The Light of a New Day

NEW TECHNOLOGY AND IMPROVED EXISTING TECHNOLOGY CREATE GREENER OPTIONS

by Richard Cadena

During the recent design of a lighting system in a small church in Central Texas, the impetus for this article was derived. For the uninitiated, it gets hot in Texas in the summertime - hotter than, well, hotter than you can imagine, unless you've experienced it.

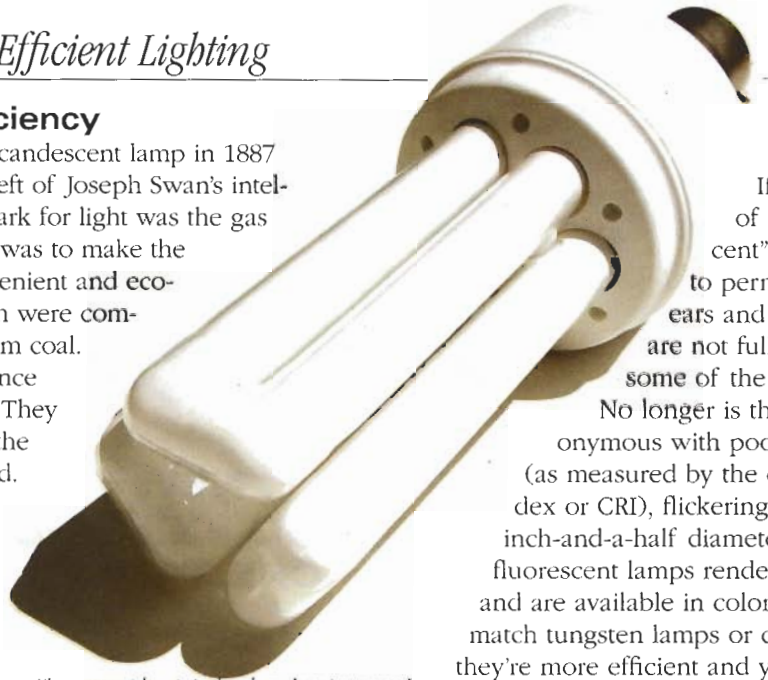
One of the first considerations in a job like this is, of course, to provide adequate (or more than adequate) lighting so the congregation can see what's happening on the platform. Among the secondary considerations are to provide an aesthetically pleasing composition and to focus attention where it should be. But in Texas, and many other parts of the world, another very important consideration is to use sources that produce enough light without producing too much heat. Another way of saying that is to use energy efficient light sources.

On this particular project, the interior designer insisted that there were no fluorescent lamps used at all anywhere in the building. Unfortunately, she had a lot of pull with the owner, so, despite my pleas to consider other options, incandescent lamps were used everywhere, including the house light, which added considerable load to the HVAC system. Her concerns were warranted. Fluorescent lights earned a terrible reputation from the ghastly light and the miserable headaches they produced in the heyday of the 4' long 1.5" diameter tubes. The standard institutional troffers that were used in grade school rendered skin greenish and flickered ever so slightly most of the time, and drastically some of the time.

But the new technology has all but left those characteristics far behind. We've come so far, so fast that it's sometimes hard to keep up, which explains why some designers still cringe at the mere thought of using fluorescents. But fluorescents aren't the only other option for greener lighting. Recent developments in LED technology have pushed them past the threshold of usability in many areas that were previously out of reach for them. And a new lamp source dubbed LiFi (short for light fidelity) is gaining traction in theatrical lighting.

Benchmarks in Efficiency

When Edison perfected the incandescent lamp in 1887 (some say he perfected the theft of Joseph Swan's intellectual property), the benchmark for light was the gas lamp. All that had to be done was to make the incandescent lamp more convenient and economical than gas lamps, which were commonly fueled by gas made from coal. These lamps were a maintenance problem and a health hazard. They had to be individually lit and the glass globes constantly cleaned. Over time the soot from the combustion blackened the entire room, and when they burned they gave off ammonia and sulphur. Sometimes they starved the room of oxygen and made people ill. So the world was less concerned about energy efficiency in Edison's time as long as incandescent light was reasonably affordable and long lasting. On that promise Edison delivered. The incandescent lamp that Edison perfected is the basis for the same lamps we commonly use today; very little about them has changed.



Fluorescent lamp technology has improved considerably over the last few years. Today's CFLs render color much better, have less flicker, and can dim to 20%

Nikola Tesla, the inventor of the AC synchronous motor and a brilliant inventor, knew a century ago that incandescent technology was terribly inefficient. He thought the future of lighting was arc lamp technology, which, at around 60 to 100 lumens per watt, depending on the type of arc lamp, is much better than the less than 20 lumens per watt provided by today's incandescent lamp.

But Tesla's efforts were in vain and to this day the vast majority of lighting tasks in the theatre and in the sanctuary are handled by incandescent lamps - until now, that is. Although there probably won't be a mass exodus away from conventional incandescent lamps, new emerging technologies will certainly give us more options in the design of energy efficient lighting and save money in the process.

