

# Trip the light fantastic

The potential cost savings and energy reductions promised by LED technology could spell the end for traditional incandescent lighting on airport runways and taxiways, but there remain many hurdles to overcome. **Dr Nadarajah Narendran** of the Lighting Research Center tells Jim Banks that the technology is very promising, but its performance depends on the product rather than the principle.

**W**hether we are aware of it or not, we are surrounded by light-emitting diode (LED) technology, which is often used for indicator lights on many household appliances. In recent years, this solid-state lighting system has found wider use due to the strength of its brightness and its energy efficiency.

These two factors are making LEDs an increasingly viable alternative to the incandescent bulbs traditionally used in airports to light runways and taxiways. Energy efficiency is a particularly important feature as the aviation industry, and the world in general, looks to reduce carbon emissions and save on energy costs. With LED technology, a 40-Watt lamp used on a taxiway, for instance, could ultimately be replaced with a 3-Watt LED light.

“There are many coloured and white lights on an airfield. Historically, incandescent technology has been used, but using LEDs for coloured lights is a no-brainer, because of their lower energy consumption,” explains Dr Nadarajah Narendran, director of research at the Lighting Research Center (LRC). “When you use a colour filter on an incandescent light, you throw away 80% of the energy. LEDs can provide different colours, and all the energy they use is converted into light.”

The LRC is part of the Center of Excellence for Airport Technology at the Rensselaer Polytechnic Institute in New York, and is the world’s leading university-based research and education organisation devoted to lighting. It studies the potential performance and application of LEDs

in airport and airfield lighting. Dr Narendran spearheads LRC’s solid-state lighting programme and organises the Alliance for Solid-State Illumination Systems and Technologies (ASSIST), an international organisation of researchers, manufacturers and government agencies working to overcome the technological hurdles facing LED lighting.

## Multiple advantages

Given his intimate understanding of the technology, Narendran is keen to stress that while energy efficiency grabs the attention, LEDs have many other advantages for the aviation industry, including reduced maintenance and higher visibility.

“There is also the issue of ruggedness and reliability. LEDs have

a much longer life as there is no filament, which means they perform much better in high vibration areas. And when pilots see LEDs they seem brighter as there is more saturation than incandescent bulbs. The reduction in energy use and the increased ruggedness are driving the adoption of LED technology in the aviation industry," he says.

"Many countries already have legislation in place to phase out incandescent lights, so they will need a new technology. Compact fluorescent lamps are not an option, as you can't get the intensity you need for them to be seen at a distance. So, it is logical to look at LEDs."

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### Overcoming inertia

As Narendran's work with ASSIST suggests, there are many issues to address before the aviation industry wholeheartedly embraces LED technology. Making the switch is not as simple as merely changing a bulb. LEDs are fundamentally different, and require extensive work for integration into the kind of large and complex lighting systems found on airfields.

"There is a lot of inertia with traditional technologies, so the switch to LEDs won't be rapid. First, there is the cost issue, as LEDs are more expensive. Second, there are infrastructure challenges.

The energy supply on runways was created to power and control incandescent lamps, and this is not friendly for LEDs. So, we need solutions to address those issues," says Narendran.

That said, some airports have already changed over to LED technology for taxiway lights, and some have even extended this to runway lights. LEDs have found

applications in San Diego International's runway guard lights, Dallas/Fort Worth's taxiway centre line lights, Hawaii's Lihue Airport's taxiway lights and multiple sites at Reno-Tahoe Airport in Nevada, US. And as work progresses on the issues of cost and infrastructure renewal, the list of airports with LED indicator lights on the airfield is like to grow more rapidly.

Part of LRC's work to overcome these challenges consists of co-operation with the Federal Aviation Administration (FAA) and its research divisions. Since 2005, these organisations have worked on projects addressing remote airfield

lighting, blue LED taxiway lights, LED aviation signal brightness, LED runway guard lights, standalone solar-powered LEDs and while-lit colour for LED airfield lighting. Based on the results of these investigations, the LRC is creating and amending performance metrics to accommodate LED airfield lighting.

"LEDs are brighter, so for pilots the feedback is different. The metric used to quantify light levels is, therefore, incorrect and needs to be recalibrated. That is one of the things we are working on with the FAA," comments Narendran. "We need to make sure the performance of LEDs is the same for the pilot's eyes, so we need new metrics. We don't want pilots to complain that the lights look different. We are also working on issues with the infrastructure for LED lighting."

A lot of work remains to be done, despite the obvious advantages that LED technology offers. In many ways, selling the idea of the technology is the easy part. The more difficult task is to

overcome the inertia that results from the higher cost of LED systems and the potential disruption that may be caused by the installation of new infrastructure.

### Products not principles

These challenges will be easier to address when there is a better understanding of, not just the technological principles that underlie LED systems, but also of the capabilities of the different systems on the market. At present, there can be a marked difference between the benefits promised by LED technology and the performance of specific LED products. If airports make the switch to LEDs, they will be investing in a product, not a technological principle, so they are understandably keen to know how each product will perform.

Legislation will no doubt drive airports to consider LEDs, but it will be down to all the manufacturers of LED systems to realise the technology's advantages of energy efficiency, cost reduction, ruggedness and improved visibility.

"The potential energy savings are huge, but infrastructure design may mean we don't see the expected energy savings. We are looking at how to solve that. Also, LEDs don't like heat, which can mean they have a shorter life than expected. So, the future is not just about the technology of LED, but also about the specific products that are designed.

Performance can vary if, for example, thermal management is taken into account. It is the choice of product that is important, not just the choice of technology," explains Narendran.

"The upfront cost of LED systems is higher, but there will be a cost saving over their lifetime if the right product is chosen. It is currently very hard to estimate how long a product will last, so we need better, accelerated test methods. Airports must look at the savings of products, not the technology. It is not just about the reduction in wattage, but about infrastructure, installation and lifespan. Nevertheless, the future of the technology is very promising." ■