❑ The Commission is gathering information to determine how to proceed with products listed in Phase 1 of the OIR.
- ❑ The ITP is an opportunity for stakeholders to inform the Commission's policy, direction, and process.
- ❑ ITP requests product, market, and other relevant information.
- ❑ During this session, we will discuss the results of the ITP for Displays.



# Display Categories

Display categories under initial consideration:

- ❑ Computer Monitors
- ❑ Digital Picture Frames
- ❑ Professional Signage (e.g. airport signage)
- ❑ Electronic Billboards



# Information Requested

- ❑ Product Definition & Scope
- ❑ Existing Test Procedures
- ❑ Sources of Test Data
- ❑ Existing Standards & Standards under Development
- ❑ Product Lifetime
- ❑ Product Development Trends
- ❑ Operations
- ❑ Energy-consuming Features
- ❑ Energy-saving Features & Technologies
- ❑ Control Features
- ❑ Market Characteristics
- ❑ Installed Base Characteristics
- ❑ Market Competition



# Responses

Responses addressing the information requested:

- BanBillboardBlight
  - “Illuminating the Issues: Digital Signage and Philadelphia’s Green Future” by Gregory Young
- California Investor-owned Utilities
- Consumer Electronics Association’s Appendix:
  - Energy Consumption of Consumer Electronics in U.S. Homes in 2010 – Final Report to the Consumer Electronics Association (CEA) – December 2011
- Information Technology Industry Council



# Product Lifetime

Responses include the following:

- “design life for computer monitors is estimated to be four-years based on an energy consumption study conducted by Lawrence Berkeley National Laboratory (LBNL 2011).”
- “...more than half of all displays are over five years old; annual residential sales of about 13 million units imply a mean product lifetime of about 10 years.” (CEA 2011)
- “...free from defect for 1 to 3 years or 3 to 5 years...typical minimum design targets”  
“For enterprise models...typical replacement cycle is 3-5 years”  
(ITI)



# Duty Cycle

Table 2.1 Duty Cycle for Computer Monitors by Sector

Sector	On (hrs/day)	Sleep (hrs/day)	Off (hrs/day)
Residential	6.4	9.9	7.7
Commercial	6.8	11.2	6.0

Sources: Fraunhofer 2011; Navigant 2009

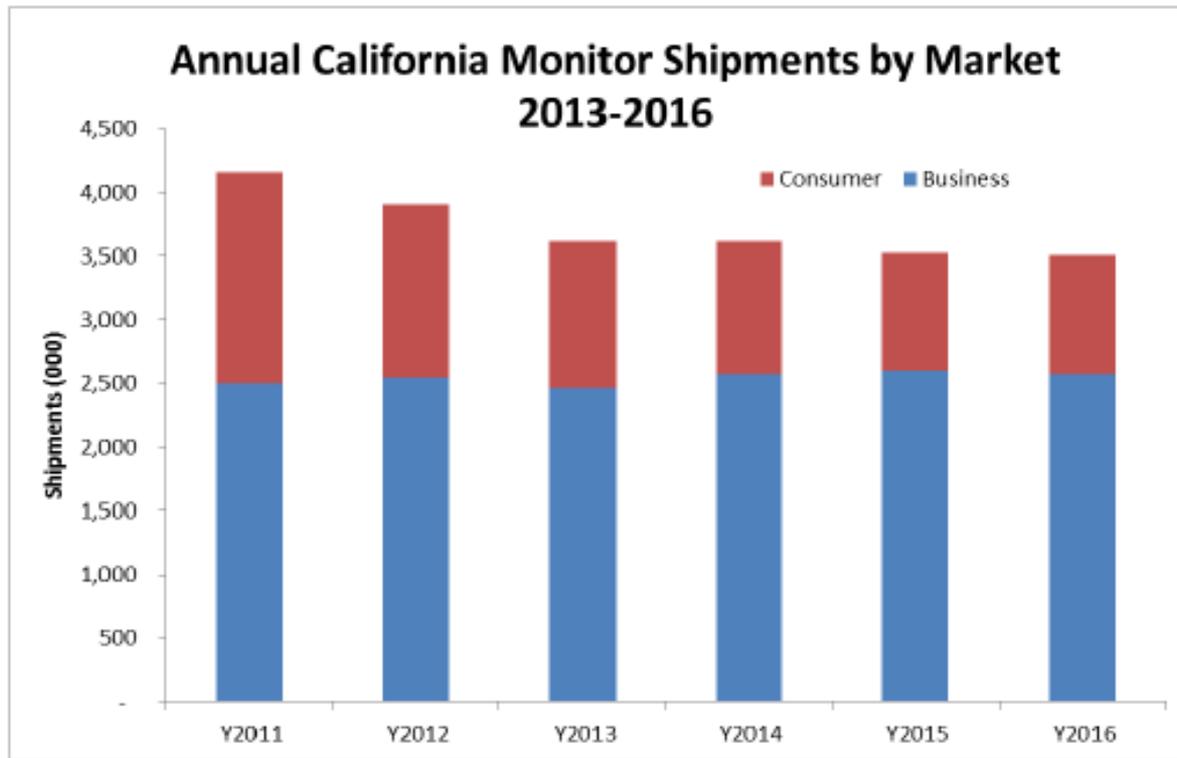
Table 2.2 Calculated Annual Hours in Power Mode for Computer Monitors by Sector

	On (hrs/yr)	Sleep (hrs/yr)	Off (hrs/yr)
Residential	2,336	3,614	2,811
Commercial	1,632	2,688	4,440
Shipment-Weighted Averages	1,939	2,983	3,838

Assumes five workdays/week & 20 days time off = 240 work days annually.  
 Assumes the computer is off the other 125 days in the year.  
 Shipment-weighted averages are based on 63% business and 37% consumer.



