NRDC Update on TV Energy Use and Proposed CA Efficiency Standards

By: Noah D. Horowitz
Sr. Scientist
NRDC

December 15, 2008

Road to Efficiency – Early ‘08

- TVs shipped overly bright resulting in higher consumer energy use than necessary
- Industry (both panel makers and TV manufacturers) actively working on improved LCD and plasma designs
- IEC 62087 “on mode” power test method adopted this summer
- Energy Star 3.0 went live in November 2008. Now covers on mode power.
- Industry still not making TV energy use data easily available.

Road to Efficiency – Step One

- Industry rapidly moves to forced set-up menu and/or use of photo sensors that automatically adjust brightness levels
- Cuts reported power use by ~10%-25%
- Easy path for meeting E-STAR and proposed CEC Tier 1

Road to Efficiency – Step Two (LCDs)

- Achieve additional savings of 30%-50% by shifting to new “eco modules”
- New eco modules being offered by all major panel makers. Many TV makers beginning to incorporate them into late 2008 and in 2009 models

Improved LCDs – Common Recipe

A. More efficient pixel structure

B. Add high transmittance film (more light gets thru)

C. Move to more efficient lamps

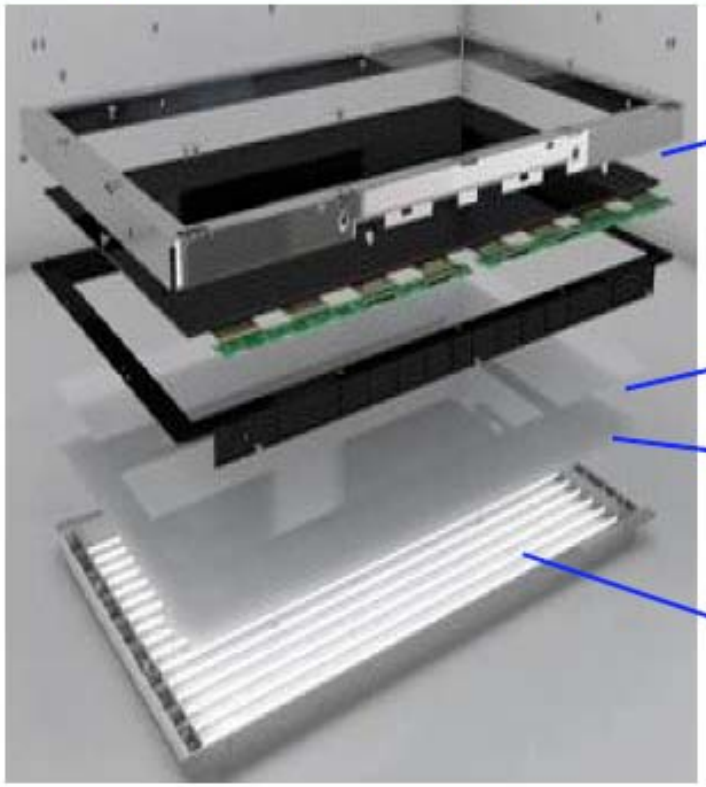
D. Remove unneeded lamps while preserving brightness. Also eliminate need for lamp holders, inverters, etc.

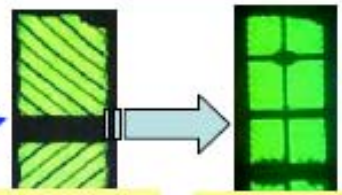
E. Shift to smaller, less expensive power supply

ACHIEVE DRAMATIC ENERGY SAVINGS AT LITTLE TO NO INCREMENTAL TOTAL COST

ECO-TVs (LCDs)

ECO technology
→ High eff. CCFL + optical design for reduction CCFL





AMVA1 AMVA3

Cell transmittance improvement

High efficiency optical film

Cross Section View of prism shape

Patterned DP for reduce CCFL

High efficiency CCFL

30% to 50% power reduction

Road to Efficiency – Step Two (Plasmas)

- Move to next generation panels and increase efficiency from 2.5 to 5 lumens/watt
- Ability to cut power in ½ by maintaining current brightness levels
- Panasonic, plasma market leader, showed 5 LPW TV at January 2008 CES show with announced release date of mid-2009

Panasonic Double Efficiency PDP Technology

5 lm/W Plasma – Showcased at CES in January 2008, Expected to be on the market by Mid-2009

PANASONIC INTRODUCES NEXT-GENERATION PLASMA DISPLAYS AT 2008 INTERNATIONAL CES

Revolutionary Plasma Technologies Boast Dramatic Energy Efficiency, Less Than One-inch Super-thin Profile and 150-inch Ultra-large Screen

Las Vegas, NV (January 7, 2008) – Panasonic, the leading brand by which Matsushita Electric Industrial Co., Ltd. is known, today announced that the company has developed three prototype plasma display panels (PDPs) using ground-breaking technologies. The prototypes include a 42-inch panel with double efficiency technology that halves energy consumption while maintaining the same brightness*, a less than one-inch super-thin 50-inch PDP and the world's largest 150-inch advanced high definition (HD) PDP. The three prototypes are on display at the 2008 International Consumer Electronics Show (CES) that starts on January 7 in Las Vegas.

At the core of these cutting edge PDP's lies the double efficiency technology used in the 42-inch prototype. After thoroughly reviewing its existing IC technology and panel structures, Panasonic developed new phosphors and cell design technology for improved discharge and new circuit and drive technology to significantly reduce power loss. As a result, the 42-inch prototype has twice the luminance efficiency and provides the same brightness as the existing 42-inch 1080p full HD PDP, while cutting the power consumption by half.

The double-efficiency technology forms the base for next-generation PDPs, enabling even thinner profiles, larger screens, brighter images, higher definition and lower power consumption. The revolutionary technology promises to open up new possibilities for PDPs. Higher density HD PDP's that can be used as master monitors for movie studios will become possible through this innovative technology.

"…the 42-inch prototype has twice the luminance efficiency and provides the same brightness as the existing 42-inch 1080p full HD PDP, while cutting the power consumption by half."

Full Press Release:
http://www2.panasonic.com/webapp/wcs/stores/servlet/prModelDetail?storeId=11301&catalogId=13251&itemId=215174&modelNo=Content01072008044330094&surfModel=Content01072008044330094

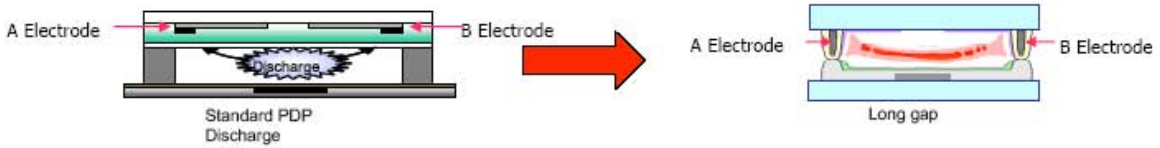
“Flat Panel TV Technology Advances”

by Ross Young, Founder and Chief Research Officer, DisplaySearch

March 2008

How to Increase Luminous Efficiency to 5 lm/W?

- **Increase discharge efficiency**
  - Increase Xe concentration of the gas mixture.
    - As Xe concentration increases, more UV light is produced which excites the phosphors.
  - A long gap cell structure which increase the distance between electrodes can be adopted, improving discharge efficiency.



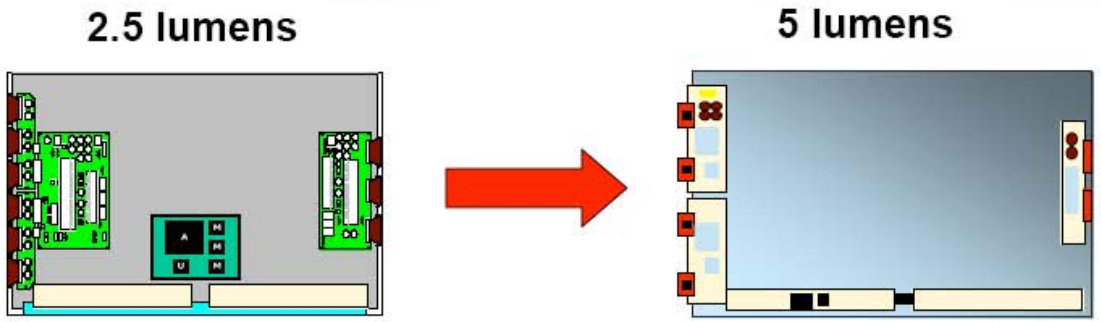
  - Low voltage driving technology
    - Requires enhancements to the MgO and dielectric materials so that both a wall charge and a stable discharge can be achieved at low voltages.
    - Pioneer’s Crystal Emissive Layer. By placing this layer on top of the MgO, it enables more ions to be generated, significantly lowering the discharge voltage.
- **Increase optical efficiency**
  - Largely defined by the cell structure and aperture ratio
  - Requires optimized barrier ribs and structure and location of the electrodes
  - High efficiency phosphors – nano particles – to generate more visible light during discharge
- **Reduce wasted power consumption**
  - Reduce panel capacitance
    - Reduce permittivity of the dielectric layer

“Flat Panel TV Technology Advances”

by Ross Young, Founder and Chief Research Officer, DisplaySearch

March 2008

What Happens to Cost at 5 lm/W?



- **Driver IC costs expected to fall by 25%** - Address voltages decline by 40-50% to 30V. Driver IC channels can increase to 512-768 pins.
- **A and B drive board costs by 20%** - Sustain voltages would drop around 35% to 120-140V, reducing the cost of the components on the A and B drive boards as well as allow for increased integration and simpler PCBs.
- **Logic board/circuitry costs fall 10%** - Additional integration can be realized, PCB could even be eliminated.
- **Mechanical costs fall by around 25%** - Reduced heat allows for the elimination of expensive heat shields.
- **Power supplies fall by 50% due to lower voltages** - now similar to LCD power supply costs.
- **Costs fall by 9% - 11% depending on the size/resolution** – since device structure remains the same, no impact on depreciation or panel materials.

Additional Benefits

- Most “eco designs” are also much thinner.
- Yields lower packaging costs and shipping costs throughout the supply chain (get more into the box and container).
- CEA has not mentioned these financial savings.
- Reduces overall environmental footprint of TV manufacturing and distribution.

Road to Efficiency – Beyond CEC Tier 2

- LCDs – dramatic additional savings from move to LED backlights
  - New Apple laptop has LEDs
  - Cost increment dropping rapidly
- Plasmas – move to 10 lumen/watt through additional enhancements. Potential manufacturer cost savings up to 35%.

“Flat Panel TV Technology Advances”

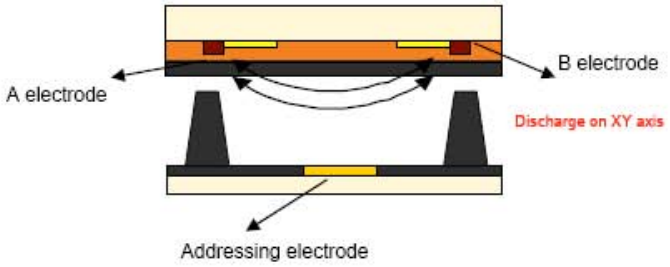
by Ross Young, Founder and Chief Research Officer, DisplaySearch

March 2008

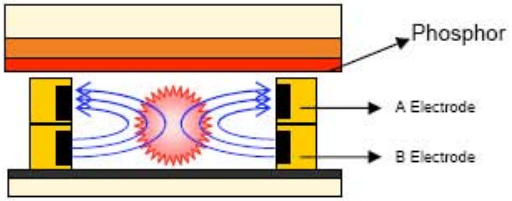
How to Increase Luminous Efficiency to 10 lm/W?

- **Adopt a spatial discharge structure**
  - In surface discharge, discharge occurs between the A and B electrodes in 2 dimensions.
  - Spatial discharge incorporates an additional dimension, cell depth, which significantly increases the discharge efficiency.
  - Also, the addressing electrode can be eliminated, significantly reducing the manufacturing costs.

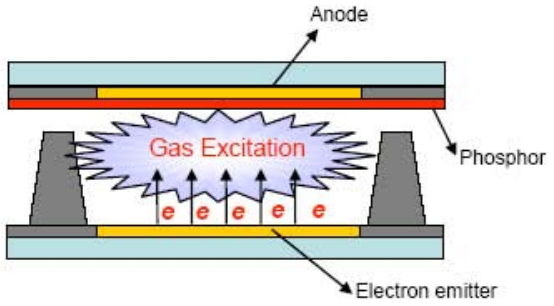
Surface Discharge



Spatial Discharge



- **Alternative methods**
  - Excite the gas without discharge.
  - Electrodes replaced with anode and an emitter.
  - As in FEDs, electrons are emitted by an emitter and accelerated by the anode. Electrons collide with the gas, exciting it and generating UV light.
  - Emitter development needed due to lack of vacuum.



