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PREFACE

In its April 2, 2008 Scoping Order, the California Energy Commission's (Energy Commission) Efficiency Committee (Committee) established the scope of Phase I of the 2008 Appliance Efficiency Regulations' Rulemaking regarding possible amendments to the Appliance Efficiency Regulations (Title 20, California Code of Regulations, Section 1601 through Section 1608). Phase I was initially divided into two separate, concurrent rulemakings, Part A and Part B. Later in April 2008, the Committee established Part C to consider televisions and any additional topics separately.

The Committee conducted public workshops on July 16 and December 15, 2008 to seek comments from interested parties regarding possible appliance efficiency standards for televisions. Pacific Gas & Electric Company (PG&E) and the Consumer Electronics Association (CEA) submitted written proposals for consideration. This report discusses the 45 day language that has been developed for televisions standards.

This rulemaking is to adopt efficiency standards for the active mode and standby mode power consumption, power factor, luminance control, and labeling of televisions with a screen area less than or equal to 1,400 square inches in size. Televisions with screens greater than 1,400 square inches in size will be included in the Phase II of this rulemaking.

This report covers standby and active mode power consumption, luminance control and power factor, labeling requirements, and use of the International Electrotechnical Commission (IEC) test method "Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment," IEC 62087 Edition 2.0 for televisions.

Staff Report for Proposed Efficiency Standards for Televisions. California Energy Commission, Efficiency and Renewable Energy Division, Appliances and Process Energy Office.

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ABSTRACT

This staff report contains proposed amendments to the Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601 through 1608) to be considered as part of the 2009 Appliance Efficiency Rulemaking, Phase I, Part C (Docket # 09-AAER-1C).

This report presents staff analysis of the legislative criteria, background, television energy use measurements, federal regulations and test method, proposals for television standards, staff proposed standards, statewide energy use, savings and cost analysis, technical feasibility, power factor, policy issues and next steps, stakeholder comments, and proposed regulations related to televisions.

The proposed regulations will generate an estimated 6,515 GWh in energy savings annually after all existing stock is replaced. The overall energy cost savings to consumers for California is expected to be approximately \$8.1 billion. The estimated total value of this regulation is approximately \$8.7 billion, which is the sum of energy cost savings from the proposed standards and savings in avoided construction cost of a \$615 million natural gas power plant.¹

Keywords: Appliance Efficiency Regulations, appliance standards, televisions, energy efficiency, plasma, LCD, CRT, DLP, rear projection.

¹ PG&E CASE study published on July 3, 2008 estimates the peak demand reduction to be 615 MW. The cost of building a natural gas power plant is approximately \$1 million per 1 MW according to the Energy Information Administration (EIA) <http://www.eia.doe.gov/oiaf/aeo/assumption/pdf/electricity.pdf>

Legislative Criteria

Section 25402(c) of the Public Resources Code authorizes the California Energy Commission to adopt standards for the energy efficiency of appliances whose use, as determined by the Energy Commission, requires a significant amount of energy on a statewide basis. New and upgraded standards must be technologically feasible and attainable and must “not result in any added total costs to the consumer over the designed life of the appliances concerned.” The added total cost is obtained by comparing the cost and performance of a typical model that the consumer would purchase with the proposed standard in effect, to the cost and performance of a typical model that the consumer would be expected to purchase without the proposed standard in effect.

The proposed regulations supported by the evidence in the record that has been provided by the stakeholders and contained within this staff report comply with Public Resources Code section 25402(c)(1) criteria. The proposed regulations were specifically designed by considering existing technologies used by manufacturers that have been found to be feasible and result in attainable efficiencies for televisions. These regulations have been found to reduce a significant amount of statewide electrical energy consumption (6,515 GWh in energy savings annually), and will not result in any added costs to the consumer over the television’s design life.

Background

Changes in Televisions Broadcasting and Technology

Televisions have been a part of the American household since the late 1930s. The first models were exclusively cathode ray tube (CRT) based and sold in wood cabinetry. Since then televisions have evolved greatly, and in the last 30 years televisions have become a standard appliance in nearly every living or family room across the country. Today it is also common for households to own multiple televisions placed in several rooms in the house. In the mid 1980’s the first alternative to the cathode ray tube was introduced to the American household: the projection television. Projection televisions were made in much larger sizes, however their energy consumption was still comparable to CRT televisions which was, and is, fairly low.

The very signal used to broadcast television has changed significantly from the original guidelines by the National Television Systems Committee (NTSC). Televisions broadcasting stations have used terrestrial analog signal transmission to provide television programming to the public for over 60 years. Each analog television channel required a large amount of bandwidth for broadcasting a black and white, and then later a color television signal. The availability of radio frequency bandwidth became scarce with the limited broadcast channels available. In the 1980’s, cable and satellite services started providing television signal to consumers through alternate means. These service providers made it possible to add hundreds of television channels, a possibility that revolutionized the television broadcasting industry. By the late 1990s, broadcasters started using digital signal technology to broadcast their programs. One of the advantages of a digital signal is that it transmits information much more efficiently

than an analog signal while being less susceptible to interference, making it possible to broadcast a clearer, higher-resolution picture while using much less of the available broadcast space. In June of 2009, the Federal Communication Commission (FCC) required that all broadcast television stations convert their signal transmission from analog to digital signals.

In the late 1990's, new digital television display technologies such as plasma, Liquid Crystal Display (LCD), and Digital Light Processing (DLP) displays began to enter the market. DLP is a rear projection technology that projects light pulses to display an image, whereas plasma panels use charged gases to illuminate display pixels that create the television images. LCD screens display pixels which selectively block light provided from behind the television screen by cold cathode fluorescent lamps (CCFL) or other light sources to create images. All three technologies reproduce a much higher resolution image with far greater fidelity than a typical older cathode ray tube, which goes hand-in-hand with the ability to broadcast higher resolution television signals using digital signals. Currently, modern digital televisions are commonly referred to collectively as "flat screen televisions" as they have a flat surface and are typically not more than a few inches thick and can be used for applications, such as wall mounting, that historically have not been possible due to the sheer bulk of a CRT.

The aspect ratio is another important difference between older CRTs and modern flat screens. The aspect ratio is the relationship between the width of the picture and its height. The television industry uses 4:3 for most programming. In the 1950s, the film industry moved to a larger aspect ratio, 16:9, to offer something more than television to get people out of their homes and into theaters. Today's widescreen televisions have adopted the larger aspect ratio of the film industry. Television broadcast stations have been slower to adopt this change, but most television programs are now being produced and broadcast in 16:9 for viewing on modern flat-screen television sets.

All of these changes have set the stage for a television industry that is experiencing furious competition, lightning-fast evolution and astonishing innovation. Television technologies are advancing more rapidly than ever before, providing more and greater benefits to consumers and viewers.

Changes in Televisions Energy Use

The popularity and increase in demand of televisions has led to strong competition and rapid innovation to provide consumers more functionality and features. As a result the energy consumption of televisions has been growing rapidly over recent years, and this trend is expected to continue in the near future for the following reasons:

- *LCD and plasma televisions use more electricity.* Energy consumption per square inch is typically higher for plasma and LCD televisions compared with CRT and DLP televisions.

- *Growth in average screen size.* Consumers normally replace old CRT televisions with larger size models partly due to change in display screen aspect ratio. Thin flat screen televisions are able to fit in spaces previously unavailable to CRTs whose depth scaled with size. Since television energy consumption is related to screen size, larger average sizes equate to higher consumption.
- *Growth in number of television units per household.* New large televisions (25 inches in screen diameter or larger) are being purchased for the family room and older and smaller televisions are being moved to other rooms in the house, which means most homes have two or more televisions.
- *Downward trend in prices of high-definition flat screen digital televisions.*
- *More hours of television use.* Televisions are now used for more than just watching broadcast television. Using the television to view cable/satellite content, DVDs, play video games, and display digital photos is increasingly common. Televisions are generally viewed during peak hours of electricity use.
- *Analog to Digital format.* The Federal Communications Commission (FCC) has mandated that beginning June 18, 2009 all television broadcast must have transitioned from analog to digital format. This requires television owners to purchase a set top digital tuner or a new television with a built-in digital tuner.

The majority of the televisions in California are also closely connected to associated electronics such as cable television tuners/set top boxes, satellite receivers/tuners, Internet Protocol Television (IPTV) devices, Digital Video Recorders, digital signal converters, Digital Versatile Disc/Blue-Ray players, and video game consoles. Overall, these devices provide greater availability of television programming and result in an increase in daily televisions use averaging more than five hours a day.

Currently the total energy used by television viewing, and the associated peripherals commonly connected to them, is estimated to represent about 10 percent of residential electricity use.² The Energy Commission has found to be a significant amount of energy use statewide. PG&E submitted to the Energy Commission in July, 2008, their revised Codes and Standards Enhancement (CASE) Initiative study related to televisions. This study showed a continuous increase in household television energy use. PG&E analysis further showed that there is significant energy savings technologies used in the existing television market that could be implemented, and proposed that efficiency standards be developed.

The television industry has announced several innovative design methods and technologies they will implement in the next couple years that will provide additional reductions in

² <http://www.nrdc.org/air/energy/energyeff/stb.pdf>

television energy consumption. These new design methods and technologies will be further discussed in the “Technical Feasibility” section of this report.

Television Energy Use Measurement

Setting practical energy efficiency standards for modern digital televisions requires an accurate measurement of energy consumption while in the active mode. Energy use measurement of digital televisions is intricate due to varying technologies and sizes, including a continuous advancement of technologies and techniques for improving picture quality. Energy Commission staff has reviewed the current United States Department of Energy (U.S. DOE) method for testing and measuring active mode energy consumption of television sets and has concluded that the test method is outdated and not applicable to digital televisions. This U.S. DOE test method was written to measure energy consumption for black and white televisions displaying National Television System Committee (NTSC) analog radio frequency (RF) signals. The Federal Communications Commission (FCC) requires starting June 18, 2009, that all television stations must broadcast their program transmission in Advanced Television Systems Committee (ATSC) format, and must stop broadcasting NTSC analog radio frequency signals. There is no provision in the U.S. DOE’s test method to convert ATSC digital signal to NTSC RF signal for accurately testing the energy consumption of color digital televisions designed to display high-resolution and/or ATSC format images.

To have an universal industry standard for measuring television energy use for digital television, the International Electrotechnical Commission (IEC) developed an active mode test method titled “Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment,” also referred to as IEC 62087-Edition 2.0. This test method includes the testing of digital televisions that operate in ATSC format. The development of this test method was supported by the television manufacturers as a “consensus-developed test method” and has become widely accepted and used by the consumer electronics industry. This test method was accepted by the television manufacturers for use as the ENERGY STAR® specifications that require manufacturers to use the test method to generate their energy use data under the ENERGY STAR® logo. PG&E recommended the Energy Commission adopt IEC 62087-Edition 2.0. Energy Commission staff recommended that the test data collected by using the updated IEC test method be used to set any future energy standards. Amendments and guidance to the IEC 62087 Edition 2.0 have been proposed to further specify testing and reporting conditions for televisions implementing automatic brightness controls and forced menus. This ensures a measurement of power consumption that better reflects the real world consumption.

Federal Regulations and Test Method

Currently there are no federal energy efficiency standards in effect for digital and analog televisions. Under federal law the Energy Commission is not preempted from adopting active mode or other energy conservation standards for televisions.

At this time, California's *Appliance Efficiency Regulations* regulate televisions in standby mode only. To comply with the California standards manufacturers test their televisions using the IEC 62087: 2002 (E) *Methods for Measurements for the Power Consumption of Audio Video, and Related Equipment* to determine if their units meet the standby power requirement. The U.S. DOE also has a test procedure for television sets, found in 10 CFR Pt. 430, Subpt. B, App. H, however the test method is not appropriate for measuring the on mode energy consumption of the modern color digital televisions that compose nearly the entirety of California's market.

The U.S. DOE test procedure was adopted in 1977 and is titled, "Uniform test method for measuring the energy consumption of television sets." The 32 year old federal test method for television sets was designed for black and white CRT televisions and has long been obsolete. Since there were no commercially available digital televisions when the DOE first adopted this test method, it is obvious that it was intended to cover only analog CRT television sets.

As new digital technologies have emerged in the last few years, other federal agencies, such as the Federal Trade Commission and U.S. DOE and United States Environmental Protection Agency's (EPA) ENERGY STAR®, have adopted new test methods acknowledging the substantial changes in television technology.

