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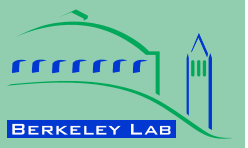

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International Comparison of Energy Efficiency Criteria and Test Procedures in Standards and Labeling Programs for Computer Monitors and Commercial Gas Stoves

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Executive Summary

This report presents a technical review and comparative analysis of existing and/or proposed international mandatory energy performance standards, and voluntary and mandatory energy efficiency labels and test procedures for two products – computer monitors and commercial gas stoves – being considered for revised and new minimum energy performance standards (MEPS) in China. An overview of the scope of international programs, energy efficiency and other energy-related requirements, description and detailed summary table of criteria and procedures in major test standards are presented. In addition, an estimation of potential energy savings if China were to adopt revised MEPS comparable to international levels is provided for computer monitors. A proposed methodology for estimating potential energy savings based on the European Union experience is provided for commercial gas stoves in the absence of available sales or energy consumption data.

Computer monitors labeling programs exist in the U.S. and Canada, Hong Kong and Korea and mandatory standards and categorical labeling programs have been proposed for Australia and the European Union (EU). The scope of standards and labeling (S&L) programs for monitors have been expanding over time, ranging from a narrow scope of only monitors in older voluntary labeling programs to a broader scope that includes other display products such as commercial signs and digital photo frames with similar features and performances in the newest proposed S&L programs. However, large digital displays, medical equipment displays and personal electronics and displays are excluded in all programs. In terms of efficiency metrics, all programs except Korea's e-standby label have power requirements for on-mode as well as standby- and off-modes. For on-mode power requirements, most programs calculate the maximum allowable power consumption in watts as a function of viewable screen area and resolution. The U.S. ENERGY STAR program uses different formulas for setting on-mode power requirements based on the display sizes and whether the monitor features automatic brightness control. Specifically, the recent ENERGY STAR v6.0 revision has expanded the size categories from two to five and introduced power allowances for enhanced performance and automatic brightness control. The EU Ecodesign proposal uses an energy efficiency index with a tiered approach of increasing stringency to account for expected rise in LED applications in backlit displays, and does not include additional allowances for new functionalities. Standby and off-mode power consumption limits are becoming more stringent over time as shown in proposed program requirements, decreasing from 2W standby and 1W off-mode to 0.5W for standby (and off-mode in the U.S.) and 0.3W for the most stringent off-mode requirement in the EU. Computer monitors' status as globally traded products has fostered international harmonization in the test procedures with most programs adopting the IEC test standard and/or

ENERGY STAR test standard for on-mode power measurements and all programs adopting IEC 62301 for standby power measurements.

Based on this international review, regular updates of S&L programs are needed to keep pace with computer monitor's rapid rate of technological development as evidenced by the major revisions undertaken for ENERGY STAR in just over four years and the introduction of allowances to address new performance features. There is also a growing trend of grouping computer monitors with other similar products including commercial signage displays, digital photo frames, and televisions in newer standards and labeling programs. For countries such as China, key lessons learned from recent international experiences include the need for more performance measurement data collection to improve comparability across test methods, the need to address newly emerging functionalities and enhanced performances of display products through either power allowances or tiered standards approach, and the importance of test procedure harmonization. A simple stock turnover analysis shows that if China were to adopt the most stringent standby and off-mode requirements that exist today, it could save up to 1330 GWh annually by 2030. Cumulatively from 2013 to 2030, a total of 20.3 TWh to 21 TWh could be saved depending on if a one-off or tiered standard is implemented for standby in 2013 (and in 2018 for tiered approach), with the vast majority of savings from standby power reduction.

Although S&L programs have been in place for residential gas cookstoves for nearly a decade, there is currently no existing voluntary or mandatory MEPS or labeling program in the world. The EU considered adopting S&L requirements for commercial gas stoves in a 2009 Ecodesign preparatory study for cooking products but ultimately excluded it from both Ecodesign standards and EU Energy Label due to lack of reliable data, lack of suitable efficiency measurements, low sales figures and fragmented market. In the absence of any existing efficiency program for commercial gas stoves and given the similarities between household and commercial gas stoves, a review of the EU Ecodesign proposal for residential gas stoves and the recently revised U.S. MEPS for residential cooking products found very different efficiency metrics between the two programs. The U.S. only mandates that all gas cooking products not have a constant burning pilot light. The EU proposes a tiered approach with minimum gas burner efficiency being raised from 52% one year after the legislation enter into force to 65% five years after the legislation enters into force, along with standby power requirements and power management functionalities. In the absence of any harmonized international or leading test method, the U.S. and EU both use its own method for measuring gas cooktop energy consumption.

As illustrated by the few countries that considered adopting MEPS and/or labels for commercial gas stoves, data availability and the appropriate test method will be two of the major barriers facing China's standard-setting and label development process. Data collection different from that of common household or commercial energy-using products will be needed to support commercial gas stove S&L development, and the EU approach of linking commercial gas stoves to for-profit and institutional food services outlets can be considered as a starting point. In developing test procedures, the common approach of measuring efficiency by measuring the energy used to heat water in comparison to a theoretical minimum can be referenced but specific user behavior need to be considered to improve the test procedure's representativeness of real life efficiency. In the absence of any China-specific data on stock or usage of commercial gas stoves to conduct a potential savings estimate, the EU Ecodesign study is reviewed in terms of key assumptions (e.g., 12 year lifetime, existing efficiency levels of 23%-55%) and best available technologies for improvements (pot presence sensors, electronic ignition as replacement for pilot lights, gas burner design changes).

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1. COMPUTER MONITORS

1.1. Overview of Scope of International Standards and Labeling Programs

As an increasingly common item of home and office electronic equipment, computer monitors are being covered by a growing number of international energy efficiency labeling programs, and more minimum energy performance standards (MEPS) have recently been proposed. The major standards and labeling programs for computer monitors include the voluntary U.S. and Canada ENERGY STAR endorsement labeling program, voluntary Hong Kong endorsement labeling program, mandatory Korea e-standby labeling program and two new proposals for MEPS and categorical energy labeling programs in Australia and the European Union (EU). Australia and EU's proposed labeling programs are similar in that both labels would differentiate between ten efficiency grades or classes using an energy efficiency index, with the least efficient class set at the MEPS level and the top four classes or grades intended for super-efficient products. Section 1.5 contains a summary table for all of these programs and test procedures.

The scope of these programs differs and reflects changing technological trends for computer monitors. On one end of the spectrum, older standards and labeling programs including the existing U.S. and Canadian ENERGY STAR version 5.1 and Hong Kong endorsement label cover only computer monitors. On the other end of the spectrum, more recently revised ENERGY STAR version 6.0 specifications and proposed EU Ecodesign standard and EU Energy Label encompass a broader scope that covers other display devices such as digital photo frames and commercial advertising signage displays. The proposed EU Ecodesign standard also covers televisions because recent technology trends in the development of televisions and computer monitors share similar features and performance and computer monitors are expected to be more efficient than televisions since they do not include a tuner. In fact, Korea's e-standby program requirements already apply to both computer monitors and televisions. Australia's proposed programs reflect a hybrid between old and new regulations; its proposed MEPS covers only computer monitors as it directly follows the older ENERGY STAR version 5.1 specifications but its energy labeling program is linked to the recently revised 10-star categorical energy label for televisions.

Some similarities can be seen in the specific products excluded in international MEPS and labeling programs for computer monitors. The U.S. and Canadian ENERGY STAR and Australian proposed MEPS and labeling programs all exclude large displays with diagonal screen sizes of greater than 60 inches and medical equipment. All of the reviewed programs, including the recently finalized ENERGY STAR version 6.0 revision and proposed EU Ecodesign and labeling program all specifically exclude mobile computing and communication devices such as smartphones, tablets and electronic readers. This represents a general international consensus that the energy efficiency of newly emerging technologies in personal display devices will need to be regulated in separate standards and/or labeling programs in the future.

1.2. Energy Values in Existing Programs

The energy-related criteria set by international MEPS and labeling programs for computer monitors and related displays all cover on-mode, sleep or standby mode and off-mode power consumption, with the exception of Korea's e-standby program which only sets standby power consumption limits.

1.2.1. On-Mode Power Consumption Limits

For on-mode power consumption limits, the proposed Australia MEPS and the existing ENERGY STAR version 5.1 specifications on which it is based differentiate between monitors with and without automatic brightness control (ABC). The on-mode power consumption limit for displays with ABC are set assuming the display is in low ambient lighting conditions 20% of the time. For displays without ABC that are below a diagonal screen size of 30 inches, the formula for determining on-mode power consumption limits are differentiated between units with high and low resolution (with the threshold set at 1.1 megapixel). The specific power consumption limit for a given display with ABC is then set based on resolution and screen area. For displays over 30 inches without ABC, the on-mode power consumption limit is impacted only by the screen size. In contrast, the Hong Kong voluntary label sets the on-mode power consumption limit for computer monitors based only on resolution and does not consider screen size or viewable screen area. For both displays with and without ABC, the formula for calculating power consumption limits are essentially the same for ENERGY STAR version 5.1 and Australia's proposed MEPS level, with the exception that a lower screen area coefficient of 0.00775 rather than ENERGY STAR's coefficient of 0.05 is used for displays less than 30 inches in Australia.

The revised ENERGY STAR specifications effective in June 2013 and EU Ecodesign proposal for computer monitors and other displays show significant differences in how on-mode power consumption is set for the label and MEPS, respectively. A major change in the ENERGY STAR version 6.0 specifications for displays is further differentiation in allowable power consumption by display sizes based on both resolution and screen area. Rather than the two size categories of above and below 30 inch screen size, the new ENERGY STAR specifications sets power consumption limits for five size categories as well as a separate category for large signage displays between 30 and 60 inches. The introduction of more differentiated size categories is intended to allow higher qualification rates in key sizes that are becoming increasingly popular with consumers, including 19-, 20-, 22-, 23- and 25-inch monitors. For the signage display category, the new ENERGY STAR specifications adopt the power consumption limits currently set for large displays between 30 to 60 inches. Another important change in ENERGY STAR version 6.0 is the introduction of pixel density, rather than megapixels, as the unit for calculating resolution when determining the power consumption limit of displays with high resolution image quality. Lastly, ENERGY STAR version 6.0 also introduces for the first time additional power allowances for features such as ABC and enhanced performance. To incentivize the production of more displays with effective ABC, 10% additional power allowance is given for displays with ABC that are able to achieve at least 20% on-mode power reduction. To account for greater energy consumption of enhanced performance displays that meet all three performance criteria in terms of greater contrast,

resolution and color gamut, a 30% additional power allowance for enhanced-performance displays is also given.

As another newly formulated proposal for setting computer monitor and other display MEPS and labeling thresholds, the proposed EU Ecodesign and energy label regulation currently undergoing review presents another approach to regulating the energy efficiency of electronic displays. Under the EU Ecodesign proposal, the MEPS for displays are not set as absolute values calculated using a formula, but rather as an energy efficiency index. The energy efficiency index compares a unit's actual power consumption with a baseline power consumption set based on screen area. Two size categories – displays with screen areas of greater than or less than 16.5 dm^2 – are used for determining the baseline power consumption. The MEPS are also set in a three-tiered approach in order to account for recent and expected future technological development of displays. The tier 1 MEPS level help address the additional energy associated with the recent rise in displays with additional functions and higher resolutions without introducing adjustment adders and correction factors, while the tier 2 and 3 MEPS account for expected performance gains with increasing applications of LEDs in backlit displays. The proposal also reduces the on-mode power consumption for calculating EEI by 10% for displays with automatically activated ABC if ambient light intensity is automatically reduced. The Ecodesign proposal specifically avoided introducing additional allowances for new functionalities because the European Commission believes these functionalities should be user controlled or power managed.

