

**3rd INTERNATIONAL
STREET LIGHTING + SMART CONTROLS
CONFERENCE**

Brisbane, March 2017

**Conference Report
By
Max Hipkins, Mayor
City of Nedlands, Western Australia**



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1. Introduction

The 3rd International Street Lighting + Smart Controls (SLSC) Conference was held by the Institute of Public Works Engineers Australia (IPWEA) 14 – 17 March 2017 at the Brisbane Convention and Exhibition Center, South Bank, Brisbane.

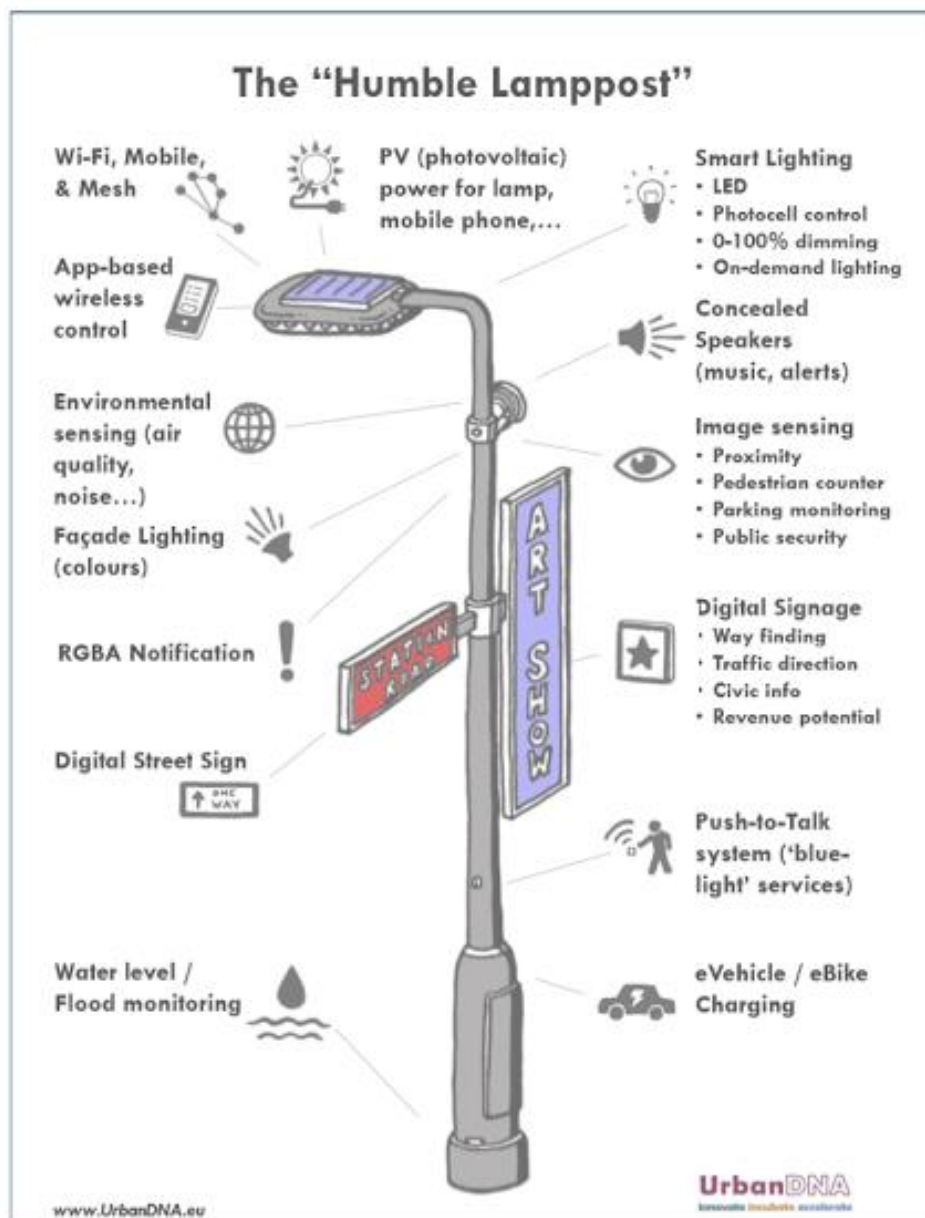
The conference demonstrated how light emitting diode (LED) street lighting and smart controls can achieve economic, energy and environmental savings and at the same time increase community safety, reduce road accidents and improve the liveability of cities and towns. It addressed the latest international and local developments and future trends of the industry. Over 350 people attended the conference, from Australasia, North America, Europe and Asia, with about 10 from WA.

This report summarises the content of conference sessions attended and includes highlights of speaker presentations.

