

**Draft 2 Version 7.0 ENERGY STAR Displays Specification Stakeholder Comment Summary and Response**

Topic	Subtopic	Stakeholders Comment Summary	U.S. Environmental Protection Agency Response
Definitions	Product Type	<p>One stakeholder expressed support for the Draft 2 proposal to define a Signage Display as having a diagonal screen size greater than 30 inches and pixel density less than or equal to 5,000 pixels per square inch but suggested that the maximum reported luminance criterion be lowered to 250 rather than 400 cd/m<sup>2</sup>. The stakeholder noted that some signage displays are designed for indoor applications where the maximum luminance is 250 cd/m<sup>2</sup>.</p> <p>Another stakeholder commented that many computer monitors have luminance above 400 cd/m<sup>2</sup> so that only pixel density and area criteria are relevant to defining a Signage Display. The same stakeholder also noted that the proposed ENERGY STAR definition is not harmonized with the definition that is likely to be used in the EU Ecodesign Regulation for displays.</p>	<p>EPA thanks the stakeholders for this feedback. EPA has chosen to retain the proposed definition for Signage Displays presented in Draft 2, where signage products can be defined as having a maximum reported luminance greater than 400 cd/m<sup>2</sup>. Since many computer monitors have a maximum reported luminance greater than 250 cd/m<sup>2</sup>, lowering the maximum reported luminance would not provide a robust enough differentiator between products. EPA understands that many signage products are also intended for outdoor use, where the maximum reported luminance would need to be higher than it is for indoor use. However, to help differentiate those signage products with a lower maximum reported luminance from computer monitors, EPA proposes including "ships without a mounting stand" to further distinguish the two types of products.</p>
Definitions	Enhanced Performance Display	<p>One stakeholder commented that "other entities, utilize and refer to ENERGY STAR program requirements for definitions of products" and thus recommended that EPA clearly define enhanced performance displays in the Definitions section of the specification rather than including the criteria for receiving the enhanced performance display allowance in the Certification Criteria sections of the specification. The stakeholder also suggested EPA retain the Version 6.0 definition of enhanced performance displays.</p>	<p>EPA proposes to retain its approach from previous drafts, where the specification provides a set of allowances for monitors containing a combination of criteria based on contrast ratio, viewing angle, resolution and color gamut. EPA proposes not to create a separate definition for monitors at this time because features that create 'enhanced performance' functionality can evolve. For example, with this specification revision, EPA has seen further differentiation among enhanced performance displays based on color gamut, indicating that increased performance and functionality are not static. In order to maintain flexibility in the future, where the criteria for enhanced performance displays may further evolve, EPA prefers to address and account for enhanced performance displays by describing the set of features that must be present in order for such products to be eligible for a power allowance. In addition, EPA considers that other stakeholder groups are still able to harmonize their own definition for enhanced performance displays with EPA's designated set of criteria for enhanced performance functionality as described in Section 3.3.4 of the draft specification.</p>
Definitions	Automatic Brightness Control	<p>One stakeholder commented that the definition of Automatic Brightness Control suggests it functions without user intervention (i.e. does not need to be enabled) and thus suggested that the wording be changed to:  "Automatic Brightness Control (ABC): The self-acting mechanism that, when enabled, controls the brightness of a Display as a function of Ambient Light Conditions".</p>	<p>To maintain the simplicity of the definition, EPA proposes adding a note that the ABC functionality must be enabled to control the brightness of a Display.</p>

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Definitions	Native Vertical Resolution	One stakeholder suggested a revised definition of Native Vertical Resolution to clarify the visibility of the pixels: “Native Vertical Resolution: The number of physical lines along the vertical axis of the Display within the visible area of the Display that produces images”.	In this case to maintain the simplicity of the definition, EPA proposes adding a note that the physical lines must be visible and not hidden under a bezel.
Scope	Professional Signage Screen Brightness	One industry organization suggested EPA limit the scope of Signage Displays to those intended for indoor operation by excluding displays with maximum luminance above 950 candelas per square meter.	EPA proposes not to exclude displays with maximum luminance above 950 candelas per square meter at this time. EPA will continue to monitor the market and determine the appropriateness of maintaining a scope that includes all potential brightness levels once more data becomes available.
Automatic Brightness Control		One stakeholder reiterated that there are many unknowns with regard to the operation of Automatic Brightness Control with considerable variation among manufacturers and the implementation of software. Therefore the stakeholder suggested harmonizing ABC testing with the TV test method where possible and collected data from industry on ABC control curves at typical ambient light conditions. The stakeholder additionally noted that many monitors in the EPA dataset do not appear to need the ABC allowance to reach the 25 percent qualification threshold. To better ensure actual energy savings, the stakeholder therefore suggested that the incentive require best-practice ABC implementation based on efficient control curves that complement the ability of the human eye to resolve bright and dark sections of a display screen.	EPA has maintained the Draft 2 Automatic Brightness Control (ABC) approach given the lack of data on how ABC is used by consumers. The 5% ABC allowance for computer monitors is relatively conservative compared to the On Mode Power calculation savings offered under the ENERGY STAR TV specification. EPA notes that TVs are likely to operate under more widely varying illuminance than computer monitors and thus it is more appropriate to place a greater emphasis on this functionality in the TV specification.

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Total Energy Consumption	Duty Cycle	<p>One industry group asked for clarification of how EPA arrived at the Total Energy Consumption duty cycle weighting of 35% of time spent in On Mode and 65% of time spent in Sleep Mode. The group suggested EPA determine appropriate factors for differing groups of monitors under consideration because as proposed the formula in some cases will not yield realistic results.</p> <p>A separate stakeholder suggested Off Mode be included in the Total Energy Consumption cycle in addition to Sleep and On Modes.</p>	<p>Given that the majority of computer monitors operate with a host computer, EPA has adopted the Version 6.1 ENERGY STAR computers specification Total Energy Consumption duty cycle weighting of 35% of time spent in On Mode and 65% of time spent in Sleep Mode for conventional Desktops, Thin Clients, and Integrated Desktop Computers. This duty cycle was originally derived from an industry study capturing millions of computers conducted within the past decade. A more recent December 2014 study published by Lawrence Berkeley National Laboratory confirms that Desktop computers are in active/active-idle mode for 7.3 hours a day which is roughly 30% of the time. Previous studies estimated a range of 4.5 to 11.2 hours a day. For consistency EPA has harmonized with the ENERGY STAR computers specification duty cycle. Additionally, EPA notes that the duty cycle is intended to represent an average use profile whereby product energy consumption can be compared side-by-side for the purposes of ENERGY STAR certification.</p> <p>Source: Desroches et al. December 2014. Computer usage and national energy consumption: Results from a field-metering study, Lawrence Berkeley National Laboratory  <a href="http://eetd.lbl.gov/sites/all/files/computers_lbnl_report_v4.pdf">http://eetd.lbl.gov/sites/all/files/computers_lbnl_report_v4.pdf</a></p> <p>EPA thanks the stakeholder for the suggestion to include Off Mode in the Total Energy Consumption duty cycle. EPA does not have clear data on how often users manually turn off their computer monitor. Furthermore, the dataset indicates a minimal average power difference of 0.1 W between Sleep and Off Mode for those monitors that have an Off Mode function. Therefore EPA is retaining a separate power limit for Off Mode rather than integrating it into the Total Energy Consumption duty cycle.</p>
Total Energy Consumption Requirements	Resolution Allowance	<p>One stakeholder recommended EPA set the Total Energy Consumption resolution allowance at 12.264 kilowatt-hours per megapixel (equivalent to 4 W per megapixel in On Mode). Lowering the allowance from 6 W per megapixel in Version 6.0 to the proposed 2 watts per megapixel in Version 7.0 (Total Energy Consumption equivalent of 6.13 kilowatt hours per megapixel) is too drastic and cannot sufficiently capture models at 4K resolution.</p>	<p>EPA has maintained the 6.13 kilowatt hours per megapixel resolution allowance noting that it sufficiently captures models across a wide range of resolutions up to 4K/Ultra High Definition. Energy efficient technology employed in today's UHD models allows a reasonable proportion of high performance models to meet the proposed Version 7.0 Total Energy Consumption requirements. The data do not support an increased resolution allowance equivalent to 4 W per megapixel in On Mode power as subtraction of this allowance from measured On Mode power values results in negative values for several more efficient models.</p>

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Total Energy Consumption Requirements	Pass Rate	<p>One industry group commented that as currently proposed in Draft 2, the Total Energy Consumption requirements for computer monitors would result in significantly less than 25% of products qualifying for ENERGY STAR and therefore recommended further review to ensure that it does not excessively restrict products from qualifying for ENERGY STAR. Conversely, another stakeholder commented that they would not be supportive of less stringent Total Energy Consumption monitor requirement as the Draft 2 proposed levels allow an appropriate amount of models to be eligible for ENERGY STAR certification.</p>	<p>Over 20% of computer monitor models in the current Version 6.0 ENERGY STAR dataset meet the proposed Draft 2 Version 7.0 Total Energy Consumption requirements. EPA also analyzed separate data submitted by industry in response to Draft 2, which show over 23% of models can meet the proposed criteria. EPA expects technology to continue to improve by the time Version 7.0 takes effect so that the top quarter of energy efficient computer monitors on the market are recognized.</p>
Enhanced Performance Displays	Criteria	<p>One stakeholder commented that there are technologies that may meet and exceed by far the contrast ratio and color gamut, but do not meet the total native resolution requirement of greater than or equal to 2.3 megapixels. The group argued that these technologies still need more energy and would benefit from the enhanced performance allowances.</p> <p>Another commented that high brightness and color gamut conformity across a display is a clear indication of a display being of enhanced performance and requested that the following two additional technical features be added to the Enhanced Performance Display (EPD) definition to ensure that only displays offering truly enhanced performance are able to take advantage of the extra allowances:</p> <ul style="list-style-type: none"> <li>- a brightness and color uniformity of &gt;90% across the image;</li> <li>- color and brightness stability at the delivered specified performance across the specific working temperature range and nominal working life.</li> </ul> <p>This stakeholder also suggested that additional models may be able to meet EPD criteria even if not indicated as such in EPA's dataset. Additional effort should therefore be spent on identifying these models rather than increasing the allowance to ensure sufficient selection.</p>	<p>EPA found only one example of a &lt;2.3 MP monitor meeting EPD color and viewing angle criteria in its and stakeholders' datasets. EPA therefore concludes that all three criteria together serve as reasonably useful differentiators.</p> <p>EPA will also include optional reporting of color uniformity to assess if this criterion can serve to further distinguish EPDs in a future version of the specification.</p>

