ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 8, August 2018

A Study on Energy Saving Display Systems in Resource Draining Zones

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ABSTRACT: The need of renewable energy usage is in increased demand day by day. In communication technology display systems play a significant role. Technology advents brought great change in display device architectures. The handheld display devices depend on battery life for their functioning. In this paper a comprehensive study performed on display technologies in energy saving point of view. We identified the necessary factors in utilization of OLED technology based displays in resource draining communication zones especially in war zones, space, Bio-hazard environments where devices must sustain for longer periods on low battery consummation. Some techniques to overcome the shortfalls of OLED technology discussed. The paper also presents a comparative analysis on some key factors related to durability of OLED display systems with other varieties of display devices.

KEYWORDS: Display Systems, Organic LED, Resource, Communication System, LCD, LED, QLED.

I.INTRODUCTION

The introduction of molecular based Organic LEDs reduced the cost of display devices compared to inorganic based LED panel devices [2]. OLEDs are thinner in size and supports passive matrix or active matrix for higher resolution and larger displays [8]. They are fabricated into two or more layers formed with synthesized organic materials as high transparency films [1][7]. OLEDs support high illumination, fluorescence with more energy efficiency enabling designer colours [4].Their scalability in energy utilization makes them to function well for longer periods. The no back-light technology makes them to exhibit true black colour. These systems are in demand in areas where display systems has to sustain for longer periods on low battery power consummation [3][4]. Even though there is a complexity of time and selection of organic materials in creation of OLED systems they are best suited for future echo friendly display environments. In this paper OLED technology to support energy saving display systems studied in contrast with other LED technologies. The usage of OLED based systems in power resource draining environments is discussed. In Section 2 various display systems and their technologies are discussed. In Section 3 OLED technology utilization in resource draining areas described. In Section 4 comparison of OLED among other flat panel display technologies is done followed by conclusion.

II. DISPLAY SYSTEMS

A. Plasma Panel Systems

Plasma is kind of fluorescent light. It is a gas including collection of ions and electrons. The application of voltage increases ionic charges in gas leads to release of photons. If electrical current passed through plasma electrons and ions are attracted to cause collision. These collisions produce energy and makes electron to reach higher level, when it falls back to original energy level releases energy in the form of a light photon. Plasma displays use Xenon and Neon atoms [5]. Due to their collision energy is liberated and light is produced. Though these photons are mostly ultraviolet in nature not visible to us but play an important factor in exciting photons that are visible to us. A plasma display consists of fluorescent lights which causes the formation of an image on screen. These fluorescent lights are illuminated and the

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different colours are formed by combining the composite colours. The structure of plasma panels is shown in Fig-1given below.

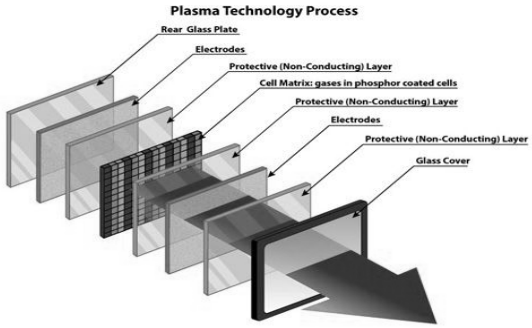

Fig. 1 Plasma Panel Display System

B. LCD Panel Display Systems

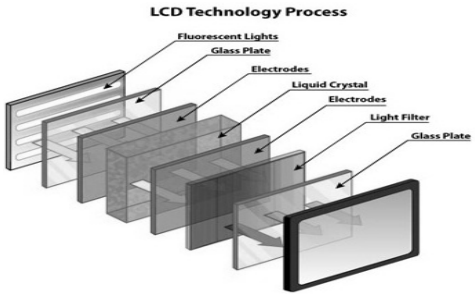

Fig. 2 LCD Panel Display System

A Liquid Crystal Display is a combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCDs consume less amount of power compared to CRT and LED and low in cost providing excellent contrast. LCDs are thinner and lighter compared to CRT and LED. Some shortfalls of LCD's are requiring additional light sources, range of temperature is limited for operation, low reliability, speed is very low and LCD's needs an AC drive.

C. LED Panel Display Systems

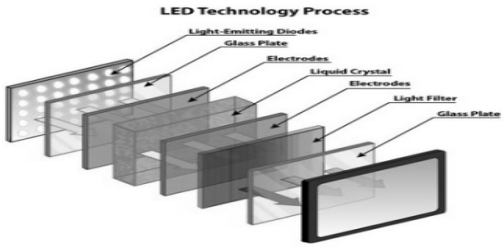

Fig. 3 LED Panel Systems

LED stands for Light Emitting Diodes. They are tiny electronic dischargers to generate light using movement of electrons through a semiconductor. LEDs are so small compared to fluorescent and incandescent light bulbs. They are extremely bright but not suitable for individual pixels on screen. The individual LEDs illuminate pixels in clusters.

