Green Displays Conference

May 18, 2011 - Los Angeles Convention Center

Driving Energy Efficiency and Sustainability in the Display Industry

Bruce Berkoff,
Chairman LCD TV Association

1st GREEN DISPLAYS CONFERENCE

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Driving Energy Efficiency and Sustainability in the Display Industry

AGENDA

8:30
Opening Address & Conference Chair Welcome
Bruce Berkoff – Chairman – LCD TV Association
8:45
Keynote Address: What's Next for Green Display Technology
Jun Souk – Senior Advisor – Samsung Electronics
9:30
LED Backlighting & Energy Efficiency
Ross Young – Senior Vice President – IMS Research
10:00
Semiconductor Advances Leading to More Energy Efficient Displays
Tushar Dhayagude – VP Sales & Marketing, Co-founder – mSilica (Acquired by ATMEL)
10:30
Coffee & Networking Break
11:00
Ambient Light Sensing Electronics Used to Save Energy
Darrell Benke – Senior Marketing Manager – TAOS, Inc.
11:30
Panel Discussion – Energy Efficiency in Flat Displays
12:15
Lunch & Networking Break

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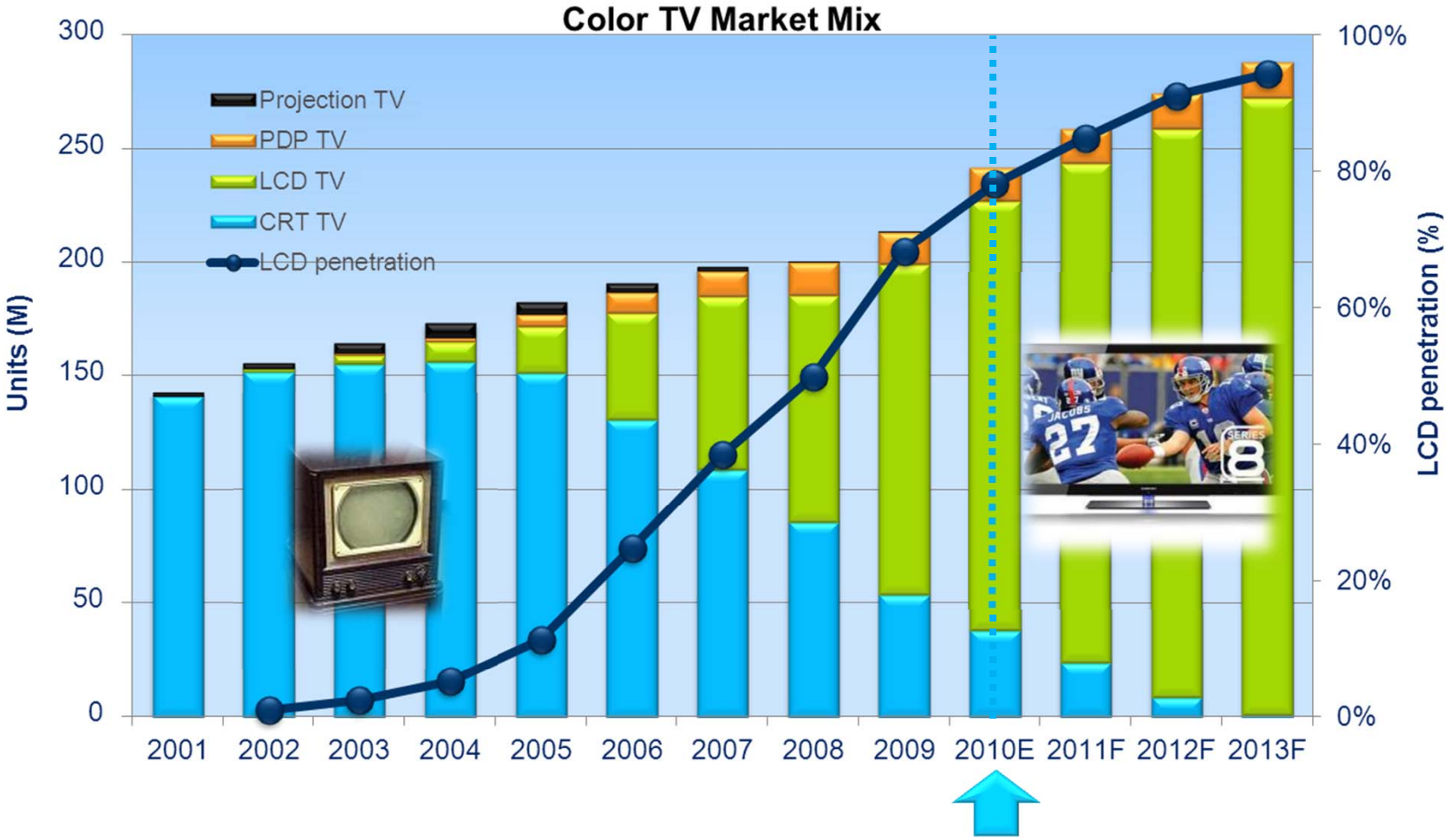
Driving Energy Efficiency and Sustainability in the Display Industry

AGENDA – cont.

1:20
Keynote Address: LGD's Approach for Green Display
Mike Jun – Vice President, Head of R&D Center – LG Display
2:00
Regulatory and Environmental Aspects of Flat Panel Displays
Dr. Werner Becker – Head of Global Regulatory Affairs Performance Materials Division – Merck KGaA
2:30
Sustainability and CO2 Footprint from a Materials Supplier Perspective
Andreas Weisheit - Head of Global FPD/Solar & Asia Market Development - Linde
3:00
Coffee & Networking Break
3:30
Cleaner, Better, Lighter Glass for the Display Industry
Robert (Bob) Quinn, Manager, End Market Intelligence - Corning
4:00
Energy Friendly LED Displays
Ken Lowe, Vice President & Co-founder, Vizio
4:30
Energy Efficiency in Display Devices
Bruce Nordman, Lawrence Berkeley National Laboratory
5:00
Panel Discussion – Sustainability, Renewables & Logistics in the Display Supply Chain
Moderated by Bruce Berkoff

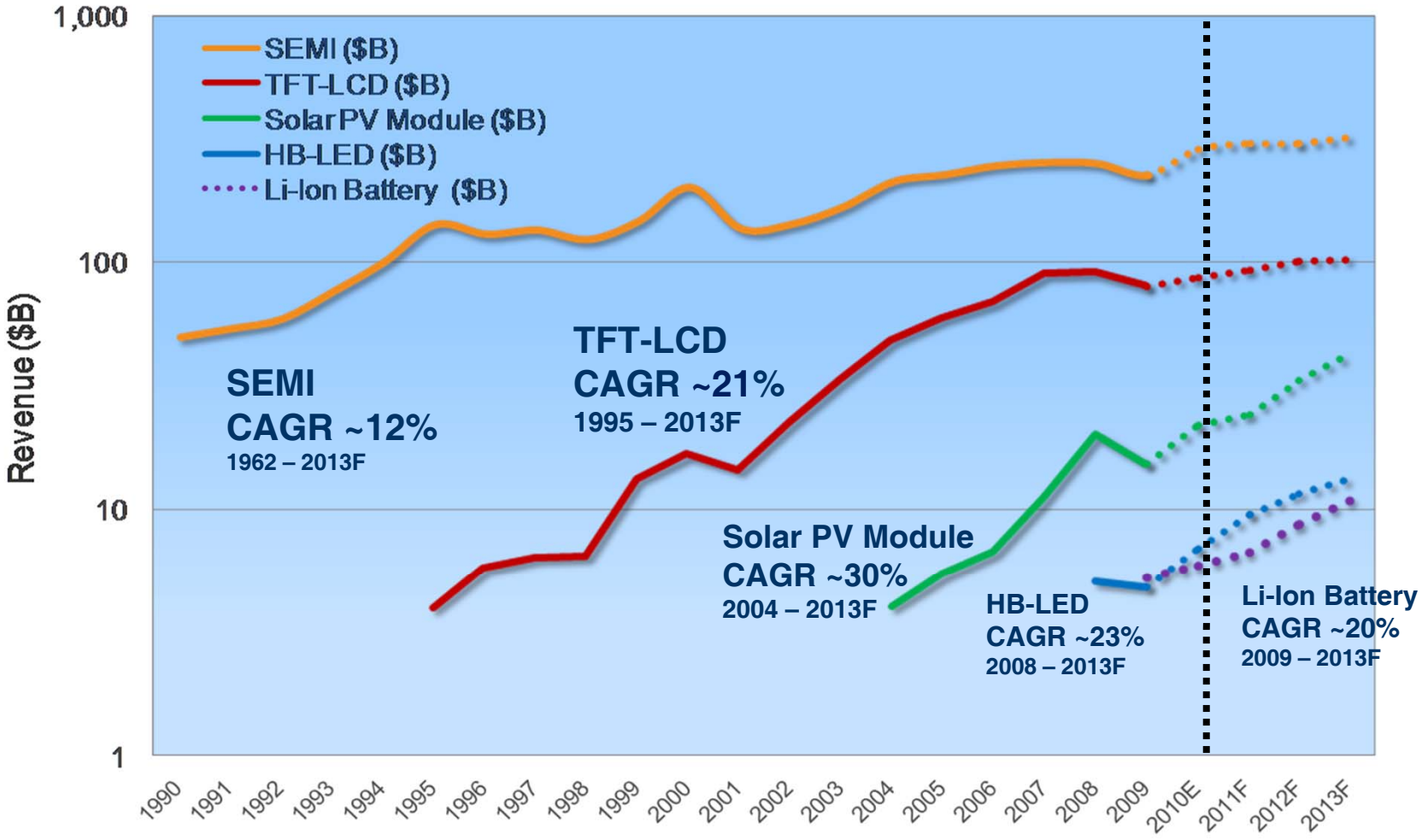
TV Unit Demand by Technology, TV = LCD



Shift in Dominant Technology from CRT to LCD

Source: Display Search, ADR, Applied Materials (Feb 2010)

Global Revenue of Major "new" Industry Markets "Greening" the world, and growth….

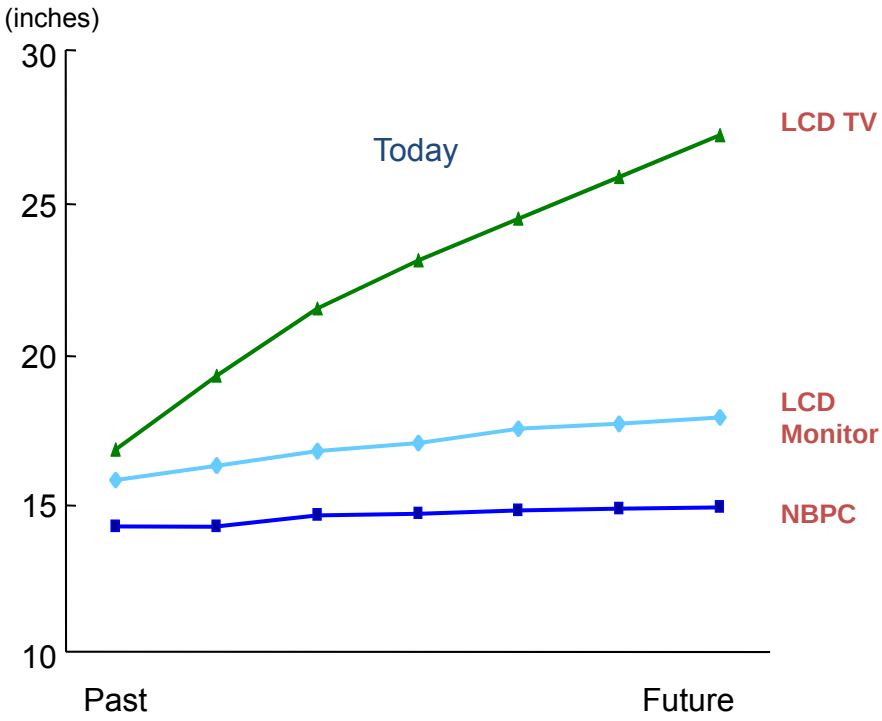


Source: IC Knowledge through 1983, SIA 1984 to present, Companies' announcements , Display Search, Photon Consulting, Bank of America-Merrill Lynch, IIT Japan, Avicenne, BCC

LCD Average Size is Growing, Especially for TVs (from 2005!!!)

More glass per person is coming…… (bigger, means more energy use???)

Large a-Si TFT-LCD average size (10” and above)

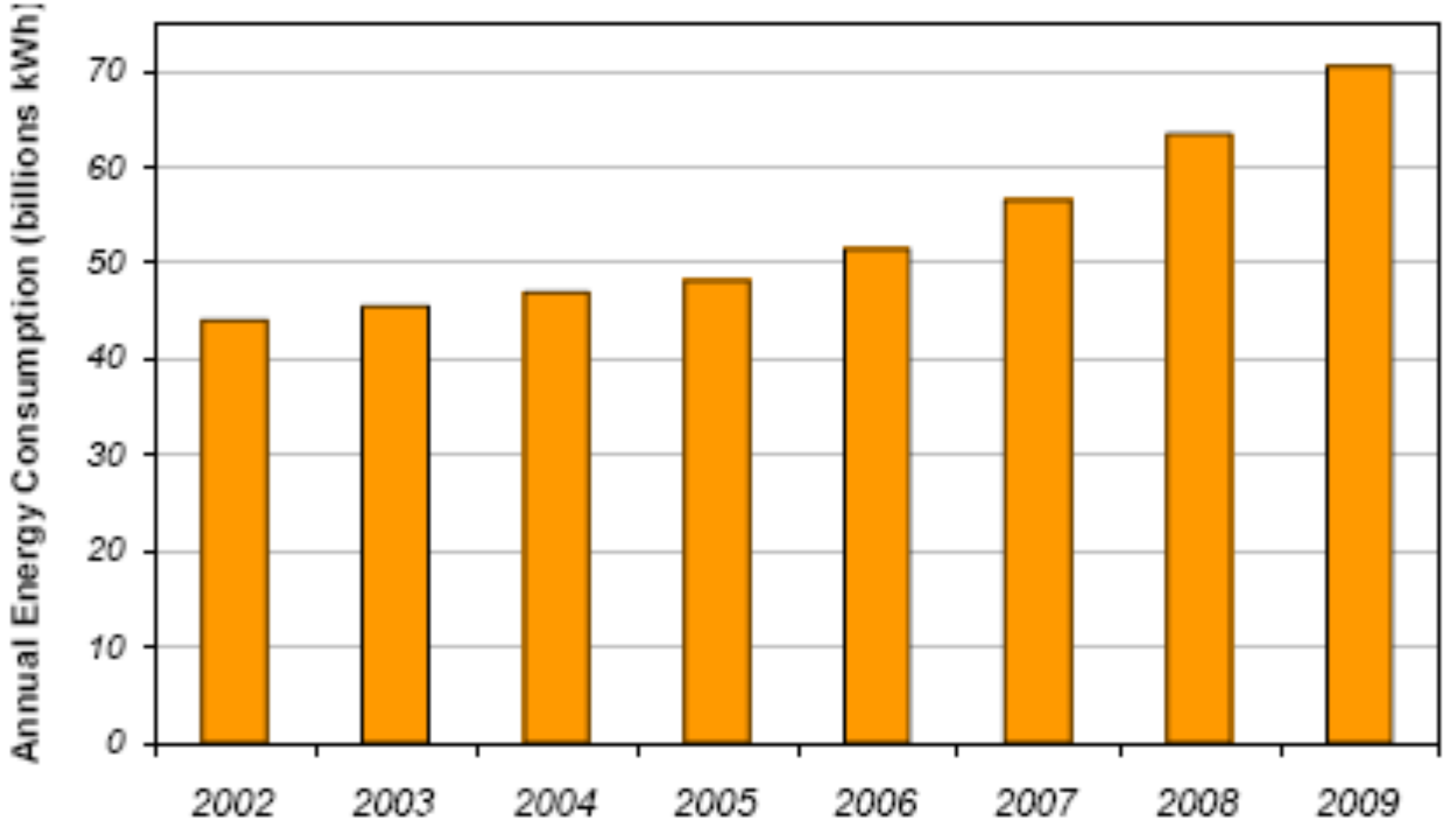


LPL’s 55W LCD panel next to a 15” LCD panel, almost 12x in area

This 55” LCD is almost 12x the area of a 15” XGA monitor panel, and is almost ~7x the resolution and ~7x the area of a 20” VGA TV

Source: Source:DisplaySearch Quarterly DT MNT Shipment & Forecast Q1 '05
DisplaySearch Q1 '05, private communication (NBPC)
DisplaySearch US FPD Conference 2005 (TV)

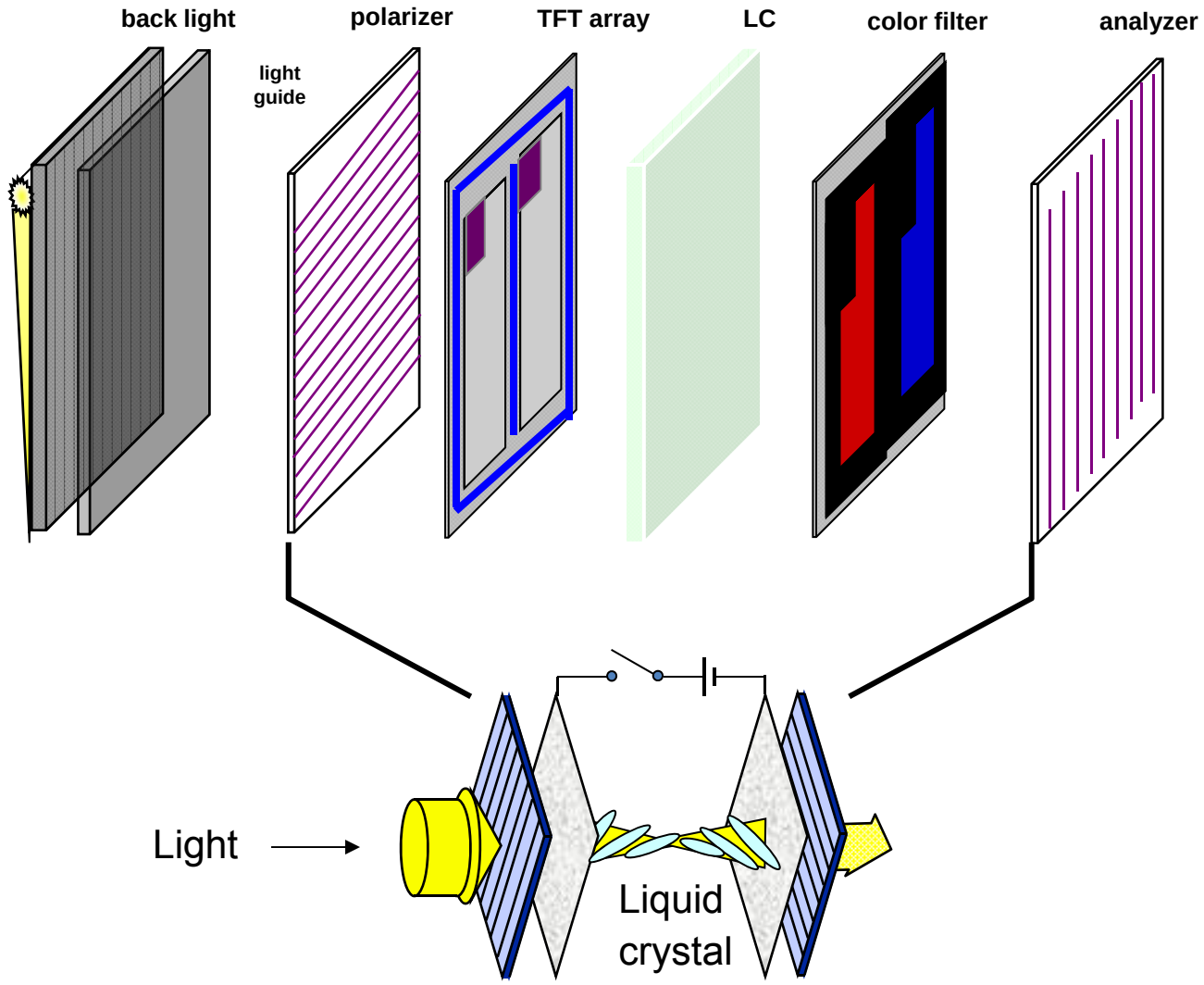
Estimated US TV Energy Consumption, growing fast! (2007)



53 Terawatt Hours!=53 Billion kWh @ about $0.10 per kWh is over *$5 Billion in retail power* in USA alone for 2006!

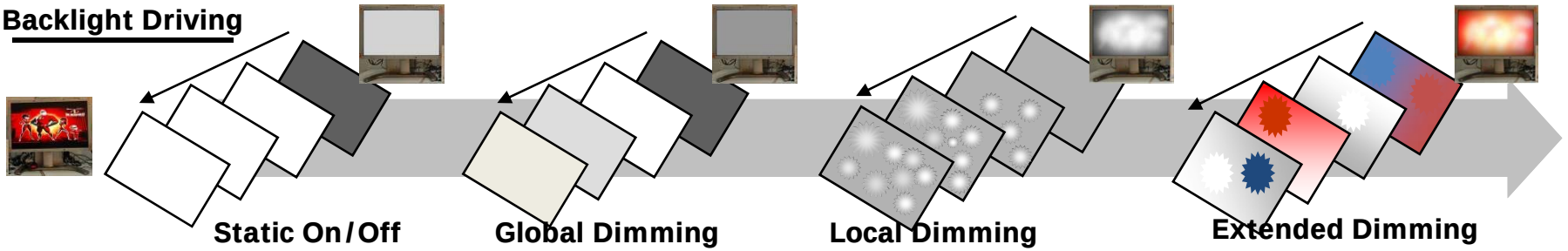
Source: National Resources Defense Council

TFT-LCD Structure – a big shutter

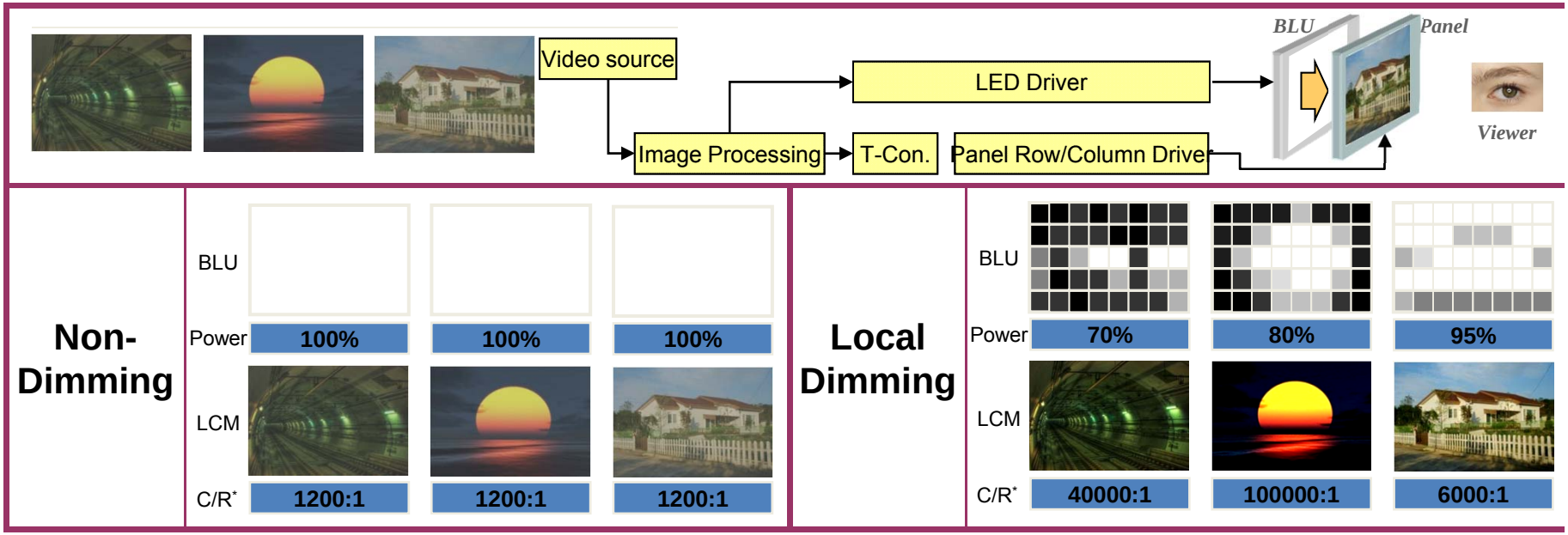


Effects of Local Dimming (1), and extended dimming too…lower power!!!

