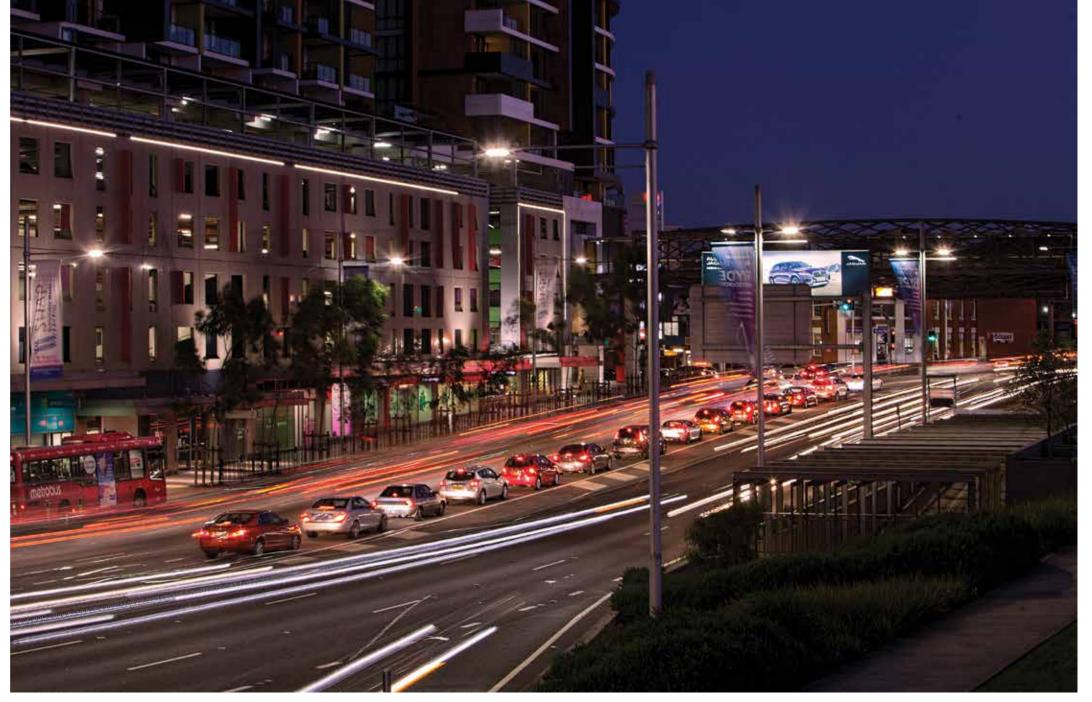# Smart street lighting –
connecting the dots in the evolving smart city

BY PENNY JONES

As cities all over the world start using their lamp posts to dip their toes into a smarter future, we catch up with four smart street lighting experts – a rep from Lighting Council Australia, an industrial designer, a consultant and a futurist – to get their take on the evolution of smart cities.

Smart arterial LEDs over Ryde Road in the City of Ryde. Image supplied by Duane Shore, Gerard Lighting.

David Crossley

David Crossley is Technical Manager for Lighting Council Australia (LCA) where he is responsible for sitting on standards committees and communicating with stakeholders in the smart street lighting market.

How do you define smart street lighting?
Smart street lighting can be defined as a street light that incorporates digital technology. Specifically, smart lighting consists of LED luminaires (able to be dimmed if needed), data collection sensors and communication technology.

What are the benefits of smart street lighting?
Increased energy efficiency, reduced maintenance costs and longer lifetimes over traditional street lighting technology. It can also improve public health and environmental outcomes. There's no mercury in LED street lights and new lights are designed to reduce sky glow, minimising disruption to turtle and bird hatcheries. Smart street lighting devices can also collect and communicate wide-ranging data relevant to transport, environment, weather, city management, energy, safety and security service applications.

What is a smart city and how does street lighting fit in?
The vision of the smart city is to use information and communications technology to achieve best possible resource usage, increase productivity and services, while allowing greater connectivity between people and places.