1.2.2. Standby- and Off-Mode Power Consumption

A comparison of the standby- and off-mode power consumption limits in existing and proposed MEPS and labeling programs highlights advancements in reducing computer monitors and displays' inactive energy consumption in recent years. While older program requirements including ENERGY STAR version 5.1 and the related Australian proposal and the Hong Kong label set the limits for standby mode power consumption at 2W and off-mode at 1W, the newer U.S. ENERGY STAR revision and EU proposal reduces standby power limit to 0.5 W. The EU Ecodesign proposal is also more ambitious in lowering the off mode power limit to only 0.3 W, while the U.S. sets off-mode power limit at 0.5 W. Moreover, U.S. ENERGY STAR version 6.0 gives additional allowances for displays with different data or networking capabilities, while the EU Ecodesign proposal provides a higher standby power allowance of 1W for displays that constantly provide information or status display. Beginning in 2015, the EU also sets two-tiered networked standby allowable power consumption for displays with and without high network availability functionality.

1.2.3. Additional Energy Related Requirements

Besides setting the maximum power consumption limits for on-, standby- and off-modes, ENERGY STAR and the EU Ecodesign programs also include other energy-related power management requirements. Both the existing ENERGY STAR version 5.1 and forthcoming ENERGY STAR version 6.0 specifications require qualifying products to have external power supplies that meet international efficiency marking

level V performance and default power management features. The ENERGY STAR version 6.0 specifications further requires computer monitors and displays to automatically switch into standby- or off-mode within 15 minutes after being disconnected. Similarly, the EU Ecodesign proposal also requires monitors and displays to automatically switch into standby- or off-mode within four hours of inactivity after a warning alert has been shown; and requires networked electronic displays to automatically switch into power management function within 20 minutes by 2015.

1.3. Comparison of Test Procedures

Although standards and labeling programs for computer monitors and displays were introduced only within the last ten years, their status as globally traded products has fostered international harmonization in the test procedures for measuring their energy performance. In measuring the active power consumption of computer monitors and displays, there is general harmonization with IEC 62087 for televisions. The ENERGY STAR program uses the IEC test standard content in conjunction with its own test methods, while the EU directly follows the IEC test standard for televisions. Besides IEC 62087, the other major test standard adopted for computer monitors and displays is the ENERGY STAR Test Method for Displays, which is also adopted by Australia for its proposed MEPS and labeling programs. For non-active power measurements, there is complete harmonization in the test standard for measuring standby power consumption as all programs adopt IEC 62301 for standby power measurements.

Two new developments in test procedures for computer monitors and displays have been observed in recent years. First, the new ENERGY STAR test method revised in June 2012 provides much more detailed requirements for light measurements, such as specified ambient light measurement tolerance levels and a standardized light source. It also specifies the methods for measuring power in monitors and displays with network connections. Second, newer proposals including ENERGY STAR version 6.0 and EU Ecodesign are both harmonized with the updated IEC standards IEC 62087 Ed. 3.0 and IEC 62301 Ed. 2.0 for measuring on-mode and standby-mode consumption, respectively. These two trends illustrate that updates to test procedures are necessary to account for the rapid advancements in display technologies as well as revisions in harmonized international test standards.

1.4. Barriers to Program Development and Lessons Learned from International Experiences

The evolution of MEPS and labeling programs and their accompanying test procedures for computer monitors and displays demonstrates the product's rapid rate of technological development and the need for standards and labeling programs to keep pace. For example, major revisions have been initiated for the ENERGY STAR specifications and test procedures for computer monitors and displays just over the last four years. The EU proposal also reflects the first time that MEPS are set for networked standby power consumption, an increasingly common feature of office displays. The convergence of performance and features amongst different technologies with display functions has resulted in a

growing trend of grouping computer monitors with other similar products including commercial signage displays, digital photo frames, and televisions in newer standards and labeling programs.

As other countries including China begin initiating new or revised MEPS and labeling programs for computer monitors and possibly other display products, there are several key lessons that can be learned from the challenges that the U.S. and EU have faced in their recent standards and labeling development experiences. First, because performance measurement data on computer monitors and other displays tend to be sparse, there is a need to collect more data from manufacturers and industry before and during the standards and labeling development process. This is particularly important in ensuring comparability if a country intends to use the same measurement method as televisions for display products. Second, in light of recent technological changes, extra functionalities and high performance of display products need to be addressed in both standard-setting levels and test procedures. This includes possibly providing additional power allowances for specific functions or if a set of high performance criteria is met as specified in U.S. ENERGY STAR version 6.0, or by following a tiered approach as proposed for the EU. The tiered approach can help accommodate extra functionalities by giving manufacturers more time to adapt and improve the efficiency of functionalities over the short-term, while still accounting for expected efficiency gains from newer technologies such as backlit LEDs for televisions. Third, in terms of test procedures, cross-country experiences have demonstrated the importance of test standard harmonization as virtually all existing programs have adopted test procedures based on the IEC standards and/or ENERGY STAR test standard.

