Power Play: Creating NextGen Displays for the Planet & Human Health

By Jeff Yurek

Looking ahead in 2023, it's sure to be another exciting year for the display industry as the global innovation map grows -- from flexible and more immersive displays to enhanced digital signage technologies, microLEDs , OLEDs, projection technologies, quantum dots, and laser-based display technologies, to name a few.

With the increasing usage of digital screens, energy consumption has become a critical issue for electronic display users and the industry. If you look back to the height of the pandemic in 2020, for example, consumer electronic energy consumption was at an all-time high. According to a report commissioned by the Consumer Electronics Association, consumer electronics accounted for 4 % to 5% of US energy consumption in 2020; 3.3 billion devices in 120 million homes used 176 terawatt hours. About 40% of that energy use was display-related.

While the display industry has made big strides in developing new technologies that use less and less energy while providing better images, how can we create more enviro-friendly technologies that require even less energy consumption and blue light that are better for the Earth and human health? It's a question I have asked myself a lot lately.

That question first led me to J. Norman Bardsley, a physics professor and an internationally recognized expert on this topic. In a 2022 presentation, Bardsley pointed out, for example, that current LCD and OLED displays are very inefficient. That's because for both LCDs and OLEDs, most of the light is trapped inside the display. In LCDs, 90%-to-95% of the light from the LEDs is blocked by thin film transistors and filters. OLEDs, similarly, lose most of the light they produce to metal electrodes and circular polarizers. Bardsley believes that substantial reduction in power consumption in displays is possible, but success will require lots more R&D and reprioritization within industry.

It will certainly require a significant investment in the industry to drive more energy-efficient display technologies. In addition to hardware display improvements, we may also be able to use software and artificial intelligence to extract more energy efficiency out of displays.

Intel, for example, is using edge computing and AI to maximize energy efficiency. Intel has developed a new power management technology for mobile displays that can cut battery consumption in half under some circumstances. Intel has also partnered with Lenovo, the first to launch an enhanced version of the Intel® Visual Sensing Controller (Intel® VSC), an AI-powered chip that ensures a seamless experience no matter how the user is using the device. The Intel VSC helps users have a secure, responsive, immersive, and power-efficient PC without compromising performance, quality, or battery life by using smart sensing solutions to intelligently manage power consumption and deliver great user experiences.

Intel has even found that reducing the power of a PC by 2.5W over the lifetime of the PC will save about 2.5 million metric tons of carbon footprint in the environment over the next 10 years. This is equivalent to CO_2 emission in Washington, D.C. in 2017. Pretty powerful stuff, so-to-speak.

As an industry, we definitely have a lot more work to do. So, how do we get there? During a recent conversation with my colleague and industry expert Kunjal Parikh, he said driving systems-level thinking of efficient power management is key to delivering energy-efficient displays without compromising the user experience. One example of that would be using camera sensors to understand users' behavior. Intelligently monitoring a user's presence/absence and turning off the display when they are not looking can save a surprising amount of power– a bit like the way modern cars switch the engine off at red lights and in traffic.

"I would like the display industry to take a system-level approach to think beyond hardware and look for opportunities to invest in software and the sensing ecosystem to take full advantage of building intelligent display systems," said Parikh, Chief Display Technologist & Architect for Intel. "Invest in technologies like NanoLEDs and Micro-LEDs, which are the future of energy-efficient displays."

Besides reducing energy-consumption to protect the planet, I'm also extremely interested in how our increasing exposure to high-energy blue light may impact our health. According to the International Dark Sky Association, "Research suggests that artificial light at night can negatively affect human health, increasing risks for obesity, depression, sleep disorders, diabetes, breast cancer and more. Exposure to blue light at night is particularly harmful. Unfortunately, most LEDs used for outdoor lighting — as well as computer screens, TVs, and other electronic displays — create abundant blue light."

One company working in this area is Eyesafe, which is partnering with the electronics industry to create industry-leading standards and blue light mitigating technology solutions inside the display, and in aftermarket accessories. I hope the industry keeps innovating and working together on this.

While we still have a long way to go, I believe we can create displays that enable rich, immersive experiences that have less of an impact on our Earth and health.

Parikh said it best: "The climate crisis is real. Let's do our part in building a better and cleaner future for our children and the generations to come. Energy-efficient and sustainable displays are the critical elements to accomplish that goal."

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