

# INTO THE *light*

A dragline illuminated with Phoenix 300 W  
ModCom Hi LED floodlights.





# NATE KLIEVE, PHOENIX PRODUCTS CO. INC., US, EXPLAINS HOW LED TECHNOLOGY CAN REVOLUTIONISE MINE LIGHTING SOLUTIONS.

**T**he mining industry goals of today are different than they once were. Targets for productivity, safety and environmental sustainability are increasingly scrutinised. As commodity prices drop, operating expenses rise. At what point will this trend taper and how can mine operators arm themselves to enjoy a prosperous future?

Little can be done to control the demand and pricing structure of a volatile industry, so mines around the world are starting to attack the problem from the other end – operating costs.

With efficient, green technology, such as LED lighting, mines can maximise their limited resources.

## DURABILITY IMPACTS MAINTENANCE REQUIREMENTS

Most lighting challenges that operators face are the result of the high-vibration conditions on mining equipment. The constant, rapid movement is detrimental to traditional fixtures. For this reason, lighting related maintenance has always been a huge burden for mine operators.

Whether replacing an entire fixture or repairing a broken lamp or ballast,

lighting maintenance on mining equipment is time consuming, expensive and dangerous. Because LED lighting is solid-state technology, there are no fragile filaments or breakable glass components vulnerable to the constant shock and vibration.

Quality LEDs are also typically rated for at least 50,000 operating hours. Due to strict mining regulations, some applications require lights to be on 24 hours/day. This can equate to almost six years of lighting. The lifetime of traditional light sources, by contrast, is far less: between 2000 – 20,000 hours in





Newly installed ModCom Hi LED fixtures on a boom.

perfect conditions. Upgrading lights to LED can, therefore, significantly reduce maintenance expenses.

After accounting for the cost of the lamp, the labour and the downtime, there is a considerable price tag on each replacement. Mine operators report that maintenance is anywhere from 30 – 70% of their total operating costs. Eliminating the maintenance associated with lighting fixtures is a quick and easy way to bring these costs down and lessen the financial burden.

### Every component matters

LED technology continues to prove its durability within the rigours of mining applications. Phoenix Products Co. Inc. – a lighting manufacturer located in Milwaukee – installed its first LED fixture in 2009 on a rotary blast hole drill. After five years, the same fixture is still installed and has required no maintenance.

However, with the introduction of LED technology, every component of the fixture should be analysed. For the first time in history, a light source is available that can outlast the assembly of many fixtures. If the company designing the light does not carefully consider the wear and tear that the fixture will undergo during the LED's long lifetime, the customer will be left with a fixture that is not functional, even if it still illuminates.

“Choosing the right manufacturer for LED lighting is critical to protecting your investment,” explains Yazi Fletcher, chief technical officer at Phoenix. “There are many fixtures being put onto mining equipment that won't live up to the 50,000+ [hours] rated life that most producers of LEDs promise.” He goes on to explain that the cause of the failures will have nothing to do with the light source. It will likely be a different component, such as the driver, housing, lens or a poorly designed heat sink.

### Customised equipment lighting

Historically, light fixtures on active equipment, such as electric rope shovels, were left on all day because power interruptions were so disruptive. Getting systems back up and running can cost thousands of dollars in unplanned downtime on the machine. Traditional high intensity discharge (HID) light fixtures require a warm up period of up to 20 min before they reached full illumination. Those 20 min in the dark could create an unproductive shift or, worse still, an unsafe pit.

LED technology completely eliminates this issue for mine operators. LEDs are instant-on light sources. Within nanoseconds of the shovel operator flipping the light switch, the fixtures will be at full illumination all the way around the machine. Over time, some lighting

requirements may change, due to the safer conditions LED technology creates.

This inherent characteristic can also further amplify the energy savings that LED offers for mines to meet their environmental goals. Switching to LED lights can reduce kWh energy usage by between 50 – 70%. For areas that have historically kept lights illuminated during daylight hours, energy usage can be reduced by half again.

### Responsible use of light

The introduction of LED technology has significantly decreased the negative effect that lighting has on the environment, as well as increasing the comfort of operators. Efficient and responsible use of light is becoming a higher priority, as organisations all over the world focus on the preservation of darkness where light has historically intruded. When mining operators come to consider how they might responsibly use light, they must consider the way their operations contribute to the following:

- **Light pollution:** Light pollution refers to wasted artificial light directed upward to the sky. It causes an otherwise dark sky to be illuminated with excessive, unnecessary lighting from below. Light pollution disturbs wildlife, wastes energy and obscures views of the night sky. Organisations, such as the International Dark-Sky Association, are increasing the industry's awareness of light pollution in an effort to “preserve the night”. They have even instituted a certification programme for manufacturers of lighting fixtures to minimise light pollution.
- **Light spill and light trespass:** Light spill refers to light that is cast in unintended spaces. Outdated lighting technology and inefficient design are the biggest instigators of light spill. Light trespass is of a more severe variety: it is a type of light spill that occurs when the excessive light creates a nuisance. Imagine a street light that shines right into a bedroom at night. Not only does it cause an inconvenience; it wastes resources.