Existing street lighting infrastructure is well placed to become the backbone for a smart city because street lamps are ubiquitous, already connected to a reticulated electricity supply and provide good visibility for communications, vehicular, pedestrian and environmental monitoring.

What is LCA's role in the switch to smart street lighting?
As the peak body representing lighting equipment suppliers in Australia, LCA's role is to promote smart street lighting and bring stakeholders together to plan the future. In 2016, we held a Smart Street Lighting Forum

LED lighting installed in Melbourne's Chinatown Catenary.

Image supplied by Melbourne City Council.

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to seek solutions to current barriers and work out how to develop, improve and expand the market. We released a discussion paper outlining the differing perspectives and issues faced by stakeholders shortly after, and are now working with the Institute of Public Works Engineering Australasia on a roadmap for the future.

Who are the key stakeholders?
They include the COAG Energy Council and the various regulators in Australia, street lighting asset owners (this is mostly the electricity distributors), the state government roads authorities, local governments, lighting suppliers and designers, technology solution providers and financial institutions.

With such a diverse range of stakeholders, what are some of the main issues that have come up?
There are quite a few, but one of the main issues with the current regulatory arrangements is that they don't specifically contemplate services such as street lighting, service levels or environmental issues, they only consider electricity networks. This certainly needs to change. Also, the regulations need to be amended to accommodate adaptive or variable output lighting.

Another issue concerns ownership and legal responsibilities, the ownership of assets and the legal responsibility to provide lighting are not aligned. For example, the roads authorities in the various councils are responsible for lighting but the electricity distributors own all the assets. The impact of this is that there is little incentive for them to change to efficient technologies.

What's the solution?
There needs to be recognition by all levels of government that change is needed, and it should be agreed at the highest level. From LCA's perspective, it's quite simple. Here is a clear opportunity to save energy, build smart cities and develop the smart street lighting market in one go.

Ian Dryden

Ian Dryden has been an industrial designer for Melbourne City Council for the last 30 years. Most recently, Ian has been working on a project to change the Council's 14,500 street lights to controllable LEDs using the city's unique 'mesh radio' network.

What is the mesh radio network and how is it related to Melbourne's smart street lighting strategy?
Victoria's mesh radio network connects over a million smart meters across homes and businesses in the state. The IP based network (or mesh radio) solution allows energy use and other data to be relayed between meters and then through telecommunications networks. We've been able to connect our smart LED street lights to that network resulting in a controllable system where we can dim individual lights, easily establish the location of outages as well as monitor and analyse energy usage. I think Melbourne has been very lucky because our ability to use the mesh network has been a very inexpensive way to control and monitor our lighting in a situation where we don't own the underlying asset.

What are the cost savings?

We'll get a 65% reduction in the end. Our energy bill is $1.6 million per year at the moment, but we expect it to drop to between $400,000 and $500,000.

What are some of the benefits of the street lights you've installed?

A key focus is to keep the city presentable with appropriate street and decorative lighting so we can attract the 'evening crowd' and help them navigate the streets, bars, cafes and bookshops. For instance, in St Kilda Road all the trees are lit up in winter and summer so you can see a change of season. We are also designing lighting that is more geared towards pedestrians and cyclists, which increases activity in an area making it safer.

There have been some concerns around the effects of powerful LEDs on health. What kind of research have you done into that, and what kind of mitigating actions have you taken to prevent negative health outcomes?

Melbourne University has done some research into it and I've also been on the Australian Standards Committee for Obtrusive Lighting. The main findings are that if you end up with lighting in the blue hues, you have the potential to affect peoples' sleeping rhythm. We've tried to mitigate that by avoiding certain light sources and making sure lights are dimmed to a good level.

We've found dimming works particularly well in our parks. Our parks' hues are around 3000K which makes the fauna and flora look fantastic. We've found that by dimming the lights on commissioning, not only are we saving energy, money and the lifespan of the LED, but we're able to create a lovely, gentle atmosphere which people are attracted to.

Is there anything really innovative going on in this space that has inspired you or that you'd like to import into the Melbourne model?

