Putting Your Facility in the Best Light: Part 1 - Service Station Lighting Designed for Changing Needs

As lighting technology evolves, choosing the right lighting fixture for a petroleum marketing facility can be difficult. However, understanding the specific purposes and benefits of lighting technology and designs, and choosing the right one for the job, can be easy. Scott Ready, of LSI Industries, and other experts walk us through the process of ensuring that the petroleum facility lighting fixtures we choose will work to our best advantage.

Lighting technology update:
In 1999, PE&T ran a two-part feature on the technology of lighting for petroleum facilities ("Canopy Lighting Technology: Don't Be in the Dark," May, p. 18; and "Canopy Lighting: Value that Is Clearly Visible," June, p. 16.) These articles were based on interviews with more than a dozen experts on the subject. They covered the history and development of lighting technology, including problems that had been overcome, and provided an in-depth look at modern lamp and "luminaire" technology used in canopy lighting. "Luminaire" refers to a complete lighting unit that consists of a lamp, ballast and components designed to distribute the light, position the lamps, protect the lamps and connect them to the power supply. Because of the importance of lighting in the successful marketing and safe operation of petroleum facilities, PE&T invited several lighting fixture manufacturers to provide an update on their technologies and guidance on the selection, installation and use of petroleum facility lighting fixtures. Representatives from three manufacturers responded positively: Terry Folkedahl of Ruud Lighting (a division of ADLT), Racine, WI; Scott Ready and Tim Clark of LSI Industries Inc, Cincinnati, OH; and James P. Wang of Hubbell Lighting, Inc., Christiansburg, Virginia. Following are their articles.
The day-to-day marketing of a petroleum station typically comes down to one crucial physical factor: the canopy. The canopy communicates the station's brand identity, be it that of a nationally recognized chain or of a locally owned operation. The canopy's looks also impart to the potential customer in one quick glance the professionalism and particularly at nighttime, the safety of the operation. Besides issues of appearance, functionality and visibility, the petroleum industry can add another concern to its list regarding canopies-lighting ordinances.

Lighting law revolution

Municipalities across the country are developing ordinances to control the amount of light that businesses and other sites generate. Some states, such as Texas and Maine, have passed lighting-control laws. Other states are considering similar actions.

Spill light, or light that strays from the intended area of illumination, is a growing concern and annoyance that communities seek to control. Some architects and lighting professionals predict that by the end of this decade, about 50 percent of communities nationwide will have some type of lighting ordinance on their books.

What does this mean to the petroleum station owner? Often, it means being caught between opposing issues. Intense levels of lighting are desirable for attracting customers as well as for their security and personal sense of safety. But uncontrolled levels of illumination can create glare that shines onto neighboring properties or causes what is known as "sky glow," wasted light that shoots upward into the heavens.

Serious safety problems also may come into play for drivers if the lighting produces excessive amounts of glare. "The brightness of gas station canopies is a big problem," says Nancy Clanton, president of Clanton & Associates, a Boulder, CO, lighting design and engineering firm. Clanton's remarks were cited in an article titled "Blinded by the Light" that appeared in the August 2000 issue of Progressive Grocer magazine.

According to the article, Clanton explained: "If you over-light something, and people leave your establishment, they have to re-adapt to the one foot-candle (a low amount of light) of the roadway. It could take several minutes for this to happen with elderly drivers. There is a potential for lawsuits from accidents, because people just can't see." (Nancy Clanton also is a committee chair of the Illuminating Engineering Society of North America (IESNA) and is on the board of the International Association of Lighting Designers.)

On the other end of the spectrum, if the lighting of the station is inadequate, the illumination cast under the canopy will be ineffective. That makes the station a less desirable stop for customers looking to fill their gas tanks in a safe-looking environment after dark.

So what is one to do? For petroleum stations in residential locations or in areas with tight lighting restrictions, the answer lies with canopy lighting that provides "full cutoff."

Figure 1:
The illustration shows light by distribution zone. Most of the light output (80 to 86 percent) from all three Constellation lenses stays in the visibility zone, where light is most needed.

What is full cutoff?
"Full cutoff," as defined by IESNA, refers to the restriction of light at or above 80 degrees (see Figure

1). IESNA developed the term in 1999 in connection with its role of developing guidelines and design practices for lighting.

Typically, most of the glare from a service station's canopy lighting falls in the light distribution zone of 50 to 90 degrees from nadir (zero degrees). Full cutoff, in terms of the Ruud Lighting technology discussed in this article, means that the fixture will emit no light at or above 90 degrees. The light that falls below 50 degrees illuminates the area under the canopy and is called the visibility zone. This means that fixtures with this technology:

• Controls light spill onto neighboring properties
• Reduces glare that can negatively affect vehicular and pedestrian traffic
• Complies with most lighting ordinances

Petroleum station owners today need to carefully consider their lighting needs in terms of the full cutoff technology and the growing requirements for achieving the above-listed performance features.

This petroleum station canopy uses the Flat Lens version of the Constellation, with 320-watt Uni-Form® pulse start metal halide lamps.

Full-cutoff technology

Recognizing today's challenges regarding canopy lighting and the potential benefits of full-cutoff lighting, Ruud Lighting used its expertise to develop a canopy fixture exclusively for the petroleum industry that offers full cutoff. The fixture, called the Constellation, offers three interchangeable lenses, two of which meet the requirements for full cutoff.