The new test method proposed by the Energy Commission is IEC 62087, Ed. 2.0: *Methods of Measurement for the Power Consumption of Audio, Video and related Equipment*. This test method is widely accepted by the television manufacturers and other stakeholders. PG&E recommends that the Energy Commission adopt this test method and harmonize with the television industry and the ENERGY STAR® program. The proposed test method for the standards cannot become effective until the repeal of the federal test method. This fact is captured in the language of the proposed regulations. In essence the language delays the implementation of standards until one year after the effective date of the proposed test methods.

Proposals for Television Standards

PG&E submitted to the California Energy Commission their Codes and Standards Enhancement (CASE) Initiative "Analysis of Standards Options for Televisions" document on April 1, 2008. A revised proposal was submitted by PG&E on July 3, 2008 that was jointly endorsed by the other California investor owned utilities (Southern California Edison, San Diego Gas and Electric, and Southern California Gas companies). PG&E's analysis indicates that energy consumption of digital flat screen televisions is in addition to other factors, proportional to the screen size. The demand for larger screen size televisions is continuously growing; consequently, energy consumption is also on the rise. The PG&E analysis shows that significant energy can be saved in the future by requiring the sale of energy efficient televisions, and proposes that standards be developed. PG&E proposed two tiers of Standards for high definition and full definition televisions as shown in Table 1.

Table 1
PG&E Proposed Standards

	Effective Date	Maximum Active Mode Power Usage (Watts)
Tier 1	January 1, 2011	0.20* Screen Area (in ²) + 32
Tier 2	January 1, 2013	0.12* Screen Area (in ²) + 25

The Consumer Electronics Association (CEA) also proposed that the Energy Commission adopt television standards to amend Title 20 of the California Code of Regulations such that, effective February 17, 2009, any manufacturer intending to sell a digital television in the state must submit an energy use declaration for each model prior to sale. The declaration would include the model numbers of all televisions, the type of display technology employed (e.g., LCD, plasma, CRT, Rear Projection), along with the active mode power consumption of the model(s) as calculated pursuant to IEC 62087, Edition 2.0. CEA stated that the mandatory reporting requirement would allow the Commission to better monitor and evaluate consumption and efficiency trends for televisions. It also would allow the Commission to review direct evidence that technological advancements and market-oriented programs continue to drive energy efficiency improvements in televisions.

CEA also proposed a consumer education campaign, in partnership with the Energy Commission, U.S. EPA, and other key parties, designed to support and encourage consumer purchases of televisions meeting the new ENERGY STAR® 3.0 television specifications. The new specification, a result of collaboration between government, industry and energy efficiency stakeholders, will help guide Californians to purchase televisions that are up to 30 percent more efficient than non ENERGY STAR® televisions according to the U.S. EPA. Finally, CEA also welcomes the Energy Commission review of and contributions to industry's recommendations and research supporting energy use disclosure requirements for televisions.

Staff Proposed Standards

Staff proposes that the Energy Commission adopt television standards that include and expand upon items proposed by PG&E and CEA:

PG&E proposed items:

- Two tiers of efficiency standards for active mode power consumption which will apply to televisions less than or equal to 1,400 square inches in size,
- A revision of the existing standby mode standard to reflect technological advances,
- A requirement that televisions meet a specific power factor standard, and

- A requirement for luminance performance standard.

CEA proposed items:

- A requirement for manufacturers to submit energy use information and product information, and
- A requirement for energy disclosure on television packaging.
- Automatic power down requirement.

Energy Commission staff’s standards proposal is summarized in Table 2. At the end of this report, staff provides the draft of specific edits to the Title 20 code, including new definitions to support the proposed standard levels.

Table 2: Staff Proposed Standards

Existing Standards for Televisions				
Effective Date	Screen Size (area in square inches)	Maximum TV Standby-passive Mode Power Usage (watts)	Maximum On Mode Power Usage (P in Watts)	Minimum Power Factor for (P* ≥ 100W)
January 1, 2006	All	3 W	No standard	No standard
Proposed Standards for Television				
<u>TIER I STANDARD</u>				
January 1, 2011	Area<1400	1 W	$P \leq 0.20 * \text{Screen Area (in}^2) + 32$	0.9
<u>TIER II STANDARD</u>				
January 1, 2013	Area<1400	1 W	$P \leq 0.12 * \text{Screen Area (in}^2) + 25$	0.9

*P = Power in Watts.

Throughout this rulemaking the Energy Commission requested data input for the record from various stakeholders, such as the NRDC and CEA that would provide corroborating support for opinions expressed concerning the effects the proposed television standards would have on California consumers and businesses. The Energy Commission delayed its rulemaking process almost a year to obtain additional information from CEA to support its concerns. The Energy

Commission staff has now completed its record and is recommending to adopt the proposed standards based on the record provided by the stakeholders.

Energy Commission staff is proposing two tiers of active mode power consumption with different effective dates. In addition, televisions of sizes greater than 1,400 square inches will be considered in a later Phase II of this rulemaking. Energy Commission staff conducted an energy savings analysis on televisions of all sizes in December 2008, and draft proposed standards were prepared and presented to stakeholders in December 15, 2008 workshop. Stakeholder comments received were then analyzed by staff and incorporated into staff's proposal. Energy Commission staff analysis found that proposed standards for large screen televisions are technologically feasible with existing technology and that these larger televisions will be able to meet the proposed standards on the proposed effective dates. The record before the Energy Commission shows that many television models of the varied technologies studied in this report currently meet the proposed standards.

Small retailers requested the Energy Commission consider excluding the large screen televisions from this rulemaking. Some of the television models they offer for sale to their customers currently do not meet the proposed Tier II standards and small retailers are concerned about the availability of models by the proposed effective dates. Specifically, many small retailers are high-end, specialty home entertainment providers that sell models that are customized as part of a home theater installation and they cannot afford to lose customers in the current economic environment. While 58 inch televisions and greater represent a small portion of overall sales in televisions, they make up a large portion of these small retailers/installers' business. In response to the small retailers' business interest staff proposed excluding the large screen (televisions greater than 1,400 square inches in size), custom home theater televisions from this portion of the rulemaking.

Energy Commission staff's energy efficiency analyses of large screen televisions found that energy loss from the proposed standards excluding the big screen televisions is potentially significant, but lost energy savings can be captured by adopting a standard for these televisions in a subsequent Phase II rulemaking. Energy Commission staff has estimated the large screen television sales data by using estimates from North American sales data that includes Canada and Mexico's television sales. Energy Commission staff estimates showed that sales of these large screen models are low, but that the energy consumption relative to smaller televisions is extremely high and would represent a significant energy use in California. In addition the sale and size of large televisions is expected to grow rapidly in the coming years. There is a 103 inch plasma television already in the market. By further increasing size and resolution, even movie theater screen size plasma will no longer be a dream.³

³ <http://www.advanced-pdp.jp/fpd/english.html>

The Energy Commission has found that there are feasible technologies available for large screen television that would meet or exceed the proposed Tier II standard, and that there are still many implementation opportunities for energy savings technologies in large screen televisions. Highly energy efficient large screen televisions are available. For example, the record shows that the new Mitsubishi LaserVue 65 inch television in on mode consumes 135 watts of power. The LaserVue series will include televisions ranging from 65 inches to 82 inches, all featuring 3D-Ready viewing technology. According to Mitsubishi the on mode power consumption for all its LaserVue televisions series will be 135 watts which uses one third the power of a comparable LCD television and one fourth the power consumption of a comparable available plasma television. New super efficient LCD models have been introduced to the market including 50 inch and larger models from Sharp and Samsung that meet the proposed Tier 2 standard, 3 years before its effective date. This technological innovation is expected to continue and energy commission staff is unaware of any technical limitations regarding its application to even bigger screen sizes. Energy Commission staff is sensitive to the concerns of California's small retailers and thus has recommended to remove this size from the current proposed standards and address these sizes in a separate Phase II rulemaking so that retailer issues can be addressed in greater detail. Energy Commission staff will continue to collect sales information and data, will monitor technology improvements, and will gather energy consumption data related to large screen televisions.

Energy Commission staff's proposed regulations also incorporate CEA's suggestion to require manufacturers to submit energy use information and product information and require energy disclosure on television packaging.

California's current Title 20 standards regulate televisions only in the standby mode. This standard requires the maximum standby mode power to not exceed 3.0 watts for all televisions. The energy used in standby mode represents approximately 5 percent of the total energy consumed by a television; it is estimated that 95 percent of the energy consumed by televisions is consumed while in the active mode. Due to this, the Energy Commission has determined that the active mode energy efficiency standards for televisions would result in significant energy savings statewide.

The Energy Commission has determined that a significant amount of energy savings could be achieved by reducing the current standard of 3 watts for standby mode. The record supports that the appliance efficiency data submitted by most television manufacturers shows that television standby mode power consumption is commonly below 1 watt⁴. Because of this, the Energy Commission staff recommends that the current maximum energy consumption during standby requirement of 3 watts be lowered to 1 watt and thus be harmonized with ENERGY STAR® and global standby standards. The Energy Commission therefore finds that the standby

⁴ Between June 1, 2008 and June 1, 2009 726 out of 768 televisions reported less than 1 watt in TV standby-passive mode leading to an estimated current compliance rate of 94.5%.

mode of 1 watt to be feasible resulting in attainable efficiencies for televisions, that will reduce a significant amount of statewide electrical energy consumption and will not result in any added costs to the consumer over the television's design life.

Energy Commission staff is interested in promoting energy efficiency and welcomes CEA's suggestion to work together to educate California consumers. However, CEA's proposal alone does not offer the necessary statewide impact, cost effectiveness, feasibility, and the energy savings necessary to mitigate rapidly growing television electrical load that will be achieved through the draft television efficiency standards.

Energy Commission staff has included proposed luminance performance standards for televisions. One method of lowering television power consumption to meet the proposed standard is to dim the television's default settings. To a point this improves picture quality as well as reduces power consumption, however if the settings are too dim the quality and utility of the television can suffer. This would most likely lead to the consumer adjusting the screen settings brighter and therefore undo the energy savings intended by the regulation. The proposal ties the luminance of the default mode to the brightest luminance preset mode. This guarantees that the television will not be too dim relative to other modes the user may select and will protect the proposed on mode standards from being manipulated. The proposal requires that the default mode be at least 65 percent of the luminance of the brightest mode. This harmonizes with the newly adopted ENERGY STAR® specifications and minimum energy performance standards developed by Australia's Department of the Environment, Water, Heritage and the Arts.

Statewide Energy Use

Current Estimated Energy Consumption for Televisions in California

PG&E's CASE report provides current retail sales trends for televisions, and it shows a continuous growth in sales of LCD televisions at approximately 88.2 percent market share, with flat screen plasma televisions accounting for 10.5 percent, and digital light projection (DLP) accounting for 0.5 percent of the market share respectively. Cathode Ray Tube (CRT) televisions sales have effectively been replaced by DLP, LCD and plasma flat screen televisions on store shelves with current market share of only 0.8 percent. However, there is still a large existing stock of CRT televisions in use. According to PG&E's estimates, the total number of televisions in use throughout California is approximately 35.4 million, with total annual sales of approximately 4 million.

PG&E estimates that the statewide energy consumed by televisions is more than 2.3 percent⁵ of California's gross system electricity usage. The Energy Commission has determined that this is a significant statewide energy use by this appliance. The coincident peak demand for television energy use is further estimated to be 615 megawatts.⁶ Of the various types of television sets widely in use, plasma and LCD televisions consume significant energy and their use, numbers, and size are growing. The sale of CRT, rear projection, and DLP televisions has declined rapidly and their sales have diminished to less than two percent of all television sales.

PG&E has estimated in Table 3 how much power each type of technology requires to display a picture (per square inch of screen area) and the average power per television for each type of television technology.

Table 3: Average Power Use in Watts per TV Technology Type

TV Type	Energy use per square inch	Power Use by Average Size	Annual Power Use *
CRT	0.23 watt	101 watts	192.6 kWh/year
DLP and rear projector	0.14 watt	245 watts	467.2 kWh/year
LCD	0.27 watt	144 watts	274.6 kWh/year
Plasma	0.36 watt	361 watts	688.4 kWh/year

*Annual power use is calculated by multiplying power use with hours of television use per year. According to PG&E's CASE study annual hours of use per television are 1907.