2. Summary of Take-home Messages

- The humble lamppost with smart controls and remote monitoring can be used for much more than street lighting (see following page);
- Use of LED street lights results in increased energy productivity of around 40%;
- 10% of street lights in Australia are already LED – Victoria and Tasmania are leaders;
- IPWEA has provided a roadmap for the industry to convert to LED street lighting;
- The Clean Energy Finance Corporation provides funding to Local Government to convert to LED street lights;
- Conversion globally is happening now, with LEDs providing a 3-5 year payback;
- Smart controls (at least GPS and independent metering) is the norm;
- Smart controls will add about \$100 to the cost of a \$300 luminaire (light fitting)
- There are innovative delivery models, with government coordination;
- Australia and NZ have comparatively low levels of urban street lighting but a high incidence of light pollution;
- Much research has been done on the correlation between the level and type of street lighting and incidence of motor accidents;
- Better street lighting can save 30% of injuries and fatalities at night, with a cost/benefit ratio of 4; a high level of lighting is critical in reducing fatalities, by up to 78%;
- Blue/white 4,000 Kelvin light is best for keeping motorists awake; yellow 3,000K light is preferred by residents; LEDs have sharp cut-off so proper design is essential;
- Select appropriate luminaires for each application; user participation is essential;
- Los Angeles experienced a 63% energy saving after installing LEDs (only paying for what is used), maintenance was reduced 50%, crime also reduced. With individual diagnostics, on/off ability and solar-powered where power supply difficult, every pole generates revenue;
- Sydney installed LEDs to reduce carbon emissions by 70% and achieved energy savings of 47%. It has a luminaire failure rate of only 0.4% and is installing multi-purpose smart poles for Wi-Fi and mobile phone coverage for its light rail;

- The City of Ryde, NSW, is progressively acquiring poles and wires with a power undergrounding project, sharing information with public, exploring potential for motion sensing and aiming to make money from smart poles similar to bus shelter income;
- Canberra is currently upgrading its 80,000 street lights via a Digital Action Plan 2016-2019 as part of a Smart City Strategy, with Wi-Fi as the driver, also smart parking to mobile phones; maintenance funds are used to install smart city fixtures; the City seen as an innovation laboratory with street lights as assets to generate revenue;
- Most Councils pay but have no say in the powering of street lights. They don't want ownership of poles when power prices are regulated; if Councils can wrest ownership from distribution network service providers (DNSPs), street lighting would be cheaper (because no regulatory authority would be involved) and poles could be a revenue earner for Councils; it is important for cities to own the data that comes from the poles but not to own the poles;
- Street lighting is not needed for autonomous vehicles but pedestrian areas will always have to be lit;



- Street lights can be managed with star or mesh (where poles talk to each other) systems; inter-operability is important to allow central control over different systems;
- Dynamic lighting allows power to be increased to compensate for dust that reduces light output; if managed, can increase energy saving to 80%;
- LED lighting is now universally accepted, all discussion is now about smart controls;
- Lighting doesn't just serve the community, it shapes it and lights up our imagination.

3. Conference Program

DAY 1 (EVENING)

Tuesday 14th March 2017

6:00pm –
7:30pm

Civic Reception

Hosted by Brisbane City Council and Brisbane Lord Mayor, Graham Quirk.

Address by The Hon Angus Taylor MP,
Assistant Minister for Cities and Digital Transformation

Location: Brisbane City Hall, 64 Adelaide St, Brisbane

Starting
from
6:50pm

Guided walking tour of Brisbane's LED installations.

Led by BCC's Engineers (groups of 20).

Walking Tour Details:

Route:-

- City Hall, via King George Square
- Albert St into the Queen Street Mall (QSM)
- QSM to Edward St
- Edward Street (eastern side) to City Botanic Gardens (CBG)
- CBG to Albert St
- Albert St to QSM
- QSM to Victoria Bridge (Northern side)
- Pedestrian ramp to Stanley St Boardwalk
- Back under Victoria Bridge into South Bank



8:15am – 8:40am	<h2>Conference Opening</h2> <p>Welcome to the Country</p> <p>Welcome by IPWEA President, Mr Ross Goyne</p>
8:40am – 9:40am	<h2>Street Lighting & Smart Controls Programme (SLSC) from Government's perspective</h2> <p>Margaret Sewell, First Assistant Secretary, Department of Environment & Energy</p> <ol style="list-style-type: none"> The SLSC Programme from an IPWEA perspective – Mr Robert Fuller, Chief Executive, Institute of Public Works Engineering (IPWEA) Around the World in 8 minutes – LED and Smart Controls – Graham Mawer, Co-author of SLSC Roadmap & Director, Next Energy Key Findings from the SLSC Industry Roadmap – Godfrey Bridger, Project Manager & Co-author of SLSC Roadmap & Director, Strategic Lighting Partners (SLP), New Zealand Free download at www.slsc.org.au / www.slsc.org.nz SLSC Model Specifications for LED Luminaires and Control Systems – Bryan King, Co-author of SLSC Roadmap & Director, Strategic Lighting Partners (SLP), New Zealand Q&A from delegates
9:40am – 10:10am	<p>Morning Tea, Exhibition and Networking</p>
10:10am – 12:20pm	<h2>Leading the Way</h2> <p>Sponsored by Light Source Solutions</p> <ol style="list-style-type: none"> Streetlights and Smart Cities: New technologies and revenue generating applications – Ed Ebrahimian, General Manager/Director, City of Los Angeles Bureau of Street Lighting, What can Australia learn from the US? – Interview with Ed Ebrahimian Auckland Transport – Australasia's largest LED and CMS Controls retrofit: The real world experience – Peter Martin, Contract Manager, Auckland Transport, New Zealand Sydney's street lighting Journey and Vision – Paul Gowans, