ENERGY STAR® Displays Stakeholder Meeting: Draft 1 Version 5.0 Specification

September 25, 2008

Christopher Kent, U.S. EPA
Kent.christopher@epa.gov

Welcome

Christopher Kent, U.S. EPA

Overview

- Welcome
- Introductions
- Agenda Review
- Meeting Goals
- Overview of ENERGY STAR

Introductions

Today's Agenda

10:00 a.m.	Welcome & Introductions
10:15 a.m.	EU perspective
10:25 a.m.	Overview of draft 1
10:45 a.m.	ITI presentation
11:00 a.m.	Break
11:15 a.m.	Overview of data analysis process
12:30 p.m.	Lunch
1:30 p.m.	Luminance discussion
2:00 p.m.	Discussion of Tier 2 opportunities
3:15 p.m.	Break
3:25 p.m.	Wrap-up
3:45 p.m.	Meeting adjourned

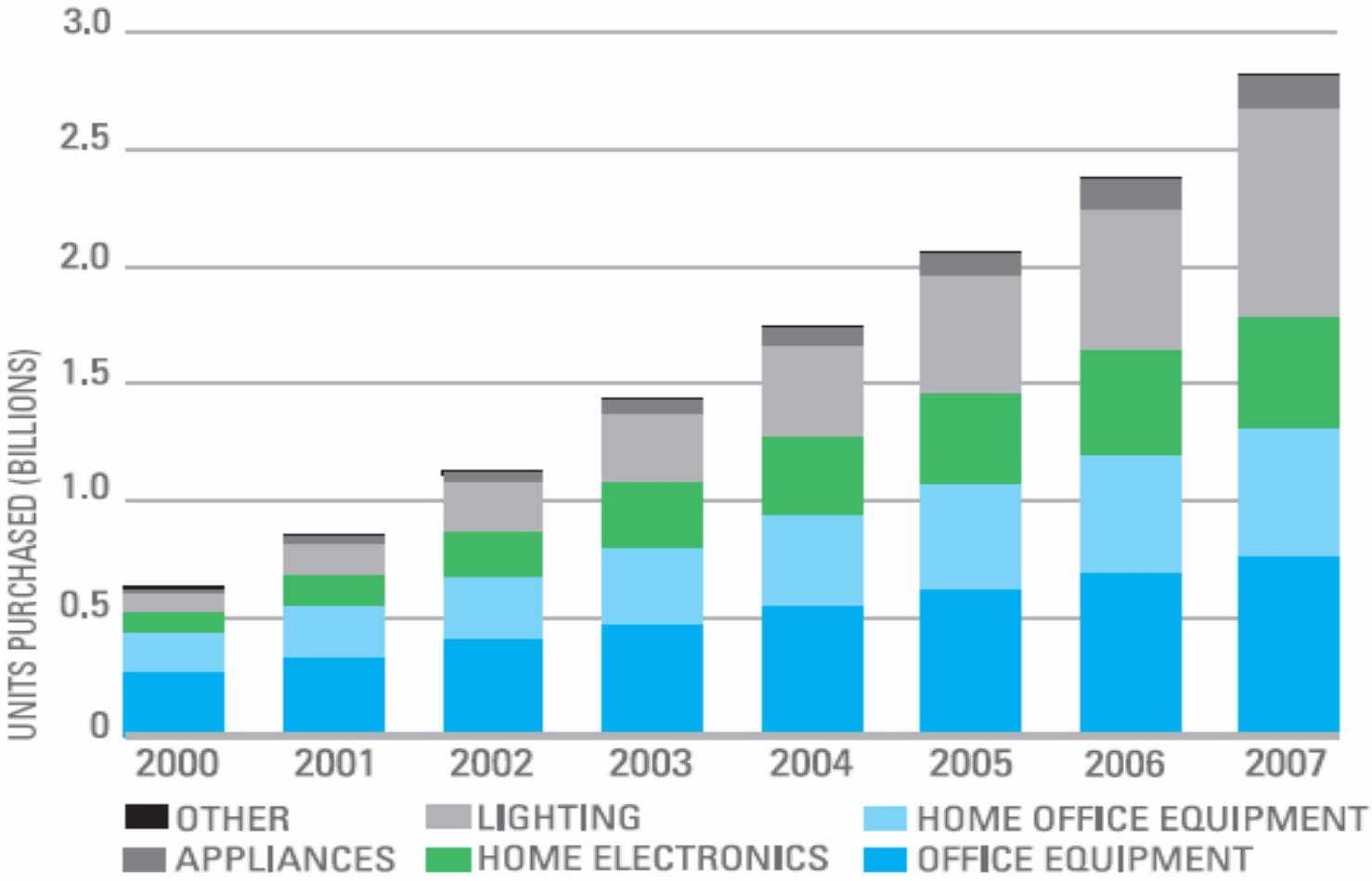
Meeting Goals

- Present details on changes between Version 4.1 monitors specification and Version 5.0 displays specification
- Present data analysis used to inform V5.0 requirements
- Gather feedback on key areas to inform development of Draft 2 Version 5.0 specification
- Initiate discussion on Tier 2 levels/opportunities

ENERGY STAR Overview

- ENERGY STAR is the government-backed symbol for energy efficiency
  - Identifies products in almost 60 categories that use less energy without sacrificing quality or performance
  - ENERGY STAR qualified products are an easy, convenient solution to energy and cost concerns
- In 2007, with the help of ENERGY STAR, Americans saved $16 billion on their utility bills
  - Saved enough energy in 2007 alone to avoid greenhouse gas emissions equivalent to those from 27 million cars

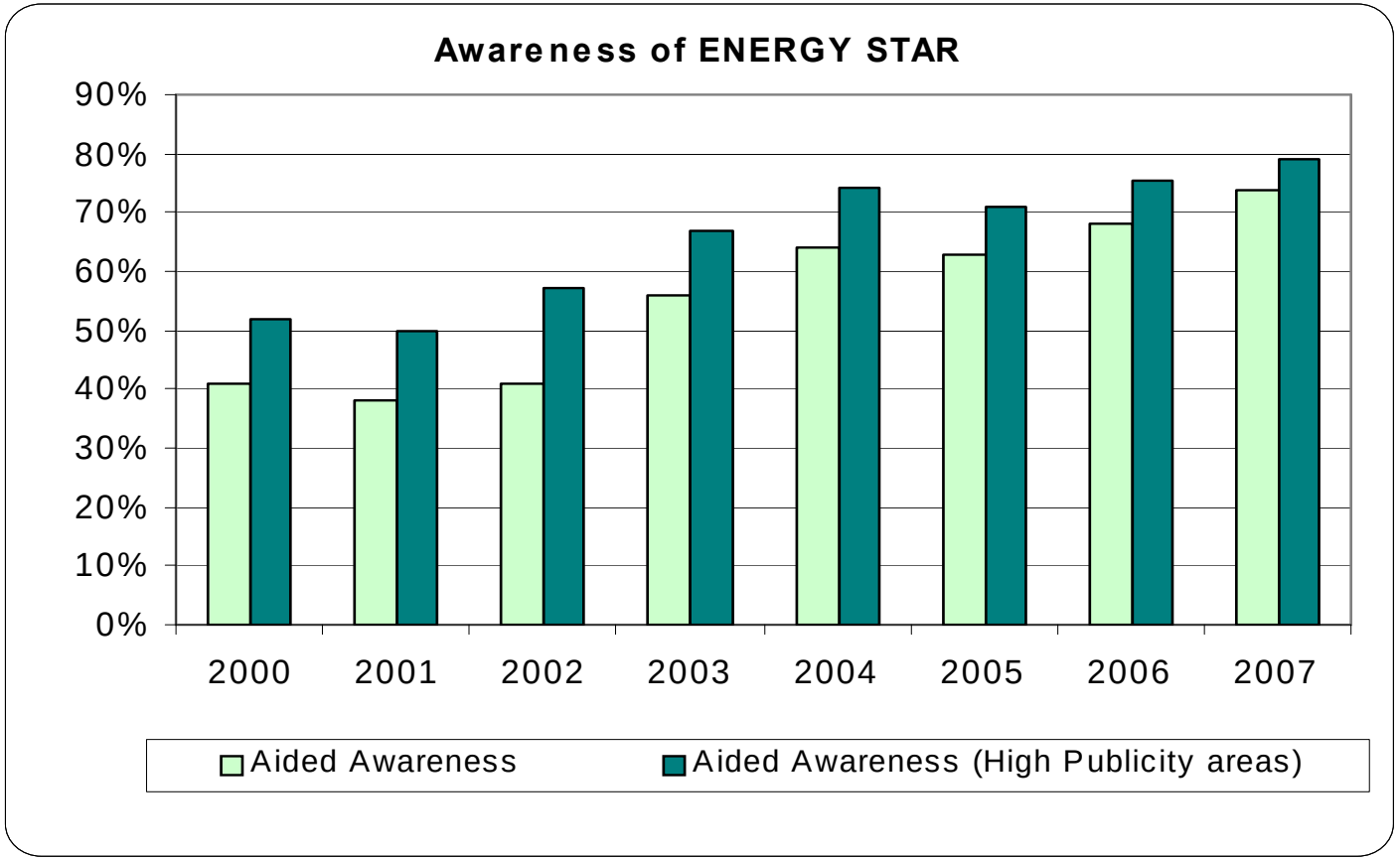
Purchased Products



More than 2.5 Billion ENERGY STAR qualified products purchased since 1992

EPA

Awareness of ENERGY STAR



Awareness is even greater--nearly 80%--in areas where there have been sustained promotions of ENERGY STAR by local energy efficiency program administrators. (CEE DRAFT findings)

Monitors Program

- As of August 2008, 45 partners have qualified 1,900* monitor models (worldwide distribution)
- Estimated market penetration of qualified monitors for 2007: 92%

Viewable Diagonal Screen Size (S)**	Number of Qualified Models
S ≤ 15 inches	97
15 < S ≤ 17	435
17 < S ≤ 19	690
19 < S≤ 21	219
21 < S≤ 23	327
23 < S ≤ 25	95
S > 25	37

*Actual number of qualified models could be higher, based on qualification of model families

**Avg. = 19.3”; Median = 19”

ENERGY STAR Monitors To-date

- Tier 1 Version 4.0 effective January 1, 2005
- Tier 2 Version 4.1 effective January 1, 2006
- Estimated program savings to-date from Version 4.1 monitor specification:
  - 20 billion kWh
  - 3.9 MMTC

Version 5.0 Timeline To-date

- 10/29/07 – Launched V5.0 development process; released discussion guide
- 11/27/07 – Web meeting to discuss V5.0 development
- 12/20/07 – Data request for non-qualified models
- 3/11/08 – Data request for qualified models at various luminance levels
- 7/24/08 – V5.0 displays specification distributed

EU Perspective

Paolo Bertoldi,
European Commission DG JRC

Jan Viegand,
Technical Consultant to EU

ENERGY STAR Agreement US - EU

- Agreement US Government – European Community on office equipment (2000, 2006)
- New and revised specifications developed together
  - US EPA and European Commission
- Both sides need to approve specifications before taking effect
- Product groups:
  - Computers
  - Monitors
  - Imaging Equipment
  - Servers

Close collaboration

- Input to specifications
- Commenting papers
- Attending meetings

The EU Approval Process

- European Commission approves new specification
- Member States consulted
  - MS technical experts group
  - ECESB – European Community Energy Star Board with all Member States and 3rd party stakeholders

Stringent Levels Required

- Target: 25 % compliance level
- Member States focus on levels

The Governments Buy ENERGY STAR

- ENERGY STAR regulation: EC and central governments should specify energy-efficiency requirements not less demanding than ENERGY STAR for larger contracts

- National procurement initiatives
  - Topten for 14 EU countries - www.topten.info
  - The Netherlands: Senter-Novem government procurement
  - Denmark: Danish Electricity Saving Trust Purchasing Guidelines www.savingtrust.dk
  - Other Member States

EU Registration and Database

- Registration is possible in EU for manufacturers on the EU market
- US registered products available for EU transferred to EU database
- Web site www.eu-energystar.org

Ecodesign of Energy Using Products

- Directive in place
- Implementing Measures under preparation
- For further information:
  http://ec.europa.eu/enterprise/eco_design/index_en.htm

Proposed Changes from Version 4.1 to Draft 1 Version 5.0 Specification

Christopher Kent, U.S. EPA

Key Changes from Version 4.1

- Change in category-name to ‘displays’
  - Scope broadened to include digital picture frames and professional signage
- Testing products at default, as-shipped luminance setting
  - Requiring ‘out-of-box’ testing
- On Mode requirements based on resolution *and* screen size
  - Accounts for over 70% of variance
  - Tier 2 requirements TBD, proposed effective date of October 21, 2011
- Displays working towards long-term convergence with TVs

Key Changes from Version 4.1 (Cont.)

- Testing at low and average ambient light levels to determine effects of automatic brightness control
- Tier 2 Sleep Mode requirement of 1 watt
  - Identical to Tier 2 Off Mode requirement
- Sleep Mode enabling harmonized with current computer specification
- External Power Supply (EPS) requirements for models bundled with them
  - EPSs will have to meet ENERGY STAR EPS specification in effect when Version 5.0 Displays specification takes effect

ITI Presentation

Ken Salaets, ITI

Information Technology Industry Council

Leading Policy for the Innovation Economy

ENERGY STAR® DISPLAYS

Comments on Draft 1

Ken J. Salaets

September 25, 2008

I T I

- The leading global IT companies
- The ITI “ENERGY STAR Working Group” turned 15 this year
- Active ESWG member companies: 19
- Global commitment = global engagement

Key Topics

- “Displays” v. Monitors
- Monitors: Limitations on Product Coverage
- Monitors: Impact on Features Horizon
- Testing: Luminance Levels
- Testing: On Mode Power Consumption
- Implementation Date

“Displays” v. Monitors

- One size does not fit all: the differences outweigh the similarities
- Merging of requirements necessitates compromises that could undermine the effectiveness of the specification
- Digital Picture Frames: Questionable whether the costs can be justified by the energy savings potential

Recommendation

- Distinct mode and testing requirements for each product group based on user cases
- Change labeling requirements for Monitors to allow flexible approaches a la the current Computer and Imaging specs
- Reconsider labeling requirements for Professional Signage and Picture Frames

Product Coverage

- Draft 1 formulas for “on” mode do not take into consideration the professional displays
- The data set used for establishing the draft 1 on-mode limits only contained one display with an IPS panel
- Professional displays use IPS (In Plane Switching) panels, which are the best overall LCD technology for image quality, color accuracy and wide viewing angles
- IPS panels require a higher level of backlighting than standard TN displays

Recommendation

Revised Definitions:

- Standard displays - displays that utilize LCD panels other than IPS
- Professional displays - displays that utilize IPS LCD panels

Recommendation

Display Category	Maximum On Mode Power Consumption
Standard displays < 30” viewable diagonal screen size and < 1.1 MP resolution	TBD
Standard displays < 30” viewable diagonal screen size and ≥ 1.1 MP resolution	TBD
Standard displays ≥ 30” viewable diagonal screen size	TBD
Professional displays < 30” viewable diagonal screen size and ≥ 1.1 MP resolution	TBD
Professional displays ≥ 30” viewable diagonal screen size	TBD

Impact on Features

- Future display models may contain features that consume extra power in off, sleep, and on modes
- In some cases, it may not be possible for the end user to turn off power to these features

Recommendation

- The ENERGY STAR test method should allow the extra features to be electrically disconnected by the test technician for purposes of testing
- Any special modifications to the test unit would be reported to ENERGY STAR on the product submittal form

Luminance Level

- Display brightness is the most customer noticeable feature
- Displays are typically set to higher brightness levels in retail showrooms since brighter displays often sell better
- Shipping displays with lower brightness settings will result in customer dissatisfaction, high returns, increased service calls, and potential damage to manufacturer AND ES brand

Recommendation

- Keep "default setting" at the Version 4.1 levels of 175 cd/m^2

On Mode Power Consumption

- A new 15 inch monitor category with resolution of 1366x768 (1.05 MP) is gaining traction in the marketplace
- The current test methodology does not reflect this development, many that these monitors are unlikely to qualify for ENERGY STAR
- The test criteria need to be modified to allow this monitors to be grouped with other 15" displays that have similar viewable screen areas.

