

Mobile PC Display Power

Kamal Shah

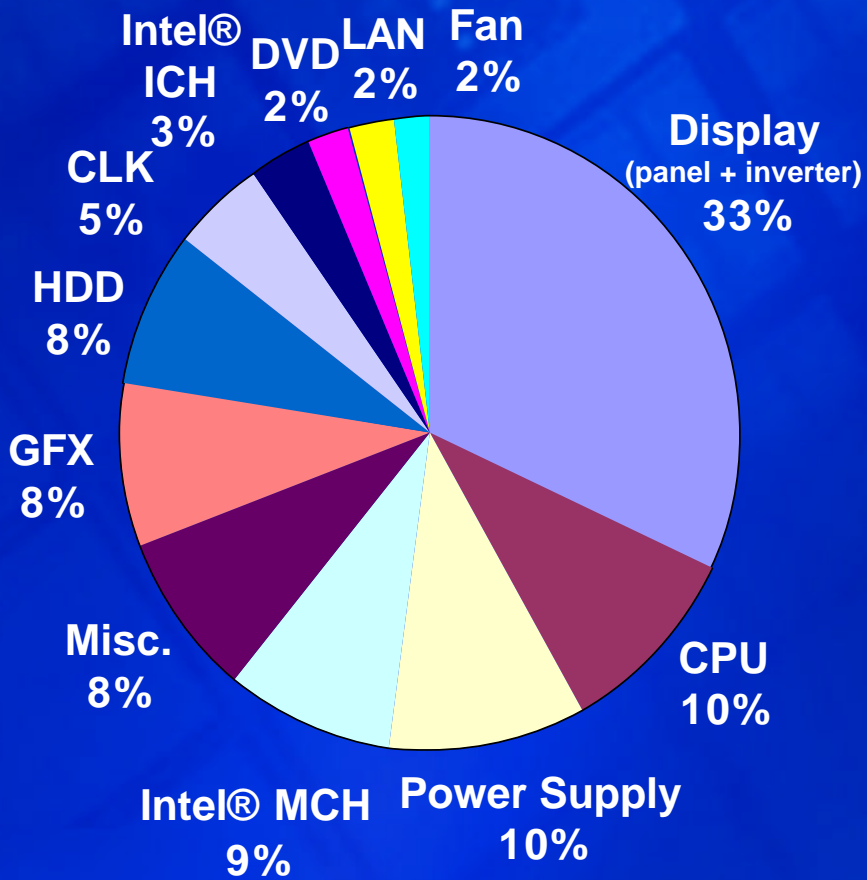
Mobile Platforms Group

Intel Corp.