# CA Market Data: Consumer & Business



**Figure 6.1 Annual California Monitor Shipments by Market**

Source: Calculations based from shipment data from IHS iSuppli 2012



# U.S. Market Data: Screen Size

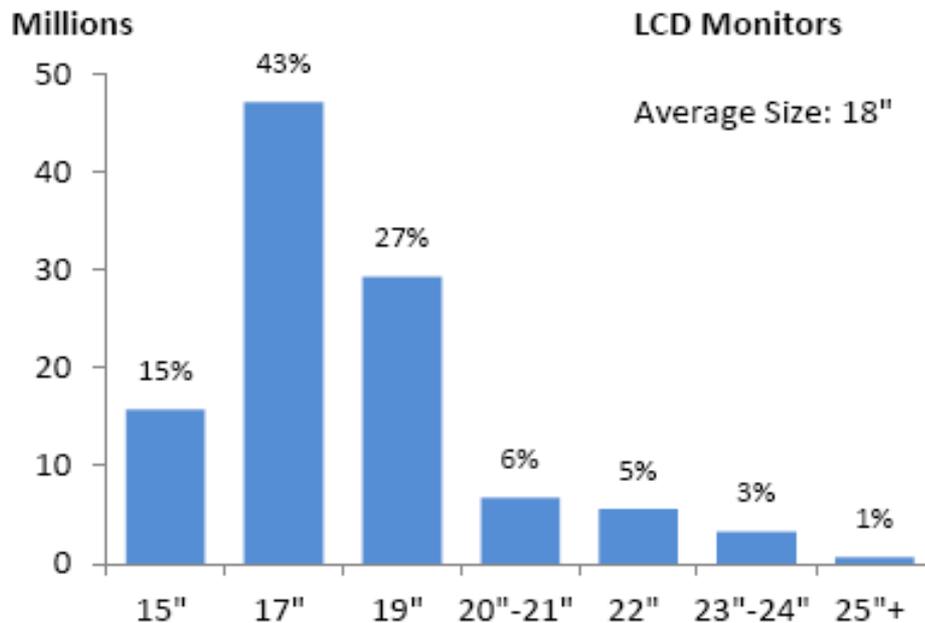


Figure 3-20: Diagonal viewable screen size of the 2010 installed base of LCD monitors  
CEA 2011



# U.S. Market Data: Screen Size

**Table 1: Average Diagonal Size of Key FPD Applications**

Key Applications	2010	2011	2012	2013	Average Size Difference (2010-2013)	
Desktop Monitor	19.9"	20.3"	20.7"	20.9"	1.0"	5%
LCD TV	33.2"	34.5"	35.9"	36.1"	2.9"	9%
Mobile PC	13.6"	12.8"	12.1"	12.2"	-1.4"	-10%
Mobile Phone	2.4"	2.6"	3"	3.3"	0.9"	38%
OLED TV	15"		55"	55"	40.0"	267%
Plasma TV	46.3"	47"	48.1"	50"	3.7"	8%
Portable Media Player	2.8"	3.1"	3.1"	3.6"	0.8"	29%
Portable Navigation Device	4.3"	4.5"	4.5"	4.6"	0.3"	7%
Public Display	41.7"	41.3"	44.9"	46.5"	4.8"	12%

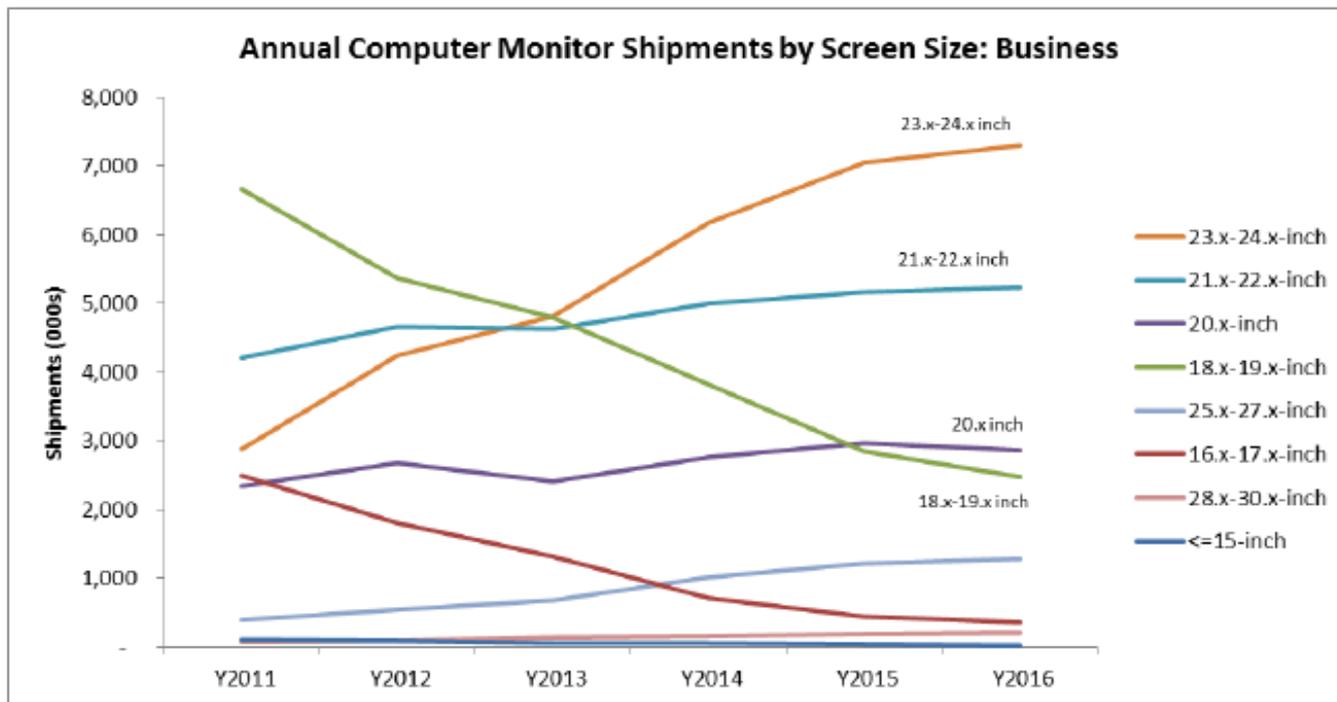
Source: NPD DisplaySearch *Quarterly Worldwide FPD Shipment and Forecast Report*