To be honest I can't help but be excited by everything happening in the LED market at the moment! One of the things that's really interesting about upcoming LEDs is that soon they will be able to 'talk' between themselves

rather than via a smart device. Another area of interest is LED glare control which, so far, has been a really tricky business. Some emerging technologies in this area have got fantastic possibilities in terms of controllability and colour-changing.

But the thing that probably excites me the most is that battery powered solar systems are becoming a real option. We've got a couple of gardens where this type of system, located on one of the buildings, will enable us to light the entire park. For a city that's really interesting: going off-grid and controlling it ourselves.
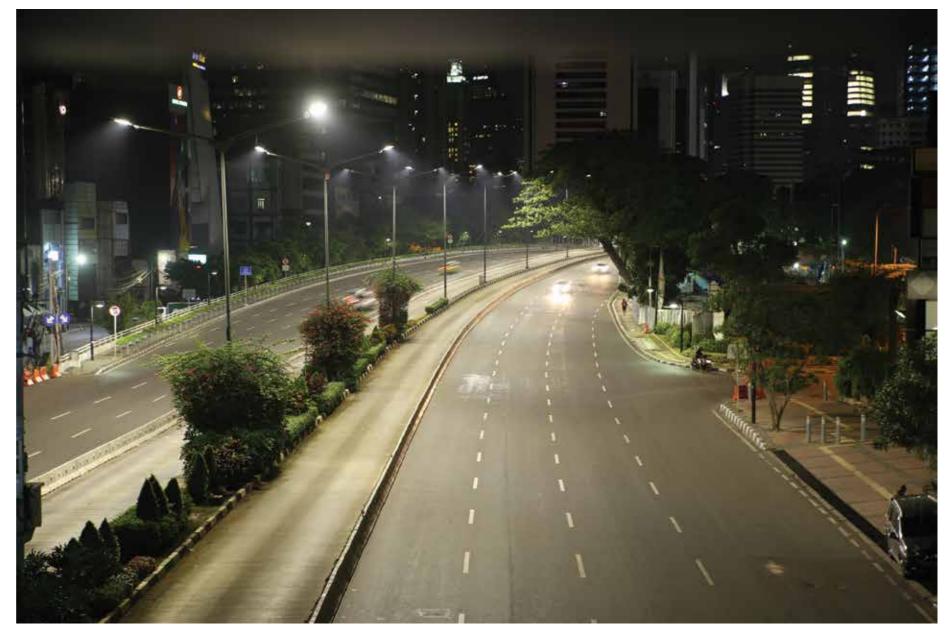
Paul Brown

Paul Brown is MD of Ironbark Sustainability, a consultancy that specialises in working for local government on energy and water efficiency projects, asset management and policy. For the last 10 years Ironbark have carved out a specialty in energy efficient street lighting and, most recently as the technology evolves, smart street lighting control systems.

How is local government approaching the explosion of new technologies in the smart cities space?

There's a lot of interest, but what we often see is that the dots aren't connected. There could be three sections of a council all working independently on different elements of a smart cities agenda. Our role is to help them join the

Philips Lighting implemented one of the world's largest connected street lighting systems in Jakarta, Indonesia (CityTouch and RoadFlair). Image supplied by Philips.

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dots and maximise the opportunities. How to plan for it from a technical perspective, how to engage the market, and how to deliver, implement and monitor it.

With so much choice out there, councils need to be aware that they've got choices in terms of procurement. Also, compatibility is a massive issue, so having systems that talk to each other is essential. It's very early days, and there are few councils who've worked it out, so there is not necessarily a right answer, but there are certain right questions they should be asking.

What kind of questions?
The right questions are: is it compatible with other products? Are we able to buy from different product providers? Who owns the data? Can we freely access and download it? Can we use this system if you, the provider, is not running it?

It's really about the control of the system and the ability of the council to have choices around procurement in the future.

What councils are leading the pack at the moment?
Ryde Council in NSW has been slowly but steadily implementing a smart lighting system in one of their CBD areas. Melbourne is in the process of rolling out a citywide smart lighting system in both metered and unmetered installations. Depending on where you are geographically, there's different options as to how you can deploy large-scale smart lighting systems. The Victorian mesh network, for example, has enabled their smart street lighting installation to be one of the biggest in the world.