PG&E estimates that the existing stock of televisions is made up of 63 percent CRT, 30 percent LCDs, 5 percent plasma flat screen, and 2 percent DLP. The July 8 2009 revised PG&E study estimates the average television use to be 1907 hours per year. Table 4 shows the estimated total energy consumed in California per year by each type of television technology.

Table 4: Total Energy Consumed Per Year by Each Type of TV Technology

Television Type	Existing Stock (Million Units)	Power Use (W) by Average Size TV	Energy consumption per year in Millions of kWh/year
CRT	22.3	101	4,295.1
DLP and Projection	0.7	245	327.1
LCD	10.6	144	2,910.9
Plasma	1.8	361	1,239.2
Total	35.4	129.78	8,772.3

⁵ <http://www.ecdms.energy.ca.gov/>

⁶ http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-07-16_workshop/proposals/PGE_Revised_Television_Proposal.pdf

*Source: Average watts per square inch and average screen area per technology is derived from analysis of Energy Star®, CNET, CEC PIER, EICTA, and MTP television data sets

The power consumption for each type of television technology is calculated by multiplying the existing stock with the average wattage used and multiplying the product by the average hours of use per year. Summing the energy consumption for all television types, the estimated statewide total energy use attributable to televisions is an estimated 8,772.3 gigawatt hours/year.

Savings and Cost Analysis

Based on PG&E’s analysis, the annual energy savings is estimated at 3,831⁷ gigawatt-hours (GWh) for Tier I, and 2,684 gigawatt hours for Tier II, after the existing stock is replaced.

Table 5: Energy Savings and Reduced Costs for LCD and Plasma TVs – Tier I and Tier II

Tier	Design Life (Years)	Annual Unit Energy Savings (kWh/year)	Incremental Cost of Improvement Per Unit (\$)	First-Year Unit Energy Cost Savings (\$)*	Reduced Total Cost over the Design Life (\$)**	Simple Payback Period (Hours)	Annual Sales (millions of units)	First-Year Statewide Energy Savings (GWh)
I	10	132	0	18.48	164.21	0	4.0	528
II	10	84	0	11.76	104.50	0	4.0	336

Source: PG&E’s July 3, 2008 Revised TV Proposal and subsequent materials presented at July 15, 2009 and December 15, 2009 workshops.

Design life, incremental cost of improvement, annual energy cost savings and annual sales are provide in PG&E’s July 3, 2009 Revised TV Proposal and subsequent materials presented at July 15, 2009 and December 15, 2009 workshops. Energy savings for Tier I are calculated by subtracting base case from Tier I energy use. Energy savings for Tier II are incremental and are calculated by subtracting Tier I from Tier II.

*First-year energy cost estimated to be \$0.14 per kilowatt hour. Source: California Energy Commission’s *Staff Forecast: Average Retail Electricity Prices 2005-2018*.

**The present value of a kWh over a 10 year design life is calculated to be \$1.24 using \$0.14 per kilowatt hour with a 3 percent discount rate.

Table 5 summarizes the energy savings and reduced costs for LCD and plasma televisions due to the proposed Tier I and Tier II standard levels. The design life and incremental cost per unit

⁷ Table 8 of Appendix A of PG&E’s CASE study July 3, 2008.

for televisions is based on the PG&E CASE study. Based on currently available information the estimated incremental cost per unit is negative or \$0.00⁸ for Tier I and negative or \$0.00 for Tier II. There will be no increase in the purchase price of televisions due to the proposed efficiency standards because existing technologies, such as the use new phosphors with enhanced gas mixtures that causes pixels to glow can improve the efficiency of Plasma televisions and the use of light ray dispersing plastic film for LCD technology that actually reduces both the number of energy using lamps and the size of the power supply needed thus reducing the total cost to build the television. The Energy Commission standards are performance-based and technology-neutral and provide industry with complete flexibility on how they design their products to achieve the required levels.

This negative cost is annual unit energy savings were calculated by multiplying the average annual reduction in energy use per unit with energy price. The first year statewide energy savings were calculated by multiplying the average annual unit energy savings by the total number of annual unit sales in California for these types of televisions. The reduced total cost over the design life is calculated by multiplying the estimated design life in years by the estimated annual reduction in electrical energy use due to implementing the proposed standard (kWh/Unit/Yr) by the \$/kWh. The simple payback period is instantaneous because of the conclusion that the standards have zero or negative costs.

It is important to note that televisions larger than 1400 inches are not included in the proposed regulations, but instead will be covered under a subsequent Phase II rulemaking. This exclusion certainly comes with some loss in energy savings compared to the proposal put forth on December 15, 2008, and in the above model would lead to a decrease in the “Annual Sales” of televisions. However the annual sales data used to calculate energy savings is well under the 4.4 million units estimated to be sold in California in 2011.⁹ Staff used a 4.0 million unit sales figure for California which still represents a conservative estimation of the total unit sales of televisions of 1,400 square inches and less.

Economic Impact of Television Standards

The proposed standards by their very nature and intent will impact the television market. It is therefore important to evaluate and estimate the impact the proposed standards will have to the California economy and job opportunities in the state.

The first step is to describe the expected results of regulation. For both the January 1, 2011 and January 1, 2013 on mode power requirements there is an existing base of television models manufactured in 2009 which currently meet the proposed standards. The goal of the regulations are to cause a market transformation in the remaining energy wasting televisions being sold

⁸ PG&E’s CASE Study April 2, 2008 page 12, Section 5.2.

⁹ PG&E revised CASE study July 3, 2008

today so they will be manufactured to meet the minimum efficiency standards by 2011 and 2013. As discussed above the Energy Commission can only adopt efficiency standards after showing technical feasibility. This means that the Energy Commission staff has found that it is feasible for all television models to meet the standards by incorporating design or technology changes in existing manufacturing. The Energy Commission incorporates what it determines to be reasonable implementation dates, based on the magnitude of redesign, to cause the desired market change to greater energy efficiency and significant statewide energy savings. The Energy Commission uses its regulatory authority to drive the lower efficiency televisions to a new, more efficient level.

Typically the market transformation comes at a premium. In most cases more efficient technologies and appliances come with an associated incremental cost. This incremental cost to consumers is a result from the manufacturer's cost of compliance with standards. However, the Energy Commission has determined from the record that televisions are generally an exception to this rule. While there are some technologies that can be implemented at an incremental cost increase, such as the implementation of automatic brightness control, the Energy Commission had determined from the record that there are many efficiency measures for television that have zero or negative cost. Television screen settings can be changed to meet compliance without changing any parts or manufacturing processes. Component suppliers such as 3M, Augora Technologies, and Imagine Design have developed new films for television screens which have a total incremental cost which is reduced to zero due to the cost savings by the manufacturer by the reduction in parts needed for the television.¹⁰ Therefore the cost of compliance can be negative, zero, or positive depending on the route a manufacturer chooses to pursue. For the sake of the analysis here it will be assumed that there is no unit price increase as a result of compliance and that competition will continue to keep prices stable.

While the Energy Commission finds it is feasible for all manufacturers to make their entire line of products compliant with the proposed regulations, in the end it is up to the manufacturer to implement efficient technologies and designs. This means that there may be television models which may not be sold or offered for sale in California. There are several reasons that Energy Commission staff determined that this will have an insignificant effect on the California economy.

Consumers in the state will have available for purchase a number of energy efficient compliant models that will be substitutes for the energy wasting non-compliant models that may no longer be sold or offered for sale in California. The qualified product list created by ENERGY STAR® shows that for a given television size several manufacturers already produce compliant televisions. This negates the potential "monopoly" effect on television prices as there will continue to be competition by multiple manufacturers. In addition manufacturers, retailers, and

¹⁰ http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-12-15_workshop/comments/LCD_TV_Association_TN-49783.pdf

distributors take a risk by producing non-compliant models for sale in the US but not in California. It is very difficult to manage supply chains to the accuracy of state borders and much of the television market is organized into a much larger “North America” market. Therefore continuing to produce and sell non-compliant televisions becomes a discouraging legal liability with potential violations of California State law. Lastly compliant models will be more competitive than non-compliant models. According to ENERGY STAR® analysis¹¹ “there are feature-rich models from 20 different television manufacturers available today that currently meet the proposed on mode requirements in a range of price points and sizes.” It is important to note that the on mode efficiencies referenced here for ENERGY STAR® 4.0 television specifications are nearly identical to the Energy Commission’s January 1, 2013 Tier 2. Efficient televisions with the same features and at the same cost as non-efficient televisions offer additional value to the consumer and therefore are more competitive. This especially is true as the Energy Commission proposes labeling requirements, maintains a publicly searchable database of appliances, and as the Federal Trade Commission (FTC) continues work on a national labeling program.

The proposed regulations will provide a significant economic benefit for the economy of California. These benefits route from the reduction and avoidance of electrical generation to a reduction in consumers spending on purchasing electricity for energy wasting televisions. Electrical consumption leads to the export of money from the California economy. 23 percent of the electricity consumed in California is generated outside of the state. In addition the state’s largest fuel source for electrical generation is natural gas, of which is 86.5 percent is imported.¹² The cost of fuel is 77.7 percent of operating expenses for fossil fuel powered plants¹³ and is therefore a significant portion of retail price of electricity to California businesses and residents.

Reduction of energy consumption affects the least economical electrical generation in the state. In order to maximize revenue and minimize retail price of electricity the cheapest forms of generation possible are utilized to meet demand first. This means that additional demand is generally generated by less economical power plants. Peak loads are particularly uneconomical as they require power plants to be on standby in order to be prepared to meet demand for a few hours a day or year. The proposed standards will reduce the coincident peak and overall electrical demand of California which will lead to more economically efficient generation within the state.

The proposed regulations are estimated to reduce energy demands by 6,515 GWh/year after the stock of Tier 2 compliant televisions in California At \$0.14 per kWh this translates to statewide homeowners saving \$912.1 million per year on electrical bills. This money saved in energy costs will represent an equal increase in discretionary income. According to analysis by the California

¹¹ Final Draft Versions 4.0 and 5.0 Energy Star® TV Specification Comment Response Summary Document, September 3, 2009

¹² 2007 Integrated Energy Policy Report (IEPR), publication number CEC-100-2007-008-CMF

¹³ Energy Information Administration’s Electric Power Annual Report 2007

Department of Finance¹⁴ for every \$1000 of personal income, California receives \$22.39 in sales taxes. This correlates to annual sales tax generation of \$20.4 million and represents a present value of \$181.5 million dollars to the state of California. These numbers are likely understated due to differences between total personal income and discretionary income.

RAND California data shows the gross state product in retail to be \$112,891 million while employing 2,070,705 in 2005.¹⁵ This correlates to one job per \$54,518 of retail output. Adding \$912.1 million per year gross state product would generate approximately 16,730 jobs in retail. Discretionary income may be spent in other sectors than retail including transportation and other services. The \$912.1 million is not pure economic investment in the gross state product as some of it is diverted from utility gross product. However as pointed out earlier 23 percent of generation occurs out of state and the majority of fossil fuels used for electrical generation are imported. This will lessen estimated growth in gross state product by approximately half resulting in the creation of 8,365 jobs after adjustment.

The estimated value of energy cost savings of the proposed regulation is \$8.1 billion to California consumers. This is calculated by multiplying 6,515 gigawatt hours by the present value of \$1.244 for saving 1 kilowatt-hour of energy for 10 years. Although we assume the price of electricity is \$0.14 per kilowatt-hour in California we diminish the value of money in the future versus money today, therefore arriving at a value less than \$1.40 for saving 1 kilowatt-hour of energy for 10 years. The \$8.1 billion of value from television energy savings is the total present value of converting all televisions to Tier 2 compliance.

Other Economic Analysis

The CEA commissioned Resolution Economics, LLC to conduct an economic analysis of the staff report issued for the December 15, 2008 workshop. This report concluded that the December 15, 2008 proposed standards would result in damages to state sales tax, state income tax, consumer electronics revenue, and loss of jobs. The analysis does not apply to the express terms proposed by the Energy Commission in relation to this rulemaking. The analysis was based upon different on mode power requirements, implementation dates, and sizes of televisions than the currently proposed language for regulation.