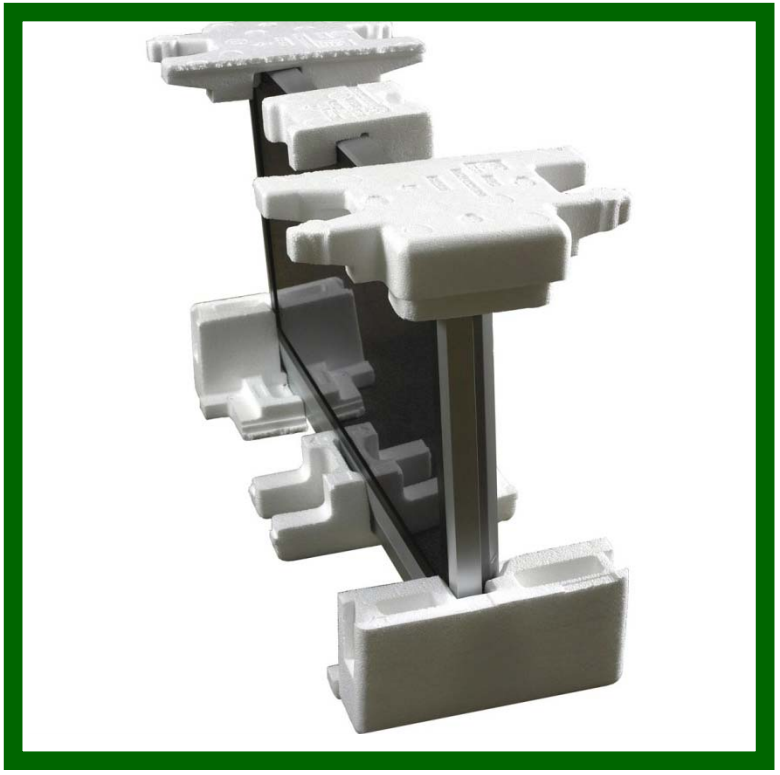
◆ **Contrast Ratio / Power consumption**



LG Display



Oversized Foam means more $ for shipping & logistics!
(was 14”, down to 8”, now with LED <1” TV, sub 4” possible!)

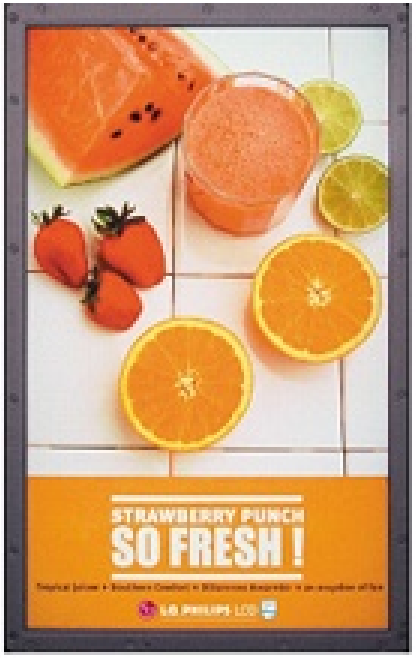


ARCEL
ADVANCED FOAM RESIN

NOVA Chemicals®

Back to LCDs….Many New LCD Applications were on the Rise'05, (& are)

Portable DVD Players



Portrait Advertisements

Rear-seat Automotive Entertainment

Portable Gaming Devices

Universal Remotes

Medical

2005:
“Green is good”, and that means lower energy, and better for the environment and better for many corporate bottom lines!!

This is true for LCD manufacturing, like Sharp and LG.Philips LCD (and others) with strong emphasis on recycling chemicals and low emissions, and products without lead, etc.

This is also true for products which save energy in usage:

LCD’s use less energy than a CRT, of a similar size, but as average size grows, so does average energy use per home, and that is a problem for all countries!

“Berkoff’s LAW” for Technology (2005),

The Display Industry is tough..., easy to make a small fortune, but most start with a large one and work their way down...

Often companies forget **“Berkoff’s rule”,**
where “**science always loses to engineering**,
engineering always loses to economics, &
economics always loses to politics”

..... e.g.“face issues”, (we don’t have to like it but, let’s not forget it....
ex: Plasma and Projection)

LCD Flat panels are here to stay, and have great **“WAF”** , “wife acceptance factor” (SID’98=me), solutions are **needed**... & coming!.....

What's Next for Green Display Technology?

Jun Souk *SID Fellow*

Samsung Electronics

SAMSUNG

Resolution
HD→ Full HD

2007

Frame Rate
60→120Hz

2008

Slim LED TV
CCFL→ LED

2009

3D TV

Frame Rate
120→240Hz

2010




LED Backlighting and Energy Efficiency

Ross Young
SVP, Displays, LEDs and Lighting
IMS Research
ross.young@imsresearch-usa.com
www.ledmarketresearch.com

World's First LED TV

- Marketed for its improved color performance.
- Used RGB direct-lit LED backlighting.
- Used high power, large chip RGB LEDs.

Sony 46" Qualia 005

Thickness: 5"
Weight: 130 lbs
Power: 612W
Price: $15,000
# of LEDs: 2160

Today's 46" LED TVs

Sony Bravia EX520

Thickness: 1.65"
Weight: 31 lbs
Power: 103W
Price: $989

Samsung 46D6000

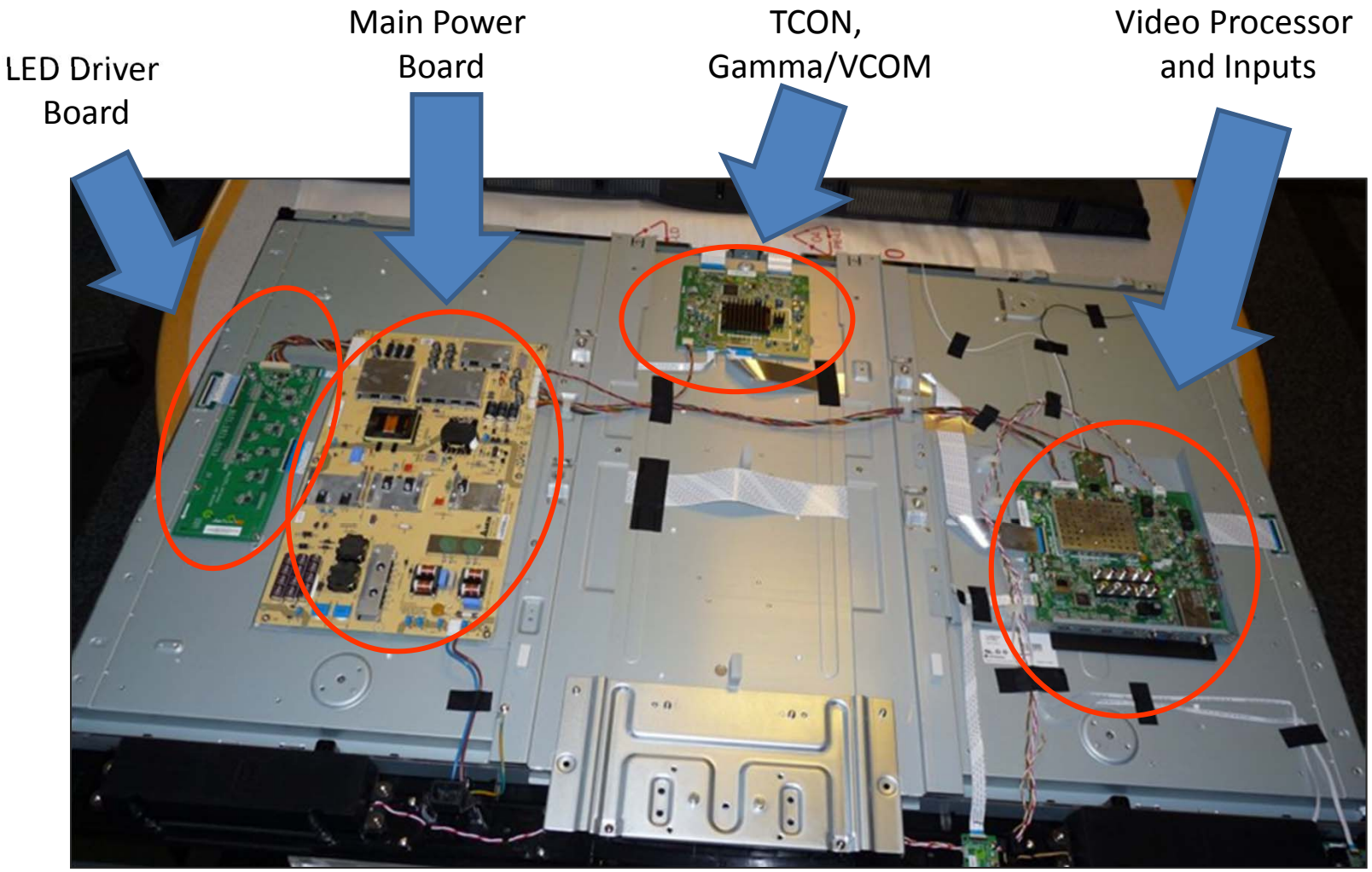
Thickness: 1.2"
Weight: 30 lbs
Power: 67W
Price: $1167