■ **Glare:** Glare is another historic irritation in the lighting world. Glare is a visual sensation created by excess, uncontrolled brightness. It is a very important lighting design factor to consider, especially for outdoor applications. Glare can be characterised in two ways: discomfort glare, which creates an irritation and/or eventual pain for an operator; and disability glare, which creates an actual reduction in visibility. Either issue impairs the ability of a person to perform tasks and decreases productivity and safety.

LED technology and lighting control makes it possible to control the way light sources affect the surrounding environment with respect to light pollution, light spill and glare. They can therefore help mine operators ensure light is being used responsibly.

By design, LEDs are much smaller light sources than traditional options. Each diode can be controlled through lensing to aim the light exactly where it is needed and eliminate light pollution, light spill and glare. This is the most prominent characteristic of LEDs that allows for control and energy waste reduction. It can decrease light pollution by up to 50% and energy waste by up to 70%.

Another control option that LED technology presents is dimming controls. A system can be installed that controls the light output from 0 – 100% for certain areas that do not require full illumination at all times. Adjustments can then be made for the time of day and the type of activity occurring in the illuminated area.

LED technology is also setting the mining industry up for future advancements. One such advantage takes inspiration from standing freezers in grocery stores that are only illuminated when a customer is detected in that particular area. Through the use of new sensing technology and instant-on LED lighting, it is possible to make significant savings in energy costs by turning lights off when they are not needed. This same mentality could be applied to lighting in an active mine pit. Through advanced sensing technology, LED lights could be turned on and off

automatically, as and when they are needed.

An example of this in practice is single side loading of a haul truck. If a certain location of the mine only allows for single side loading, why should the lights along the opposite side of the shovel keep burning energy? What if those lights were only illuminated when they were needed? The savings LED offers can be increased exponentially, as mines employ more advanced controls.

### Light quality improves conditions

In addition to the reduction in glare, LED fixtures provide improved light quality and night visibility due to higher colour rendering, increased uniformity and better depth perception when compared to many traditional lighting options. These factors are especially vital for draglines due to the longer distances associated with their manoeuvres.

Because there are mine operators that prefer the colour of high pressure sodium fixtures, switching to LED lighting might create a challenge. In response to this concern, amber LED technology is now available through select lighting manufacturers. This allows mines to take advantage of the benefits of LEDs without compromising their preferred colour rendering.

Using LED technology illuminates areas that were previously considered unreachable with traditional lighting options. Productivity and working conditions are improved while usable space is maximised.

LED technology is also preparing the industry for the automated mines of tomorrow. Experiments with automation are widespread and ongoing. High quality, instant-on lighting will be even more important when a mine operator needs to manually intervene on an autonomous machine. The qualities of LED improve the visual images captured by remote cameras, which the industry could see more of as technology associated with automation advances.

### Fewer striations mean less fatigue

LED fixtures have also been known to prevent operator fatigue. One cause of operator fatigue is striations on a lit

area. A striation is a shadow within a beam of light typically created by unevenness in the light output. These shadows are very hard on an operator's eyes and can impair vision and productivity.

Many HID fixtures (or poorly designed LEDs) have striations that compromise the safety and productivity on a minesite. This issue can be prevented. Consider an operator in the seat of the equipment for a continuous 8 – 12 hours. Even under the best conditions, this can be taxing. But, without proper lighting, a task that is physically demanding can quickly become dangerous.

### The bottom line

The benefits of LED technology are clear. Despite the initial investment, minesites are seeing the payback more quickly than the options previously available.

But what does this mean in actual numbers? In one scenario, operators of a mine consider a retrofit of the 1000 W HID floodlights on a shovel. They can choose to simply purchase 13 new 1000 W lamps or they could retrofit the shovel with the comparable 300 W LED floodlights. If they select the LED option, the mine will see a 70% decrease in lighting-related energy usage, as well as an estimated 85% reduction in lighting-related maintenance. When all initial costs are considered, this equates to an average payback of 1.91 years. But this is only the beginning. Over the lifetime of the light source, a minesite has the opportunity to save about US\$ 100,000 with LED over comparable HID fixtures. The carbon footprint of that shovel's lighting will also be decreased with a 70% reduction in CO<sub>2</sub> emissions.

As the mining industry moves to acceptance of LED lighting, the potential gains can be maximised. The options exist well beyond floodlights, as mining companies reconsider lighting within electrical rooms, machinery houses and walkways to further improve efficiency. Within the capabilities of LED technology, there are countless advantages for mining companies that remain untapped. 