The CEA analysis omitted the impact of electricity cost savings to consumers which the Energy Commission has found to be a significant economical benefit to the state of California (see above; "Economic Impact of Television Standards"). In addition the CEA report alleges damages to taxes, jobs, and revenue based on the fundamental assumption that fewer people will buy televisions, which is not supported by the record and the finding by the Energy Commission discussed above (see above; "Economic Impact of Television Standards"). For example, if 10 percent of televisions are non-compliant at the time of the new regulation the

¹⁴ http://www.dof.ca.gov/html/fs_data/stat-abs/Tables/P12.xls

¹⁵ <http://ca.rand.org/stats/economics/economics.html>

economic model assumes that roughly half of consumers will buy a substitute model, and that the other half simply will not buy a television. This assumption causes consumer dollars to disappear from the California economy, when in reality consumers will just substitute compliant television purchases in light of the wide availability of competitive models and if not would spend in others ways.

The basic concept of CEA's economic analysis was presented at the December 15th 2008 workshop. In this workshop CEA's chief economist Shawn DuBravac stated that their economic model is "built in such a way that if you would have other assumptions you'd like us to run, we're happy to put those assumptions in."¹⁶ The Energy Commission suggested that the economic benefits of energy reduction be included and that the scope of the economic analysis be expanded to the state economy in place of the consumer electronics portion of the state economy. The Energy Commission also suggested that the CEA economic analysis include positive impacts to the consumer electronics industry from increased discretionary income for consumers. Despite the vetting of assumptions in the Energy Commission workshop, the economic study released by CEA on March 23, 2009 did not address suggestions and criticisms brought forth by the Commissioners and their advisors.

Energy Commission staff does not find that the impacts outlined in the CEA report are supported by the record. The economic impacts of the proposed regulations are expected to be positive for California and California consumers.

The proposed standards help meet the goals of Assembly Bill 32 which calls for the reduction of greenhouse gasses in the state of California. The California Air Resources Board (CARB) released a scoping plan in December of 2008 which outlines appliance efficiency regulations as a critical part of meeting the goals of the bill. The proposed television regulations significantly contribute to the appliance efficiency goals of the scoping plan. To aid with policy decisions CARB and University of California Berkeley developed economic models of the impacts of energy efficiency and conservation on the California economy.

"Multiple studies have been conducted assessing the economic impacts of CARB's Scoping Plan. CARB's own economic analysis using the Environmental Dynamic Revenue Assessment (E-DRAM) model projects that the state's proposed package of policies will increase overall personal income by \$14 billion, overall gross state product by \$4 billion, and result in the creation of 100,000 additional jobs. Using the Berkeley Energy and Resources (BEAR) model, we find that if California improves energy efficiency by just 1 percent per year, proposed state

¹⁶ December 15th, 2008 Efficiency Committee Workshop:
http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-12-15_workshop/2008-12-15_TRANSCRIPT.PDF

climate policies will increase the Gross State Product (GSP) by approximately \$76 billion, increase real household incomes by up to \$48 billion and create as many as 403,000 new jobs.”¹⁷

Technical Feasibility

Energy Efficiency Improvements with New Technologies:

Television technology has changed rapidly over the last decade along with related television programming services. The most obvious pressure on manufacturers has been to make televisions larger, cheaper, and include more enhanced features and functionalities. Unfortunately this drive has led to a corresponding increase in energy consumption.

The two most widely available television technologies are plasma and LCD. Plasma televisions use approximately 32 percent more energy than LCD televisions. Some plasma television set manufactured in 2008¹⁸ draw more power than a large refrigerator, even if the television is only used a few hours a day. Powering a television plus an extensive entertainment system—with set-top boxes, game consoles, speakers, DVDs and digital video recorders—can add nearly \$200 to a family's annual energy bill.”¹⁹

The Energy Commission has determined from the record that there are many new technologies found in televisions currently being built and sold in the market that effectively reduce their energy consumption, that the use of these technologies has not imposed and does not impose a large cost on either the manufacturer or consumer, and that they would greatly decrease the energy consumption of the most inefficient televisions still being sold in the market were they incorporated into these units.

CNET and ENERGY STAR® television test data shows that there are large screen plasma televisions that are able to meet the proposed Tier I and Tier II standards, and records show that manufacturers have been steadily working to improve the energy efficiency of plasma televisions. Panasonic, for example, has developed a more energy efficient plasma display that was introduced at the 2009 Consumer Electronics Show in Las Vegas. Through the development of new phosphors and cell design technology, as well as optimizing the electronic driving circuits for better efficiencies, their new display boasts doubled energy efficiency. By reducing

¹⁷ “California Climate Risk and Response” November 2008, Research Paper No. 08102801
http://are.berkeley.edu/~dwrh/CERES_Web/Docs/California%20Climate%20Risk%20and%20Response.pdf

¹⁸ http://www.samsung.com/us/consumer/professional-displays/professional-displays/plasma/PH63KLFLBF/ZA/index.idx?pagetype=prd_detail&tab=spec

¹⁹ <http://www.sciam.com/article.cfm?id=choosing-an-energy-efficient-tv>

energy consumption by half, plasma could, in the near future, be on at least equal footing with LCD displays in their energy consumption.²⁰

Advance Plasma Display Development Center Corporation (APDCC) aims to develop Plasma Display Panel (PDP) with cell pitch of 0.1mm and luminous efficacy of 3 lumens per watt. This luminous efficacy corresponds to 10 lumens per watt for cell pitch of 0.3mm. To realize the so-called "10 lumen/watt technology", the energy loss must be minimized for the small cell pitch.²¹ APDCC state that "PDP is energy-saving because it consumes less power in black scene. For example, power consumption can be decreased to less than 70W with a 42 inch PDP when luminous efficacy of 10 lumens/watt is materialized."

This continues the great progress made by manufacturers to improve the energy efficiency of plasma televisions in recent years. Jim Palumbo, president of the Plasma Display Coalition (PDC) representing the top plasma television manufacturers, says the industry has reduced power consumption 30 percent in the past six years.²²

Many new technologies and techniques are now available to manufacturers that can help to decrease television energy consumption. Panasonic, as mentioned above, has released new plasma televisions equipped with what they term "Neo PDP technology", a technology first debuted on January 8, 2008. Panasonic Neo PDP employs larger cells to emit more light at lower power and makes the screen much brighter than normal plasma. Panasonic's Neo PDP screen is only 1 inch thick and is 50 percent brighter than similar sets at no increase in consumed power.²³ Toshihiro Sakamoto, Senior Managing Director of Panasonic and President of Panasonic AVC Networks Co said on August 2, 2008 "We plan to expand the lineup so that we will be able to reduce the power consumption of all (Panasonic) PDP televisions to be on par with that of LCD televisions_by FY/2009."^{24 25 26}

LCD panel technology is likewise constantly evolving in all areas, from developments in the use of different liquid crystals and improved backlight technology for improved picture performance, to manufacturing processes that help improve the yield factor (and in so doing reduce costs). Developments in LCD Backlight Technology include Improved Fluorescent Backlights, LED Backlights, and Color Field Sequential Technology.²⁷. Specific examples follow, starting with improvements in fluorescent backlights in LCD panels:

²⁰ http://www.electronichouse.com/article/the_real_efficient_plasma and

<http://ezinearticles.com/?Should-a-New-Energy-Efficient-Plasma-TV-Be-in-Your-Future?&id=979498>

²¹ <http://www.advanced-pdp.jp/fpd/english.html>

²² <http://www.usnews.com/articles/business/2007/12/06/your-new-plasma-tv-may-be-an-energy-hog.html>

²³ <http://www.electricpig.co.uk/2009/02/24/panasonic-neo-pdp-tv-tech-unveiled/>

²⁴ <http://www.hdtvinfo.eu/news/hdtv-articles/panasonic-plasma-tv-with-lower-power-consumption.html>

²⁵ <http://www.plasma-lcd-facts.co.uk/pdf/pdf-the-future-still-looks-bright-for-plasma-tvs.pdf>

²⁶ http://www.hdtvmagazine.com/columns/2007/10/hdtv_almanac_bright_future_for_plasma.php

²⁷ <http://www.practical-home-theater-guide.com/lcd-panel.html>

- Samsung is making use of a flat fluorescent lamp (FFL)²⁸ instead of the standard cold cathode fluorescent tubular lights (CCFL) to power some of its flat-panel LCD HD televisions. The main advantage is that FFLs have a paper-thin form factor that produces light from its entire surface, offering the potential for greater picture uniformity, better brightness, and a higher contrast ratio.²⁹
- Philips originally employed the use of intelligent electronics in the control of the multiple high output fluorescent lamps operated in a scanning mode on some of their high-end LCD displays.^{30, 31} This scanning principle is now being used by other television makers like LG, VIZIO, and Toshiba to generate blank frames in their 240Hz refresh rate dejudder^{32, 33} processing.
- Sony's new television technology, Hot Cathode Fluorescent Lamp (HCFL) micro tubular backlight panel, uses 40 percent less energy than a standard (cold cathode) fluorescent backlight panel.^{34, 35, 36} A 52 inch HCFL television uses only 127 watts in active mode while maintaining the same level of brightness as conventional CCFL LCD televisions.

Sony has also incorporated an intelligent Presence Sensor function in its televisions to sense if a viewer is present or not in the room, and is able to temporarily turn off the television picture, instantly reducing power consumption by 50 percent ^{37,38}.

- Similarly, actively controlling the backlight brightness level in synchronization with the picture content helps improve gray scale performance and deeper black levels while saving energy.³⁹

LCD Light Emitting Diode (LED) television backlight technology was rare only a few years ago, but is now premium mainstream technology. LED backlighting enjoys a number of advantages over LCD panels using cold-cathode fluorescent lamps (CCFL), with the most significant being improved picture performance that is similar to CRTs with extremely deep blacks and

²⁸ <http://www.practical-home-theater-guide.com/lcd-panel.html>

²⁹ <http://www.eup-richtlinie.at/download/lot5/task6.pdf>

³⁰ <http://www.practical-home-theater-guide.com/lcd-panel.html>

³¹ <http://ipcommunications.tmcnet.com/news/2005/may/1146944.htm>

³² Telcine Judder and Motion interpolation is a form of video processing in which intermediate animation frames are generated between existing ones, in an attempt to make animation more fluid.

³³ http://reviews.cnet.com/4321-6475_7-6594645.html

³⁴ http://www.sony.ca/view/press_715.htm

³⁵ <http://www.displayblog.com/2009/01/11/ces-2009-sony-kdl-52ve5-52-eco-lcd-tv/>

³⁶ <http://www.cybertheater.com/sony-debuts-eco-bravia-ve5-lcd-tv-series/>

³⁷ <http://www.reuters.com/article/pressRelease/idUS16657+08-Jan-2009+PRN20090108>

³⁸ <http://www.connectedhome.com.au/product/sony-bravia-we5-energy-efficient-tv>

³⁹ <http://www.practical-home-theater-guide.com/lcd-panel.html>

impressive dynamic contrast ratings.⁴⁰ This is in addition to significantly reduced power consumption and longer lifespan that is typical twice that of CCFL based models. Examples include:

- In July 2009, Sharp television manufacturer unveiled a new line of LED-backlit LCD televisions. New television energy consumption data released by Sharp on the new line of LED LCD television of 32, 40, 46, and 52 inch size models show that the new televisions exceed the Tier II energy consumption between 20 to 40 percent.

Sharp's new 52 inch LED television consumes 105W, exceeding the EPA's ENERGY STAR® criteria for TVs: Version 3.0 by 68 percent; a 46 inch LED consumes 90W, exceeding ENERGY STAR® guidelines by 63 percent; a 40 inch LED consumes 75W, exceeding ENERGY STAR® guidelines by 60 percent; and a 32 inch LED consumes 55W, exceeding ENERGY STAR® guidelines by 52 percent.^{41, 42}

- Samsung's LED LCD television technology is approximately 40 percent more efficient than their already-efficient, ENERGY STAR® qualified LCD televisions.⁴³

Color sequential technology is becoming popular as a method of eliminating the color filters in LCDs. In 30 to 40 inch LCD panels, the color filter accounts for some 25 percent of the total cost of the LCD display panel, and as an additional layer that light must pass through before reaching the viewer these panels require an even greater amount of light be generated to account for the filter's transmissivity (the amount of light that is able to pass through it without being lost).⁴⁴ Thus, eliminating the color filters represents a significant way of reducing costs, simplifying the production process, and saving significant energy all at once.^{45, 46, 47}

LCD with Optical Compensated Bend (OCB) technology⁴⁸ enables a wide viewing angle of 176 degrees in all directions, which is comparable to that of a CRT. Both plasma and LCD now has a wide viewing angle.