Semiconductor systems in energy efficient LED displays

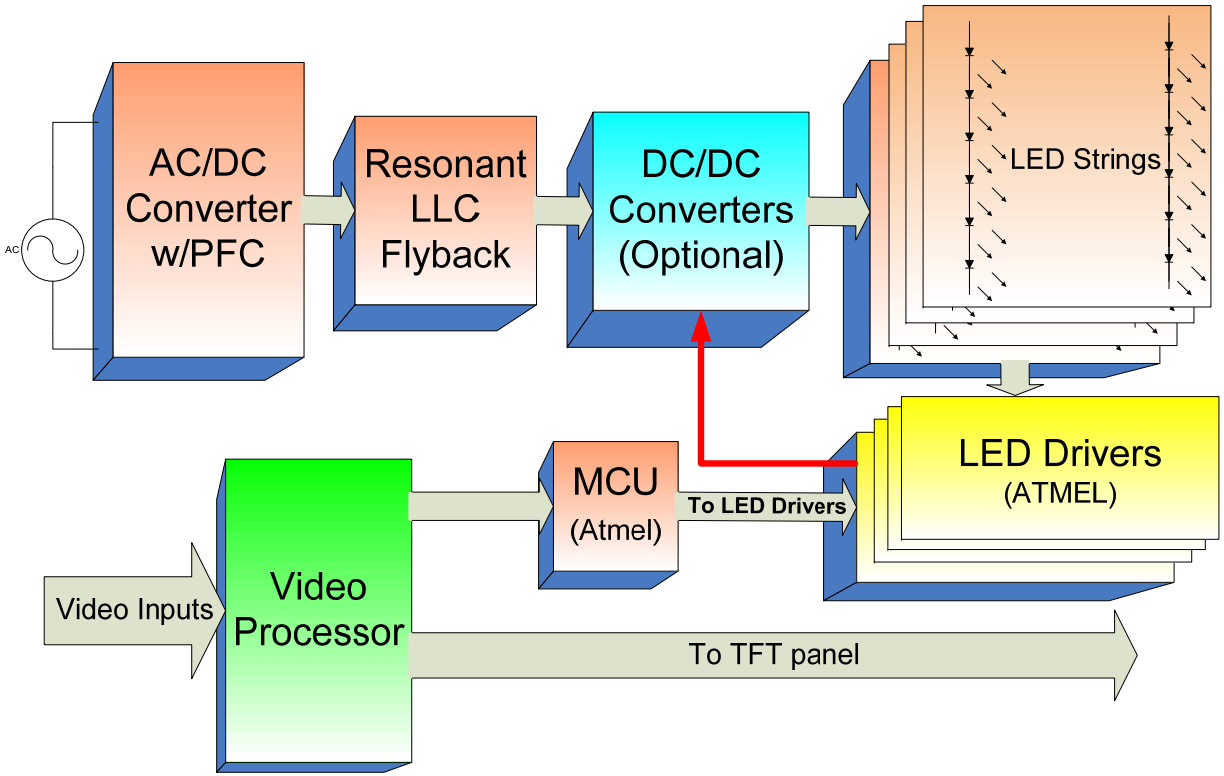
Tushar Dhayagude

Marketing Director
Atmel Corporation

LCD-TV Electronics



LED Backlight Electronics & Efficiency



Key factors affecting power consumption

- System electronics configuration
- Optimal efficiency of the LED driver

Power Budgets for 55” LED Backlit TVs

	High Voltage Edge		Dynamic Edge		80 Tile Direct		240 Tile Direct	
Power Stages	*AC/DC + DC/DC*	***Only AC/DC***	*AC/DC + DC/DC*	***Only AC/DC***	*AC/DC + DC/DC*	***Only AC/DC***	*AC/DC + DC/DC*	***Only AC/DC***
LED Strings	4	**4**	16	**16**	80	**80**	240	**240**
LED Current (A)	0.15	**0.15**	0.06	**0.06**	0.04	**0.04**	0.015	**0.015**
LEDs/string	50	**50**	30	**30**	10	**10**	12	**12**
LED Vf (V)	3.8	**3.8**	3.5	**3.5**	3.5	**3.5**	2.7	**2.7**
Dimming factor	1	**1**	0.85	**0.85**	0.7	**0.7**	0.6	**0.6**
Average LED Power (W)	114	**114**	86	**86**	78	**78**	70	**70**
Efficiency	0.75	**0.87**	0.75	**0.87**	0.75	**0.87**	0.75	**0.87**
Power Consumed (W)	152	**131**	114	**98**	105	**90**	93	**80**

- Dimming factor: Power reduction factor during local dimming
- Average LED power is obtained by multiplying the # of LED strings, LED Current, LEDs/string, LED Vf and dimming factor
- Total power consumed = Power consumed ÷ efficiency

Saving Energy with Ambient Light and Proximity Detection Sensors

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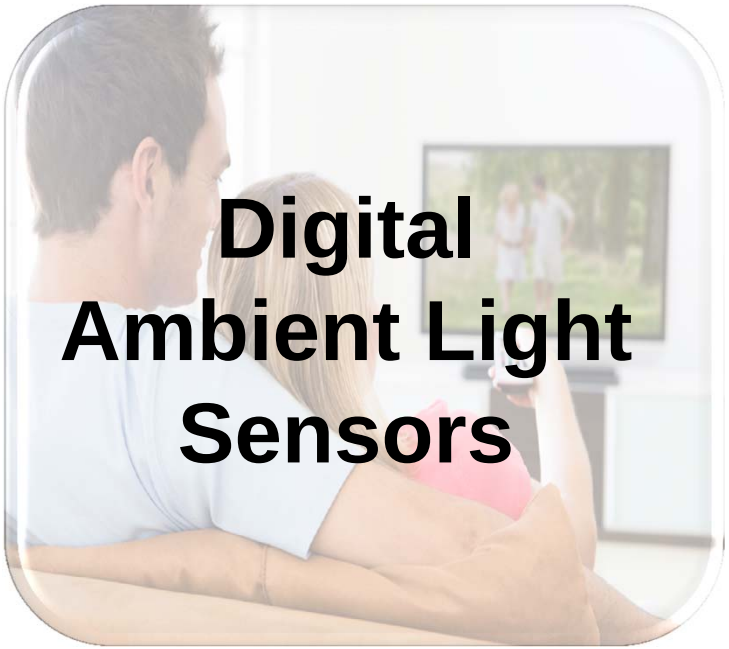
May 18, 2011

