Displays and Lighting: Toward a Bright Future

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Light is vital for life: light sources play an indispensable role in the daily life of all human beings. Quality of life, health, and security depend on light and on its quality. In addition, humans have always tried to make information content accessible in a way that appears to their senses and in a manner as close as possible to their natural perception. Today, our world cannot be conceived without light and displays, and both are indispensable keys to sustain development for every knowledge-based society.

Since the flat-panel display research in 1970s was focused on alphanumeric displays, the concepts and techniques for actually fabricating image displays were not studied. The breakthrough was seen on the experimental TV display at NHK in 1973, which appeared in *SID Journal* in 1973, and many works were published in *IEEE Transactions on Electron Devices* in 1975. Following this impact, both Tsutae Shinoda of Fujitsu and Hiroshi Ishii of Sharp succeeded in fabricating the practical color TV displays. Today, flat-panel display technology has largely replaced the bulky tubes on our desks. It has been an enabler for mobile information use. Therefore, it has largely changed our working environment through office mobility with notebooks and mobile phones. Furthermore, the advancement of displays from bulky cathode ray tubes (CRTs) to flat-panel displays in office applications already had a large effect on the environment: less material used, less energy consumption for production and use, less radiation exposure, and much less electronic waste.

The development of new light and flexible display technologies and applications will provide citizens with information at any place and at any time upon request. Fully transparent displays form a subset of several display technologies and have many opportunities. These can leverage technology development in the organic light-emitting diodes (OLEDs), liquid crystal display (LCD), and other effects, and there are now propositions that can allow edge-illuminated screens to operate. Indeed, the societal impact of displays leveraged toward intelligent systems is huge and will even be enhanced by future smart display-driven systems.

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For centuries, mankind has essentially used burning or heated materials as light sources. The invention of the first arc lamp by Faraday, in the beginning of the 19th century, and the development of incandescent light bulb by Edison 50 years later, together with the introduction of the electric power grid, paved the way for the first mass-produced light source that offered clean and reasonable bright illumination using electricity. Currently, more than 30 billion lamps operate worldwide, consuming more than 2,650 billion kWh per year, which is 19% of the global electricity production worldwide, corresponding to more than 2% of the world energy primary energy use. Furthermore, the annual greenhouse gas associated with this electricity is estimated to be on the order of 1.5 billion tons. In the next two decades, it can be estimated that the need for light will increase by a factor in the order of two. The conversion of electrical energy into visible light with higher efficiencies and brightness becomes a real need and requires major research and development efforts in academia and industry. Since then, light source developments have been evolutionary, with incremental improvements in efficiency. In the last decade, overall system gains in lighting efficiency have resulted primarily from the substitution of more efficient sources for less efficient ones. However, after

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Cement, and Rural Electric Power Committees do today. Holding the sessions of our Power Electronics and Electric Machines Committees at a specialized conference allows the 2009 Annual Meeting to accomplish its other key goal—added member value.

Many of our members have repeatedly stressed the need for our Society to provide targeted continuing education opportunities in application-specific disciplines such as electric power. The conference organizers for the 2009 Annual Meeting, led by Society Vice-President Bruno Lequesne, have made continuing education a major focus in 2009. Working closely with the Education Department, chaired by Donald Dunn, the Meetings Department, chaired by Mark Nelms, and the Houston Section of the IEEE (the 2009 Annual Meeting will be in Houston), Vice-President Lequesne has assembled a unique plan for the 2009 Annual Meeting, which allows our Society to continue to meet the needs of many of our technical committees as well as fulfill the many other functions that are part of our Annual Meeting, all while dramatically increasing the available continuing education offerings. Because of the reduction in the number of technical sessions made possible by relocating the Power Electronic and Electric Machines technical and business meetings to ECCE in 2009 and future years, we anticipate smaller venues in the future and an associated reduction in costs. In my opinion, this is a rare situation where all of our members stand to benefit.

THE CONFERENCE ORGANIZERS HAVE MADE CONTINUING EDUCATION A MAJOR FOCUS IN 2009.

The detailed descriptions, calls for papers, and numerous other details on the two conferences in 2009 will be included in the next edition of *IEEE Industry Applications Society Magazine*. I hope that you will find these new offerings to be attractive and that you are able to get involved and participate in some way. As always, I am willing to hear any suggestions you have for further improvements in anything we do. Feel free to contact me at any time. ***IAS***

from the editor's desk

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increasing steadily throughout the previous 75 years, the efficiency of conversion of electric energy into visible light by commercial light sources appears to have reached a plateau of about 33% of the theoretical maximum. Currently, the next revolution in lighting is taking place: solid-state lighting (SSL). In the long term, SSL, inorganic LEDs and OLEDs, as well as lasers, will become the next-generation light sources.

In the future, lighting systems will likely be used for illumination purposes as well as detector or communication tools. The synergy between lighting and displays is evident here because long-life materials for light-emission (OLED) and switching transistors or transparent transistors for see-through lighting and displays are important goals. Indeed, higher-performance displays and lighting will require similar technological advances in flexible substrates, encapsulation, packaging, interconnects, and more. When the borders between lighting and displays will be abolished? It is probably a question of less than two decades.

Lighting and display are drivers for technological innovation and two of the most important key technologies for markets in the 21st century. The articles in this issue will illustrate some key issues in this domain. ***IAS***