Is it cool to use cool ?

by John Rossetti

The term 'cold lighting' is used within the film & TV lighting industry as a generic term for energy efficient, Fluorescent, LED, and Plasma (panel) lighting sources which emit little or no radiant heat.

History

The technology is not so new; Evidence exists of neon lighting being used on a film set in Teddington Studios England in 1948. Indeed John Logie Baird used a small neon light in 1927 with his 30 line TV demonstrations!

The first practical products were introduced to the film industry by Frieder Hochheim of Kino Flo fame in 1987. The use of fluorescent lighting in television was first patented by Paul Costa, founder of Videssence in 1989.

I first came across Videssence when Paul demonstrated his new lighting equipment at Pinewood Studios in that year to the Society of Television Lighting Directors. I think it would be fair to say that the technology was met with a mixed reception.

The Technology

In simple terms the fluorescent bulb is a glass tube coated with a powder and filled with mercury vapour. It has electrodes at both ends and when electricity is passed through the electrodes, the gas is ionised, a current flows, the mercury vapour emits UV radiation plus a powerful emission of green light. The UV is absorbed by the Fluorescent powders on the tube walls causing the powders to emit visible light.

In an incandescent light bulb when electricity is passed through a filament it causes it to heat and produce light. Depending on what is inside the glass bulb - usually a vacuum - plus an inert gas and a halogen gas - the rate of burn is controlled and the glow is maintained.

The downside of an incandescent bulb is that, as an emitter of visible light, it is not very efficient. Most of what is produced is heat, however the upside is that what light is produced is quiet pure in terms of its spectrum.

The ratio of light to heat given off by a bulb is known as its luminous efficiency: a typical 100w bulb is only about 8% efficient.

The quality of the colour of the light emitted from a source is known as the Colour Rendition Index (CRI)

A black body radiation is defined as having a CRI of 100. This is why incandescent lamps have that rating, as they are, in effect, almost black body radiators. The best possible faithfulness to a reference is specified by a CRI of one hundred, with the poorest at the bottom, having a CRI of zero.

Early fluorescent tubes were produced to be efficient and produce as much light for as little electricity as possible. The CRI of a fluorescent is produced by mixing materials that form the powder that is coated on the inside of the tube and in the early days of fluorescent, the CRI of the light was not deemed to be that important or achievable.

Having identified the benefits of fluorescent light to the film industry, what Frieder Hochheim of KinoFlo did was to work in collaboration with the fluorescent tube manufactures to find a powder mix that gave a better (higher) CRI at a given colour temperature.

KinoFlo produced two tubes with a CRI of 90+ and a colour temperature of 3200 Kelvin and 5500 Kelvin.

As the technology progressed, fluorescent tube manufacturers started to produce even more efficient versions with acceptable CRI until a point came where, for television at least, a bulb was available off the shelf that could be used in especially designed lamp heads; enter Videssence.

Osram / Sylvania came up with a 32 watt biax tube that was of a size that could be incorporated into a lamp head of a shape that was specifically useful for television studios. This coincided with the State of California offering financial incentives to anyone who could show a saving in power consumption for lighting. TV studios were amongst the first to take advantage of that offer.

> "TV studios were amongst the first to take advantage"

Owing to the make-up of the powder that coats the inside of the fluorescent tube, the more efficient the CRI the lower the light output. This means that if you want perfect colour rendition, you need lots of tubes or a higher wattage to compensate.

Kino came out with the Wall-O-Lite, a fixture using as many as 10 tubes, TV had to wait, at least until the 55 watt biax tube was invented. Biax stands for bi-axial, a glass tube bent in two, so you get double the light for the same length of glass. It was the 55-watt tube that enabled real progress to be made in fixture design and is still popular to this day.

Running in parallel to the development of tube design was that of ballast design. The ballast is a separate box of electronics that starts the process of the fluorescent tube igniting and then maintains that light during its use. Early ballasts were of the magnetic (reactive) type, which were not very efficient and ran at mains frequency. A later design called an electronic ballast was eventually designed, which was more efficient, enabled dimming, and ran at such a high frequency it appeared to be flicker free.

Since 1962 we have had light emitting diodes (LED). These devices are

semiconductors that emit light when electricity is passed through them. The colour of light produced depends on the gas they are filled with, early design LED's were quiet dim and only produced in red, yellow or green and latterly blue. Now they are getting brighter, have better lenses and are available in white.

A number of manufactures produce lamp heads for film & TV that incorporate LED's. I think we have come full circle and, in use terms, we are now with LED use where we were with Fluorescent all those years ago. Flat panel and other technologies such as those being developed by Rosco are also being looked at but are still in their infancy, but watch this space, as the advantages of cold lighting are becoming increasingly popular we will see more and improved products.

