FusionLighting

Fact Sheet

The re-lighting of the Space Hall and the plaza of the Forrestal Building demonstrates two new and exciting lighting technologies – the development of the electrodeless sulfur lamp and the efficient distribution of light through light pipes. Both hold the promise of significant near-term energy saving.

The Department of Energy and the Lawrence Berkeley Laboratory are supporting the ongoing development and application of each of these new technologies.

The Environmental Protection Agency and NASA are also supporting specific aspects of the development of the electrodeless sulfur lamp.

Smithsonian National Air and Space Museum

Three 90 foot long pipes, each lit at one end by a single electrodeless sulfur lamp, have replaced 94 conventional lamps to light the Space Hall.

The results:

- Light levels have increased by a factor of three
- Energy usage has been cut by a fourth
- Unwanted UV has been cut in half

Other advantages:

- Installation and retrofit costs of the sulfur lamp and light pipe combination were less than half the costs of a conventional lighting upgrade project.
- The light pipe significantly reduces maintenance costs. With the new system, the lamps are positioned for easy maintenance while the light pipe distributes the light throughout the exhibition area.

The Forrestal Building — headquarters of the United States Department of Energy

A single 240 foot long light pipe, powered at each end by a single electrodeless sulfur lamp, has replaced 240 175 watt conventional HID lamps to light the entrance and roadway outside the building.

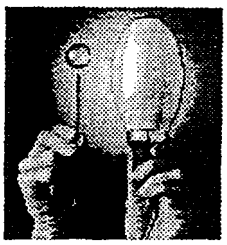
The results

- Light levels have increased by a factor of four
- Energy usage has been cut by two-thirds

Other advantages:

- The optical design of the light pipe provides a broad-beam, high-lumen distribution of light along the pedestrian walkways while illuminating the roadway with a narrow beam of non-glare light.
- This is the longest continuous light pipe of its type ever constructed.

About the lamps



The sulfur lamp (left) was invented, designed and built by Fusion Lighting, Inc. of Rockville, Maryland. The unique technology is protected by a variety of patents and patent applications in the U.S. and other countries.

These are demonstration lamps. Commercial versions of the high-power electrodeless sulfur lamp are being developed by Fusion Lighting.

The light emitted from one of these sulfur bulbs is equal to over 250 standard 100 watt incandescent lamps.

The bulbs are electrodeless, meaning that there are no wires connected to the bulb. There is no filament or metal electrode within the bulb.

Light is generated by heating sulfur with microwave energy, identical to that of home microwave ovens.

The spectra of the sulfur light contains all colors of the rainbow, closely matching that of the sun, but with very little heat or ultraviolet in the beam.

Each bulb, about the size of a golf ball, runs at 5,900 watts producing 450,000 lumens with a CRI of over 80.

There is no mercury used in the bulbs.

About the light pipes

The light pipes were invented, designed and built by A.L. Whitehead Ltd., Vancouver, Canada.

The reflector material used in the light pipe is manufactured and sold by 3M, and is protected by various patents.

The light guides are ten inches in diameter and are fabricated in ten-foot sections.

The light pipes are of all-plastic construction. Each ten-foot section weighs approximately 30 pounds.

About Fusion Lighting, Inc.

The Company has 28 people working on developing innovative new lighting products based on the technology of the electrodeless sulfur lamps.

It was started in 1993 as a spin-off from Fusion Systems Corporation, a NASDAQ-listed capital equipment maker and the pioneer in microwave lamp technology.

FusionLighting

Q&A

Q In what ways is the lighting system really new?

A Everything is new. The light source is an electrodeless sulfur lamp.The two installations in Washington are the first of what Fusion Lighting believes will be a family of high quality super-efficient light sources. The "light pipe" is also new and represents an advanced concept in light distribution. The light pipe acts as a "drip irrigation" system for light. It places the light exactly where it is needed.

Q When was the sulfur lamp discovered and by whom?

A The electrodeless sulfur lamp was invented in 1990 by scientists working for Fusion Systems Corporation in Rockville, Maryland. This technology is now being developed exclusively by a new company, Fusion Lighting, also of Rockville, Maryland.

Q Where has the support for the development come from?

A Many sponsors have been involved with the early and on-going development. The two demonstration projects at the DOE's Forrestal Building and the Smithsonian's National Air and Space Museum represent a collaborative effort between the Department of Energy's Office of Renewable Resource, Fusion Lighting, Dr. Lorne Whitehead (inventor of the light pipes) and the National Air and Space Museum. Dr. Lee Anderson of the DOE was instrumental in coordinating the project and in bringing all of the parties together.

