A Comparative Study On Different Lighting Displays

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Abstract

In this paper how the LEDs are more preferable compared to the other lighting displays, discussing about their characteristics, how they are used in different types of display applications like OLED, Light Emitting Diode, and LCD by comparing their characteristics and their parameters.

1. Introduction

Light-emitting diodes, LED or light emitting diode lights use semiconductors to display different types of colours. LED lighting is even replacing other sources of light because LED lights are much more environmentally friendly. This is because they are energy efficient and can last up to 50 times longer than other types of lights. LEDs have grown in popularity due to their lower power consumption and higher reliability than other light sources. These versatile devices are now also being used in imaging applications and high-resolution displays.

2.Types of Led's

LEDs are of two kinds .They are Normal LED and Organic LED.

2.1. Normal LED:

LED is essentially a semiconductor diode with a positive and a negative side joined together. The place at which these two sides join is call a p n-junction, where p stands for positive and n for negative. In semiconductor physics terminology, the negative side has an excess of negative charges, or electrons, while the positive side has a net deficiency of electrons. The deficiency of electrons creates a net positive charge on the p-side. When the negative and positive terminals of an LED are connected respectively with the positive and negative sides of a battery, the electrons cross the p n-junction and recombine with the net positive charge on the p-side. This recombination causes the atoms to emit light. Such LEDs are made up of inorganic semiconductors, such as Ga Asp or Alga As.

2.2. Organic LEDs

An organic LED, or OLED, is similar to a regular LED except that it is made up of organic semiconductor material, such as Alq3, which has the chemical formula Al(C9H6NO)3. This organic material is sandwiched between two electrodes and produces light when current is made to flow through its volume. The active material is thinner than a regular LED. OLEDs are commonly used in high-resolution displays for devices such as televisions, computers and cell phones. OLED currently has is its relatively short life span.

3. Categorizing LED's

In recently LED lights have come into thousand household. Different manufactures have different standards towards LED lights.

There are different LED powers, different sizes, different characteristics. Depending upon the application and desired results, they can be used for a type of product. All LEDs are not equal in quality and performance.

3.1. Depending on the Power

3.1.1. High-Power LEDs:

Error! Reference source not found. High-power LED lights are becoming more popular for home use. High-power LEDs (HPLED) produce a much stronger light source than most other LEDs. The danger of an HPLED overheating is high and must, therefore, be mounted on heat-absorbent material, allowing the light to cool through convection. Too much heat can cause an HPLED to burn out quickly.HP-LEDs are becoming common replacements for fluorescent and incandescent lights as they are proving to be more energy efficient. Their initial cost is relatively high but due to a long lifespan, they typically save on energy costs in the long term. Many HP-LEDs are known as solid state lights. Their electroluminescence is generated through a small, solid mass, rather than through more sensitive and brittle bulbs or fluorescent tubes.

3.2. Depending on the Colour

3.2.1. Bi-colour LEDs:

Bi-colour LEDs combines two light emitting dies connected to one lead in one encasing, allowing for the case to emit two different colours. The current flow of the dies alternates to produce the colour variation. These LEDs can also produce a third light when the flow of both dies is equal.

3.2.2. Tri-colour and RGB LEDs:

Tri-colour LEDs combines two light emitting dies in one encasing. In contrast to the bi-colour LEDs, the tri-colour dies are connected to two leads. This enables the two LEDs to light up simultaneously and be controlled. The third lead shares one of the common leads.

RGB LEDs are the red, green and blue light emitting diodes, commonly found in LED televisions and projections. The LEDs are emitted through a four-wire connection on a common lead. These LED lights usually include a controller and are often used at parties. With more sophisticated controllers, these lights can actually display more than 16,000,000 different possibilities of light combinations.

3.3. Depending on the Intensity:

3.3.1. Super Flux LEDs:

Error! Reference source not found. Large video screens are often made from LEDs. Super Flux LEDs are found most commonly in large panels, such as billboard advertising. These types of LEDs are designed for maximum light emission, as they consist of two positive and two negative leads.

3.3.2. Flashing LEDs: Flashing

LEDs are stand-alone lights that serve as indicators. To make a LED flash or blink, a vibrator is integrated into the circuit that interrupts its flow in intervals.

3.3.3 Lighting:

These lights are a cluster of LEDs combined to form one light bulb. They are available in different shapes and sizes and are suited for use in homes. There are many of them that can operate on 120-240 volts of electricity, but there are not very many of these available in the market.

In LEDs we have **Error! Reference source not found.**Miniature LEDs and Alphanumeric LED

Alphanumeric LED lights are available in two different formats. Seven segment and Starburst. The Seven segment LED lights can display each number and even a few letters, while Starburst LEDs display all the letters. These were widely used in the 1970s and 80s, but have decreased in popularity due to the rise of LCD displays, which had greater display flexibility and consumed less power.

Error! Reference source not found. Miniature LEDs can often be found in small electronic devices. Miniature LEDs are some of the most common types of LED lights and can be found in an array of devices with surface-mount or through-hole designs. Miniature LED lights are used mostly as indicator lights on devices such as cell phones or calculators. It is possible to use a miniature LED light without a casing, or package, such as a dome or cube. Miniature LED lights fall into one of three categories: low current, standard and ultra-high output.

4. Lighting Display

Now a days Lighting display is very important compare to other lighting systems. These days mainly two types of Displays are very famous among people.

4.1. LCD Vs LED:

LCD (Liquid Crystal Display) and LED (Light Emitting Diode) Displays are two major display technologies being widely used today. LED Displays are technological advancement of LCD displays. LED displays are the LCD displays with an LED backlight to power up the LCD panel. It means that LEDs are placed behind or around the LCD panel to enhance the luminosity and video definition of the monitor screen. Cold cathode lights are used as backlight in LCD displays. In LED displays all the concepts are same except this backlight feature, which is replaced by LEDs.

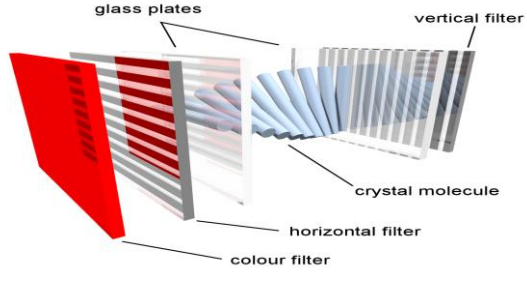


Fig. LCD structure

LED TVs are the newer variant of displays available in the market. Since LED TVs are newer technology displays. They are considered to be better than LCD.So here we discuss the basic differences between the two technologies.

4.1.1. Contrast/Black Levels:

Led displays have better contrast ratio as compare to the LCD display. Major drawbacks for a LCD display are that it is unable to create the dark areas of the

images on the screen. Due to this reason there is a loss of image quality and detail. Whereas LED displays produces better black areas which in tun produces better contrast and more detailed image in the dark areas.

4.1.2. Colour Accuracy:

Colour accuracy of led display is much better than lcd display. Though the difference is not very large but it is still notable. So if you are looking for better colour accuracy then led display should be your first choice.

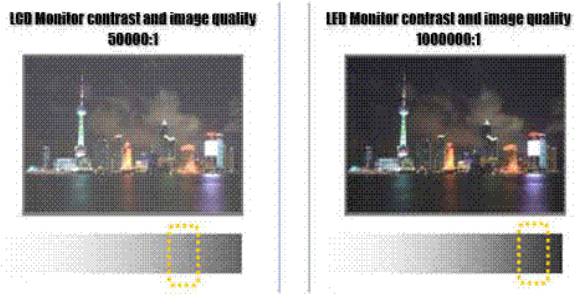


Fig. Color Accuracy between LCD and LED.

4.1.3.Viewing angles

Led displays have much better viewing angles than the lcd display. In case of LCD display beyond the 30 degree from the center the contrast ratio of the image start to diminish. LED display do not have any such limitation and they have much larger viewing angle.

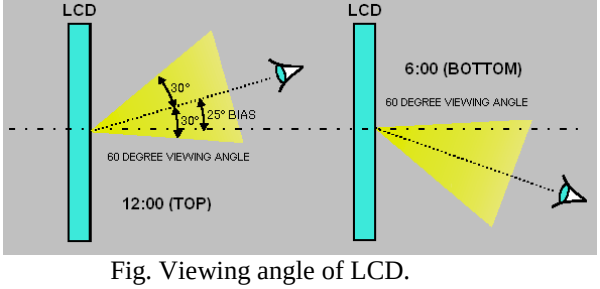


Fig. Viewing angle of LCD.