USES

As I have already said, cold light sources are very efficient, they give off very little heat for the amount of electricity they consume. In new build TV Studio applications they can save the need for large power supply feeds and almost certainly eliminate the need for air conditioning, on location, a lot of light can be produced without a special generator set and many can be plugged into a regular domestic house outlets. Recently the addition of very powerful fluorescent tubes, enables lamp head designers to manufacture a fixture with a computer aided designed precision reflector and multiple tubes, powerful enough to replace a tungsten lamp heads of up to 4 Kw!.

As to what cold lights of given make or type are used for, depends on your taste in lighting techniques. The secret of any good lighting is the amount of control. You may want a narrow beam of light for the key, a flood of light for the fill and a medium beam for a back light. With traditional incandescent lighting this was fairly easy. The lamp head usually had a lens and or focus control and for soft or fill, light was produced with various types of diffusion.

With a fluorescent lamp head, the source of light is usually the same - an opaque tube in front of a large reflector - however not all lamp heads are "soft sources", I like to think of them as broad sources, some, as in the case of the Videssence Baby Base light, are very compact and can make, at close range, a near ideal key or back light.

The method of achieving control with fluorescent is by using a control screen on the front of the light. This takes the form of a metal or plastic honeycombe. The thickness or depth of the material will only allow the light to be transmitted on a given axis to the bulb thus producing light in varying angles. To enable use of these types of lamp heads at greater distances, either a more powerful wattage bulb must be used or some manufacturers offer intensifiers. These are large snoots that fit on the front of the light, the inside surface is coated with a highly reflective material that collect the spill light and redirects it forward, such intensifiers can also have honeycombes to further direct the light at a given angle.

Because of the combined efficiency of the ballast and fluorescent tube, these fixtures produce roughly four times more light per watt consumed than an equivalent tungsten wattage bulb, so a three person studio which may have been conventionally lit with 20 kilowatts (Kw) of incandescent lighting can now be lit with only 5 or 6 Kw of fluorescent lighting.

In a studio with a 3 metre high grid a 4-bulb 55-watt fixture and a narrow 30-degree control screen can easily become a key light and the same fixture with a wide 90-degree control screen the fill. Backlights tend to be closer, so a 2-bulb 55-watt fixture with a medium 60-degree screen will work fine. What these lights do not produce is a hard shadow, so it is your personal choice or the production needs that will be the final decider but, given that the light is powerful enough to be moved further away, a harder (soft) shadow will result.

From the presenter's point of view however, fluorescent lights are a welcome addition. When fitted with a control screen the resultant effect from the presenters perspective is less glare leading to longer and more pleasant times on duty especially if there is a lot of autocue use.

Fluorescents don't have much place as effects lights and probably never will. Don't expect a fluorescent source four ellipsoidal. However with the introduction of an asymmetric reflector and brighter fixtures, they can make great cyc lights.

LED

The development of the LED lamp head for our industry has however seen the introduction of many effects types of fixture. There are too many to mention here but the one that comes to mind is the Pixel Par. This neat gizmo uses 90 Red, Green and Blue powerful LED's in a par can; DMX control allows cross fading between the LED's to produce over sixteen million colour combinations. LED strip lights can be used as part of the set, to light objects and can be pinned, glued or stuck any place and are reasonably safe in expert hands because of their low voltage operation.

LED lights have started to appear as camera lights. A small number of LED's, if close enough together, can produce the harder light that fluorescent cannot. The Nila lighting system is a classic example it can produce 70-foot candle (750 lux) at 20 feet with a 12-degree spot lens, from only 6 LED's.

Another use for LED is the Gekko Kisslite ® available in 3200 and 5600 degrees K which is starting to appear on many film sets, and in their product range they have many other types of light source as well.

A word of caution for the cheaper on-camera video lights: a test is always advised, as the selection of good colour corrected LED (high CRI) devices is not always guaranteed. LED lights, like fluorescents have their uses, but they need careful selection with good heat sinks, as they can get very hot, and reliable electronics to drive them. Not all LED or fluorescents lamp heads are suitable for use outdoors. Some are very open fixtures and do not take kindly to getting wet, so it's best to check first.

Like all things new, the technology takes time to settle down. Fluorescents are more or less perfected, whilst LED's and panels sources are getting there fast! But none of these devices may suit your needs, apart from being the obvious choice where the requirement of not producing heat is important, or not needing loads of power. When you come to choose your light you may feel you are still better off with traditional tungsten lamp heads but, if you can, have some of this new stuff in with your kit as well, experiment and see for yourself what they are best suited for. Nothing does everything.

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