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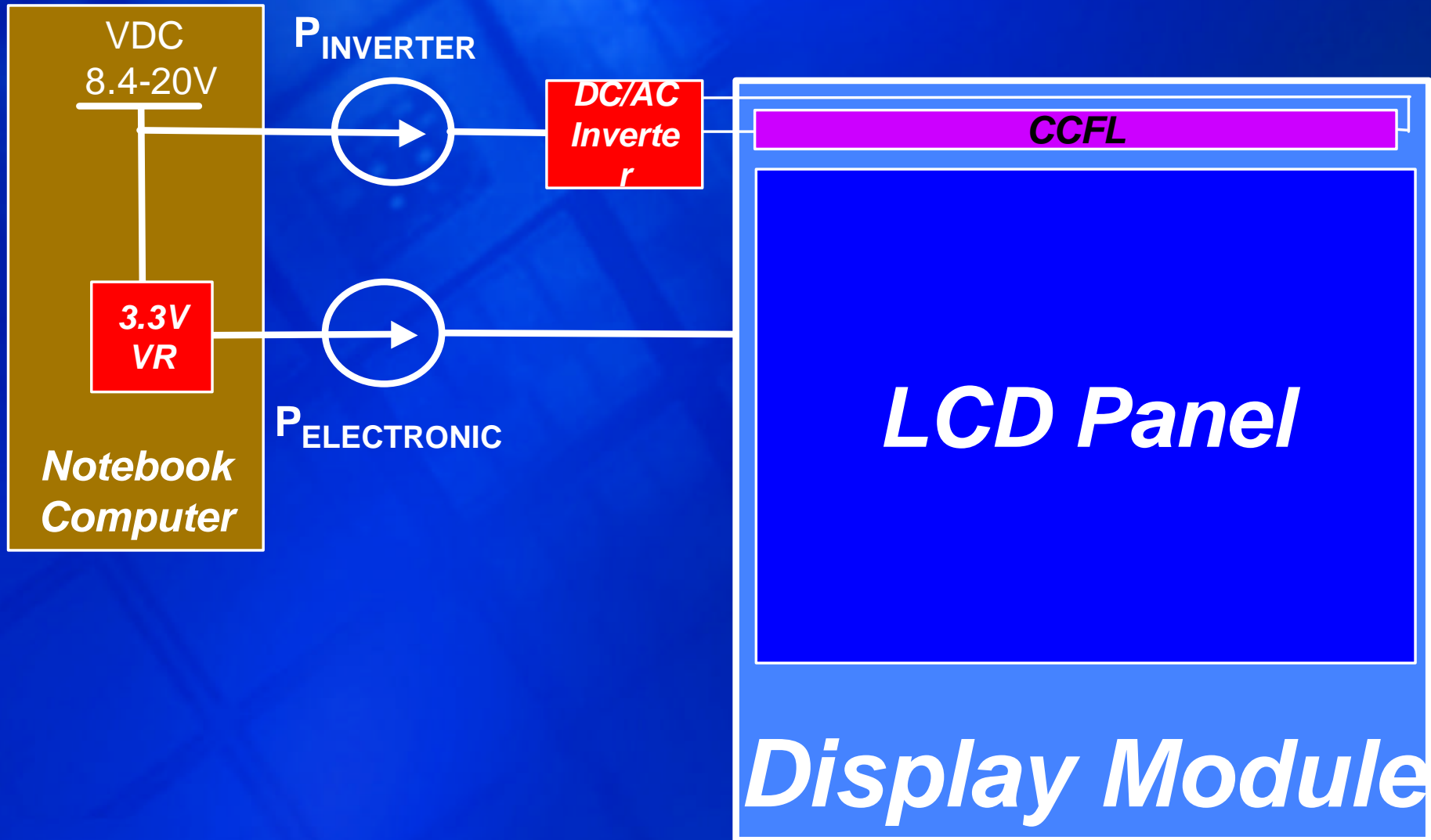
Extending Battery Life: Reduce Power Consumption

$$\text{Battery Life (hr)} \propto \frac{\text{Input Power Capacity (W hr)}}{\text{Average Platform Power Consumption (W)}}$$