1.5. Summary of International S&L programs and Test Methods for Computer Monitors and Display Products

	U.S. ENERGYSTAR v5.1 Voluntary	**U.S. ENERGYSTAR v6.0** Voluntary	**Canada ENERGYSTAR v5.1** Voluntary
Classification/Scope	Displays information from computer, workstation or server; USB flash drive; memory card; or wireless internet connection Excludes displays with diagonal screen size greater than 60 inches; TVs; medical equipment displays	Computer monitor* (i.e., diagonal screen size > 12 inches), digital picture frame (diagonal screen size < 12 inches), signage display (d > 12 inches, pixel density < 5000 pixels/in2) *Computer monitor with enhanced-performance display if it has: contrast ratio of at least 60:1, resolution ≥2.3 MP, color gamut of at least sRGB as defined by IEC Excludes displays with diagonal screen size greater than 60 inches; TVs and dual-function TVs/computer monitors; mobile computing and communication devices (e.g., tablets, smart phones); medical equipment displays	Displays information from computer, workstation or server; USB flash drive; memory card; or wireless internet connection Excludes displays with diagonal screen size greater than 60 inches; TVs (i.e., products with an integrated TV tuner)
Effective Dates	Diagonal screen size < 30 inches: 10/30/2009 Diagonal screen size 30-60 inches: 1/30/10	6/1/2013	Tier 1: Diagonal screen size < 30 inches: 10/30/2009 Diagonal screen size 30-60 inches: 1/30/10 Tier 2: All screen sizes: 10/30/2011

	U.S. ENERGYSTAR v5.1 Voluntary	**U.S. ENERGYSTAR v6.0** Voluntary	**Canada ENERGYSTAR v5.1** Voluntary
Energy Values	Maximum On Mode Power Consumption, in Watts On-Mode, with Automatic Brightness Control (ABC): Power ≤ (0.8 x Ph) + (0.2 x Pl) where Ph = measured power in high ambient lighting (300 lux) Pl = measured power in low ambient lighting (0 lux) On-Mode, without ABC: size < 30 inches and resolution (r) ≤ 1.1 megapixels: Power = (6.0 x r) + (0.05 x A) + 3.0, where A = viewable screen area size < 30 inches and resolution (r) > 1.1 megapixels: Power = (9.0 x r) + (0.05 x A) + 3.0, where A = viewable screen area size between 30 to 60 inches for any resolution: Power = (0.27 x A) + 8.0	Maximum On Mode Power Consumption, in Watts Pixel density = (r x 10^6)/A where, r = screen resolution in Megapixels and A=screen area in square inches If pixel density exceeds 14,000 pixels/inch, use screen resolution = (14,000 x A)/10^6 to calculate max power consumption size < 12 inches: Power = (6.0 x r) + (0.05 x A) + 3.0, where A = viewable screen area, r=resolution 12 ≤ size < 17: Power = (6.0 x r) + (0.01 x A) + 5.5 17 ≤ size < 23: Power = (6.0 x r) + (0.025 x A) + 3.7 23 ≤ size < 25: Power = (6.0 x r) + (0.06 x A) - 4.0 25 ≤ size ≤ 61: Power = (6.0 x r) + (0.1 x A) - 14.5 For signage displays: 30 ≤ size ≤ 61: Power = (0.27 x A) + 8.0 Additional Power Allowances: 30% for enhanced-performance displays	Maximum On Mode Power Consumption, in Watts On-Mode, with Automatic Brightness Control (ABC): Power ≤ (0.8 x Ph) + (0.2 x Pl) where Ph = measured power in high ambient lighting (300 lux) Pl = measured power in low ambient lighting (0 lux) On-Mode, without ABC: size < 30 inches and resolution (r) ≤ 1.1 megapixels: Power = (6.0 x r) + (0.05 x A) + 3.0, where A = viewable screen area size < 30 inches and resolution (r) > 1.1 megapixels: Power = (9.0 x r) + (0.05 x A) + 3.0, where A = viewable screen area size between 30 to 60 inches for any resolution: Power = (0.27 x A) + 8.0