Recommendation

- Increase category separation to 1.1 Megapixels (MP) resolution vs current draft of 1 MP.

Contact Info:

- 202-626-5752
- ksalaets@itic.org
- www.itic.org

15-minute Break

Overview of Data Analysis

Marla Sanchez,
Lawrence Berkeley National Lab

Overview of Topics

- ‘Displays’ Definition
- Overview of EPA’s Dataset
- Impact of Screen Size on Determining On Mode levels

‘Displays’ Definition

- The display of visual information is the product’s primary function.
- Under Tier 1, may have a tuner, but must be marketed as a display, not a television.
- Under Tier 2, only those products without tuners will be eligible.

‘Displays’ Definition: Primary Products

- Computer Monitors
- Digital Photo Frames
- Professional Signage

‘Displays’ Definition: Discussion

- Should minimum and maximum viewable diagonal screen sizes be included in the definition?
  - Range in current dataset is 7 to 84 inches.

- Is definition too broad, i.e., will allow products beyond computer monitors, digital photo frames and professional signage to qualify? Facilitates convergence but may need monitoring.

Overview of EPA's Dataset

- 149 unique models:
  - 109 LCD computer monitors
  - 8 CRT computer monitors
  - 9 digital photo frames
  - 23 professional displays

- Power consumption test data for luminance levels:
  - Minimum
  - Maximum
  - Factory default
  - Prescribed ENERGY STAR test procedure level

Impact of Screen Size on Determining On Mode Levels

- On Mode power consumption is most strongly correlated to:
  - Resolution for very small screen models like digital picture frames
  - Screen size and resolution for medium screen models like LCD monitors
  - Screen size for very large screen models like professional displays

Impact of Screen Size on Determining On Mode Levels (cont.)

n total=141	Resolution	Screen Area
Standard LCD Monitor (n=109)	0.85	0.77
Digital Frame (n=9)	0.75	0.37
Prof. Display (n=23)	0.28	0.93

Correlation to On Mode power for resolution and screen area variables

Impact of Screen Size on Determining On Mode Levels (cont.)

EPA conducted three separate regressions using the standard LCD monitor data (n=109) and found the following predictive equations:

- Screen area only:
  - On power (P) = 0.25 * (Screen Area, A) – 11
  - Fraction of explained variance = 0.60
- Resolution only:
  - Y = 39.9 * (Resolution, MP) – 25.2
  - Fraction of explained variance = 0.73
- SA and MP:
  - Y = 32.9 * MP + 0.057 * A – 25.2
  - Fraction of explained variance = 0.74

Impact of Screen Size on Determining On Mode Levels (cont.)

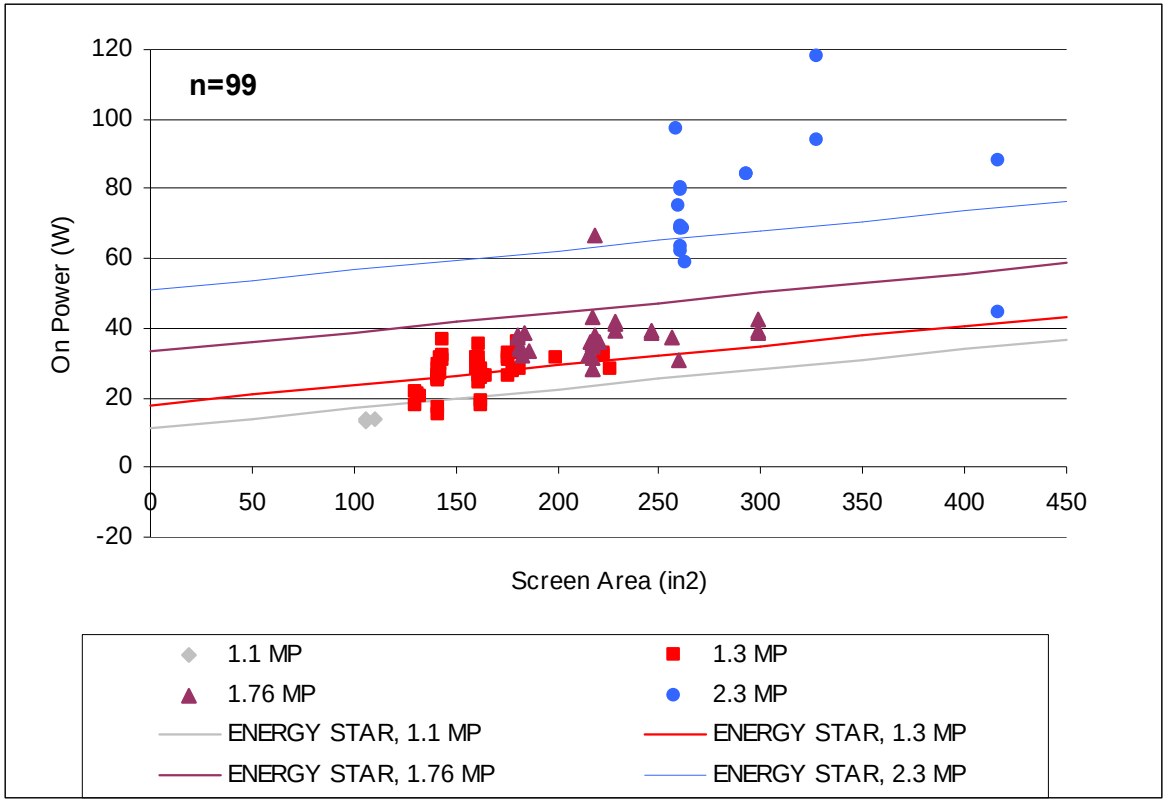
- From the predictive equations, which apply to the entire dataset, EPA developed coefficients for MP and A that generate a 28% on power only qualification rate across all models:

Display Category	Maximum On Mode Power Consumption
Less than 30" viewable diagonal screen size and less than 1 MP resolution	P = 6.5*(MP) + 0.06*(A) + 3
Less than 30" viewable diagonal screen size and greater than or equal to 1 MP resolution	P = 14*(MP) + 0.15*(A) – 19
Greater than or equal to 30" viewable diagonal screen size	P = 14*(MP) + 0.20*(A) - 44

Tier 1 On Mode Power Consumption Requirements for Displays

Impact of Screen Size on Determining On Mode Levels (cont.)

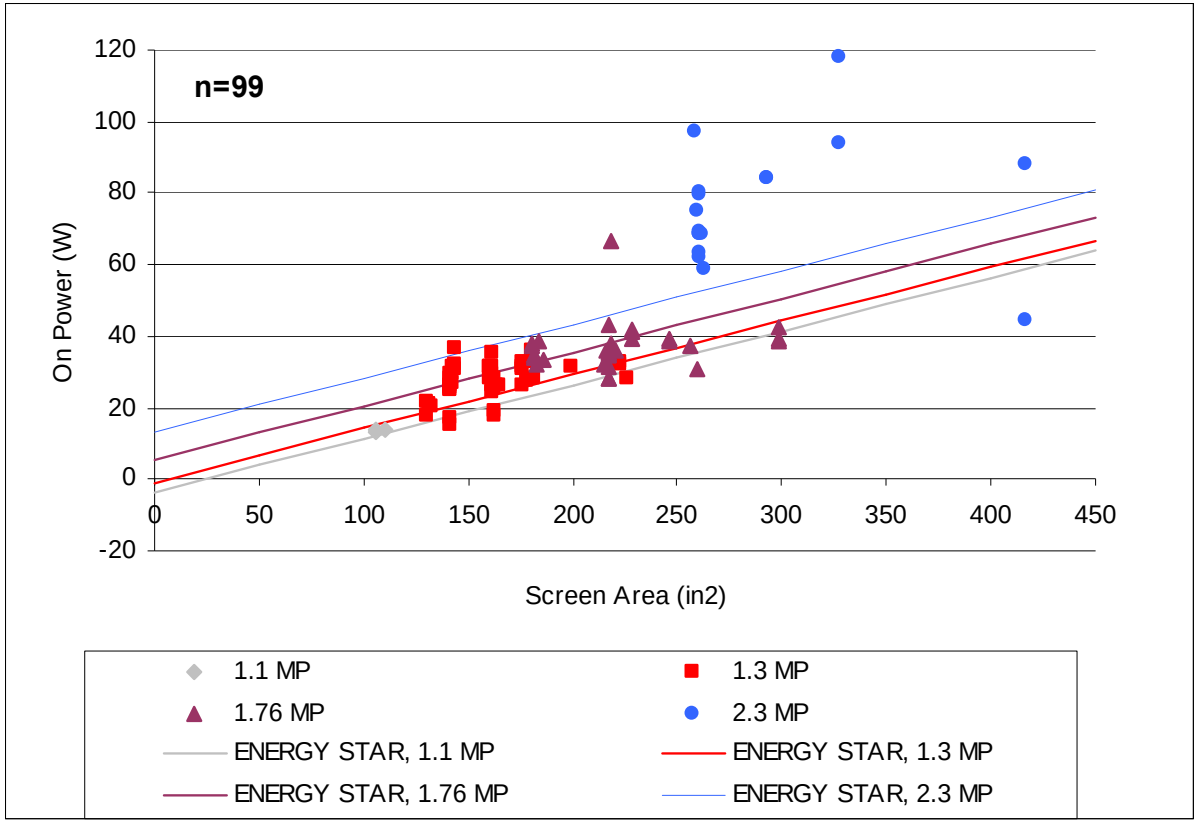
Y = 32.9*(MP) + 0.057*(SA) – 25.2 (<30” and ≥1 MP)



Applying the predictive equation resulting from the regression analysis to units of <30” and ≥1 MP (meant to encompass most standard monitors).

Impact of Screen Size on Determining On Mode Levels (cont.)

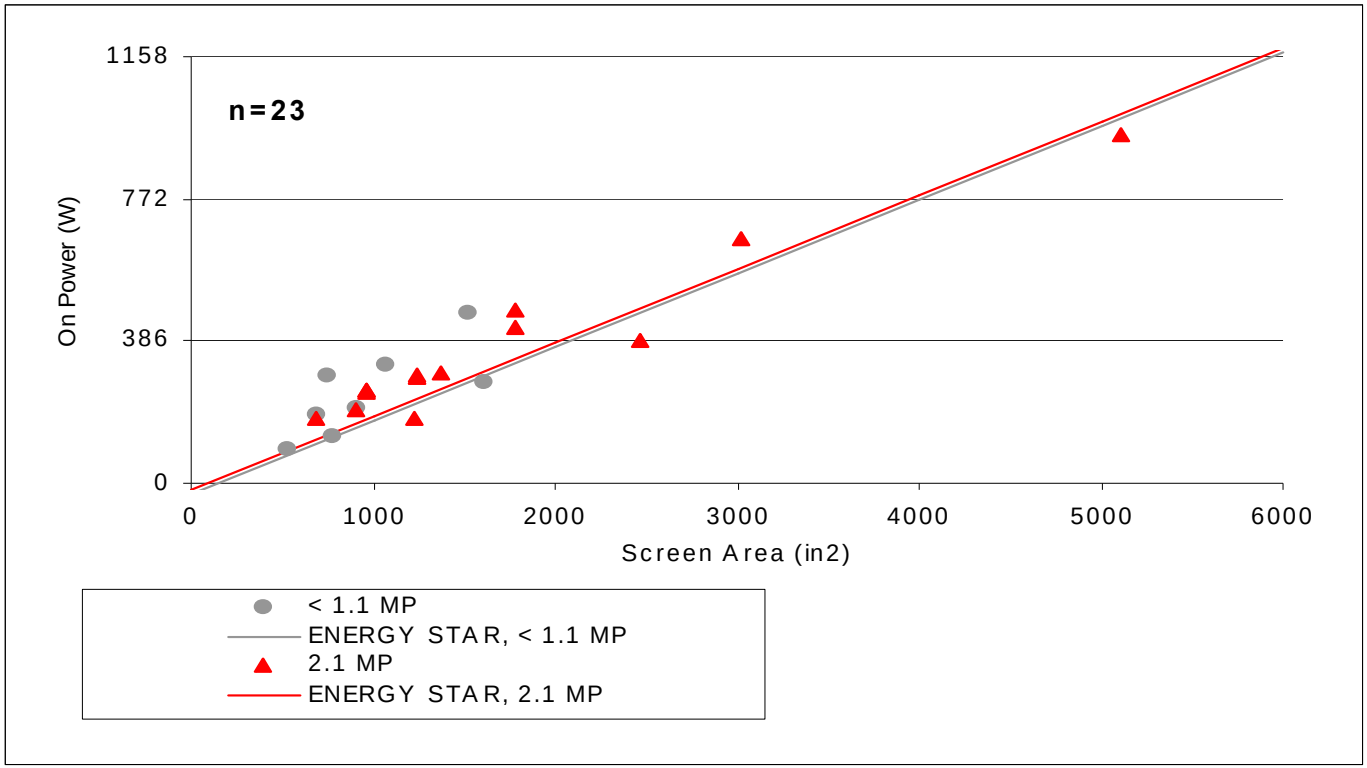
P = 14*(MP) + 0.15*(A) – 19 (<30” and ≥1 MP)



Applying the ENERGY STAR Draft 1 equation to units of < 30” and ≥1 MP (meant to encompass most standard monitors).

Impact of Screen Size on Determining On Mode Levels (cont.)

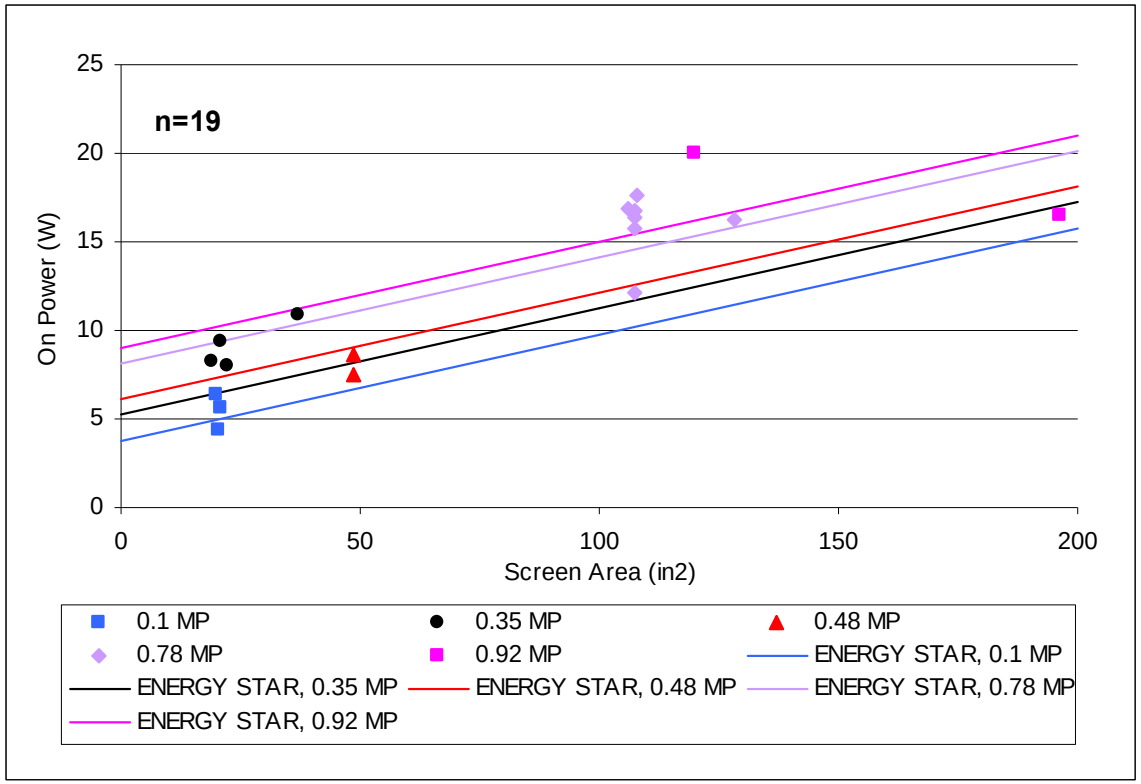
P = 14*(MP) + 0.20*(A) - 44 (≥30”)



Applying the ENERGY STAR Draft 1 equation to units of ≥30” (meant to encompass professional displays).

Impact of Screen Size on Determining On Mode Levels (cont.)

Y = 6.5 * MP + 0.06 * SA + 3 (<30” and <1 MP)



Applying the ENERGY STAR Draft 1 equation to units of <30” and <1 MP (meant to encompass digital picture frames and smaller computer monitors).