The technological improvements in LCD flat-panel displays are taking place in all the areas at rapid pace and has lead to larger displays panels, with improved response times, and higher

⁴⁰ <http://www.practical-home-theater-guide.com/lcd-panel.html>

⁴¹ http://www.twice.com/article/307744-Sharp_Unveils_Aquos_LED_LCD_TV_Lineup.php

⁴² <http://www.marketwire.com/press-release/Sharp-1014224.html>

⁴³ http://www.samsung.com/uk/consumer/detail/detail.do?group=television&type=television&subtype=led&model_cd=UE40B6000VWXXU

⁴⁴ <http://www.practical-home-theater-guide.com/lcd-panel.html>

⁴⁵ <http://insightmedia.info/reports/2007FSCM.php>

⁴⁶ <http://www.engadget.com/2006/05/25/toshiba-developing-lcds-using-field-sequential-tech/>

⁴⁷ http://en.wikipedia.org/wiki/Field-sequential_color_system

⁴⁸ http://www.tmdisplay.com/tm_dsp/en/technology/ocb.html

resolution, faster refresh rates, a better color is achieved, and making LCD television sets cheaper. Additional examples include:

1. Display panel manufacturers are using varied display enhancement technologies for LCD screens to increase the efficiency of the backlight's transformation into a picture. Light diffusing and light polarizing film technologies are available today that can enhance the energy efficiency in all sizes of televisions. 3M's Vikuiti optical film is integrated into the backlight of many flat panels of LCD televisions. 3M film alone can reduce their power consumption by 37 percent.⁴⁹
2. Many other diffusing and polarizing film technologies are being used by many manufacturers in their television models and have resulted in a significant reduction in energy consumption. California based companies Agoura Technologies⁵⁰ and Imagine Designs⁵¹ have developed light polarization and light diffusing films that can significantly improve backlight transmission, thus can significantly reduce the energy consumption in picture displays at cost savings.
 - Agoura is working on production of PolarBrite film technology⁵² for LCD backlight that will enable 30 percent energy savings. Agoura film will contribute to LCD manufacturers' ability to meet proposed Tier 1 and Tier 2 standards. The optical polarizer film will lower the active mode power requirements while decreasing the manufacturing costs. In current LCD televisions the rear polarizer films absorbs more than 50 percent of the backlight. The Agoura film technology has developed recycling polarizer technology to reclaim light that otherwise would be lost as heat, therefore reduces the light loss by more than half by recycling the light.⁵³
 - Imagine Designs Inc. of Campbell, California has developed an optics technology that combines their Flat Panel Reflector (FPR) technology with their Total Internal Reflection-Light Valve (TIR-LV) to create the Imagine Designs Display (IDD), a completely new LED based display technology which has consumes 75 percent less power for proposed

⁴⁹ http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-12-15_workshop/comments/3M_Comments_TN-49786.pdf

⁵⁰ http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-12-15_workshop/comments/Agoura_Comment_TN-49396.pdf

⁵¹ http://www.energy.ca.gov/appliances/2008rulemaking/documents/comments/Display_Technology_Overview_2009-07-16_TN-52489.PDF

⁵² <http://www.agouratech.com/>

⁵³ http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-12-15_workshop/comments/Agoura_Technologies_TN-49787.pdf

Tier 1 and approximately 69 percent for Tier 2 and costs 50 percent less to produce than current generation LED technologies.⁵⁴

3. Television models are being manufactured with photo-sensors which automatically adjust the brightness and contrast of a screen based upon the ambient light conditions, and with menu settings for brightness that are appropriate for home use while saving energy. The display management of light sensing solutions adds to energy savings in televisions. Texas Advanced Optical Solution (TAOS), light sensing chip provide ambient light sensing to control display brightness and provides color temperature to white color balance under various ambient conditions.⁵⁵ The TAOS technology also provides an integrated display calibration using Red Green Blue (RGB) color chromaticity to eliminate manual color adjustment for accurate color rendition. Furthermore, it also employs proximity detection system to detect television user presence to turn on/off the display.
 - Example: LG Electronics recently unveiled an Intelligent Sensor technology that reduces for Liquid Crystal Display (LCD) television energy consumption by 69.5 percent⁵⁶ savings when using the automatic brightness control.⁵⁷
4. In the December Workshop held by the California Energy Commission, JVC television representative Dave Kline declared that JVC has 13 television models that are proposed Tier II compliant.⁵⁸ ⁵⁹ Now JVC has 19 televisions on the August 11, 2009 ENERGY STAR® list that meet Tier 2. Compliant television size ranges from 19 to 52 inches.
5. VIZIO is one of the three leading brands of LCD and Plasma Flat Panel HD televisions, with 10 percent of the television sales in the U.S. for the year 2008. VIZIO has confirmed to the Energy Commission that they are in a position to comply with the proposed standards earlier than the proposed effective dates.⁶⁰

VIZIO has several LCD models in the market today that meet the Tier 2 standard, some four years before the proposed effective date of the standard. These models are using the latest technology and features, and are of a broad range of screen sizes.

⁵⁴ http://www.energy.ca.gov/appliances/2008rulemaking/documents/comments/Image_Design_Inc_Next_Generation_of_TV_Presentation_2009-07-17_TN-52492.PDF

⁵⁵ <http://www.taosinc.com/>

⁵⁶ <http://www.lge.com/us/press-release/article/lg-lcd-tvs-use-695-less-power.jsp>

⁵⁷ <http://www.lge.com/us/press-release/article/lg-electronics-introduces-first-ever-thx-display-certified-led-lcd-hdtv.jsp>

⁵⁸ <http://www.jvc.com/press/index.jsp?item=668&pageID=1>

⁵⁹ <http://www.avguide.com/article/jvc-lcd-tvs-exceed-energy-star-standards-0>

⁶⁰ http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-12-15_workshop/comments/VIZIO_Comments_TN-49393.pdf

VIZIO has stated in their December 2008 letter to the Energy Commission that for plasma televisions, although it is difficult for them to meet the standard today, there are significant efficiency achievements in the near horizon that will enable them to meet the Tier 2 requirements in the next couple of years.

6. The new Mitsubishi LaserVue 65 inch television in on mode consumes 135 watts of power.⁶¹ LaserVue series will include televisions ranging from 65to 82 inches, all featuring 3D-Ready viewing technology. On mode power consumption for all LaserVue televisions series will be 135 Watts, representing one third the power consumption of a comparable LCD television and one fourth the power consumption of a comparable available plasma television.
7. The McLaughlin Consulting Group (MCG), a display market and technology consulting team, has endorsed the proposed two-tiered television energy standards and recommended that the Tier 1 and Tier 2 effective dates should be moved forward to July 1, 2010 and July 1, 2011, respectively.⁶²

The MCG in their letter dated January 15, 2009 stated that “proposed California standard will encourage innovation by providing momentum for companies to adopt currently available energy efficiency technologies and to also justify investments in various emerging technologies. Currently available technologies allow televisions to meet the Tier 2 levels today and emerging technologies will allow televisions to significantly exceed Tier 2 levels.”

MCG also stated “we believe that the power efficiency gains can be delivered while sustaining the historical cost down trends of 10 percent cost reduction annually.” California consumers “will benefit from energy cost savings, thus making the proposed standard extremely cost-effective for the state of California.”

During the past several years, the MCG team has completed in depth performance and cost analysis of many of the key materials and components used in LCD backlights. Their studies and modeling of the polarization recycling films, brightness enhancement films, diffusers, and backlight architectures predict continuous improvement in performance as well as substantial cost reductions due to increased competition and production efficiencies.

8. Energy Efficient Organic LED (OLED) televisions are currently available in small sizes. The size is expected to grow larger in the near future. OLED televisions do not require a backlight to function and use significantly less power during operation. Considering how much less energy OLEDs consume over current LCD and plasma, OLED televisions will likely to become more prominent in the future.^{63 64}

⁶¹ <http://laservuetv.com/products.php>

⁶² [http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-12-15_workshop/comments/McLaughlin Consulting Group TN-49781.pdf](http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-12-15_workshop/comments/McLaughlin_Consulting_Group_TN-49781.pdf)

⁶³ <http://www.oled-info.com/oled-tv>

Based on facts in the record, the Energy Commission has determined that the proposed energy efficiency standards for televisions are technically feasible and attainable in meeting the specified dates for the Tier I and Tier II standards as required by the Public Resources Code.

Display Settings Data Analysis for Feasible Energy Savings Standards

Television power consumption in the future is expected to increase as the current stock is replaced by the newer technologies that use higher wattage, have larger screen sizes, and have increased functionality and enhanced features.

Most televisions purchased today contain within their settings menu a variety of options for adjusting the characteristics of the picture produced by the television. Many televisions also contain a variety of factory preset picture modes, each of which comprises a particular set of stored settings labeled for use with specific types of television content. Televisions are typically shipped from the factory to a retailer with very high brightness settings in order to compete on store shelves. Retail settings are not optimized for home viewing. Many consumers are unaware of the energy savings and quality improvements that can be achieved by adjusting the brightness and contrast to levels more appropriate for the home.

The brightness and contrast settings combined generally determine how much light the television emits. Unlike a light bulb, a television is an information display device; more light from the screen is not necessarily better for the user. Overly bright displays may incorrectly represent the original broadcast or movie content that the user was intended to see, or may harm picture quality by washing out dark areas of the screen or making text more difficult to read. Many manufacturers are considering automatic brightness control to enhance picture quality and save energy.

Significant reductions in energy consumption can be achieved in plasma and LCD televisions by adjusting the contrast and brightness screen settings by manufacturers before shipping televisions to the retailers. The power consumption of the television drops significantly with screen setting modifications. On average, plasma televisions will consume almost 21 percent less power when set to a low power factory preset-level, sometimes called "movie" or "pro" settings. The data on LCD televisions indicate power consumption could be reduced by an average of 16 percent through the low power factory preset.⁶⁴ PG&E's analysis of test data indicates that televisions consume high power in what is referred to as "torch settings." A torch

⁶⁴ http://reviews.cnet.com/4520-6449_7-6741419-1.html

⁶⁵ http://www.isf-europe.com/Articles/ECOS_ISF_TV_Power_Consumption_Sensitivity_Analysis_Memo.pdf

setting means very high brightness and contrast and is generally designed for store display models.

Power Factor

Power factor is the ratio of real power to apparent power. A 100 watt television can collect the energy it needs by drawing 100 watts from the grid for 1 second, or 200 watts from the grid for 0.5 seconds. While the power consumption within the television (referred to as real power) is the same in the each case, the power draw from the grid (apparent power) is very different. This television would have a power factor of 0.5 (100 watts divided by 200 watts). Many appliances draw a large amount of power from the grid, store it, use it, and then draw another surge of power. While improving power factor will not significantly alter the consumption of energy within a device, it will save energy in external ways. One important cause of energy loss due to low power factors is heat loss over wiring. Although wires are good conductors of electricity they are not perfect and convert some of the electricity they transmit into heat. These wire losses are proportional to the square of the current. Therefore an appliance that draws double the current would result in quadruple the wiring loss of power.

The proposed regulations include a requirement for power factor greater than 0.9 for televisions that consume 100 watts or more power and are manufactured on or after January 1, 2011. On November 1, 2008, ENERGY STAR® adopted new standards for televisions and for external power supplies. The new *ENERGY STAR® Requirements for Televisions Eligibility Criteria (Version 3.0)* require television manufacturers to report the “True Power Factor” of their products in order to qualify for the ENERGY STAR® label. Of the televisions submitted for qualification thus far approximately half of the models have reported a power factor of 0.9 or greater. In addition to these television requirements the recently effective *ENERGY STAR® Program Requirements for Single Voltage Ac-Dc and Ac-Ac Power Supplies Eligibility Criteria (Version 2.0)* requires that external power supplies which draw more than 100 watts have a power factor of 0.9 or greater when operated at its full load. Televisions typically draw significantly more power than this minimum value and therefore can generate the same power quality benefits as the external power supply standard. Improving power factor will reduce energy use by household distribution systems and improve the quality of power in California’s distribution system by avoiding unnecessarily high current draw.