D. OLED Panel Display Systems

Organic Light Emitting Diodes (OLEDs) are made with organic compounds that get illuminated when electricity applied. Compared to LED OLEDs are made extremely thin, flexible and remarkably small. Such small as that they can represent pixels within a pixel. The plastic, organic layers of an OLED are thinner, lighter and more flexible than the

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crystalline layers in an LED or LCD. The light-emitting layers of an OLED are lighter resulting flexible substrate of an OLED instead of rigid. OLED substrates can be plastic rather than the glass used for LEDs and LCDs. OLEDs are brighter than LEDs since the organic layers of an OLED are much thinner than the corresponding inorganic crystal layers of an LED. The conductive and emissive layers of an OLED can be multi-layered. Both LEDs and LCDs require glass for support which absorbs some light. OLEDs do not require glass. OLEDs do not require backlighting like LCDs. LCDs functions by selectively blocking areas of the backlight to make the images that you see but OLEDs generate light themselves. Because OLEDs do not require backlighting, they consume much less power than LCDs since most of the LCD power goes to the backlighting. This is especially important for battery-operated devices such as cell phones.

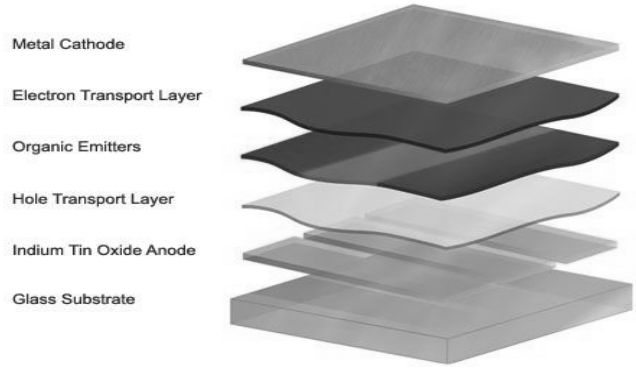

Fig. 4 OLED Panel Architecture

OLEDs are easier to produce and can be made to larger sizes. Because OLEDs are essentially plastics, they can be made into large, thin sheets. It is much more difficult to grow and lay down so many liquid crystals. OLEDs have large fields of view, about 170 degrees. Because LCDs work by blocking light, they have an inherent viewing obstacle from certain angles. OLEDs produce their own light, so they have a much wider viewing range. Seems to be perfect technology for all display systems exhibit some Problems they are

Lifetime – The red and green OLED films have longer lifetimes ranging from 46,000Hrs to 230,000Hrs but blue organics currently have much shorter lifetimes around 14,000Hrs.

Manufacturing - Manufacturing processes are expensive right now.

Water - Water can easily damage OLEDs.

D. QLED Panel Display Systems

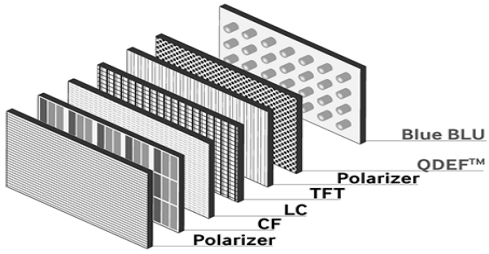

Fig. 5 QDEF Technology Display Panels

A Quantum Dot display systems use Quantum Dots(very tiny semi conductor particles) also called '*nano-Crystals*' which produce pure monochromatic as well as red, green, blue lights. Two types available 'Electro-Luminescent (ELQLED)' and 'Electro-Emissive (EEQLED)'. QDLEDS produce monochromatic rather than white light hence they support 100% more saturated colors in colour-gamut. The improvement in photo-emissive QD structures leads to increase power efficiency, peak brightness and color purity. QD filters are complex as they support depolarizers, output polarizer and color filters which improve viewing angle and efficiency.

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III.OLED IN RESOURCE DRAINED ZONES

The zones which are highly under resource draining environments such as War fields, Dusty environments, Space, Bio hazard areas and zones covered with starvation of electricity. The sanity of supplies is low in those areas where battery backup rate is an essential for durability of display systems. In future the organic compounds 3Q (ΠI-Conjugated) such as Na, Mg, P, C, Li and S can be used to self dischargeable batteries for OLED panels to make them survive more time in resource draining areas. These self rechargeable battery operated OLED technology is under researching. They need solar, wind and water to regenerate their energy. A comparative analysis given below as Table-1 between display systems on various factors gives a significant support for utilization of OLED based display systems improved the functional lifetime of display panels.