Lunch

60-minutes

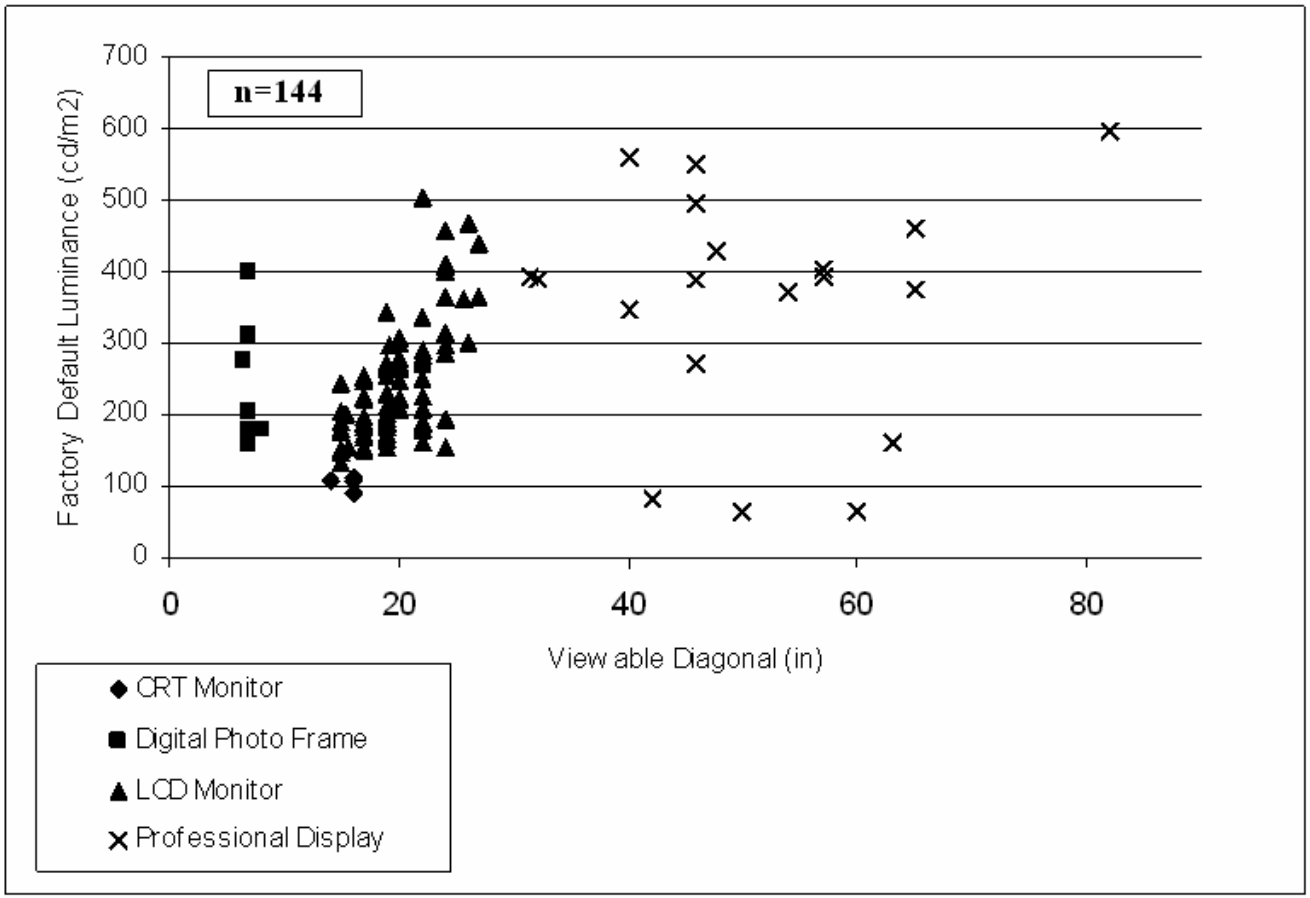
Luminance Discussion

Marla Sanchez,
Lawrence Berkeley National Lab

Prescribed vs. Default Luminance Settings

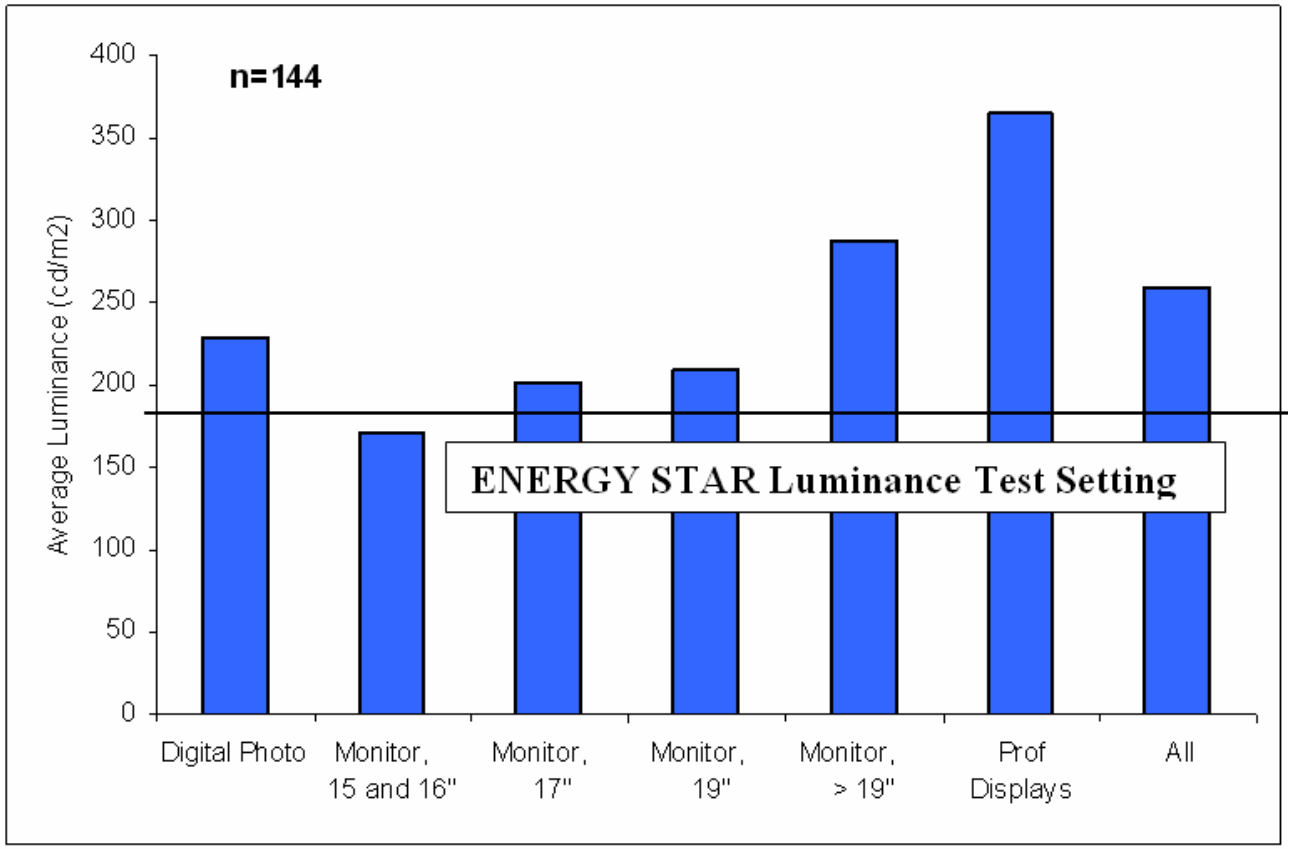
- 134 LCD models had power consumption values submitted at both factory default and ENERGY STAR luminance levels.
- **On average, as-shipped luminance was higher than the test procedure requirement.**
- To be consistent with the revised television specification and to be more representative of power consumption as experienced at the user level, EPA has proposed to amend the luminance setting in the test procedure to factory default.

Prescribed vs. Default Luminance Settings (cont.)



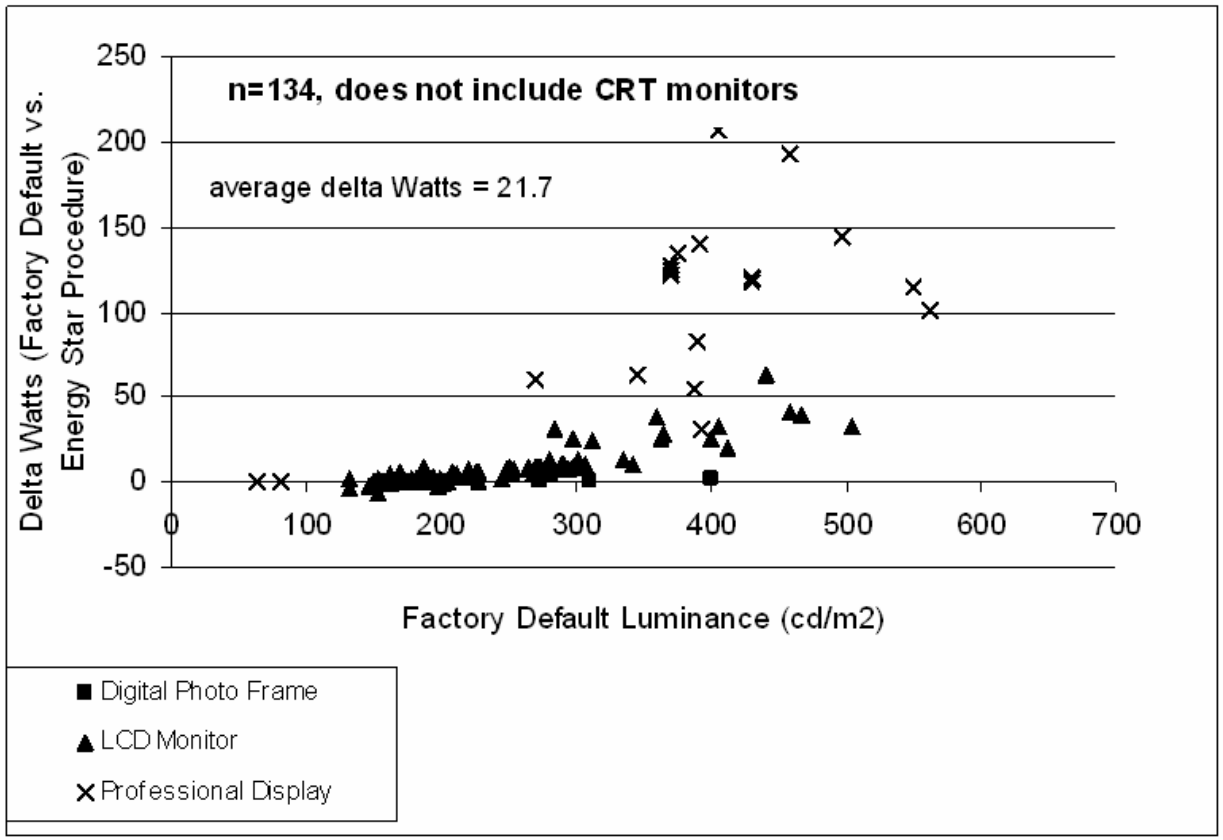
Default luminance settings in EPA dataset.
ENERGY STAR test procedure is typically 175 cd/m^2 for LCDs

Prescribed vs. Default Luminance Settings (cont.)



Average default luminance settings by screen size

Prescribed vs. Default Luminance Settings (cont.)



Delta On Mode power at factory default luminance settings

Prescribed vs. Default Luminance Settings (cont.)

- Average Factory Default Luminance = 262 cd/m^2 (n = 136)

- If the ENERGY STAR Display testing procedure were to mandate a luminance setting, it would have to be higher than the current 175 cd/m^2 in order to make up for the difference between it and the average factory default luminance.