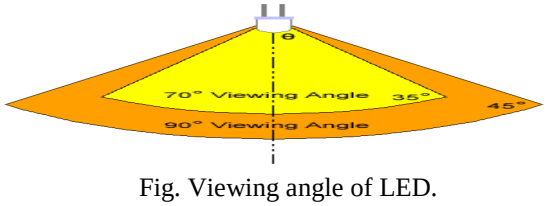
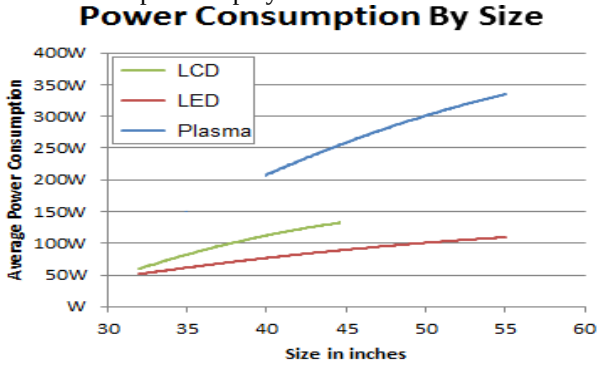


Fig. Viewing angle of LED.

4.1.4. Power Consumption:

Usually people think newer technology would consume lesser power but this is not the case with led and lcd displays. Local dimming LED display consume more power than LCD display. Sounds shocking but it is true. Therefore, the trade-off seems to be between economizing your energy bill and better picture quality. But the edge lit LED displays use less power than an LCD of the same size. Best part is there is no screen burn in problem in case of led displays so they can be used for computer displays as well.



4.2. LED (Light-Emitting Diode):

LED is the newest form of display but has been around since the 60's, usually found in lamps or the flashing light on your telephones. The way it works is , generally speaking, hundreds of tiny LEDs are used to illuminate the picture on an LCD screen, either from behind or the side.

TABLE I

PROS & CONS OF LED

Pros	Cons
Super picture quality.	Quite expensive
Slimmer than other	
Considerably low power consumption	
Can be viewed from more angles than LCD	
Has a long life span.	

4.3. LCD (Liquid Crystal Display):

The way it works is light is projected through a selection of filters until it reaches your viewing screen. An LCD uses a select type of liquid crystal known as twisted nematic (TN), which are twisted in shape. Applying a current to these crystals causes them to unwind to a certain degree depending on the voltage. A LCD is in a layer formation, it starts with a mirror on

the back for reflection, followed by a piece of glass that has a polarizing film on the bottom side, and a common electrode plane made of indium-tin oxide on top. After that is a layer of liquid crystals, followed by another piece of glass with an electrode and another polarizing film, which is at a right angle to the first one. The LCD is then hooked up to power source that provides a charge to the crystals and causes them to create an image on the screen. LCDs also have a backlight that makes the image visible to the user.

TABLE II
PROS &CONS OF LED

Pros	Cons
Reasonable Price.	Poor viewing angle.
Comes in varies sizes.	Average life span 60,000-80,000 hours.
Considerably low power consumption	Slow response time.
Bigger image and cooler running temperature.	
Light weight.	

4.4. Plasma:

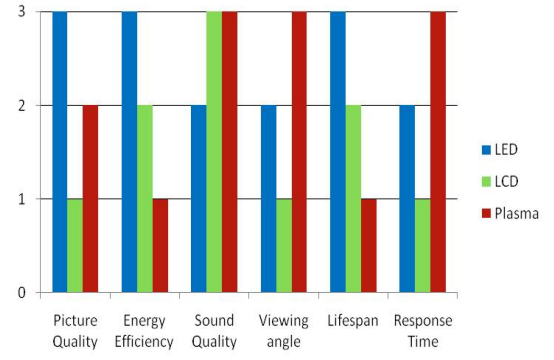
Plasma TVs are known for coming in larger screens ranging from 42" to 60". To get such a clear image, gas and electrodes are packed in-between glass panels, which when combined produces light onto your screen.

TABLE III

PROS & CONS OF PLASMA

Pros	Cons
Great range of larger sized screen	Poor viewing angle.
Can view from the high angles.	Average 60,000-80,000 hours of viewing time.
Fast response time	Hefty power consumption.
More reliable	

4.4.1. Led Vs Lcd Vs Plasma:



4.5. OLED Vs LCD:

OLED's are different types of displays that are used for electronic devices such as TV screens, cellphone screens. OLED (organic light-emitting diode) is a type of LED (light-emitting diode), where a layer of organic materials are placed between two electrodes on a substrate. An OLED has the following layers; a substrate that supports the OLED, an anode that removes electrons when current is applied, organic layers of color, conducting layer, emissive layer and a cathode on the top. OLED can be applied to a substrate in three different ways; vacuum deposition (in a vacuum chamber the organic layer is heated until evaporation and then allowed to cool on the substrate), organic vapor phase deposition (in a low-pressure hot-walled reactor chamber, evaporated organic molecules are transported to cool substrates), and inkjet printing (OLEDs are sprayed onto the substrate). Printing is the cheapest form of producing OLEDs.