## Desktop Monitor

NPD DisplaySearch anticipates challenges in desktop monitor panel demand especially in 2012 and 2013. That challenge is a result of the maturity of desktop PC bundles and stagnant replacement in the stand-alone PCs. However, consumers are buying larger-sized LCD monitors such as 23", 24", and 27", so average monitor diagonal size is increasing from 19.9" in 2010 to 20.9" in 2013.



# U.S. Market Data: Screen Size Business



**Figure 1.2 Annual Computer Monitor Shipments by Screen Size: Business**

Source: IHS iSuppli 2012



# U.S. Market Data: Screen Size Consumers

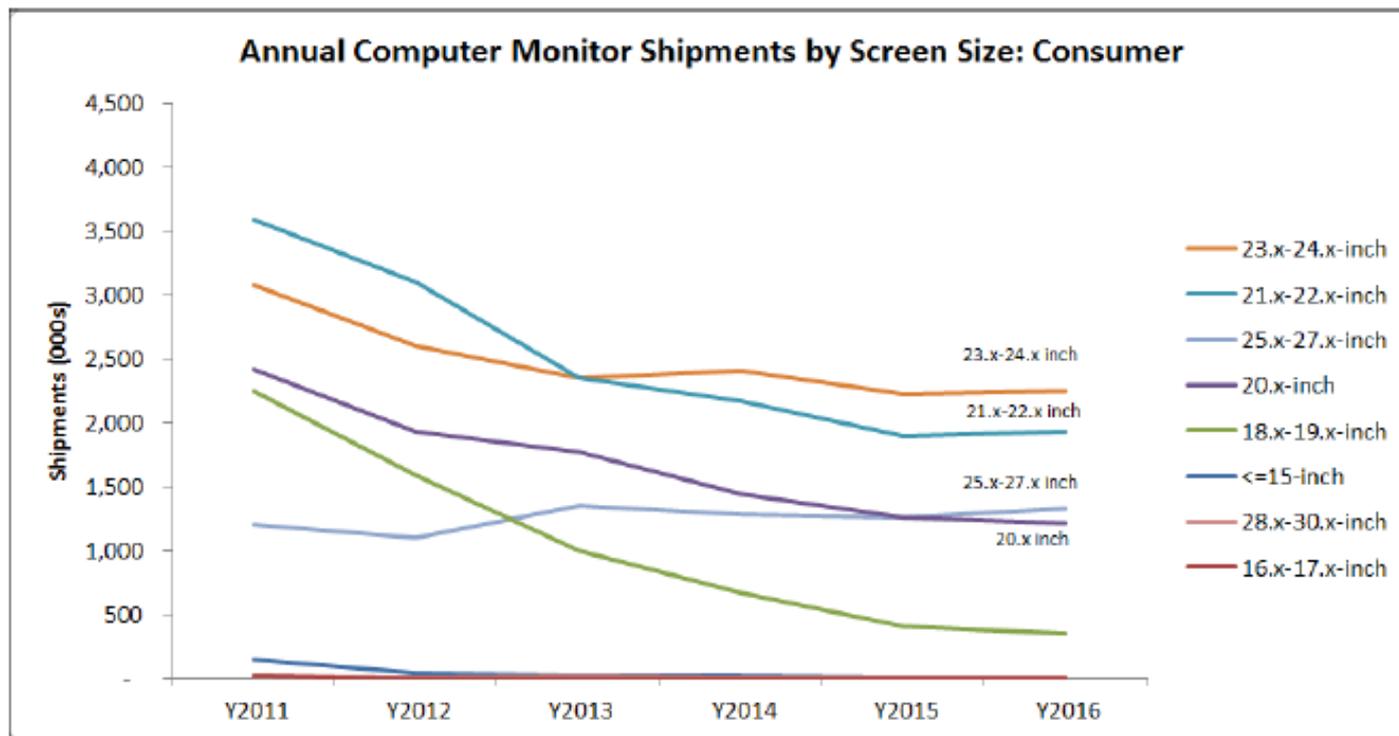


Figure 1.3 Annual Computer Monitor Shipments by Screen Size: Consumer

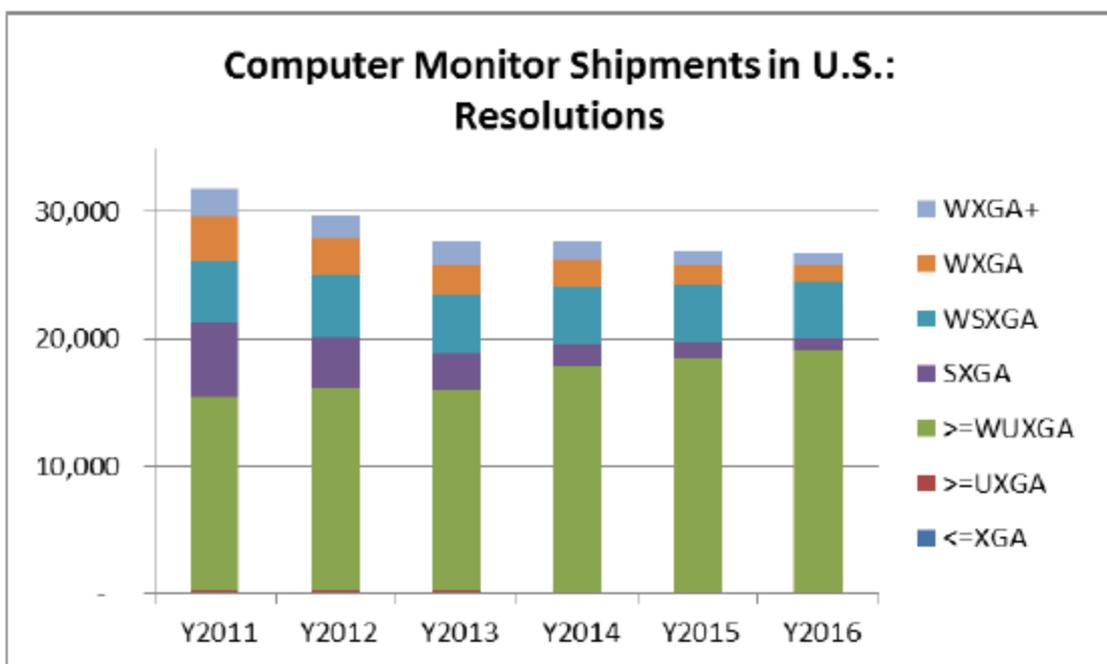
Source: IHS iSuppli 2012



# U.S. Market Data: Resolution

Table 1.3 Resolution Categorizations for Computer Monitors

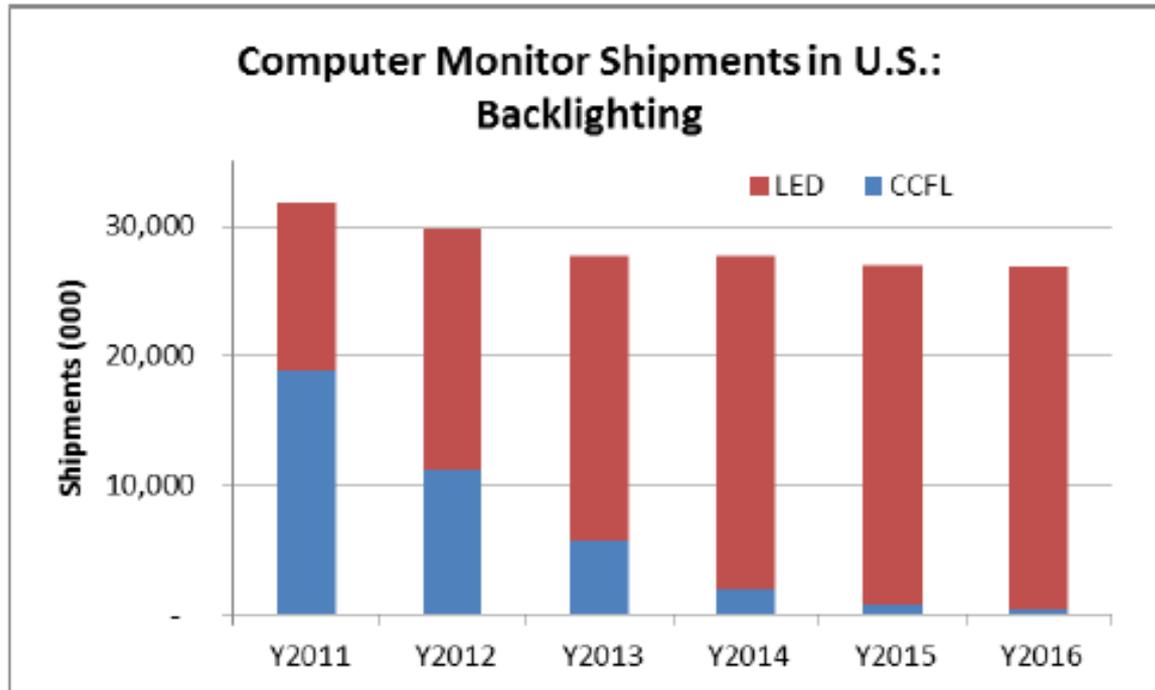
Resolution Bin	Total Native Resolution (MP)
<=XGA	0 – 0.786
>=UXGA	1.920 – 2.074
>=WUXGA	2.304 and higher
SXGA	1.311
WSXGA	1.296 (16:10 aspect ratio)
WXGA	1.024
WXGA+	1.764 (16:10 aspect ratio)



“higher resolution monitors will typically consume more power due to the increased brightness of the backlight and additional controllers required for higher resolution displays”