An anodized aluminum symmetrical reflector controls the emission of light from the lamp (bulb). The Constellation uses Uni-Form® pulse start metal halide lamps, in wattage of 200 to 400. Metal halide is an energy-efficient source of white light from the HID (high intensity discharge) family of lamps. The fixture's optical system, which consists of the lamp, reflector and lenses, provides an efficient distribution of light while controlling its spread to prevent glare. Most of the beam-in fact, more than 86 percent of the lumen output-is concentrated in the visibility zone, or the area that is below 50 degrees. Lumen output is a measurement of light quantity.

The visibility zone, which is also called "working planes," is where the business transactions occur. That is, where the customer needs to clearly discern the gas pumps, pricing and credit-card payment information. The zone also includes the fueling vehicle's surface and the area immediately surrounding the vehicle.

The three lens choices of the Constellation provide petroleum station owners with a choice of optical solutions. From the top, they are the flat lens, patterned lens and drop lens.

Lens system

A recessed fixture, the Constellation appears nearly flat underneath the canopy. Only its lenses are

visible. Three different lenses are available:

• **Flat lenses:** For low-light residential locations or areas with stringent lighting restrictions. These lenses meet IESNA's full cutoff definition.

• **Patterned lenses:** For applications that call for softer, more diffuse under-canopy illumination. These meet the IESNA full cutoff criteria. In addition, they obscure the view of the lamp by customers who look up into it.

• **Drop lenses:** For stations that need the brilliant sparkling light that will catch the attention of drivers passing by, but without creating glare. These lenses are IESNA cutoff-classified but not intended for areas requiring full cutoff. A light fixture with a cutoff classification can have some light above 90 degrees.

The three types of lenses are readily interchangeable. After initial installation, they can be changed out, with little effort and cost, to accommodated changing needs. The objective of the different lens designs and their interchangeability is to provide flexibility in meeting optimum lighting needs, even in the most restrictive of areas. After initial installation, the lenses can be changed out, with little effort and cost, to accommodated changing needs.

The Constellation lamp housing and ballast compartment install easily above the canopy. Because the optical system is symmetrical and the retaining ring installation is adjustable, exact housing orientation is not critical.

Installation

In addition to solving light glare problems at petroleum stations, Rudd Lighting wanted a fixture that could be installed easily. Following are the features of the Constellation related to that objective.

The fixture is geared for use in single- or double-skin canopies with panels that are 12 or 16 inches wide (the size most often used by US gas stations). After the fixture installer cuts a 9-inch hole into the canopy skin, the housing of the fixture attaches with a retaining ring that is held temporarily in position by two springs. The lens frame is attached to the mounting hinge and the retaining ring is secured snugly with three captive screws to allow any future maintenance worker to unscrew the fixture, without it falling out, and keep the piece in place.

The ballast compartment, which contains the fixture's electrical components, is secured to the high ribs of the canopy deck. The housing of the light fixture includes a weather-resistant power conduit that is attached easily to the remote (separate) ballast compartment.

Solid modeling

In designing the fixture, Rudd engineers used a computerized "solid modeling" program that allowed for rapid prototyping. "Solid modeling gets right to the geometry," says Rudd's Eric Haugaard, new products engineering manager. "Because the program provides a 3-D perspective, the results are far superior to results derived from the traditional 2-D drawing approach. It allows you to create

geometry that you wouldn't normally see in the two-dimensional process."

In addition, solid modeling provides the information necessary to verify the fit of the components, possible interference problems with the design or other potential snags. All of these advantages eventually lead to the biggest advantage of all: reduced time in bringing the new product to market.

The materials used in the components also reflect petroleum stations' needs for long durability. Sturdy die-cast aluminum makes up the fixture's housing, retaining ring and lens frame. The ballast's components are made of steel and all of the product's exterior hardware is stainless steel. All components receive Ruud's "automotive spec" powder-paint finish (DeltaGuard).

Product testing

Lighting product testing covers photometrics (the measurement of light flow and intensity), functionality in terms of light flow, and physical attributes in terms of thermal output and other safety factors. Photometric testing is performed by Lighting Sciences, of Scottsdale, AZ, an independent laboratory. The results are digitized into a file that is part of the software that Ruud uses to predict the lighting effect of the application.

For the Constellation, light readings were predicted at a three-island petroleum station, where the readings were measured in foot-candles. A foot-candle is a unit of illuminance or of light falling onto a surface. For example, one foot-candle is equal to one lumen per square foot.

The light readings taken in the test focused on the station's center island, horizontal at grade (ground level) and at 3 feet and 6 feet above grade to measure light falling on vertical surfaces. In this way, the number and spacing of the fixtures can be optimized for a particular canopy/island layout.

The product undergoes thermal and other testing to meet the certification standards for listing by Underwriters Laboratories, Inc (UL). The Constellation is UL listed in the United States and Canada for wet locations and for enclosure. A private organization renowned internationally, UL audits the laboratory tests and equipment used to ensure that they meet its criteria and other standards.

Ruud Lighting typically conducts its own testing on-site at its manufacturing and corporate headquarters in Racine, WI. Each product is tested for proper electrical operation, component durability, and safety.