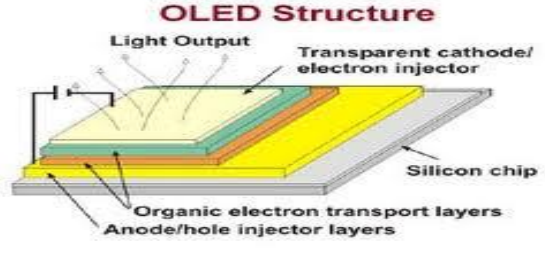


Fig. OLED structure.

When an electric current is applied across the OLED, the current flows from the cathode to the anode through the organic layers in the middle. The anode removes electrons from the conductive layer, while the cathode gives electrons to the emissive layer. As the electrons find the electron holes, it releases energy in the form of light. The intensity of light depends on the amount of electrical current and the color of the light emitted

depends on the organic material in the emissive layer. OLEDs come in different types depending on usage in different devices.

LCDs and OLEDs are very different. OLEDs are thinner than LCDs, it also consumes less power and has a higher screen refresh rate compared to LCDs. In both displays, defective or dead pixels can occur during manufacturing or use. The life span of an OLED is less, compared to LCD due to the short life span of the blue organic material. Both the displays can be used for TV screens, cell phone screens and computer monitors. An OLED can emit light, removing the need for a backlight.

4.5.1. *Comparison between LCD and OLED.*

	LCD	OLED
Thickness	Thicker compared to OLED	Thinner compared to LCD
Power consumption	Consumes more power compared to OLED.	Consumes less power compared to LCD
Screen Refresh Rate	Less than OLED	Much greater than LCD
Screen glare	Less glare	More glare; lacks readability in the sunlight
Viewing angle	Up to 165 degrees	Viewing angle better than LCD
Contrast Ratio	15000:1	Above 1,000,000:1 static.
Life span	60,000 hours	Red and Green - 46,000 to 230,000 hours, blue organics - up to around 14,000 hours

5. Conclusion

If you are looking for better picture quality and better features then LED display should be your first choice. If you can compromise a bit on quality then you can go for LCD display. Usually you would find LED displays to be more expensive then LCD displays but with increase price you get better quality. So if budget is a problem for you then try getting a smaller size led display rather than bigger size lcd display.

Then LCD compared to OLED , OLED is the better choice.

1. OLED does not require a backlight while LCDs do.
2. As a consequence of the first, OLED displays consume less power than LCD displays.
3. OLEDs have better contrast compared to LCDs.
4. LCDs cost more to manufacture than OLEDs due to the printable nature of OLEDs.
5. Printing techniques could lead to more applications for OLEDs than LCDs.
6. OLED displays have a significantly lower lifetime than LCD displays.

When you compared to OLED and LED, LED is the better option.

1. OLED can be made much smaller than LED.
2. LED has a much longer lifespan than OLED.
3. LED has many more applications than OLED.
4. LED is used for very big displays while OLED is used for small ones.
5. LED is cheaper than OLED.

Depending on the above matter LED is better. This is based on the application.

Reference

[1] Ian T. Ferguson; Nadarajah Narendran; Steven P. DenBaars; John C. Carrano San Diego, CA | August 03, 2003 ' A method of projecting useful life of LED lighting system.

[2] Iwao Yagi[1], Nobukazu Hirai[1], Makoto Noda[1], Ayaka Imaoka[1], Yoshihiro Miyamoto[1], Nobuhide Yoneya[1], Kazumasa Nomoto[1], Jiro Kasahara[1],Akira Yumoto[2], Tetsuo Urabe *Distinguished Paper*: A Full-Color, Top-Emission AM-OLED Display Driven by OTFTs

[3]http://www.enlighteninitiative.org/portal/Resources/ENewsletter/Newsltter4/EuropeanCommissionPublishesGreenPaperonLED/tabid/79346/Default.aspx.

[4]http://www.google.co.in/search?um=1&biw=1366&bih=565&hl=en&sout=0&tbm=isch&sa=1&q=power+consumption+between+led+Vs+lcd&oq=power+consumption+between+led+Vs+lcd&gs_l

[5]http://knowhow.com/article.dhtml?articleReference=920

[6] Mian Dong Dept. of Electr. & Comput. Eng., Rice Univ., Houston, TX, USA Choi, Y.-S.K.; Lin Zhong Power modeling of graphical user interfaces on OLED displays

[7] Bernard Geffroy[1,*], Philippe le Roy[2],Christophe Prat[2] Organic light-emitting diode (OLED) technology: materials, devices and display technologies