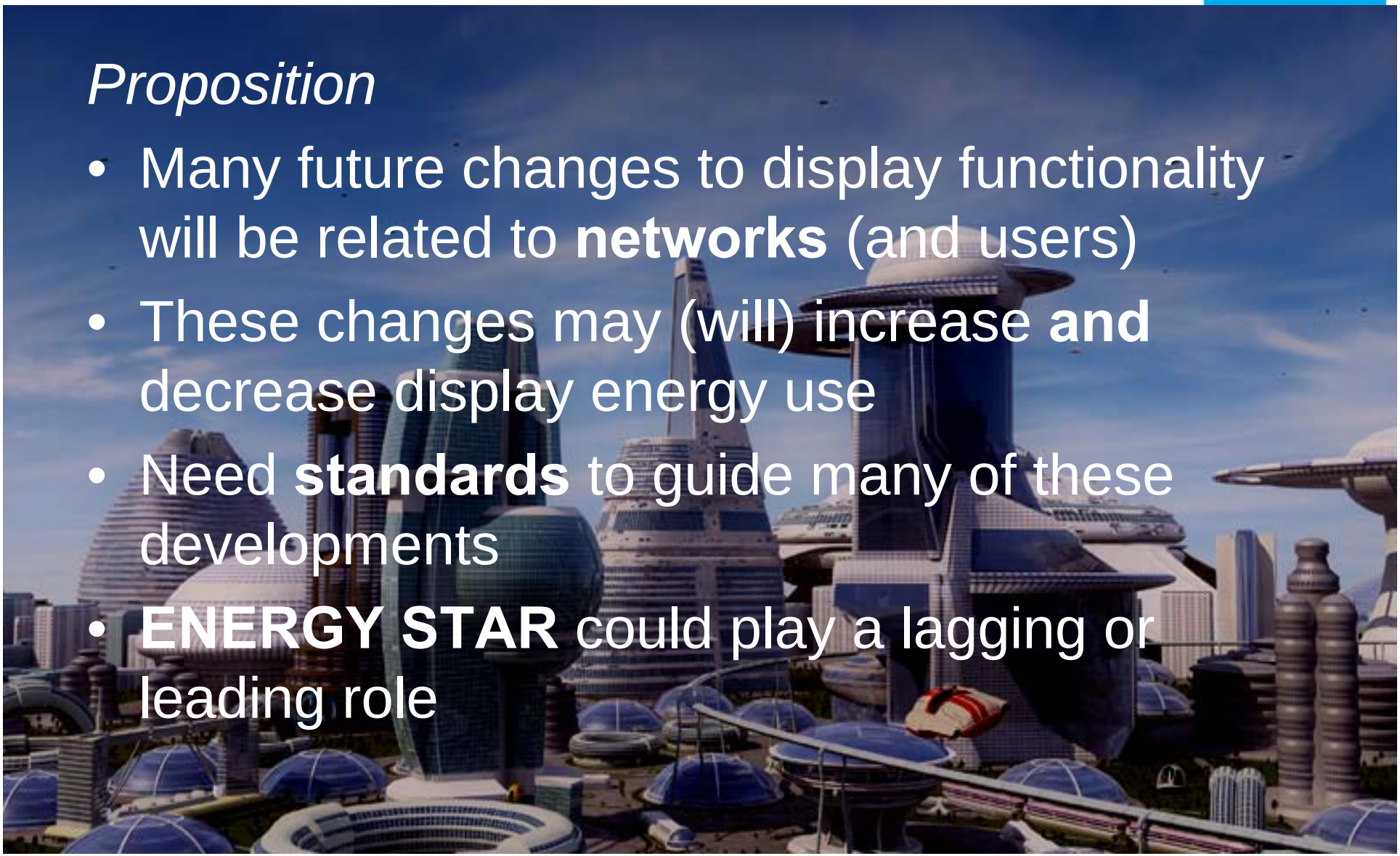
- Difference between as-used and as-shipped, possible sources of data? With/without ambient light sensing split?

Discussion of Key Tier 2 Opportunities

Marla Sanchez and Bruce Nordman,
Lawrence Berkeley National Lab

Katharine Kaplan, U.S. EPA

Future Networking of Displays



Proposition

- Many future changes to display functionality will be related to **networks** (and users)
- These changes may (will) increase **and** decrease display energy use
- Need **standards** to guide many of these developments
- **ENERGY STAR** could play a lagging or leading role

Displays today

- Connected to a single source device
  - With a data, not network link
- Source only determinant of power state
  - (aside from power switch)
- No user input capability
- No environmental sensors

This simplifies

- Test procedures
- Specifications
- Product design
- Use

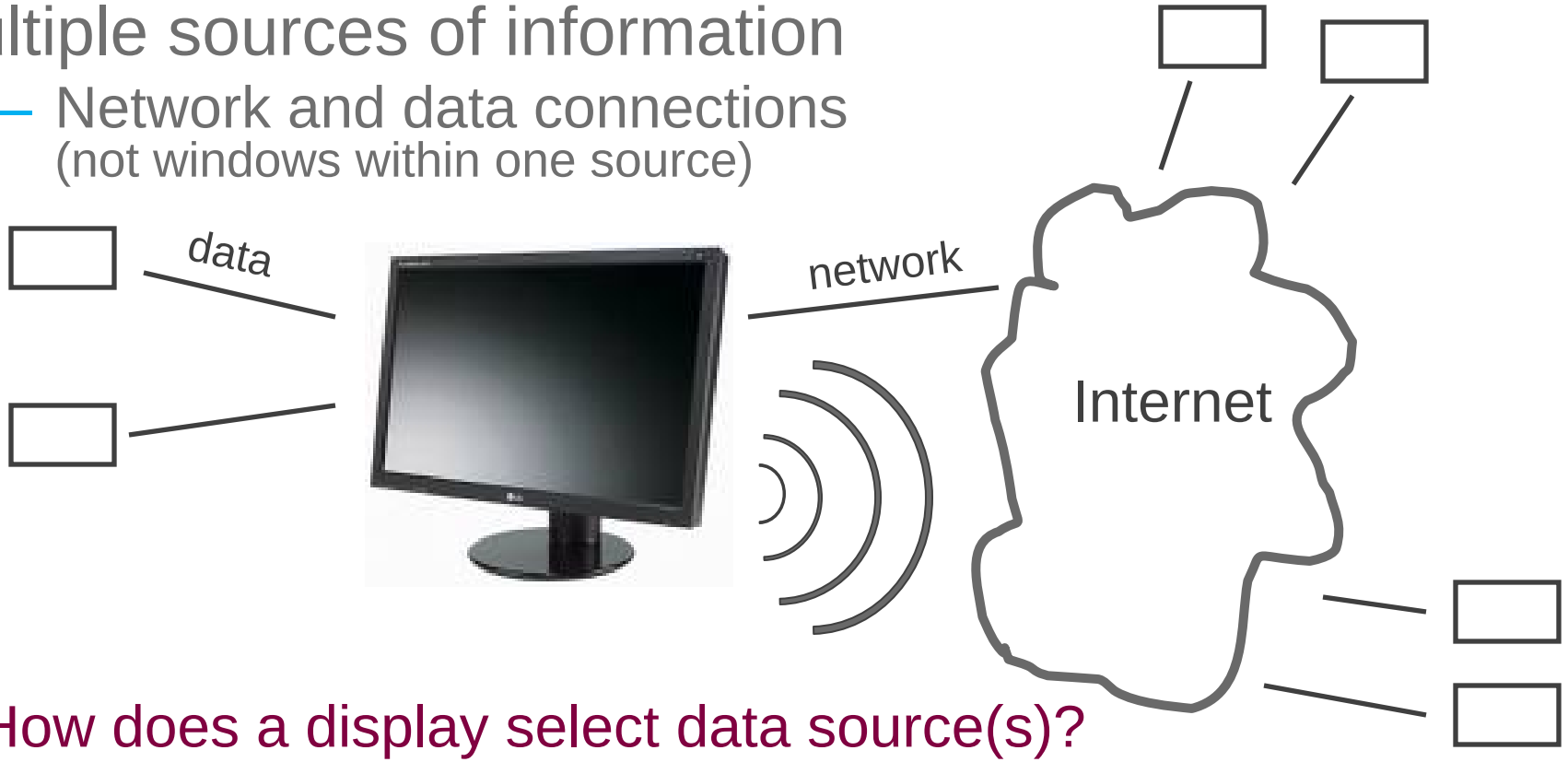
Future - Usage models

- Convergence of TVs and other display
  - Continuum from phones to monitors to large screen TVs
- Content available from many sources
  - Multiple PCs and Set-top Boxes (of various sorts)
  - Webcams in homes or offices (or anywhere)
  - User interfaces for other devices
    - Appliances, utility meter, etc.
  - User interfaces for building controls / elements
    - Lights, HVAC, security system, etc.
  - Multiple sources (windows) per display
    - Multiple displays per display
- Adding User Interface capability

Future - Sources

Multiple sources of information

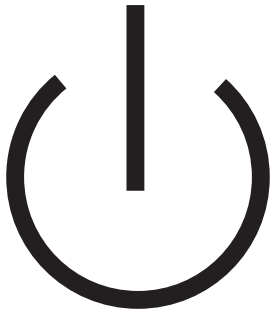
- Network and data connections
  (not windows within one source)



- How does a display select data source(s)?
- When should it “listen” (or not) to a source?
- What are power requirements for sources in different states?