# U.S. Market Data: Backlighting



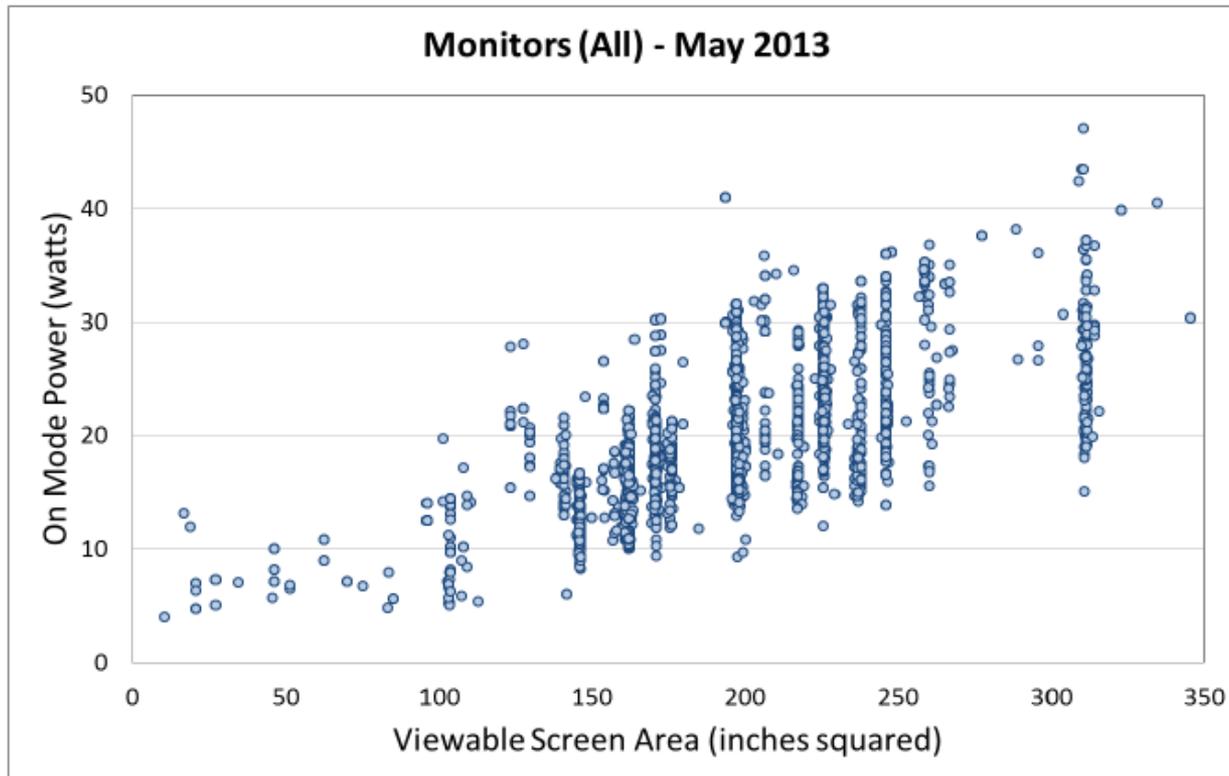
**Figure 1.5. Computer Monitor Shipments in U.S.: Backlighting**

Source: IHS iSuppli 2012



# Active Mode Power

Combining the products listed on the ENERGY STAR QPL (EPA 2013c) and including the products data used in the development of the Version 6.0 specification development process (EPA 2012a), the overall dataset of computer monitors between 0 and 350 inches-squared is displayed in Figure 2.1.



# Active Mode Power

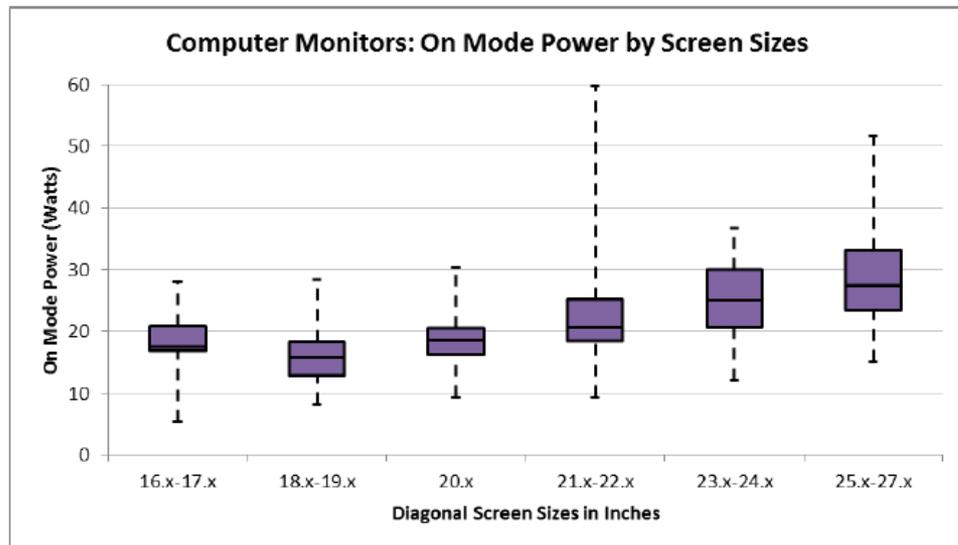


Figure 2.2 Computer Monitor On Mode Power Consumption Box Plots

Table 2.3 Computer Monitor On Mode Power Consumption Box Plot Values

On Mode Power Box Plots						
Screen Size Bins:	16.x-17.x	18.x-19.x	20.x	21.x-22.x	23.x-24.x	25.x-27.x
<b>Minimum</b>	5.3	8.2	9.4	9.3	12.1	15.1
<b>First Quartile</b>	16.8	12.8	16.3	18.5	20.7	23.5
<b>Median</b>	17.5	15.8	18.7	20.8	25.0	27.5
<b>Third Quartile</b>	20.9	18.3	20.5	25.2	30.0	33.2
<b>Maximum</b>	28.1	28.5	30.3	59.9	36.8	51.7
<b>Mean</b>	18.1	15.8	18.8	22.0	25.3	28.6
<b>Count</b>	162	840	367	876	899	174