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Full Network Connectivity	Allowance	<p>One stakeholder recommended that EPA adopt the ENERGY STAR Version 7.0 Televisions specification 3.0 watt allowance due to "the commonality of network connection circuitry used for Signage Displays and televisions." The stakeholder also noted that the ENERGY STAR displays test method specifies connection preference with Wi-Fi as the highest priority and that this distinction is important because Wi-Fi active connections generally require more power from the display circuitry than other types of connections.</p> <p>Another stakeholder expressed support for a relaxed requirement for Signage Displays Sleep Mode Full Network Connectivity since while 1 W may be technically feasible many manufacturers have been designing products to meet higher allowances in the ENERGY STAR specification for televisions and the EU Ecodesign Regulation on Networked Standby. The stakeholder therefore suggested that EPA consider a more stringent, Tier II, requirement to take effect at a later date.</p>	<p>Based on information from multiple stakeholders, EPA understands that Signage Displays and Televisions are built with the same, or similar, network connection circuitry. As such, EPA proposes a 3 watt allowance for Signage Displays to harmonize with the power allowance for network connectivity in a TV's Standby-active low mode under the Televisions Version 7.0 specification. However, as EPA signaled to stakeholders under the Version 7.0 revision to the Televisions specification, EPA also anticipates that Signage Displays will continue to reduce their power consumption in network connected low power states. As such, EPA anticipates further reducing this allowance in future revisions to the specification.</p> <p>At this time, EPA proposes to retain the Draft 2 TEC allowance for Full Network Connectivity for computer monitors, which similarly to other IT devices, have demonstrated the ability to implement network connectivity in low power states more efficiently than TVs.</p>
Curved Monitors	Viewing Angle Requirement	<p>One stakeholder commented about the challenges of measuring contrast ratio of curved monitors with a smaller radius of curvature. Therefore the stakeholder proposed that the enhanced performance allowance requirement for contrast be at an 80° viewing angle rather than 85°.</p>	<p>Based on stakeholder feedback on the limits of measuring equipment, EPA is proposing to have curved displays measure contrast ratio at 83 degrees for the enhanced performance display criteria.</p>
Curved Monitors	Additional Enhanced Performance Allowance	<p>One stakeholder requested the following additional allowances for curved monitors because the transmittance decreases about 30% from normal flat display:</p> <ul style="list-style-type: none"> <li>- For ≥99% sRGB: 0.50 x ETEC_MAX</li> <li>- For ≥96% Adobe RGB: 0.90 x ETEC_MAX</li> <li>- Normal model without wide color gamut : 0.25 x ETEC_MAX</li> </ul>	<p>EPA does not have significant data isolating the effect of a curved configuration on power demand and has therefore not proposed an additional allowance in the Final Draft. EPA will watch the energy use of curved displays and is able to amend this specification in the future, if warranted. As new data becomes available once this specification is in effect, EPA encourages manufacturers to submit data particularly for models that are not certified to ENERGY STAR.</p>

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Touch Allowance		One stakeholder commented that a display with touch technology takes more power due to touch-enabled circuits and design. Another stakeholder requested EPA provide evidence to support a touch technology allowance if proposed under Version 7.	<p>While the data indicate a lower pass rate for computer monitor models with touch functionality, one stakeholder has indicated that extra power is required even when the monitor is asleep and there is no USB data connection to the host computer, indicating that the power requirement is for the USB communication rather than touch. Since the test method does not require connecting the USB, nor does it test the touch functionality, such functionality should remain disabled and not consume additional power.</p> <p>Since the release of Draft 2, EPA has received new data on touch functionality indicating that optical touch technology used in larger displays requires more power than capacitive technology used in computer monitors, and that this touch technology is enabled in Sleep Mode for certain models. Given this usage case and the opportunity to encourage models to spend more time in Sleep Mode while not in use and to be woken up effectively by users, EPA is proposing a 1.5 W allowance in Sleep Mode for signage displays.</p>
Signage Displays	Automatic Brightness Control	One stakeholder recommended "retaining the ENERGY STAR Displays V6 ABC power allowance of 10% of the maximum On Mode power requirement as it should provide a greater incentive for manufacturers to implement an Automatic Brightness Control which will save energy."	EPA agrees and has maintained the 5% ABC allowance for Signage Displays.
Timeline		One stakeholder requested additional time to factor in new features and technologies, such as new versions of DisplayPort or USB.	Although new features are always emerging, EPA proposes to finalize the Version 7.0 based on data on existing models, but is open to reopening the specification if necessary in the future.