Future - Power State

Power State: On, Sleep, Off
(Sleep has network connectivity)



Many determinants of display power state

- Multiple data sources
- Context within a source
- Environmental sensors
  - Ambient light, ambient sound, …
- Occupancy sensors
- User interfaces
  - Touch, cameras, remotes, ….

- How to test shifting between power states?
- How to measure power for particular states?
- What are the implications for usage patterns (TEC)?

Future - Inputs and Sensors

Possible User Interfaces

- Touch
- Remotes
- Keyboards / Mice
- Audio / Speech
- Cameras / Gestures

Possible Sensors

- Ambient light
- Ambient sound
- Occupancy (direct and inferred)

Future - Inputs and Sensors

- How does the user know what inputs / sensors exist?
  - Symbols
- What inputs / sensors are active during sleep?
  - Indicators
- What (display or other) does an input or sensor wake up?
- What (display or other) do sensors influence?
- What are power requirements for inputs / sensors?
  - How active could / should they be?
  - How to test?

Impacts on ENERGY STAR

Test Procedures

- Data / network context for testing
- Functions to enable / disable / exercise
- Key functions for particular power states
- What to report

Specifications

- Features to reward with additional power
- Features to
  - encourage / discourage
  - require / prohibit

EPA

Standards needs

User expectations / User interface

- Dynamic operation
- Symbols / terms / colors
  - Power state, sources, inputs/sensors

Data / network interfaces

- Mediation of power control
- Role of user inputs / sensors

What venues to address these?
How does ENERGY STAR engage?

Ideal Result

Use ENERGY STAR to help:

- Develop and bring into market new energy-saving features
- Discourage or reduce consumption of energy-intensive features
- Create a universal set of user expectations for how to use displays
  - Enhances user experience
  - Saves energy

EPA

Other Environmental Impacts: Fluorinated GHGs

Katharine Kaplan, U.S. EPA

GHG Emissions Reductions Manufacture of LCDs

- Fluorinated compounds with high global warming potential are emitted from the manufacture of electronics
- In 2006, the equivalent of 5 MMTC was emitted from the manufacture of LCDs worldwide*
- 90% of these emissions can be abated using emission control technology

***This number is based on emissions factors from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and a worldwide production volume of nearly 90 million square meters of TFT-side for production of LCD Panels in 2006. It does not account for any current measures to mitigate these emissions.**

Opportunity for ENERGY STAR

- Reduction potential is on par with emissions reductions associated with spec revision
  - Version 5.0 will save an additional 82 lbs CO_2 over 4 years of use
  - Reducing the emissions associated with fluorinated compounds used in the manufacture of a unit can result in comparable savings of 68 lbs CO_2

Path Forward

- Require control of emissions from manufacture of LCDs used in ENERGY STAR Displays
- Require 90% destruction or removal efficiency of GHG emissions associated with fluorinated compounds
- Require appropriate documentation to verify reductions

10-minute Break

Wrap-up

Christopher Kent, U.S. EPA

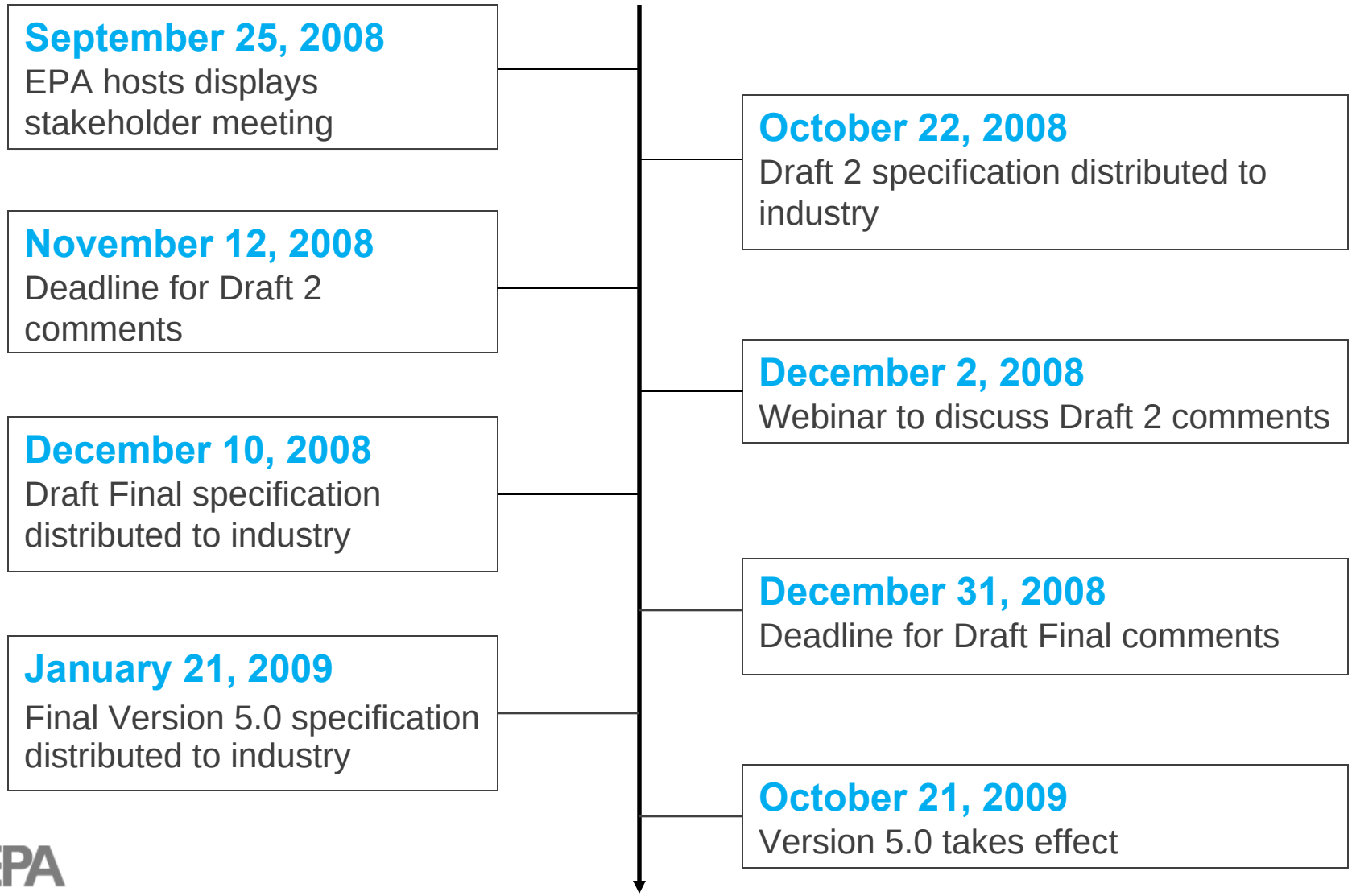
Next Steps & Discussion Summary (1)

- EPA will revise labeling requirements to include electronic labeling
- ITI to provide comments on luminance
- EPA will examine default luminance setting or percentage of maximum luminance as test condition (may require collection of additional data)
- EPA will investigate implementation of user input settings (a la TVs)

Next Steps & Discussion Summary (2)

- EPA will investigate impact of design cycle (2-3 yrs) on effective date of Tier 2
- Industry to provide data on IPS
- Industry to provide data on upcoming features/functions that may affect power consumption
- Industry to provided feedback on Key Tier 2 opportunities

Proposed Timeline for Version 5.0 Specification Completion



Outstanding questions?

Contact Information

Christopher Kent
ENERGY STAR Program
202-343-9046
kent.christopher@epa.gov

Marla Sanchez
Lawrence Berkeley National Laboratory
412-653-2949
mcsanchez@lbl.gov

Josh Forgotson
ICF International
202-862-2955
jforgotson@icfi.com

Darcy Martinez
ICF International
202-862-1234
dmartinez@icfi.com

Thank you

EPA

Learn more at **energystar.gov**