# Active Mode Power: LED Backlit

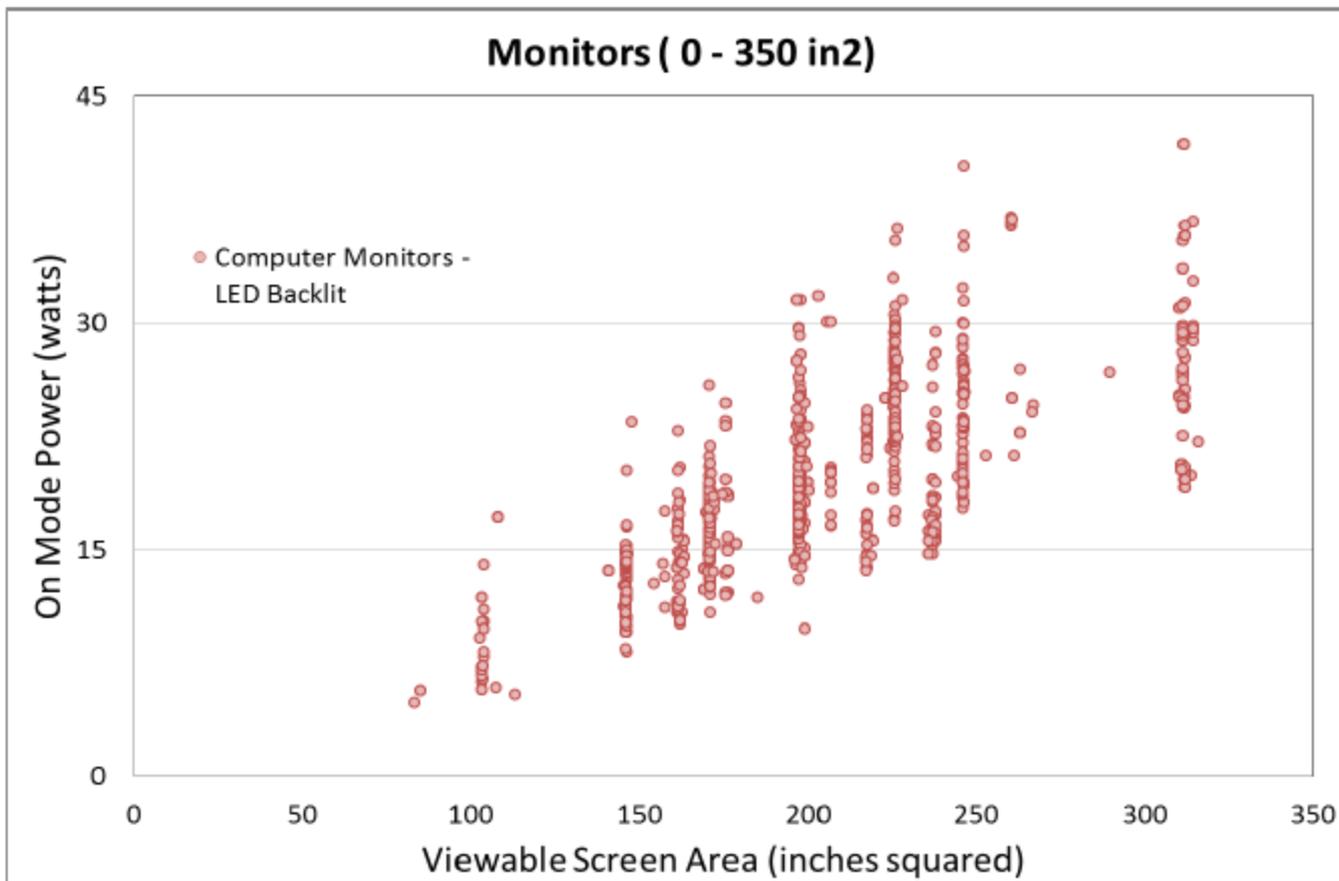


Figure 2.4 Computer Monitor On Mode Power Consumption: LED Backlighting



# Sleep Mode Power

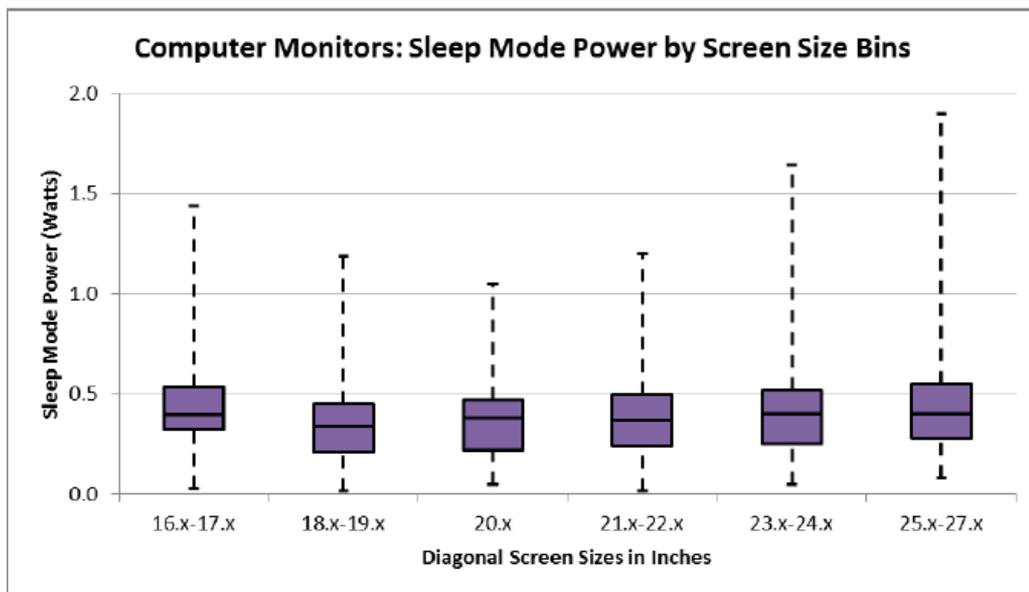


Table 2.4 Computer Monitor Sleep Mode Power Consumption Box Plot Values

Sleep Mode Power Box Plots						
Screen Size Bins:	16.x-17.x	18.x-19.x	20.x	21.x-22.x	23.x-24.x	25.x-27.x
Minimum	0.0	0.0	0.1	0.0	0.1	0.1
First Quartile	0.3	0.2	0.2	0.2	0.3	0.3
Median	0.4	0.3	0.4	0.4	0.4	0.4
Third Quartile	0.5	0.5	0.5	0.5	0.5	0.6
Maximum	1.4	1.2	1.1	1.2	1.6	1.9
Mean	0.4	0.3	0.4	0.4	0.4	0.4
Count	116	709	324	752	782	152



# Energy-consuming Hardware

For the computer monitors we tested, we found the following features that potentially add to the energy consumption of the unit.

- High Resolution
- USB charging port (power draw when charging a device)
- Touch screen (enabled through a USB port)
- Additional ports (HDMI, USB, DisplayPort, etc.)

Although not found in the units we tested, we would expect to find the following features in other units could increase a computer monitor's energy consumption.

- Camera/microphone – With increased remote working environments, it is possible that many more monitors will include a built-in camera and microphone. This option is currently available at a comparable price to standard monitors (Amazon 2013).
- Integrated speakers.
- 3D.
- Ambient backlighting (Engadget 2013).