Power factor energy savings are proportional to the power draw of the television. Therefore the proposed power factor regulations save less energy in Tier 2 than in Tier 1. Roughly 52 percent of televisions meet the proposal according to analysis of ENERGY STAR® data for use in the December 15, 2008 Energy Commission television workshop. For those which do not currently meet the proposed standards it is assumed that they will improve from a power factor of 0.53 to 0.98. The typical power factor correction circuits result in power factor performance levels of 0.98 which is why 0.9 (bare minimum for compliance) was not used. While PG&E analysis

shows the proposal to be cost effective,⁶⁶ for televisions 95 watts or more the cost to benefit ratio is marginal. Therefore the Energy Commission proposes a more cost effective level of 100 watts or more. Power factor correction technology is well developed and implementable in nearly all electronics. The energy savings are estimated to be 6 kWh per year for a 37 inch television which just meets Tier 1 standards and 3 kWh per year for a 37 inch television which just meets Tier 2 standards.

Policy Issues and Next Steps

Currently consumers are unable to assess the energy consumption and associated operating costs of purchasing a particular television model. Even though annual household television energy consumption is approaching that of a new refrigerator, there is no systematic label similar to those found on major appliances that provide estimated annual energy use and electricity costs for a particular model. Television energy use varies widely among televisions for any given screen size and represents a large energy savings opportunity.⁶⁷ The cost of operating a television is approaching the cost of the television itself. For example a 32 inch television which just meets Tier 1 standards would consume approximately 117 watts in on mode and 1 watt in standby mode. In this staff report we assume 1907 hours and on mode and 6853 hours in standby, which yields an annual energy consumption of 230 kWh/year. The present value of the energy costs to the consumer would, therefore, be \$286.12. For a 32 inch television that retails for \$380 or \$1000 the respective energy costs represents 43 percent or 22 percent of the total cost (operation cost plus retail cost) of a television. The energy consumption is therefore an important factor in the economics television purchasing much in the same way that fuel economy is an important economic factor in automotive purchases. To aid customers in making informed choices about energy consumption, the proposed regulations require energy disclosure on product packaging. Energy Commission staff also is considering using the Energy Commission's Consumer Energy Center to further educate consumers about television energy use.

The proposed regulations are designed to eliminate lower efficiency televisions from California thereby removing the poorest energy choice options from the market. The State's existing efficiency standards have historically made a significant difference in California's energy consumption. Energy efficiency is identified as a key component to achieve Assembly Bill 32 (Nunez, Chapter 488 Status of 2006)⁶⁸ (AB 32) Green House Gas (GHG) goals in the California Air Resources Board's *Climate Change Scoping Plan*.⁶⁹ PG&E analysis as presented at the

⁶⁶ PG&E Case Study: Energy Saving Estimate for Power Factor Correction in Televisions, April 13, 2009

⁶⁷ http://www.efficientproducts.org/reports/tvs/NRDC_TV-efficiency_2004.pdf

⁶⁸ http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf

⁶⁹ http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

July 16, 2009 workshop estimates the proposed regulations to mitigate 3.5 million metric tons of CO₂ or CO₂ equivalence.⁷⁰ Energy Commission staff will continue to monitor aggregate television energy consumption and identify carbon dioxide and GHG savings that can be attained through moving the consumer market toward the sale of energy efficient television models, and will inform the policy makers on the achievement of AB 32 GHG goals.

Finally, the Energy Commission is committed to working with manufactures to encourage and accelerate the development of energy efficient television technologies, and with retailers to sell or offer for sale energy efficient televisions in California. Energy Commission staff is actively seeking ways in which to minimize the impact of new regulations on businesses generally and small businesses in particular while achieving the goals and directives of California's legislature and governor's office and the enabling statutes of the California Energy Commission.

Stakeholder Comments and Responses

1. CEA, Custom Electronic Design and Installation Association (CEDIA), Consumer Electronics Retailers Coalition (CERC)/California Retailers Association (CRA), Cyber Manor, Rich Green Ink, Best Buy, Independent retailers, and Plasma Display Coalition (PDC) state that the regulatory approach is unnecessary and harmful. They suggest the use of market oriented, consumer friendly approaches such as ENERGY STAR[®] and incentive programs.

They state the proposed regulations would harm the ENERGY STAR[®] program. CEA's economic analysis shows significant loss in sales, jobs, and income tax revenue resulting from restricting TV choice. The Energy Commissions claims of large energy savings and zero cost is misleading –Savings are significantly overstated, costs significantly are understated and more analysis is cost savings is required.

Response: Energy Commission staff investigated, as an alternative to the proposed efficiency standards, the energy savings expected from relying only on the U.S. EPA's voluntary ENERGY STAR[®] Program for televisions. As a result of that investigation staff determined that the voluntary ENERGY STAR[®] program would only obtain 27 percent⁷¹ of the calculated \$8.1 billion in potential energy efficiency savings for the consumer that would result from the proposed efficiency standards.

⁷⁰ "Analysis of Standards Options" July 16, 2008 Slide 61

http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-07-16_workshop/presentations/PGE_Televisions_Presentation.pdf

⁷¹ In Energy Star's[®] 2007 Annual report the expected nationwide energy savings for all consumer electronics were estimated to be 14,700 gigawatt-hours. Using a 12 percent scaling from nationwide effects to California specific effects this translates to 1,764 gigawatt-hours of savings for the state.

<http://www.energystar.gov/ia/partners/publications/pubdocs/2007%20Annual%20Report%20-%20Final%20-11-10-08.pdf>

Staff therefore has determined that:

- i. the record supports that the energy savings difference from adopting the proposed efficiency standards for televisions instead of relying on the voluntary ENERGY STAR® Program results in a "significant amount of energy savings "on a statewide basis" pursuant to Public Resources Code section 25402(c)(1);
- ii. the record supports that the proposed efficiency standards are "based on feasible and attainable efficiencies" of television currently being made and being proposed by the manufacturers, and that these efficient televisions will result in a significant reduction in California's energy "consumption growth rates" pursuant to Public Resources Code section 25402(c)(1);
- iii. the record supports that the energy savings difference from relying on the voluntary ENERGY STAR® Program instead of adopting the proposed efficiency standards for televisions results in the use of "a significant amount of energy ... on a statewide basis" pursuant to Public Resources Code section 25402(c)(1) that is "wasteful, uneconomic, inefficient, or unnecessary" as per section 25402;
- iv. the record supports the that the proposed efficiency standards will "not result in any added total costs for consumers over the designed life" of the televisions pursuant to Public Resources Code section 25402(c)(1), and that there may be no incremental cost difference between the efficient televisions and energy wasting televisions currently be sold; and
- v. in calculating the cost-effectiveness of the efficiency standards, staff considered "the value of the energy saved, impact on product efficacy for the consumer, and the life cycle cost to the consumer of complying with the standard" pursuant to Public Resources Code section 25402(c)(1).

Thus, the Energy Commission staff has determined that it would not be appropriate to rely only on the ENERGY STAR® program to achieve the identified energy savings. ENERGY STAR® submitted a letter in July, 2008 stating that voluntary and mandatory programs can work together with careful coordination. The proposed standards' effective dates are far enough in the future that they will not conflict with ENERGY STAR®.

2. CEA and other commenter's state that the Energy Commission's proposed energy efficiency standards are removing high performance televisions from the market and as a result will impact certain distributors, retailers, and small businesses.

Response: The Energy Commission has made an initial determination that there will be no significant statewide adverse economic, fiscal, or environmental impact directly affecting businesses, including small businesses, as a result of the proposed amendments, including the ability of California businesses to compete with businesses in other states.

Based on the record before it the Energy Commission has determined that there will be no increase in the purchase price of televisions due to the proposed efficiency standards because existing technologies, such as the use of enhanced gas mixtures in plasma televisions and the use of light ray dispersing plastic film in LCD televisions, reduce both the cost to build the television and the active-mode energy consumption.

Other zero-cost strategies to improve television efficiency include measures such as changing the “as-shipped” brightness settings of television sets, which is applicable to any television and requires no change in the manufacturing process. Thus, the efficiency standards can be met by incorporating readily available efficiency technologies in televisions, which in many cases allow manufacturing changes that more than offset any increased cost and lead to low or zero net costs increases.

Efficient televisions on the market today which meet proposed standards are not more expensive than less efficient models. U.S. Environmental Protection Agency analysis of the market shows that the manufacturer suggested retail price (MSRP) of televisions which meet more stringent ENERGY STAR[®] standards are similar to those which do not.⁷² Efficient models are available at all sizes and price points, providing further evidence that energy efficiency is attainable without an increased cost to the consumer.

The Energy Commission has determined that because the manufacture of efficient televisions that meet the proposed standard is currently technically feasible, there is no added cost to build a more efficient television, and there is evidence that an increase in energy efficiency results in little to no increase in MSRP, therefore there will be no adverse economic impact to business generally, to small businesses, nor to the ability of California businesses to compete with businesses in other states.

In addition, the Energy Commission staff has determined that the proposed regulations would save consumers 6515 GWh annually over a ten year period. Staff has determined that the value of this energy savings for the California consumers over the lifetime of the television will be \$8.1 Billion. This \$8.1 Billion in consumer energy cost savings would stimulate California business because this \$8.1 Billion is an increase in disposable income that the consumer would otherwise have spent on higher energy bills.

Nevertheless, the Energy Commission invites interested persons to submit alternative proposals to lessen any adverse economic impact on business that might exist, which may include the following considerations:

⁷²[http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/television/ENERGY STAR TV Stakeholder Webinar Presentation 72809.pdf](http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/television/ENERGY_STAR_TV_Stakeholder_Webinar_Presentation_72809.pdf)

- (i) Establishment of differing compliance or reporting requirements, or timetables that take into account the resources available to businesses.
 - (ii) Consolidation or simplification of compliance and reporting requirements for businesses.
 - (iii) Use of performance standards rather than prescriptive standards.
 - (iv) Exemption or partial exemption from the regulatory requirements for businesses.
3. CEA stated in their January 19, 2009 letter written to the commission “Post-hearing comments regarding CEC Staff Draft Report and proposal for appliance efficiency standards for televisions (Docket # 07-AAER-3)” that the California Energy Commission proposal to require energy disclosures on product packaging is unnecessary and would duplicate federal efforts.

CEA in their alternate proposal letter dated July 1, 2008 stated that “CEA welcomes the Commission to review and contribute to industry's recommendations and research supporting energy use disclosure requirements for televisions.”⁷³

4. CEA stated in their comments that the Energy Commission’s claims of feasibility are based on press releases rather than careful analysis, and that the Energy Commission’s draft staff report assumes all televisions are the same.

CEA stated that California Energy Commission’s proposed standby power regulations are without adequate analysis or justification, that the proposed power factor requirements for televisions are without adequate analysis or justification, and that claims that demand for large televisions is growing is unsubstantiated.

Response: The Public Resources Code requires that the Energy Commission design energy efficiency standards to be technically feasible and attainable. The Energy Commission has determined from the record that there are many new technologies found in televisions currently being built and sold in the market that effectively reduce their energy consumption, that the use of these technologies has not imposed and does not impose a large cost on either the manufacturer or consumer, and that they would greatly decrease the energy consumption of the most inefficient televisions still being sold in the market were they incorporated into these units.

The Public Resources Code also requires that the energy efficiency standards adopted by the Energy Commission must “not result in any added total costs to the consumer over the designed life of the television.” Based on the record before it, the Energy Commission has determined that there will be no increase in the purchase price of televisions due to the

⁷³ http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-07-16_workshop/proposals/CEA_Proposal_Regarding_Televisions.pdf

proposed efficiency standards because existing technologies: the use of new phosphors can improve the efficiency of plasma televisions; the use of light ray dispersing plastic film for LCD technology actually reduces both the number of energy using lamps and the size of the power supply needed for a television thus reducing the total cost to build an LCD television; and zero-cost measures such as forced menus, reduced default brightness and factory pre-calibration exist that are applicable to all televisions. Thus, the efficiency standards can be met by incorporating these or other efficiency technologies in televisions, which in turn allow manufacturing changes that in many cases more than offset any increased cost, leading to low or zero net costs increases depending on the specific routes the manufacturer chooses to pursue.

The added total cost is obtained by comparing the cost and performance of a typical model that the consumer would be expected to purchase with the proposed standard in effect, to the cost and performance of a typical model that the consumer would be expected to purchase without the proposed standard in effect. The Energy Commission estimated from information in the record that the statewide benefit from the proposed efficiency standards for televisions will result in a savings to consumers of 8.1 billion dollars during the first ten years the standards are in effect.

Furthermore, the Energy Commission believes that press releases issued by manufacturers are credible information, based on the products that the Energy Commission has seen recently coming to the market and demonstrated at industry trade shows.