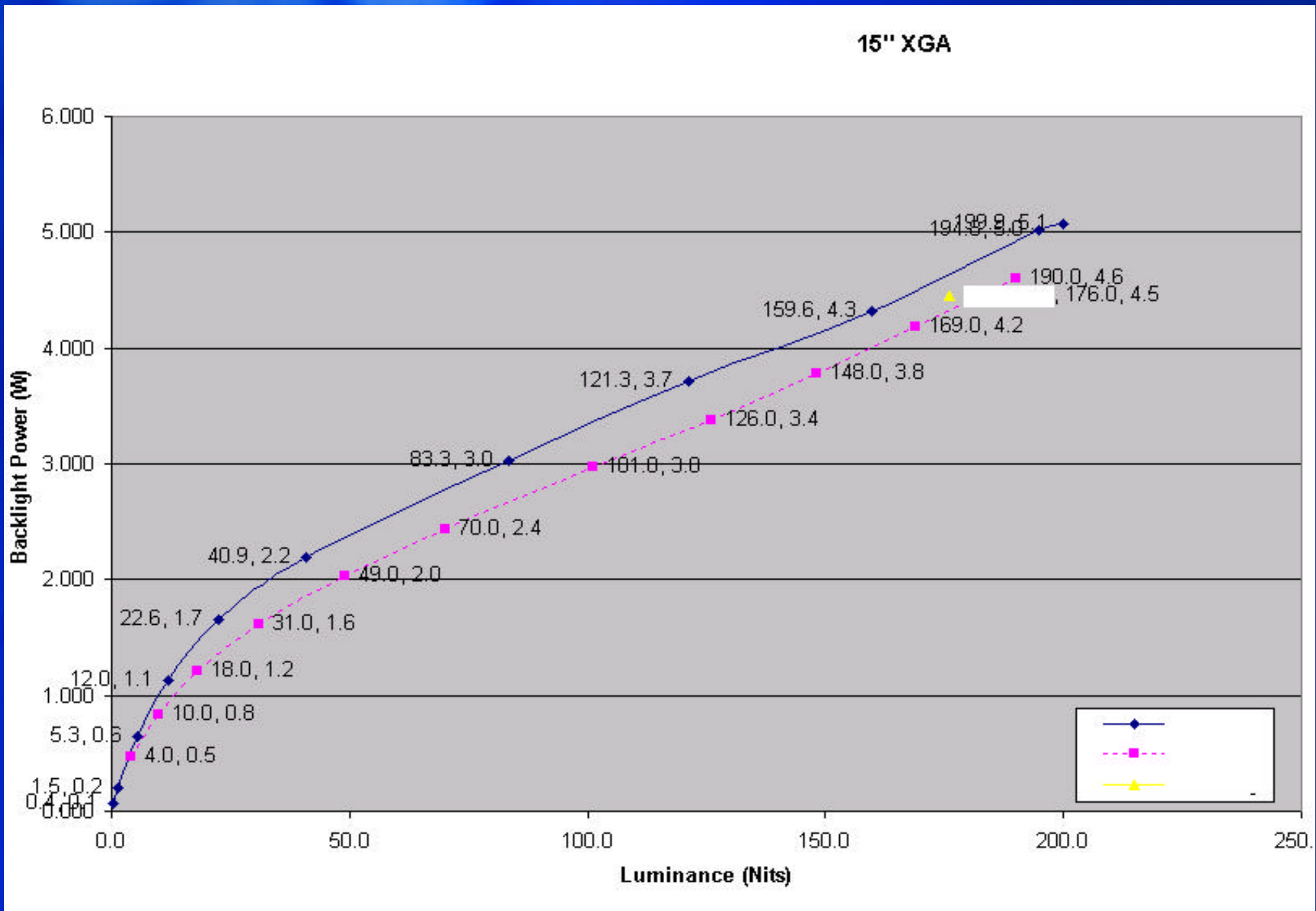


Focuses on reducing critical subsystem power consumption

Display Subsystem Power Breakout

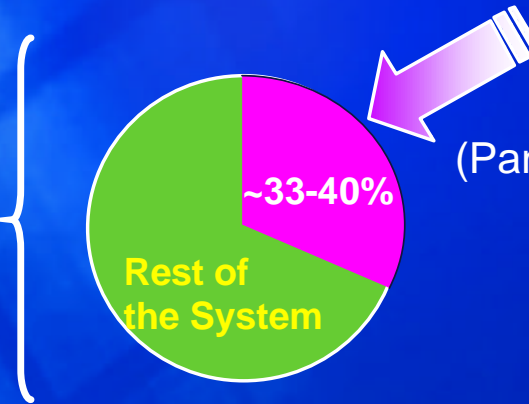


Selecting An Appropriate Inverter



Silicon Innovation: Graphics

Total Average Platform
Power Consumption



Display Subsystem
(Panel Electronics + Lighting system + Inverte

~75%

Reduce power consumption by dynamically enhancing image
brightness and contrast with a counteracting decrease in
backlight brightness