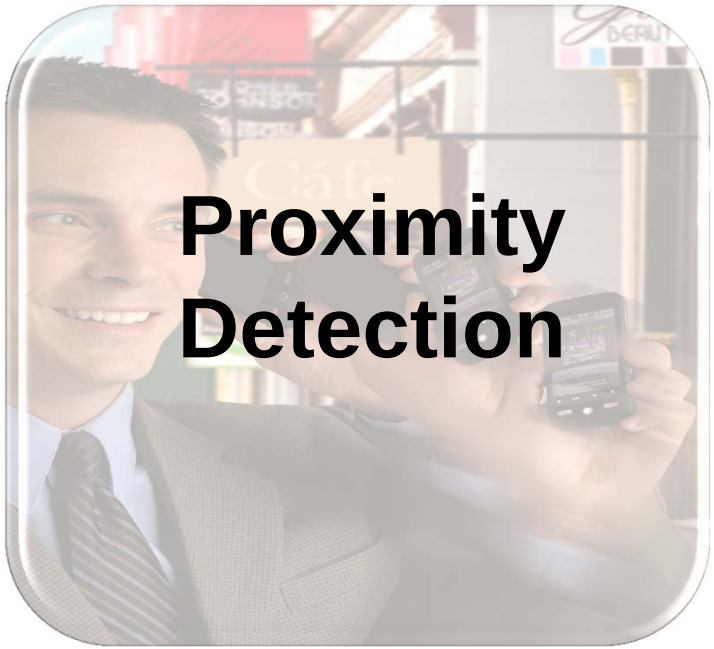
TEXAS ADVANCED OPTOELECTRONIC SOLUTIONS

Darrell Benke
Sr. Marketing Manager
dbenke@taosinc.com

TAOS

green TV

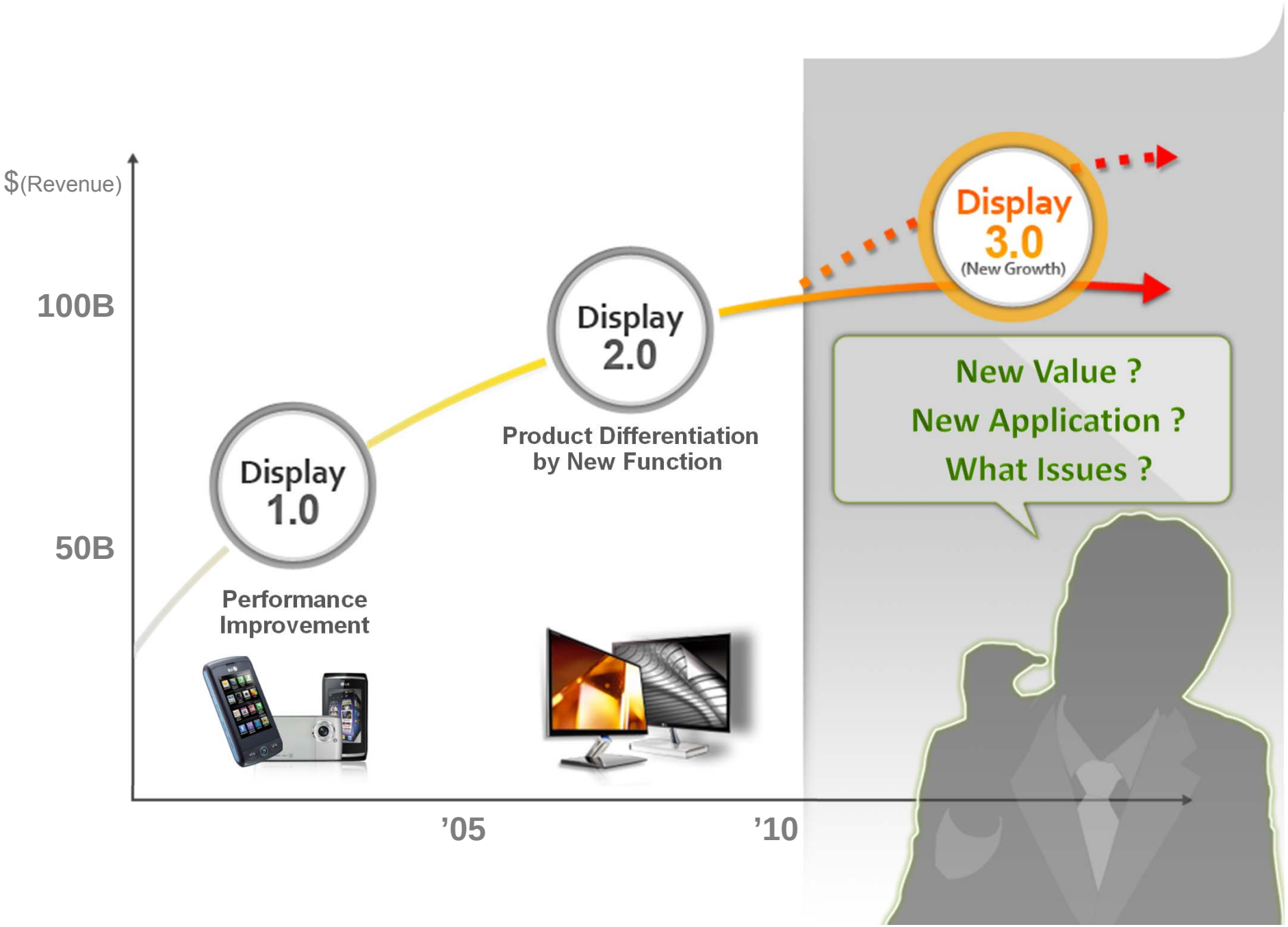




LG Display

LGD's Approach
Green Display

Mike Jun
Vice President, R&D Center
(May 18, 2011 at SID IMS Conference)


$(Revenue)
100B
50B
Display 1.0
Performance Improvement
Display 2.0
Product Differentiation by New Function
Display 3.0
(New Growth)
New Value ?
New Application ?
What Issues ?
'05
'10

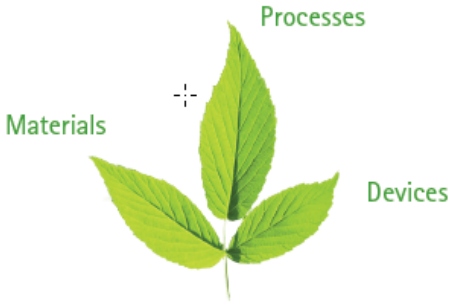
Regulatory and Environmental Aspects of Flat Panel Displays and Merck's Contribution to Green FPDs

Dr. Werner Becker, Merck KGA, Performance Materials Division,
PM-LMR, Frankfurter Str. 250, 64293 Darmstadt, Germany

SID Display Week 2011
Green Displays Conference, May 18, 2011
Los Angeles Convention Center, Los Angeles, CA, USA

Green Displays – Contributions from Merck

- Green Chemistry at Merck:
  - Safer chemical syntheses, less formation of hazardous products, no usage of greenhouse gases, safer and environment-friendly solvents
  - Preservation of resources (water, air, heating energy), waste water treatment
  - More efficient syntheses and production plants
  - Increase ‘green‘ energy sources (solar, wind energy)
  - Prevention, reduction, reuse and recycling of waste



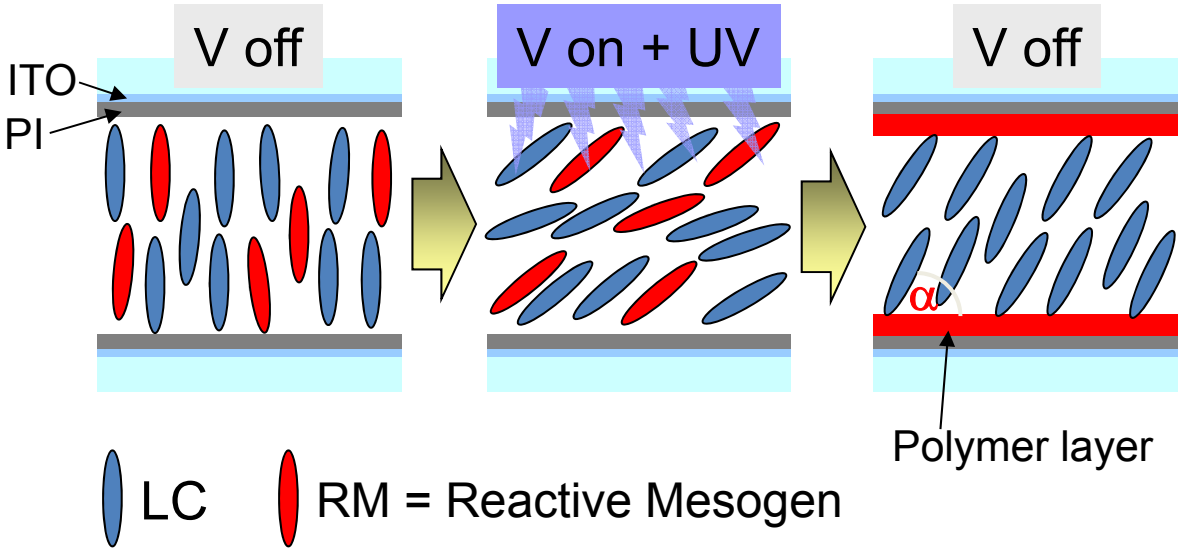
- Green^3 Concept of Business Unit LC for displays:
  - Green Materials: non-hazardous, eco-friendly, safe, legally compliant
  - Green Processes: Advanced LCD modes (PS-VA, Blue Phase), Structuring concepts
  - Green Devices: LCDs, OLEDs, LEDs, flexible displays and solar cells, LED backlights

- General Environmental Goal:
  - Project EDISON: Reduction of CO_2 emissions by 20 % by 2020 based upon 2006

New LCD Technology PS-VA (MERCK)

- **PS-VA is a LC-technology for every application (TV, Monitor and Mobile)**
- **Due to its high transmittance, PS-VA supports LCD technology by a reduced energy consumption**

PS-VA-process:



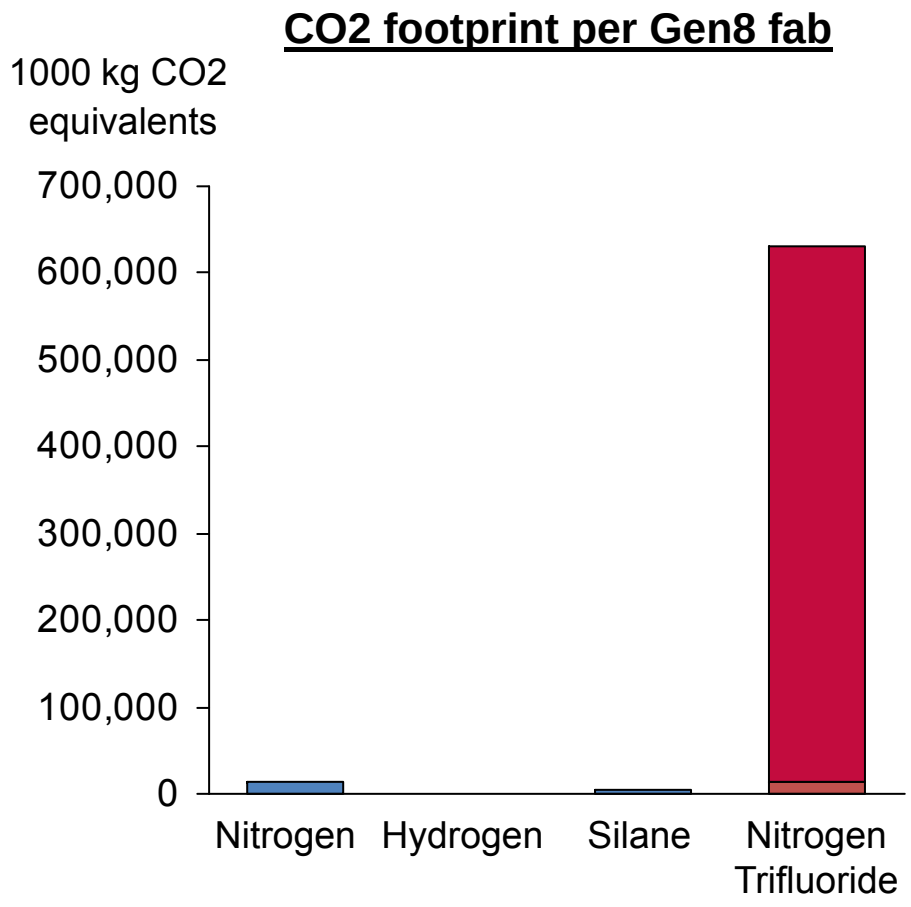
Benefits of PS-VA
Faster switching
Higher contrast ratio
Higher transmittance
Lower panel cost

Sustainability & CO2 footprint from a materials suppliers perspective

Andreas Weisheit

Green Display Conference

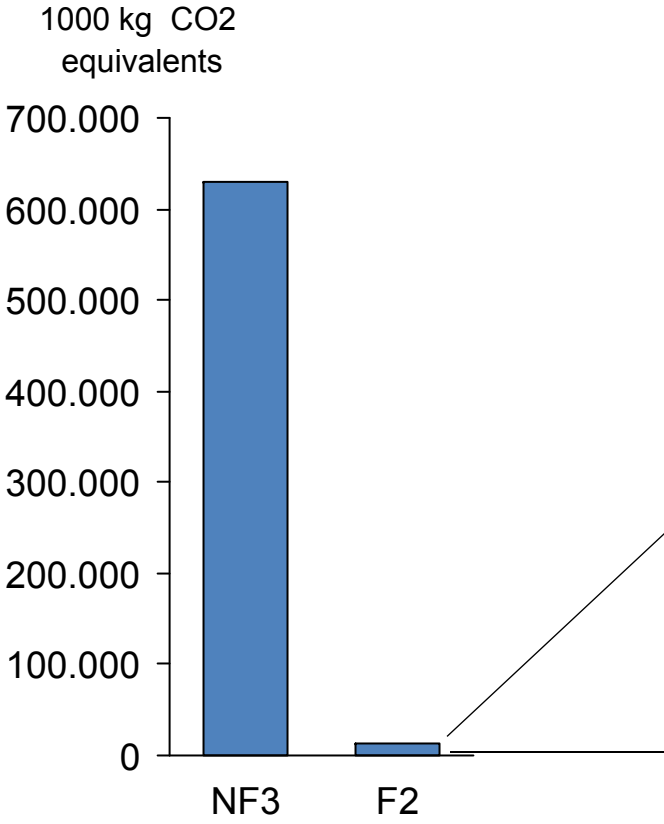
NF3 emissions during the life cycle dwarfs the contribution from all other gases.



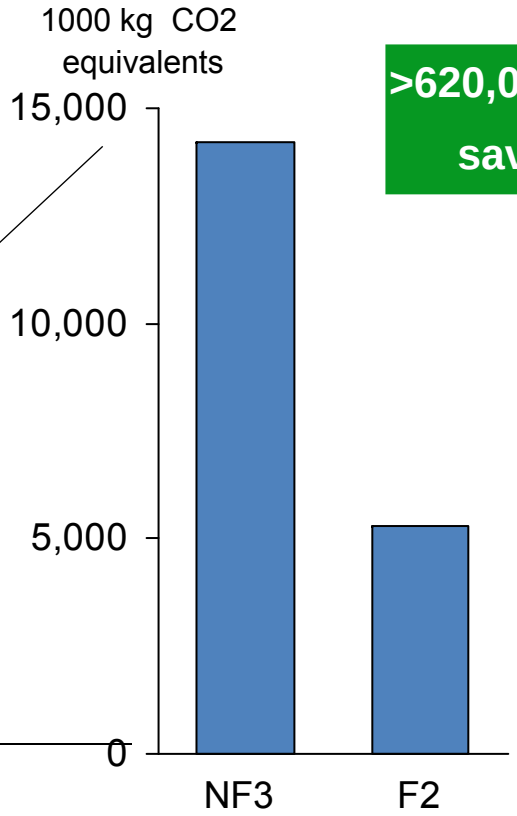
11% emission factor, average of values estimated by Wild-Scholten/Weiss/Fthenakis

Change improves CO2 footprint twice. It avoids undesired emissions in the supply chain, and reduces the CO2 footprint per kg cleaning gas.

Emissions avoidance during LC (11% model)



Direct CO2 footprint savings



>620,000 tons CO2 savings p.a.

CORNING

Display Technologies

EAGLE XG® Slim Glass Substrates

IMS Green Displays

Bob Quinn
Manager, End Market Intelligence
Corning Display Technologies

Corning is raising the bar in quality for environmentally friendly LCD glass with thinner substrates that use the award-winning EAGLE XG® glass composition with no added heavy metals or halides.

EAGLE XG® Slim glass substrates are helping make display devices more environmentally friendly throughout their lifetime by:

- Reducing energy consumption and decreasing the carbon footprint of the manufacturing and transportation processes
- Simplifying the supply chain and lowering costs by reducing or eliminating a costly etching process
- Making devices easier to recycle

If all LCDs between 2009 and 2012 were made with EAGLE XG glass substrates instead of conventional LCD glass, display makers would avoid using 19,000 metric tons of heavy metals.

That's enough potentially hazardous material to fill over 3,000 standard dump trucks.

By reducing the thickness of a glass substrate from 0.7 mm to 0.4 mm, the amount of CO_2 reduced is 1,500,000 kg, which is equivalent to a small power plant.