	U.S. ENERGYSTAR v5.1 Voluntary	**U.S. ENERGYSTAR v6.0** Voluntary	**Canada ENERGYSTAR v5.1** Voluntary
		10% allowance for default automatic brightness control if power reduction ≥20%	
	Sleep Mode: Maximum Power Requirement < 2 W Off Mode: Maximum Power Requirement < 1 W	Sleep Mode: Maximum Power Requirement < 0.5 W Additional power allowances in sleep mode for data/network capabilities: Wired USB 1.x: 0.1 W Wired USB 2.x: 0.5 W Wired USB 3.x: 0.7 W Fast ethernet: 0.2 W Gigabit ethernet: 1.0 W Wireless Wi-Fi: 2.0 W Occupancy sensor: 0.5 W Flash memory-card/smart-card readers, camera interfaces: 0.2 W Off Mode: Maximum Power Requirement < 0.5 W	Sleep Mode: Tier 1: Maximum Power Requirement < 2 W Tier 2: Maximum Power Requirement < 1 W Off Mode: Tier 1 & 2 Maximum Power Requirement < 1 W
Additional Requirements	International Energy Efficiency Marking for EPS level V performance, power management feature by default	International Energy Efficiency Marking for EPS level V performance, power management feature by default Computer monitors auto enter Sleep or Off Mode within 15 minutes of being disconnected	International Energy Efficiency Marking for EPS level V performance, power management feature by default

	U.S. ENERGYSTAR v5.1 Voluntary	**U.S. ENERGYSTAR v6.0** Voluntary	**Canada ENERGYSTAR v5.1** Voluntary
Test Method/Specs	ENERGY STAR Test Method for Displays rev Aug 2010; IEC 62087, Ed 2.0; IEC 62301 Ed. 1.0 for Standby	ENERGY STAR Test Method for Displays rev June 2012;; IEC 62087, Ed 3.0 for test content; IEC 62301 Ed. 2.0 for Standby	Same as US: ENERGY STAR Test Method for Displays rev Aug 2010; IEC 62087, Ed 2.0; IEC 62301 Ed. 1.0 for Standby
	Measurement accuracy: ±2% at 95% confidence level	Power measurement accuracy: ±2% at 95% confidence level; Light measuring device accuracy of ±2% with repeatibility within 0.4% of displayed value	Measurement accuracy: ±2% at 95% confidence level
	Refresh rate: 60 Hz for fixed pixel displays, 75 Hz for CRT displays	Refresh rate: 60 Hz for fixed pixel displays, 75 Hz for CRT displays	Refresh rate: 60 Hz for fixed pixel displays, 75 Hz for CRT displays
	Standby power measurements: measured after stable to within 1% over 3 minute period	Ambient light values measured at Automatic Brightness Control sensor; ambient light measured measured with tolerances of: ±1 lux at 10 lux; ±5 lux at 100 lux; ±9 lux at 300 and 500 lux	Power measurements: measured after stable to within 1% over 3 minute period
	Light measurement: measured with device at center of, and perpendicular to screen	Light source standardized as standard spectrum halogen flood reflector lamp with rated brightness of 980 ± 5% lumens (see diagram for test set up of light source and measurement)	Light measurement: measured with device at center of, and perpendicular to screen
	On Mode Fixed Pixel Displays: luminance setting of 175 Cd/m2 for resolution ≤1.1 MP; 200 Cd/m2 for resolution > 1.1 MP	Power measurements for network connections: activate network capabilities if available; unit connect to a single active data source or network in following order of preference: WiFi, Ethernet, Thunderbolt, USB, Firewire, other	On Mode Fixed Pixel Displays: luminance setting of 175 Cd/m2 for resolution ≤1.1 MP; 200 Cd/m2 for resolution > 1.1 MP
		Remove batteries when testing back-up battery operated products; fully charge batteries before testing solely battery operated products	

	Hong Kong Voluntary	**Korea e-Standby**	**EU Ecodesign Proposal** Mandatory	**EU Energy Label Proposal** Mandatory
Classification /Scope	Standard LCD monitors designed for use with computers only	Computer monitors with power supply output ≤ 1000W; dual function computer monitors and TVs	TVs, TV monitors, computer monitors, digital photo frames, advertising displays and public displays Excludes: projectors, high performance electronic displays, medical displays	TVs, TV monitors, computer monitors, digital photo frames, advertising displays and public displays Excludes: projectors, high performance electronic displays, medical displays
Effective Dates	Phase I: 12/22/2003 - 9/30/2007 Phase II: 10/1/2007	7/1/2009	Tier 1: 7/1/2014 Tier 2: 1/1/2016 Tier 3: 7/1/2017	
Energy Values	Maximum Power Requirements, in Watts **On-Mode:**	**Standby Power Requirement**	Maximum On Mode Power Consumption, in Watts **Energy Efficiency Index (EEI):**	Maximum On Mode Power Consumption, in Watts **Energy Efficiency Index (EEI):**
	Phase I: Power = 30 + 2 x Megapixels (MP) Phase II: If X < 1 MP, Power = 23 If X > 1 MP; Power = 28* MP	Maximum power requirement < 1 W	Screen Areas ≤ 16.5 dm2: EEI = on-mode power consumption / [(0.88 x A + 2.70) x 2.1] Screen Areas > 16.5 dm2: EEI = on-mode power consumption / [(60.645 x ln(A) - 152.64) x 2.1]	Screen Areas ≤ 16.5 dm2: EEI = on-mode power consumption / [(0.88 x A + 2.70) x 2.1] Screen Areas > 16.5 dm2: EEI = on-mode power consumption / [(60.645 x ln(A) - 152.64) x 2.1]

	Hong Kong	Korea e-Standby	EU Ecodesign Proposal	EU Energy Label Proposal
	Voluntary Sleep Mode: Phase I: ≤ 4 W (with ≤ 15 min default time) Phase II: ≤ 2 W (with ≤ 30 min default time) Off Mode: Phase I: ≤ 2 W Phase II: ≤ 1 W (with ≤ 30 min default time)		Mandatory Tier 2: 0.4 Tier 3: 0.2 Displays with automatic brightness control: reduce standard power consumption by 10% if luminance is reduced by 0-20 lux ambient light intensity Sleep Mode: When providing reactivation function only: ≤0.5 W When providing information or status display: ≤ 1W Off Mode: Maximum Power Requirement: ≤ 0.3W Displays with easily visible switch that can put display into mode with power consumption ≤ 0.01W, any other off-mode condition can be ≤ 0.5W	Mandatory A+: 0.16 ≤ EEI < 0.23 A: 0.23 ≤ EEI ≤ 0.30 B: 0.30 ≤ EEI ≤ 0.42 C: 0.42 ≤ EEI < 0.60 D: 0.60 ≤ EEI < 0.80 E: 0.80 ≤ EEI < 0.90 F: 0.90 ≤ EEI < 1.00 G: 1.00 ≤ EEI

	Hong Kong	Korea e-Standby	EU Ecodesign Proposal	EU Energy Label Proposal
Additional Requirements	Luminance: minimum of 100 Cd/m2 Contrast ratio: minimum of 200:1		**Networked Standby:** Power consumption requirements by 1/1/2015: Displays with high network availability (HiNA) functionality: ≤ 12 W Displays without high network availability (HiNA) functionality: ≤ 6 W Power consumption requirements by 1/1/2017: Displays with high network availability (HiNA) functionality: ≤ 8 W Displays without high network availability (HiNA) functionality: ≤ 3 W Default switch to standby or off-mode within 4 hours of last activity; display alert message before switching to standby or off-mode Electronic displays intended for signage may contain function for user to disable auto power-down functionality By 1/1/2015: auto shift into power management function within 20 minutes for networked electronic displays; wireless networked electronic display displays should offer possibility for deactivating wireless network connections TVs and Displays: peak luminance of on-mode as delivered ≥ 65% of brightest on-mode condition provided	