Original Image



Image in frame buffer
is brightened



Backlight dimmed to
compensate for brightened
image



Intel® 855GME Chipset supports Intel® Display
Power Saving Technology

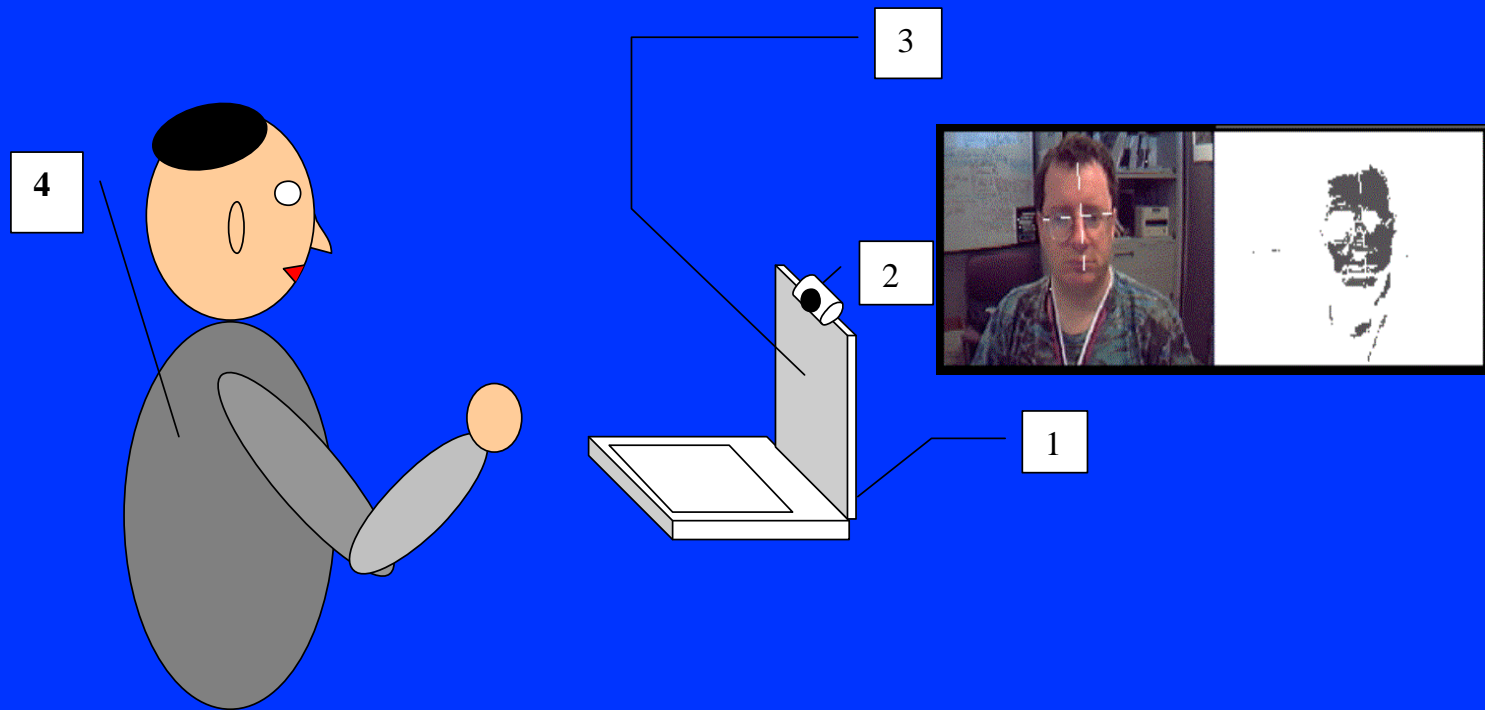
*Other names and brands ma
claimed as the property of ot

Ambient Light Sense

- **Concept**

- Embed an Ambient Light Sensor on the Mobile platform
- Allow the user to specify a reference backlight brightness at a given ambient light setting
- Adjust the backlight automatically to maintain a consistent user experience
- Provides *significant power savings in a dimly-lit environment*, but also has the potential to decrease battery life when used in a brightly-lit environment
- *Automatic backlight control* has great ease-of-use potential – noting that most users never adjust their backlight from the system's default brightness level