CORNING

VIZIO

The Best Backlight for LCD: LED

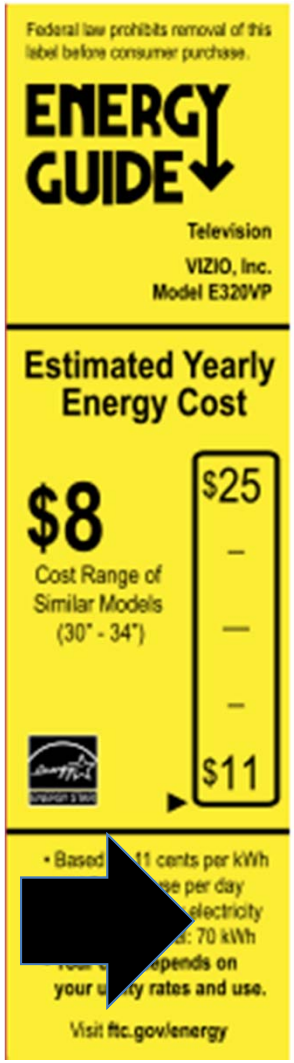
May 18, 2011

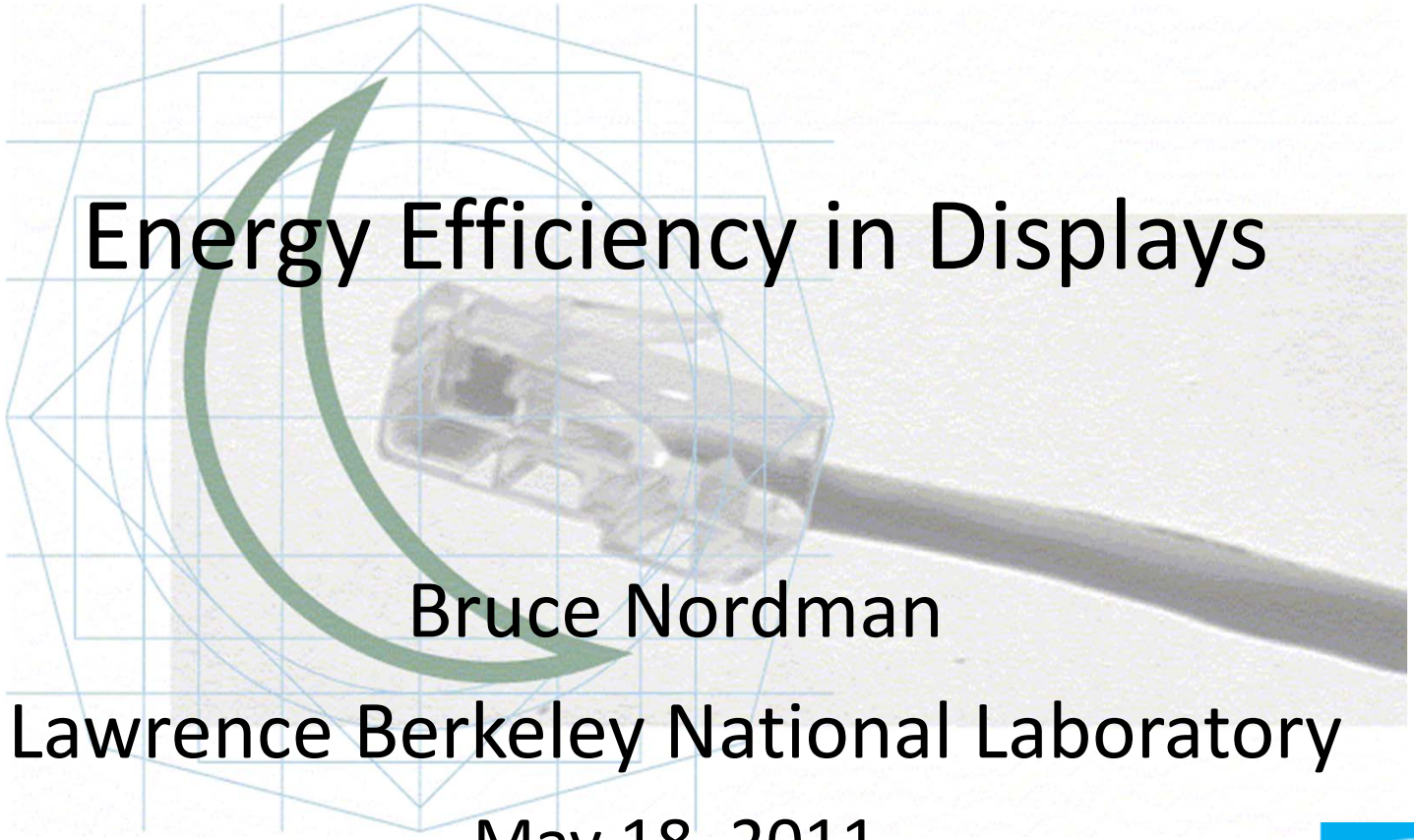
Ken Lowe

The sample Energy Guide Label opposite is for the new E320VP 32” Class Model. We are very proud that the Energy Consumption of this model is significantly lower than the range that the FTC published.

VIZIO’s energy use is

BELOW THE MINIMUM LEVEL LISTED ?!!#>





Energy Efficiency in Displays

Bruce Nordman

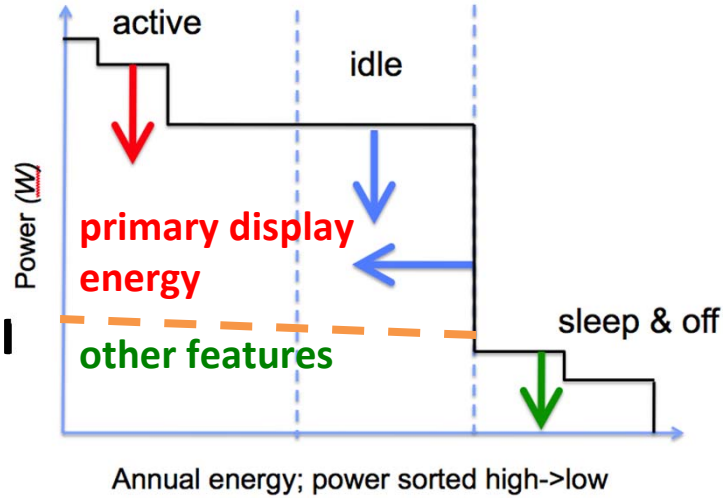
Lawrence Berkeley National Laboratory

May 18, 2011

BNordman@LBL.gov — eetd.LBL.gov/ea/nordman

Core methods to reduce display energy use

- **active energy**
  - **–core image technology**
  - **–changing service, e.g. dimmi**
- **low-power**
  - **–user interfaces**
  - **–network interface**
- **idle**
  - **–reduce time, e.g. occupancy sensing**
  - **–all active and low-power methods**

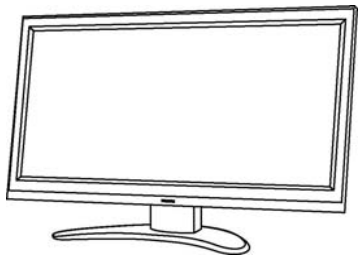


SID DISPLAY WEEK Los Angeles 2011

LCD TV Association

Inform ○ Promote ○ Improve ○ Connect

green TV



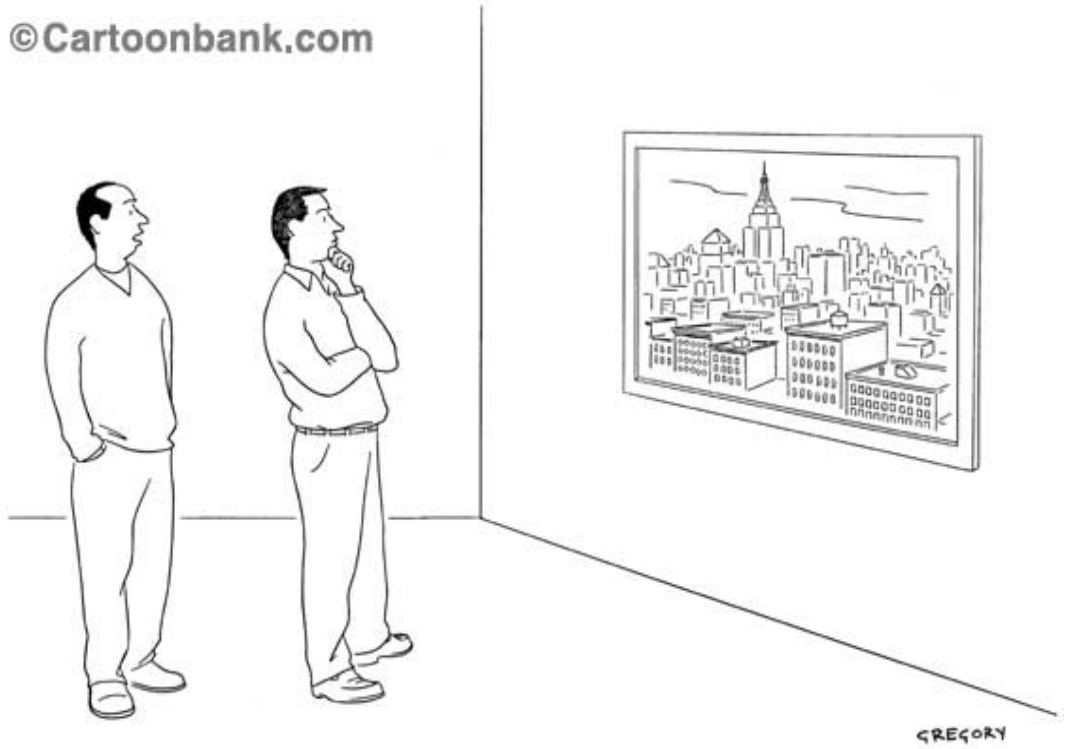
Bruce Berkoff,
Chairman LCD TV Association
1st GREEN DISPLAY CONFERENCE

SID/IMS, LA CA May17, 2011

Thank you LCD TV Association Members:

CORNING, APPLIED MATERIALS, LG Display, NOVA Chemicals, MERCK, AmTRAN, UNIPIXEL, retrevo, DisplaySearch, FlexTech Alliance, Fusion optix, mSilica, QUINN PACIFIC, HDRepair, XILINX, DOLBY, LG Electronics, Westinghouse, VIZIO, LG Innotek, TAOS

(2005)- A goal to shoot for:
A wall TV, a window TV, spray it on?, or…



"It's not high-definition anything. It's a window."

&, of course one more goal: "A great flat TV in every room!!!"

Now transparent TVs CAN BE a WINDOW too!?

LCD TV Association

Inform ❍ Promote ❍ Improve ❍ Connect

A great TV in every room!!!