5. CEA stated in their comments to the Energy Commission that the California Energy Commission analysis does not consider effects of standards on technological innovation.

CEA stated in their comments and subsequent discussion with Energy Commission staff the issue that the proposed regulations stifle technology innovations.

Response: Energy Commission staff has reviewed the comments made by CEA related to technology innovations. Staff divided the technology innovation into three main parts:

- i. The CEA and its allies spoke about stifling 3 dimensional (3D) televisions technology.

Energy Commission staff is aware that 3D televisions require a conversion box to operate and requires the use of special glasses. The conversion box can be disconnected or turned off during the test for measuring on-mode energy consumption, as stated in the IEC 62087 test procedure. The IEC 62087 test procedure measures power consumption of the television by imputing a specific video scene to the television display. This method of measuring power consumption was chosen by industry because it is only applicable to the energy consumption of the display and does not measure

consumption use of additional functions that may or may not be included in a specific television.^{74, 75}

Thus it would not impact any television's ability to meet the proposed standards, nor would the standards in any way affect the development of such a conversion box.

ii. 3-dimensional television without the box.

Another 3D technology that is currently being developed is for hand held devices and it integrates advanced 3D film with LCD displays that use Optically Compensated Bend (OCB) mode to deliver autostereoscopic viewing at a glance, without the need for special glasses. As mentioned earlier, OCB is currently used in LCD televisions to provide a wider viewing angle and higher contrast ratio, though not to provide a 3D effect. According to a press release by Toshiba, the 3D film can easily integrate into currently available thin, high resolution displays, and enables simultaneous 2D and 3D viewing of the display with no picture degradation.^{76, 77} 2D televisions that meet the standard would not require additional energy to display a 3D image. Thus, this technology would not impact any television's ability to meet the proposed standard.

iii. The CEA and its allies raised the issue of built-in or peripheral equipment such as iPod etc.

The IEC 62087 test procedure measures power consumption of the television by imputing a specific video scene to the television display. This method of measuring power consumption was chosen by industry because it is only applicable to the energy consumption of the display and does not measure consumption use of additional functions that may or may not be included in a specific television.

Some of the additional functions that are not measured for energy consumption by the IEC 62087 test procedure and are not included as part of the proposed energy efficiency standards include but are not limited to: an internet TV unit, a 3-dimensional conversion unit, an iPod unit, a VCR unit, a DVD/Blu Ray unit, a HDD unit, a FM-radio unit, a memory card-reader unit, and an ambient lighting unit. These additional functions are excluded by the test procedure because they are not required for the basic operation of the television display. The innovative technologies CEA has mentioned are to be disconnected or turned off during the test as stated in the IEC 62087 test procedure. Thus they would not impact any television's ability to meet the proposed standards, nor

⁷⁴ http://www.dlp.com/hdvtv/3-d_dlp_hdvtv.aspx

⁷⁵ <http://www.t3.com/topic/3d-tv>. <http://www.pocket-lint.com/news/25978/who-offer-3d-television-2010>

⁷⁶ <http://www.electronista.com/articles/09/01/06/toshiba.3d.mobile.displays/>

⁷⁷ <http://www.reuters.com/article/pressRelease/idUS190142+06-Jan-2009+PRN20090106>

would the standards in any way exclude or impact the development of these technologies.

6. CEA stated that the Draft Staff Report has ignored opportunities to educate consumers and support ENERGY STAR®.

Response: The ENERGY STAR® is a voluntary federal program distinct from both federal and state minimum appliance efficiency regulations. Educating consumers about the ENERGY STAR® is something staff does whenever possible; doing so does not relieve the Energy Commission of its statutory obligation to develop minimum energy efficiency standards, and further is beyond the scope of the Title 20 regulations that are the subject of this rulemaking.

7. PG&E, NRDC, VIZIO, 3M, McLaughlin Group in their comment letter requested that the Energy Commission accelerate the effective dates of the standards to:

- Tier 1 effective July 1, 2010 rather than January 1, 2011;
- Tier 2 effective July 1, 2011 rather than January 1, 2013

Response: The Energy Commission staff has reviewed these comments and has decided not to change the proposed effective dates.

8. PG&E recommend adopting a particular test method – IEC 62807, Edition 2.0, and adopting a minimum brightness level for the home setting

Response: The Energy Commission’s proposed regulations include the PG&E recommended test method.

9. CEDIA stated that television video calibration is a way to save energy.

Response: The Energy Commission staff agrees with CEDIA that proper calibration reduces energy use in the majority of cases; factory pre-calibration or auto-calibration using a light sensor are both methods that manufacturers can use at zero or low cost to reduce the energy consumption of their units.

10. Best Buy, independent retailers, PDC stated that the regulations will cause the market to move to online and “gray market” sales.

Response: The Energy Commission has not been provided data in support of this argument. Similar claims have been presented to the Energy Commission previously regarding other products and have yet to materialize into a significant impact.

11. Toshiba requested that forced menu regulatory option is inconvenient as written.

Response: Changes have been made to the definition of forced menu to better meet the goals of the Title 20 regulations at a minimum level of manufacturer or user inconvenience.

12. ENERGY STAR®, in their letter dated July 23, 2008, expressed concern that their voluntary program is distinctly different from mandatory standards and stated that careful consideration should be paid in proposing their performance levels to be used as mandatory standards. Moreover, ENERGY STAR® stated that as of November 1, 2008, when their specifications will take effect, only 27 percent of the products on the market will meet their requirements.

Given our similar goals, it would not be unusual for the energy efficiency targets of ENERGY STAR® and California’s Appliance Efficiency Program to be closely aligned. The current proposed standards by PG&E were developed based upon datasets that were partially constructed using the ENERGY STAR® qualifying models. PG&E’s proposed standards are based on data for 762 televisions dataset collected from various sources, which included data for 284 televisions that qualify for ENERGY STAR®. The PG&E CASE study proposal and workshop presentation materials have discussed the ENERGY STAR® performance levels in detail.

The following table provides a summed count of the television models used for the PG&E CASE 2008 study, by source as provided by PG&E in their July 3, 2008 revised CASE Study.

Figure 2

Data sets used for the April 2008 report	
ENERGY STAR®	175
CEC Public Interest Energy Research	70
Subtotal (April report)	245

Data acquired after the April 2008 report	
CEC Public Interest Energy Research	50
ENERGY STAR®	1165
CNET	94
European Information & Communications Technology Industry Association (EICTA)	102
Market Transformation Program (MTP Europe)	157
Subtotal (post April report)	571
Grand Total	762

Based on the data gathered from all of these sources PG&E would propose energy standards stricter than ENERGY STAR® 3.0. Many of the characteristics of the ENERGY STAR®

specifications are included in PG&E's proposal because they have already been through a rigorous stakeholder review with the consumer electronics industry to establish their attainability.

Since this time the ENERGY STAR® 3.0 specification has attained a qualified product list which includes 1166 unique models as of September 2, 2009. ENERGY STAR's® original estimate of 27 percent compliance has been shown to be an extreme underestimation as the large majority of televisions are ENERGY STAR® qualified.

In the interest in collaborating with the ENERGY STAR's® televisions program Energy Commission staff was involved and monitored the development of television specification 4.0 and 5.0. The new ENERGY STAR® specifications and the proposed regulations harmonize. The proposed regulations adopt on mode requirements similar to ENERGY STAR's® 2008 specification in 2011. The proposed regulations would then implement requirements similar to ENERGY STAR's® 2010 specifications in 2013. ENERGY STAR's® push and driving factors in energy efficiency will help motivate and transform the market and ease the impact of implementation on manufacturers.

13. In their October 10, 2008 comments, the Plasma Display Coalition (PDC) expressed concern with PG&E's and NRDC's proposed energy standards. PDC stated that PG&E misunderstands the complexities inherent in the consumer electronics industry. According to PDC the television manufacturers cannot definitively state the power consumption data of their pending models. Based upon this assumption PDC has concluded that it cannot predict how many television models would be excluded from the California market if the PG&E proposal is adopted.

The following quotation describes PDC's announcements of plasma TV energy efficiency in the years to come.

*Jim Palumbo, president of the PDC, speaking at the Display Search/NPD HDTV conference in September 2008, in Los Angeles, said that the plasma industry has made "huge" strides in manufacturing and efficiency. 2008 model screens are 15% to 20% more efficient than ones made just one year ago and Palumbo told the audience that people should start calling them "entertainment efficient" for displaying great images while sipping on just 155 watts of power (for a 42-inch 720p display). 50-inch displays in 720p and 1080p resolutions use 210 and 307 watts of power respectively. Palumbo added that the coalition will reduce power consumption of its screens by another 50% by 2012.*⁷⁸

Energy Commission staff response: While the PDC may claim that it is difficult to predict energy efficiency in future models, they have certainly made specific claims regarding the

⁷⁸ <http://www.tgdaily.com/content/view/39346/97/>

efficiency of televisions up to 2012. Panasonic has made similar announcements regarding energy efficient plasma televisions as mentioned on page 6 in the technological feasibility section of this staff report.

- According to PDC government regulation should not limit either competition or innovation for the purpose of meeting unreasonable standards proposed by those unfamiliar with TV industry dynamics. PDC states that a mandated proposal to effectively ban certain HDTVs in California will have far reaching consequences to retailers and manufacturers. According to PDC regulations take away the opportunity to sell the most desirable products (larger, higher end televisions), impact revenue and profits of retailers, and complicate their business plans.

Energy Commission staff response: The Commission is working to encourage new innovations which result in improved energy efficiency for televisions. The proposal does not ask manufacturers to sacrifice the size or quality of their units.

The Energy Commission's Public Interest Energy Research program conducted a study to explore the relationship between the screen setting and power consumption in the active mode. The analysis shows that significant energy savings can be achieved by requiring energy efficient screen settings which do not materially impact the overall picture quality of the television. The proposed standards are far less stringent than the level described by manufacturer press releases. The regulation would only serve to motivate responsible efficiency considerations while designing televisions.

- PDC commented that PG&E's proposed energy efficiency standards for televisions will foster an emergence of a 'black market' of HDTV goods that are offered for sale in nearby states. California is a leader with "early adopter" consumers who will want manufacturers that cause televisions to use higher amounts of energy than is allowable by the California Standards and will shop out-of-state or online for those products. This will increase costs to consumers and cause negative environmental impacts to long-distance deliveries. California also will risk losing tax revenue on sale of HDTVs and add-on sales.

Energy Commission staff response: The PDC has not provided data in support of their argument. Similar claims have been presented to the Energy Commission previously regarding other products and have yet to materialize into a significant impact.

- PDC pointed out that Kathleen Hogan, Director of the ENERGY STAR® program believes 27 percent of products on the market will meet ENERGY STAR® requirements, or conversely that 73 percent of HDTV sets will not qualify for ENERGY STAR®. If regulations requiring 100 percent of TVs to meet ENERGY STAR® requirements are adopted in California it would be a tremendous hardship on the industry for 73 percent of HDTVs would be banned because of "arbitrary, mandated program proposed by one utility and adopted by the State."

Energy Commission staff response: New ENERGY STAR® data indicates that a large range of TVs available in today's market qualify for the ENERGY STAR® label. Ms. Hogan's 27 percent estimate is based upon stakeholder data for televisions manufactured in 2006 and 2007. This data is outdated and does not accurately represent the television market going into 2009.

Proposed Regulations

Proposed new language appears as underline (example) and draft deletions appear as ~~strikeout (example)~~. Existing language appears as plain text. Three dots or “...” represents the substance of the regulations that exist between the proposed language and current language

Section 1601. Scope.

- ...
- (v) Televisions with a screen area not greater than 1,400 square inches, and consumer audio and video equipment, which are televisions, compact audio products, digital versatile disc players, and digital versatile disc recorders.

Section 1602. Definitions.

- ...
- (v) **Televisions, and Consumer Audio and Video Equipment.**

“Aspect ratio” means the ratio of width to height of the viewable screen area. Common examples include 4:3 and 16:9.

“Automatic brightness control” means an integrated control system that automatically adjusts the brightness of a television based upon ambient lighting conditions.

~~“Color television set” means an electrical device designed to convert incoming broadcast signals into color television pictures and associated sound.~~

“Combination TV” means a system in which a television or television monitor and an additional device or devices (including but not limited to a DVD player or VCR) are combined into a single unit in which the additional devices are included in the television casing;

“Component TV” means a television composed of two or more separate components (e.g., separate display device and tuner) marketed and sold as a television under one model or system designation. The system may have more than one power cord.