“Flat Panel TV Technology Advances”

by Ross Young, Founder and Chief Research Officer, DisplaySearch

March 2008

What Happens to Cost at 10 lm/W?

- **Lower depreciation, labor, indirect/production and panel material costs with spatial discharge:**
  - Front glass manufacturing process would be dramatically simplified due to elimination of patterning steps.
  - Rear glass process would also be cut to the elimination of the addressing electrode and a simpler barrier rib process. Barrier ribs could be cut into the glass with phosphors applied to the grooves.
  - 70% - 80% reduction in total process steps expected, from 50 to 10-15. TACT expected to be cut by 50%.
  - 40% reduction in depreciation costs expected, 30% reduction in electrode materials, 50% reduction in labor costs and a 50% reduction in indirect/product expenses.
- **30% reduction in glass costs** – At 10 lm/W, low cost soda-lime glass can be used due to reduction in high temperature process steps.
- **Lower electronics costs** – One driving board eliminated, address voltage reduced by another 20% - 30% to <20V reducing driver IC costs to similar levels as LCDs, a 50% reduction vs. 2.5 lm/W driver IC costs. Logic board cut by 30%, driving B board cut 20%.
- **Reduced mechanical costs –** Reduced heat and EMI results in lower thermal protection and mechanical costs, another 20% reduction.
- **Optical filter eliminated** – EMI shielding layer eliminated, other functions replaced by low cost coatings. Costs cut by 80%.
- **Manufacturing costs cut by 37% - 38%**

Settings Review

Historically – Shipped in “torch mode”; designed to stand out on retail floor. Overlay bright for home use but typically not adjusted

Forced Menu – User must pick between home, retail, vivid, etc. settings during set-up. E-STAR driving this positive trend.

Setting Concern

- Some manufacturers may make their “home setting” too dim as cheap compliance option
- Disappointed consumer likely to go back into menu and pick brighter setting (e.g., vivid). This results in lost savings

Need real savings not just on paper

Setting Solution

Need to add additional specificity to settings part of the code. Options include:

1) Establish minimum brightness level at X nits prior to running IEC 62087 test method - If using forced menu require TV to be set at no less than X nits, or
2) Run test at initial brightness of X% of maximum brightness

Recommend CEC convene a call in early January to gain additional input and develop improved settings language.

Note ESTAR monitor spec, China and EU all looking to address this potential loophole.

Where Are We Today?

Number of models that meet:

ENERGY STAR 3.0 – 396 models

Proposed CEC Tier 1 – 344 models

Proposed CEC Tier 2 – 101 Models

(all LCD and rear projection)

Energy Star TVs as of 12/8/08

		Tier 1		Tier 2	
Brand	Energy Star models	Number	% ES models	Number	% ES models
AOC	11	11	100%	7	64%
Clarity	2	2	100%	2	100%
Dynex	1	1	100%	1	100%
Emerson	8	8	100%	8	100%
Hitachi	6	0	0%	0	0%
Insignia	17	14	82%	6	35%
JVC	16	16	100%	13	81%
Magnavox	5	5	100%	2	40%
Panasonic	23	10	43%	0	0%
Philips	16	15	94%	1	6%
Pioneer	4	0	0%	0	0%
Polaroid	5	5	100%	4	80%
RCA	12	10	83%	1	8%
Samsung	69	69	100%	19	28%
Sansui	11	11	100%	1	9%
Sanyo	8	4	50%	0	0%
Sharp	40	31	78%	0	0%
Sony	67	61	91%	4	6%
Sylvania	11	11	100%	6	55%
TCL	1	1	100%	0	0%
Toshiba	27	27	100%	12	44%
ViewSonic	17	13	76%	8	47%
VIZIO	19	19	100%	6	32%
Total	396	344	87%	101	26%

Over 100 Tier 2 TVs As of December 8, 2008

		Tier 1		Tier 2	
Brand	Energy Star models	Number	% ES models	Number	% ES models
AOC	11	11	100%	7	64%
Clarity	2	2	100%	2	100%
Dynex	1	1	100%	1	100%
Emerson	8	8	100%	8	100%
Insignia	17	14	82%	6	35%
JVC	16	16	100%	13	81%
Magnavox	5	5	100%	2	40%
Philips	16	15	94%	1	6%
Polaroid	5	5	100%	4	80%
RCA	12	10	83%	1	8%
Samsung	69	69	100%	19	28%
Sansui	11	11	100%	1	9%
Sony	67	61	91%	4	6%
Sylvania	11	11	100%	6	55%
Toshiba	27	27	100%	12	44%
ViewSonic	17	13	76%	8	47%
VIZIO	19	19	100%	6	32%