User Attention Detection = Real-Time Power Management



1-Laptop, 2-camera, 3-LCD, 4-User

Camera is coupled with face recognition SW that can detect and track a users face. When the user turns head away from display the LCD is turned off conserving battery power that otherwise would be wasted at ~ a 3watt rate

Low power technologies

- **LTPS**
- **OLED**
- **Bi-stable**
- **Separating display from graphics**

Industry Wide Collaboration

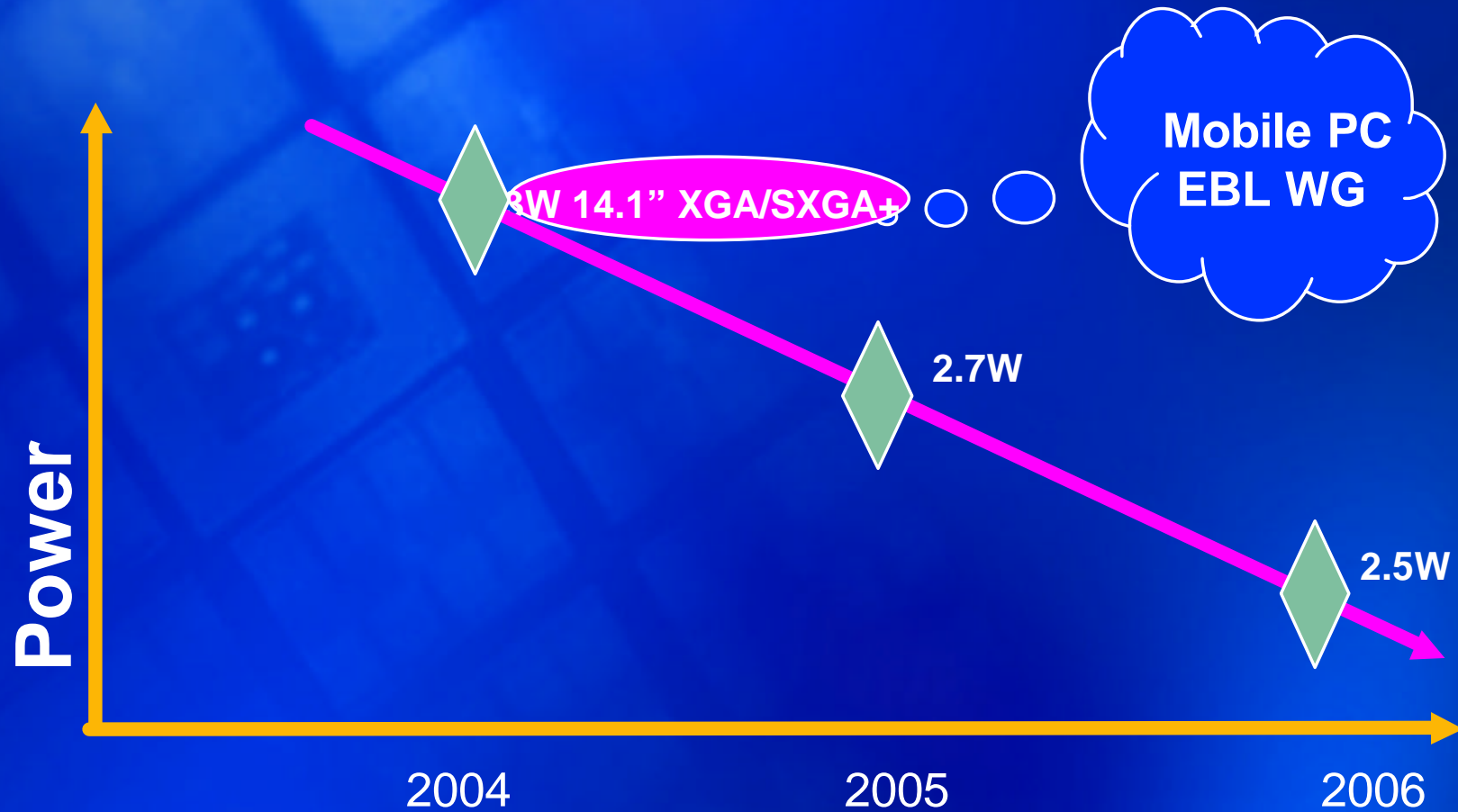
- Mobile PC Extended Battery Life Working Group
- Announced: Oct. 16, 2002 in Taipei, Taiwan
- Membership consists of major mobile PC brand makers, notebook PC manufacturers, Intel, and Microsoft
- Focus areas:
 - Usage model research and battery life definition
 - Alternative power sources
 - Power management profiles