What kinds of additional functionalities are you seeing appearing on poles?
Councils are starting to get more sophisticated in key social and shopping precincts. You

might have multifunction poles offering not just lighting but applications from mobile phone charging to wayfinding screens. Those poles are all metered, controlled and generally owned by the council. In terms of street lights, these are usually unmetered, not owned by the council and much simpler in terms of smart controls.

What do you mean by simpler?
The key difference comes down to metered versus unmetered. When it's metered, the energy consumption is variable and you have a lot more installation options. In an unmetered situation, you need to have a defined load, so that limits the products that you can put in.

From our perspective, regulatory change is needed in this area. At the moment, an unmetered street light can't have an adaptive lighting system because it doesn't have a display panel (which is required to be a "meter"), but a physical display is unnecessary these days because we can capture high-quality electricity consumption data with a tiny microchip and remotely communicate metering information.

How will the Australian smart city evolve do you think?
This is a key question and there's some fairly big picture thinking that needs to happen in the next few years. A lot of our work on smart cities at the moment is ensuring the injection of funding and technology leads to a future which builds community capacity, sustainability and economy. The downside risks from global business models for communities means local government need to be clear about their role and how they can leverage benefits for locals from smart projects and programs. The technology is the easy part, ownership and control of data and decision making at city and state level is more difficult.

Professor Simon Kaplan

Professor Simon Kaplan has a background in data analytics in large-scale distributed systems. As CEO of the Urban Institute he works to deliver new smart city services through the provision of data platforms as a place to aggregate data for integration and analytics. Simon is also an Adjunct Professor in the Institute for Future Environments at the Queensland University of Technology and was formerly the Dean of Science and Technology at the University of Queensland.

I've heard you refer to the humble lamp post as the "secret weapon in the data collection crusade". Can you explain what you mean by that?
In Europe, they frequently refer to the lamp post as the most valuable square foot of real estate in the city and this is because it has evolved way behind simply providing light. People are realising they need to not only gather a lot of information from a city and its citizens in order to function effectively in the 21st century, but there is also a growing need to communicate with things like cars, bicycles and pedestrians. Because a lamp post has that most enviable of all things – a power supply – it's a perfect place to position a wide variety of smart technologies that offer new types of functions and services.

Can you run through some of these functions and services?
The obvious one is replacing an always-on LED luminaire with one that is able to adapt the lighting to its context. Then there are communications.

Wi-Fi is often used to make the luminaire controllable but has numerous other uses too.

Other things you might put in a pole include CCTV, a public announcement system, digital signage, electric vehicle charging facilities and emergency calling to name a few. Then there is environmental sensing, where you can track things like CO_2, ozone, temperature, humidity and noise; interesting data about how your city behaves that hasn't been available on a micro scale before. You might also have parking sensors. Up to 30% of driving in a city is actually people trying to find a parking spot, so sharing information about available parking would go a long way towards reducing traffic congestion.

In terms of all these massive amounts of data, who owns it?
Usually, the city's view is they buy the hardware, they own the data, which I think is a completely reasonable position for the city to take, although they will need to license some data back to the manufacturer for maintenance and debugging purposes.

The reason I think that the city needs to own the data is because it is valuable. Traffic data, for example, is enormously valuable for a very short period of time (about 15 seconds) – after that, it's just useful and interesting.

One city might say, "This is data we can sell in the first minute to generate revenue, but then it can go on our open data portal so other people can use it."

Another city might say, "We're going to make all our data available immediately and get our money back indirectly as a result of economic development."

There is no one answer and different cities are all dealing with this differently.

Another interesting thing that's happening around data is innovative business models. In America, for example, companies are trying to own the lamp post, and offering cities all sorts of deals around Wi-Fi and interconnectivity. But then, of course, they want to own the data which in my view is a bad deal for cities.

What does your company the Urban Institute do?
We are in exactly that space of helping cities get maximum value out of their data. We take data, from various city systems, and use it to build a platform to make it valuable, which is why we are so interested in the advent of smart street lighting. ◼

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