Q Who else was instrumental in providing support?

A There is considerable interest in both the light pipe and the new sulfur light source. In addition to the Department of Energy, Fusion Lighting is receiving support in the development of the sulfur lamp from the Environmental Protection Agency and NASA. 3M has taken the lead in developing and commercializing the light pipe system.

Q What are the potential applications of the new lamp system?

A Within the next one to two years, Fusion Lighting expects to see the sulfur lamp finding its way into a wide variety of applications. These lamps will be ideal for lighting large interior spaces such as factories, warehouses, arenas and shopping malls. As demonstrated at the Forrestal Building, the sulfur lamp will also be ideal for outdoor lighting. It has many potential applications for both architectural and security lighting.

Q What will the new system cost?

A The cost of the two demonstration projects was less than half of what it would have cost to do a conventional re-lamping. Because each system is somewhat different, the actual costs of an installation will depend on many factors: the number of lamps required, the use of light pipes or other reflector system, and the desired light levels. Overall this technology can be very cost competitive. To put this into some perspective, the two lamps and a single light pipe at the Forrestal Building are replacing almost three hundred conventional lamps, ballasts and fixtures.

Q What are some of the other benefits?

A At the National Air and Space Museum, the overall light level has been increased by a factor of two, the amount of unwanted ultraviolet light has been cut in half, shadowing has been reduced and color has been improved. This was all done with a one-third reduction in energy consumption. It should be pointed out that the light pipe distribution system significantly reduces maintenance costs. With the old conventional lighting system, it was nearly impossible to maneuver around the exhibits to service a lamp. With the new system, the lamps are positioned for ease of maintenance, while the light pipe distributes the light to inaccessible exhibit areas.

Q It would appear that this new lighting system would be a major contributor to greater security in our cities and other public areas.

A We believe that cities and municipalities will be among the major users of this new technology. Improved lighting is certainly a practical way to improve both downtown areas as well as neighborhoods. Better lighting improves both esthetics and security.

Q Is there a negative environmental impact to using this lighting system?

A On the contrary. This lighting system uses sulfur rather than the more traditional mercury used in all other high-wattage lighting systems. The disposal of the bulbs will be no problem for the environment.

Q How frequently will you need to change the bulb?

A The bulbs may, in fact, never need to be changed. Because there is no filament or electrode in the lamp itself, there is nothing to burn out or break. It is possible to consider the bulb to be useable for many years.

Q What will need to be replaced then?

A Today we are using a magnetron, similar to the one in your home microwave oven, to power the lamp. This will need to be replaced after ten to fifteen thousand hours of use. In the longer term, we expect solid state devices to replace the magentrons. This will give the lamp an almost indefinite useable life.

Q The new Sulfur Lamp is powered by microwave energy. Are microwave lamps safe?

A Yes, microwave-driven lamps have been used to produce UV light for over 20 years. The microwaves are generated by a device called a magnetron. This is exactly the same system as the one used in your home's microwave oven.

Q What are some of the more exotic uses you have considered?

A There are almost too many to mention. The lamp has been well received by the Department of Agriculture where scientists are looking for ways to use this energy-efficient source of near-sunlight to grow plants in the laboratory. We are also looking at other applications where solar simulation is important.

Q When you say this is a replacement for sunlight, what exactly do you mean?

A Throughout the visible light spectrum, the sulfur lamp has bright, full-color characteristics just like the sun. The sulfur lamp is very unique in this way. Fluorescent lamps and other high-intensity discharge lamps emit only bits and pieces of the full spectra ofcolors. The sulfur lamp, just like the sun, radiates a broad spectra of full color.

Q I have heard that the sunlight qualities may also be important to peoples' psychological health.

A There are many ongoing studies in this area. The truth is we do not really know. Fusion Lighting is seeing a very high level of interest from the Scandinavian countries, where long dark winters are the norm. The sulfur lamp may prove to be a very practical approach to seasonal affect disorder (SAD), but more study will be required.

Q Are these lamps available now?

A The first two installations are using experimental lamps. Fusion Lighting expects to commercialize the first electrodeless sulfur lamps in 1995. The target product is being called the Solar 1000. It is expected to be the most efficient light source in the market.