Cutting the Last Wire
www.eblwg.org

intel.



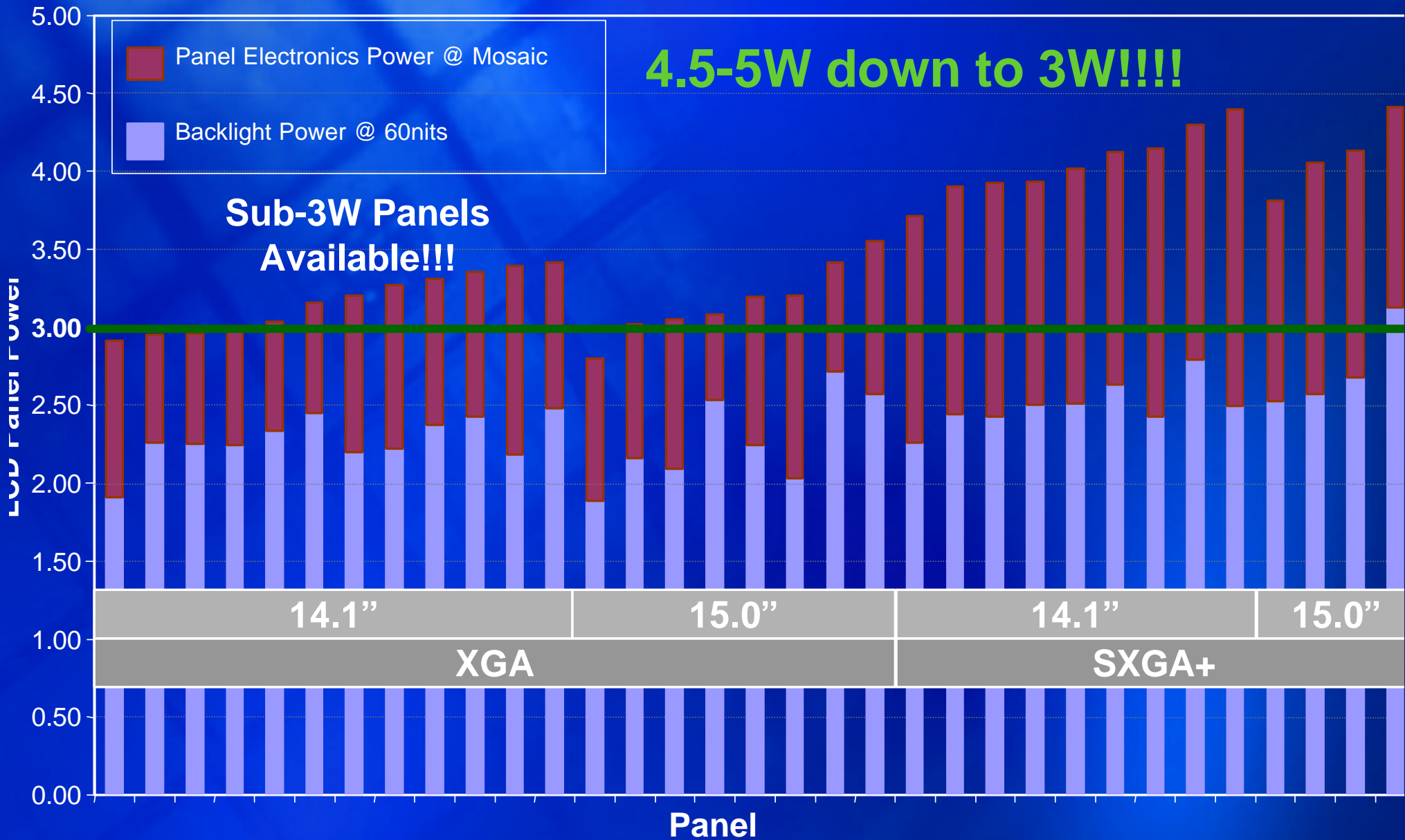
Industry Wide Collaboration



Developed Display Subsystem Power Measurement Recommendations for uniform and consistent measurement across vendors

Industry wide collaboration required to reduce platform power consumption

Industry Wide Collaboration

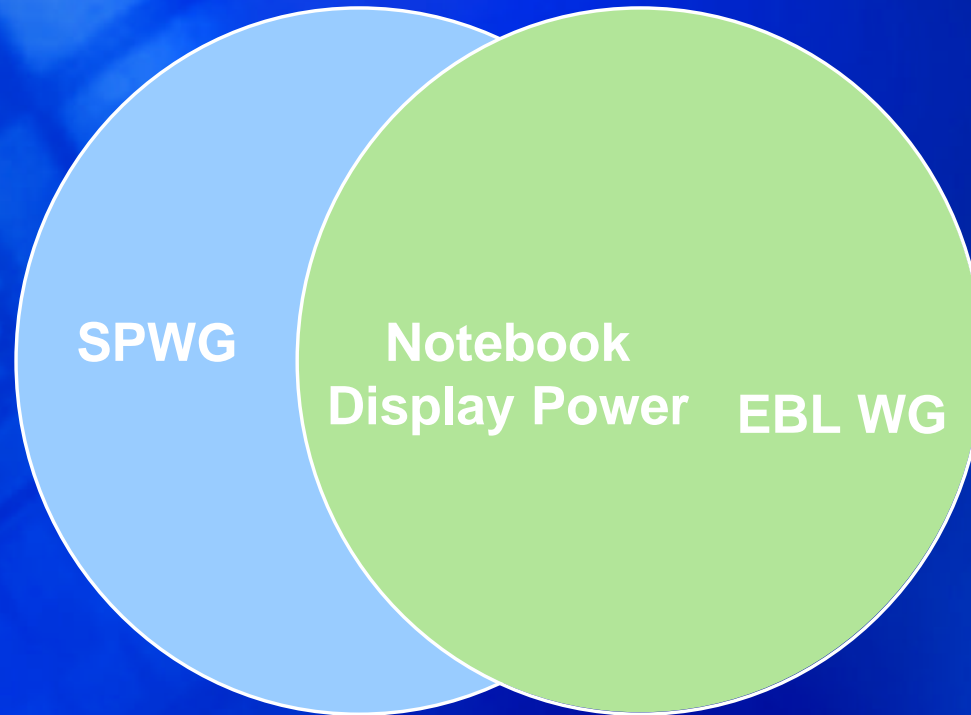


~0 3W panels in 2002, 8 in 2003 and growing!



Source: The mobile PC display panels have been provided courtesy of the LCD panel suppliers. The measurements have been performed at Intel Corp. using the methodology...

SPWG and EBL WG collaboration



- SPWG is focused on notebook display mechanical and simple electro-mechanical standardization.
- EBL WG is focused on reducing notebook PC power requirements.
- Both SPWG and the EBL WG have an interest in defining ways to standardize notebook PC LCD-related power factors.

Key Messages

- Display visual performance parameters and mobile device usage models moving in directions that require increasing power consumption
- Continuous improvement in existing technology required
- New display technologies for mobile devices must accord high priority to power consumption
- Industry wide collaboration needed to overcome common barriers

Visit www.intel.com , www.eblwg.org , www.spwg.org for more details