# Energy-consuming Hardware

## High Resolution

Comparing the power draw of two 27" LCD monitors, a 2.07 megapixels (1920 pixels by 1080 pixels) panel and the other with a 3.69 megapixels (2560 pixels by 1440 pixels) panel, we found a more than 50% increase in plug load after normalizing for other components. An increase in pixels results in increased power draw from various components including:

Table 3.1 USB Charging Power Draw

Monitor	Plug Load Power Draw	Plug Load Power Draw with 2.25W Charging Load
27" LED-LCD	22.4W	25.3W
22" LED-LCD	19.6W	22.8W

## Touch Screen

We measured the incremental power draw of enabling the optical touch screen system of a 22" LED-LCD monitor. The resulting plug load impact was approximately 1 watt. There was no measureable impact on panel transmissivity, meaning that this feature is not expected to require an increase in backlight output.



# Energy Saving Tech & Features

Backlighting – switching from CCFL to LED

Reduction of Backlight Lamps

Reflective Polarizer

Efficient Power Supply

High LCD Panel Transmissivity

Auto Power Down

Eco Setting

Auto Brightness Control

Backlight Dimming

Occupancy Sensor



# Costs

Received a little/no cost data.

IOUs are performing a cost analysis.

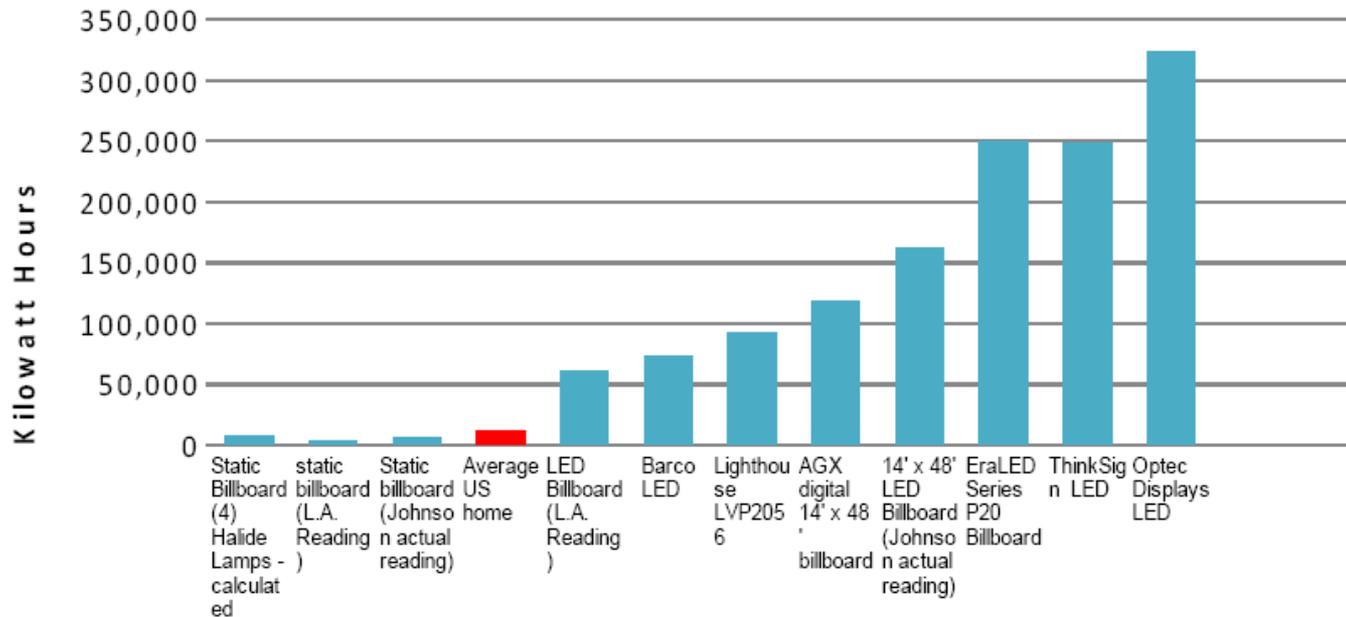
2012 ENERGY STAR Strategic Vision & Guiding Principles:  
“ENERGY STAR specifications are set so that if there is a cost differential at time of purchase, that cost is recovered through utility bill savings, within the life of the product.”