Display	Type	Back Light support	Viewing Angle Rotation	Battery Life	Display Life	Robustness
LCD	Inorganic	Yes	60°	3-5 Hours	600-840 Hours	Medium
LED	Inorganic	Yes	90°	7-9 Hours	1750-3250 Hours	High
QLED	Inorganic	Yes	90°	10-14 Hours	5300-14500 Hours	High
OLED	Organic	No(Self Emissive)	180°	26-48 Hours	46000-230000 Hours	Medium

Table. 1 A comparative factor analysis of display systems

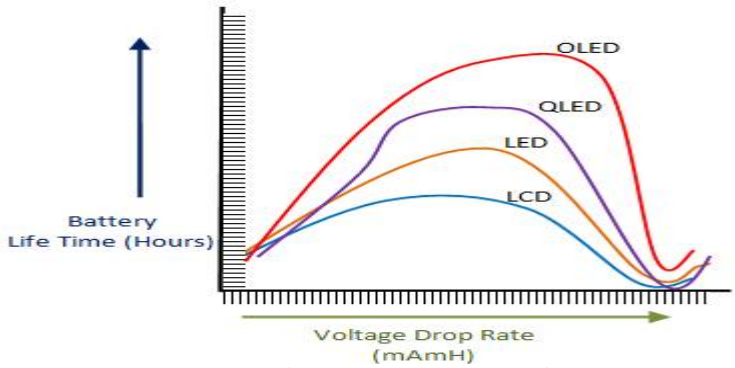

Fig. 6 Analysis of display systems battery life time

The OLED with coating of Manganese-Oxide, nano composite Zinc-oxide, polystyrene, Teflon, nano silica crystalline, Fluorinated silanes and Fluoro-Polymers are used to coat the panels to improve the water/humidity resistance of OLEDs to high rates.

IV.OLED Vs L (C/E) D

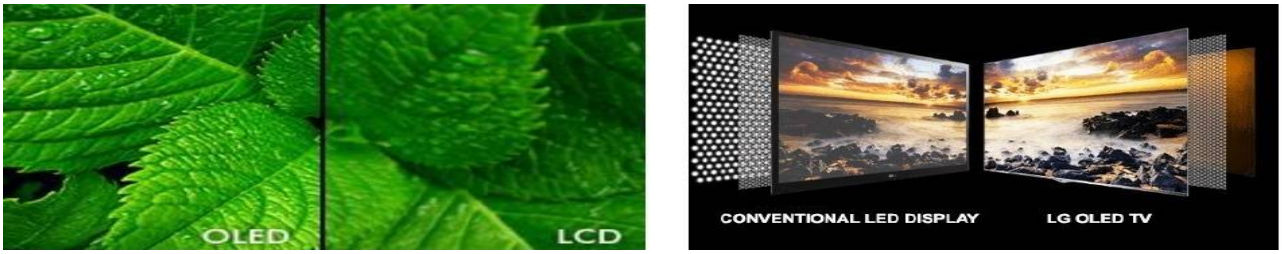

Fig. 7 OLED Vs LCD/LED

Fig. 8 OLED Flexible Sheet, OLED foldable displays and OLED smart bands

The visible spectrum supported by OLED is brighter than LCD, LED and QLED systems. OLEDs are remarkably small and occupy very less space millions of such occupy entire screen. OLED light-up and shut-off individual to each hence it supports complete (true) black displays. They can be made as large as possible and as thin as possible. Supports much wider view rang. Their lifetime is high and battery usage is low compared to LCD and LED displays. Figure 7 depicts the absolute difference in appearance of

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displayed images with True-Colour and HD technology. OLED doesn't allow unnecessary shading zones in pictures and enhances pixel clarity and intensity.

V.CONCLUSION

This paper allows us to study about various display system technologies. In the resource draining zones the application of various latest display technologies are contrasted with their energy saving efficiency rates. It has been noticed that OLED display systems exhibit high battery saving rate among other technologies like LCD, LED and QLED. They are proved to be future energy saving display systems which are in high demand in resource draining areas. The suggestions to improve the water resistance of OLEDs in this paper need an experimental study in our future work. In future an experimental based study should be conducted by authors to identify the ability to overcome drawbacks of OLED to support development of a model OLED.

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