LCD Industry Participation to Date

- All categories well represented
  - High end (e.g., Sony, Samsung)
  - Mid-level (JVC, Toshiba, Vizio)
  - Entry-level/private band (Emerson, Sylvania, Polaroid, Insignia)
- Efficient offerings available at all sizes
- Some companies focus on small sizes to start
- Efficiency leaders such as Vizio and JVC already offer broad portfolio of very efficient models
- ***Standard needed to make sure all TVs sold in CA are energy efficient, not just selected models.***

Plasma Update

- Compliant Tier 1 models already on the market
- Recent industry developments and research all point toward dramatic efficiency gains in near future. Predicted to result in **lower** cost production.
- Industry leaders Panasonic and Pioneer joint venture. Products to be introduced beginning in mid-2009 capable of hitting Tier 2. Industry roadmap promises further improvements after that.

Support for Standard from Vizio -- A Leading TV maker

"…*We have reviewed Title 20 efficiency levels proposed by the CEC for TVs, support the standard and we are in a position to comply with proposed effective dates but would also support earlier implementations.*"

"…We have 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 scan a range of screen sizes. For our Plasma TVs, although it is difficult for them to meet the standard today, there are significant efficiency achievements on the near horizon that could enable them to meet the Tier 2 requirements in the next couple of years."

Philips and Starwood Sign Exclusive ‘Green TV’ Deal

PHILIPS
sense and simplicity

October 27, 2008 10:00 AM Eastern Time

Philips and Starwood Sign Exclusive ‘Green TV’ Deal

- *Deal estimated to be worth up to $100m in new equipment*
- *Over $12m expected in energy savings*

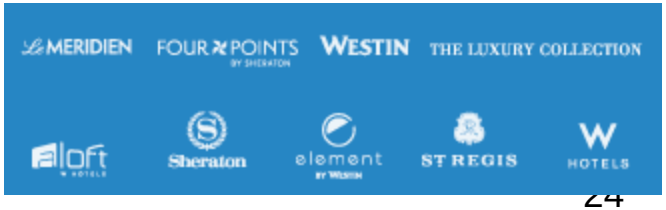
NEW YORK--(BUSINESS WIRE)--Philips Electronics (NYSE:PHG, AEX:PHI) today announced the signing of an exclusive three year agreement with Starwood Hotels and Resorts, Inc. (NYSE:HOT) to provide Philips' latest range of SmartPower^2 energy efficient televisions to Starwood's 460 properties across North America. The deal, which could be worth up to $100 million with existing opportunities and expected growth, will see industry-leading energy efficient televisions installed in new hotels and existing Starwood properties looking to convert to LCD TV technology for the first time.

In what is believed to be the biggest 'green TV' deal to date, this agreement is also expected to save the premier global hotel company more than $12 Million dollars in energy costs over the seven year lifetime of the equipment, and reduce energy consumption by up to 40 percent when compared with the televisions currently in use.

Philips will immediately begin installing these televisions, which are also available to consumers as the 'EcoTV'. Taking the recently announced growth targets of Starwood North America into consideration, at least 80,000 Philips SmartPower^2 TVs will be installed over the course of the next three years.

"This is a defining agreement for us, and is indicative of the fundamental change in mindset we have implemented around procurement and sourcing…Philips has shown us that it is easy to simultaneously provide our guests with the very latest technology while making a sound business decision that significantly impacts costs and reduces energy consumption."

- Paul Davis, Senior Vice President of Global Sourcing at Starwood.



http://www.businesswire.com/portal/site/google/?ndmViewId=news_view&newsId=20081027005388&newsLan

NRDC Recommendations

- Adopt proposed Tier 1 and Tier 2 standards contained in CEC staff report.
- Enhance language related to settings and test conditions (e.g., prevent overly dim TVs). Host conference call to discuss further.
- Publish timeline for adopting standard no later than end of Q2 2009
- Move standard effective dates up to:

Tier 1	July 1, 2010
Tier 2	July 1, 2011