Is there an incremental cost attributed to energy efficiency improvement of displays?



# Electronic Billboards

## Approximate Annual Energy Usage for Billboards Static vs. LED



AGX digital 14' x 48' billboard	117,866	\$16,148
14' x 48' LED Billboard (Florida actual reading)	162,902	\$22,318



# Next Steps

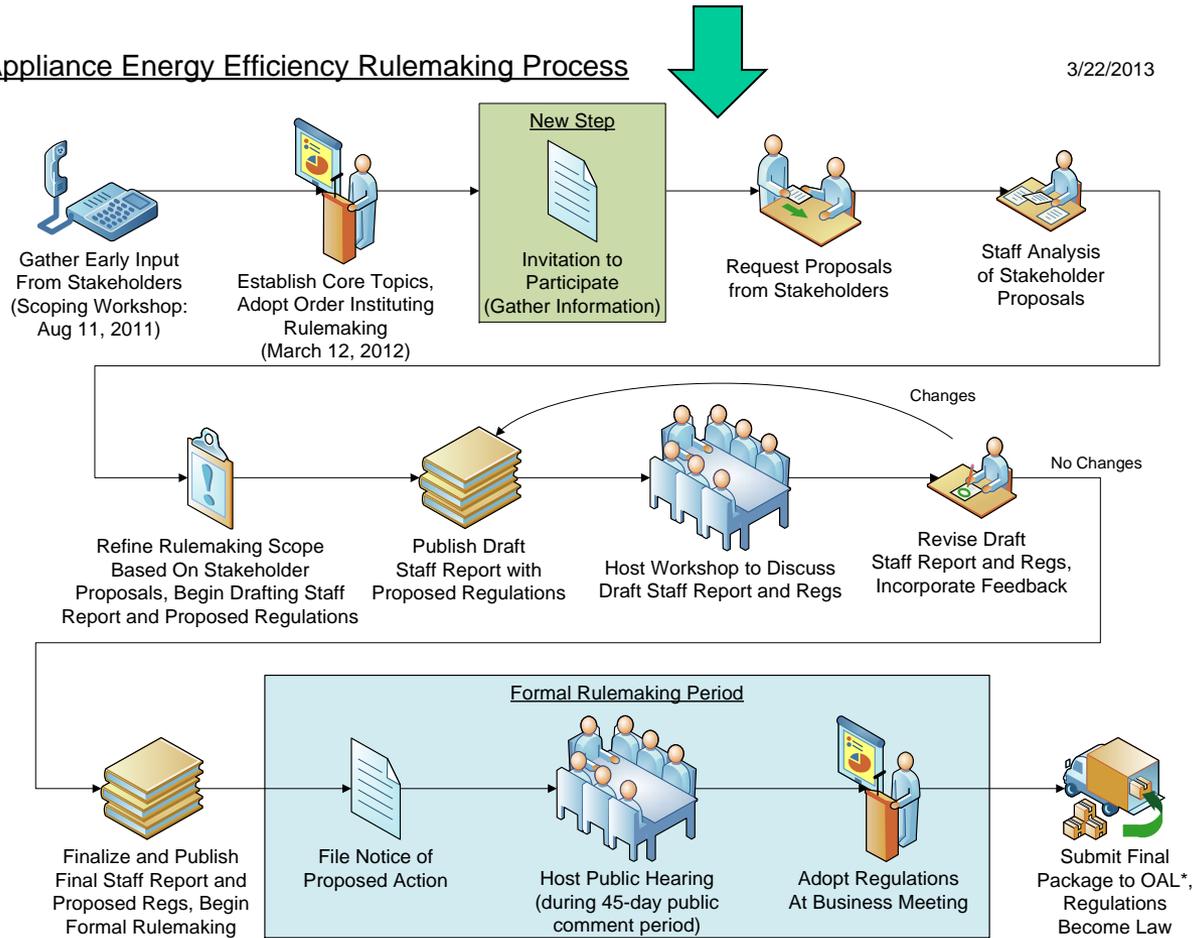
- ❑ Following the ITP workshops, the Commission will request proposals for new/updated efficiency measures.
- ❑ Interested parties may submit proposals from **June 10 to July 25, 2013.**
- ❑ Proposal Template and Guidance is forthcoming.
- ❑ Commission staff are available to discuss questions and concerns at anytime during the proceeding.



# Public Participation

## Appliance Energy Efficiency Rulemaking Process

3/22/2013



\*Office of Administrative Law



# Discussion & Comments

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Docket #12-AAER-2A  
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