Fluorescent Technology

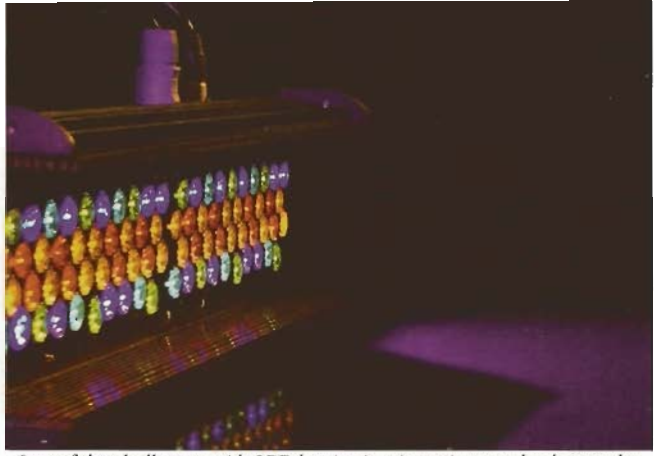
If the mere mention of the word "fluorescent" makes you want to permanently seal your ears and eyes, perhaps you are not fully acquainted with some of the newest technology. No longer is the technology synonymous with poor color rendering (as measured by the color rendering index or CRI), flickering, and four-foot long, inch-and-a-half diameter tubes. Today's fluorescent lamps render color much better and are available in color temperatures that match tungsten lamps or daylight. In addition, they're more efficient and you can use them with certain ballasts that allow them to dim to 10% or 1%, depending on how much you're willing to pay. T-8 and T-5 fluorescent lamps (the "T" designates a tube and the number indicates the diameter in eighths of an inch) are very energy efficient, put out lots of light, and don't flicker as much as the ones in your elementary school.

Compact fluorescent lamps (CFLs) are the bended or twisted versions of their tubular cousins. They have built-in ballasts and share many of the same characteristics previously described - high efficiency, relatively good color rendering, an assortment of color temperatures, and low flicker. Unfortunately most of them aren't dimmable, although some have appeared on the market lately claiming to have a dimming range between 90% and 20%. There are, however, multi-circuit fixtures that allow you to dim in steps; a nine-circuit fixture like the Spectrum Lumen Max SP-PR2214CF can be dimmed in steps of 11% by turning individual lamps on and off. Though you won't find these in PAR cans, Lekos, Fresnels, or other theatrical lighting instruments, these high bay fixtures can save lots of energy and money in the sanctuary as house lights.

LEDs

What you will find with increasing frequency in theatrical lighting is LED sources. The ubiquitous technology has been doubling in brightness every 18 to 24 months for more than 40 years and it is making big strides in other areas as well. Competition from offshore manufacturers producing good quality lighting instruments has driven the price down, all the while increasing their availability in the form of a variety of LED luminaires from battens and color wash fixtures to Fresnels and PARs. In the past, dimming has been a real problem for LEDs because they are so responsive that you can see the individual dimming steps rather than a smooth change of intensity. But software advances have led to great improvement in that area and several manufacturers have figured out how to replicate the smooth dimming of incandescent lamps in LEDs.

LEDs started out as indicator lights in the late 1960s and only became viable for use in theatrical lighting when Shuji Nakamura of the Nichia Corporation developed a high brightness blue LED. With the availability of red, green, and blue LEDs, color mixing became possible. The earliest theatrical LED luminaires were color mixing lights in a PAR form-factor and eventually they permeated the market in the form of battens and panels.



One of the challenges with LED luminaires is getting good color rendering. Some LED fixtures, like the ETC Selador line, have several colors of LEDs to fill in the spectrum to provide a higher color rendering index

But because of the narrow band nature of LEDs, early attempts to create white light by combining red, green, and blue sources were crude at best. Though they could create the appearance of white light, these RGB fixtures rendered colors poorly.

With the addition of amber LEDs, the color temperature can be better controlled and the color rendering is much improved. One line of LED fixtures called Selador (which was recently acquired by ETC) uses seven different colors of LEDs to recreate the complete spectrum, leading to a much higher color rendering and a more natural-looking white light.

With a high CRI, variable color temperature, smooth

dimming, and color mixing, there is very little standing between LED luminaires and the theatrical stage or the platform in houses of worship. Much has been written about the long life, low energy consumption, and low heat production of LEDs, and it's certainly true. But until the price of LED luminaires can compete more favorably with the under $100 price tag of a PAR can, for the most part they will supplement most lighting rigs and few rigs will be made up entirely of LEDs.

Plasma Lamps

Last year a unique new lamp source suddenly appeared in a couple of entertainment lighting products. The LiFi lamp from Luxim is a plasma lamp whose bulb is the size of a Tic-Tac and outputs 17,800 lumens. More importantly, the bulb is so small that the light it emits can be harvested more effectively, making the luminaires more efficient. In addition, it has a 10,000 lamp life, a very high CRI of 94, and the lights in which it is used produce a beautifully uniform field. So far there are at least two such luminaires; the Ocean Optics Seachanger Nemo, a dichroic color changing Leko, and the Robe Robin 300 Plasma Spot.

The LiFi is currently available only in relatively low power versions under 250 watts and it can only be electronically dimmed to 20%. But dimming is not a problem since there are lots of lights with mechanical dimmers. It's a bit early to judge the lumen maintenance (how well the output and color temperature hold up through the life of the lamp) and whether Luxim will be able to build higher power versions of the light. But there's a good chance that many more manufacturers will adopt the source and start building fixtures using the LiFi lamp.

The Future is Here Now

One can only imagine what the HVAC bill at that Central Texas church might look like in the summertime. They most likely wish they would have at least considered using CFLs for house lighting in the sanctuary. As for the rest of us, we have only to open our eyes to the new technology and realize that the future of lighting is here now. There are plenty of good alternatives to conventional lighting and more are on the way. Not only can we save money on future projects but by retrofitting existing buildings we can save lots of money there too. ◆

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