“Computer monitor” means an analog or digital device designed primarily for the display of computer generated signals and that is not marketed for use as a television.

“Download acquisition mode (DAM)” or “Standby-active mode” means the product is connected to a power source, produces neither sound nor a picture, and is downloading channel listing information according to a defined schedule for use by the electronic programming guide, monitoring for emergency

messaging/communications or otherwise communicating through a network protocol. The power use in this mode is typically greater than the power requirement in TV standby-passive mode and less than the power requirement in on mode.

“Forced menu” means a menu which requires the selection of a display mode by a user upon their first use after the manufacture of the television.

“Integrated occupancy sensor” means a feature built into a television capable of sensing presence and entering TV standby-passive mode or standby-active mode to save energy in an empty room.

~~“Monochrome television set” means an electrical device designed to convert incoming broadcast signals into monochrome television pictures and associated sound.~~

“Native vertical resolution” means the physical pixel count for the vertical axis of the television. For example a television with a screen resolution of 1920 x 1080 would have a native vertical resolution of 1080.

“On mode” means the product is connected to a power source and produces sound and a picture. The power requirement in this mode is typically greater than the power requirement in standby-passive and download acquisition modes.

“Retail on mode power” is the measurement of on mode power in the most consumptive mode available in a forced menu.

“Screen size” means the diagonal length from one corner to the corner furthest away of the viewable screen area of a television, measured in inches.

“Selected input mode” means the input port(s) selected which the television is using as a source to produce a visible or audible output. These modes are required for televisions with multiple possible inputs including but not limited to coaxial, composite, S-Video, HDMI, and component connectors.

“Television (TV)” means an analog or digital device designed primarily for the display and reception of a terrestrial, satellite, cable, Internet Protocol TV (IPTV), or other broadcast or recorded transmission of analog or digital video and audio signals. TVs include combination TVs, television monitors, component TVs, and any unit that is marketed to the consumer as a TV. “Television (TV)” does not include computer monitors.

~~“Television (TV) set” means a color television set or a monochrome television set.~~

“Television monitor” means a TV that does not have an internal tuner/receiver or playback device.

“TV standby-passive mode” means the ~~appliance~~ television is connected to a power source, produces neither sound nor ~~vision~~picture but can be switched into another mode with the remote control unit or via an internal signal.

“Viewable screen area” means the continuous total area of a television in square inches which displays a digital or analog video signal and is viewable to a consumer.

...

Section 1604. Test Methods for Specific Appliances.

...

(v) Televisions, and Consumer Audio and Video Equipment.

- (1) The test method for standby-passive mode for consumer audio and video equipment is International Electrotechnical Commission (IEC) 62087:2002(E) – “Methods of Measurement for the Power Consumption of Audio, Video, and Related Equipment.”

The following test procedures for televisions take effect as state law only on the removal of federal preemption by action such as a change in federal law.

- (2) The test method for standby-passive mode for televisions is International Electrotechnical Commission (IEC) 62301:2005, Edition 1.0 “Household Electrical Appliances – Measurement of Standby Power.”

- (3) The on mode and power factor test method for televisions shall be International Electrotechnical Commission (IEC) 62087:2008(E), Edition 2.0 – “Methods of Measurement for the Power Consumption of Audio, Video, and Related Equipment.” Televisions shall be tested using section 11.6.1: “On mode (average) testing with dynamic broadcast-content video signal.”

(A) Power Factor.

The power factor of the television shall be measured during the on mode test and the reported value shall be the average of power factor measurements taken at one minute intervals simultaneous to IEC 62087:2008(E), Edition 2.0 section 11.6.1 on mode wattage measurements. The measurement of power factor must be accurate to a hundredth of a percent.

(B) Testing Protocols.

A television shall be tested as manufactured without any modifications to screen settings with the exception of televisions manufactured with a forced menu. Televisions manufactured with a forced menu shall be adjusted and tested under the following conditions, 1 or 2, as applicable to the unit being tested.

- 1) The on mode measurement of a television with a forced menu shall be tested in the “home” mode or the manufacturer’s recommended mode for home use. In addition, the on mode of a television shall be measured in the most energy consumptive mode available in the forced menu.
- 2) If neither a “home” mode nor a manufacturer’s recommended mode for home use are available, the television shall be tested in the most consumptive mode available in the forced menu to measure the on mode power.

(C) On Mode Power Consumption.

The on mode power consumption for televisions with and without forced menus, and incorporating automatic brightness controls, shall be calculated as follows:

$$P_{a1 \text{ broadcast}} = 0.55 * P_{o \text{ broadcast}} + 0.45 * P_{abc \text{ broadcast}}$$

Where:

$P_{o \text{ broadcast}}$ = on mode power test with 300 lux entering the light sensor

$P_{abc \text{ broadcast}}$ = on mode power test with 0 lux entering the light sensor.

(D) Light Measurement Protocols.

All luminance testing shall be performed in dark room conditions. The display screen illuminance measurement (E) in TV standby-passive mode must be less than or equal to 1.0 lux. Measurements should be taken perpendicular to the center of the display screen using a Light Measuring Device (LMD).

Measurements shall be made using a reliable, accurate and reproducible measurement procedure, which takes into account the generally recognized state of the art measurement methods. Measurements shall also be made with the Automatic Brightness Control function, if such a function exists, disabled. If the Automatic Brightness Control function exists and cannot be disabled, then

measurements shall be performed with light entering directly into the ambient light sensor at a level between 300 lux and 400 lux.

1. Ensure the television is set to the Home mode, or the default mode as shipped.
2. Immediately following the on mode power testing using the dynamic broadcast-content video signal as outlined in Section 1604(V)(3) display the three bar video signal provided in IEC 62087 Edition 2.0, Section 11.5.5, which displays three bars of white (100%) over a black (0%) background.
3. After the three bar video signal has been displayed for 10 minutes, measure the luminance (L_{home}). See *Note 1*.
4. Within 1 minute of measuring L_{home} , set the television to Retail mode, or the brightest selectable preset mode, and display the three bar video signal.
5. After the three bar video signal has been displayed for an additional 10 minutes, measure the luminance (L_{high}). See *Note 2*.
6. Calculate and report the luminance ratio by dividing L_{home} by L_{high} .: Luminance ratio = $L_{\text{home}}/L_{\text{high}}$

Note 1: For television sets that are known to stabilize within 10 minutes, this duration may be reduced if the resulting measurement can be shown to be within 2% of the result that would otherwise be achieved using the full 10 minute duration.

Note 2: When possible, measurements of luminance shall be made without changing the LMD's measurement position on the display when switching between the home mode and retail mode. If this is not possible, the tester should replicate the measurement position of the LMD so that measurements in the home-mode and retail-mode are in the same position on the display.

...
The following documents are incorporated by reference in Section 1604.

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**Table V-1
Standards for Consumer Audio and Video Equipment**

<i>Appliance Type</i>	<i>Effective Date</i>	<i>Maximum Power Usage (Watts)</i>
Compact Audio Products	January 1, 2007	2 W in Audio standby-passive mode for those without a permanently illuminated clock display 4 W in Audio standby-passive mode for those with a permanently illuminated clock display
Televisions	January 1, 2006	3 W in TV standby-passive mode
Digital Versatile Disc Players and Digital Versatile Disc Recorders	January 1, 2006	3 W in Video standby-passive mode

- (3) Televisions. All televisions manufactured on or after the effective dates shall meet the requirements shown in Table V-2.
- (4) In addition, televisions manufactured on or after January 1, 2011 shall meet the requirements shown in Sections 1605.3(v)(2)(A) and 1605.3(v)(2)(B) and 1605.3(v)(2)(C) of this Article.
- A. A television shall automatically enter TV standby-passive mode or standby-active mode after a maximum of 15 minutes without video and/or audio input on the selected input mode.
 - B. A television shall enter TV standby-passive mode when turned off by remote or integrated button/switch.
 - C. The peak luminance of the product in “home” mode, or in the default mode as shipped, shall not be less than 65% of the peak luminance of the “retail” mode, or the brightest selectable preset mode, of the product.

Table V-2
Standards for Televisions

<u>Effective Date</u>	<u>Screen Size (area A in square inches)</u>	<u>Maximum TV Standby-passive Mode Power Usage (watts)</u>	<u>Maximum On Mode Power Usage (P in Watts)</u>	<u>Minimum Power Factor for (P ≥ 100W)</u>
<u>January 1, 2006</u>	<u>All</u>	<u>3 W</u>	<u>No standard</u>	<u>No standard</u>
<u>January 1, 2011*</u>	<u>A ≤ 1400</u>	<u>1 W</u>	<u>$P \leq 0.20 \times A + 32$</u>	<u>0.9</u>
<u>January 1, 2013</u>	<u>A ≤ 1400</u>	<u>1 W</u>	<u>$P \leq 0.12 \times A + 25$</u>	<u>0.9</u>
*The efficiency standards for televisions take effect one year after removal of federal preemption for the test procedures in section 1604(v), but no earlier than the effective dates in Table V-2. The January 1, 2011 efficiency standards are only effective for televisions manufactured before the effective date of the January 1, 2013 standards.				

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Section 1606. Filing by Manufacturers; Listing of Appliances in Database.

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Table X Continued - Data Submittal Requirements

Appliance		Required Information	Permissible Answers	
V	Televisions		<u>Type*</u>	CRT, Plasma, LCD, DLP, Rear Projection, Laser, OLED, LCOS
			<u>Viewable Screen Area</u>	
			<u>Screen Size</u>	
			<u>Automatic Brightness Control</u>	Yes, No
			<u>Automatic Brightness Control enabled</u>	Yes, No
			<u>Forced menu</u>	Yes, No
			<u>Native Vertical Resolution</u>	
			<u>Aspect Ratio</u>	
			<u>Integrated Occupancy Sensor</u>	Yes, No
			<u>L_{home}</u>	
			<u>L_{high}</u>	
			<u>Luminance Ratio</u>	
			<u>Power Usage in TV Standby-Passive Mode Power (watts)</u>	
			<u>On Mode Power (watts)</u>	
			<u>Retail On Mode Power (watts)</u>	
<u>Power Factor</u>				
Consumer Audio and Video Equipment	Compact Audio Products	Power Usage in Audio Standby-Passive Mode for Models Without a Permanently-Illuminated Clock Display (watts)		
		Power Usage in Audio Standby-Passive Mode for Models With a Permanently-Illuminated Clock Display (watts)		
	Televisions	Power Usage in TV Standby-Passive Mode (watts)		
	Digital Versatile Disc Players and Digital Versatile Disc Recorders	Power Usage in Video Standby-Passive Mode (watts)		

* "Identifier" information as described in Section 1602(a).

1 = Voluntary for federally-regulated appliances

2 = Voluntary for state-regulated appliances

...

(4) Declaration

(A) Each statement shall include a declaration, executed under penalty of perjury of the laws of California, that:

...

5. all units of the appliance are marked as required by Section 1607, and, for the following appliances are marked as follows:

- ...
- j. for televisions, each television shall display the on mode power consumption as determined using the test method in Section 1604(v)(3) of this Article and as certified by the manufacturer under the requirements found in Section 1606(a) of this Article;
 - k. for televisions, any publication, website, document, or retail display that is used for sale or offering for sale a television manufactured on or after January 1, 2011 and which includes a description of the physical dimensions of the television shall include the identical on mode power consumption, in watts, immediately following and in the same font and same font size as the description of the physical dimensions. as filed under the requirements found in Section 1606(a)(3)(D) of this Article.

...

Section 1607. Marking of Appliances.

...

(d) Energy Performance Information.

...

(11) Televisions.

- (A)** Each television shall be marked, permanently and legibly on an accessible and conspicuous place on the unit, in characters of equal size to the largest font used within the menu screen within the television's built in menu, the on mode power consumption, in watts, as determined using the test method in Section 1604(v)(3) of this Article and filed under the requirements found in Section 1606(a)(3)(D) of this Article.
- (B)** Any publication, website, document, or retail display that is used for sale or offering for sale of a television manufactured on or after July 1, 2010 that includes a description of the physical dimensions of the television shall also include the identical on mode power consumption, in watts, immediately following and in the same font and same font size as the description of the physical dimensions, as filed under the requirements found in Section 1606(a)(3)(D) of this Article.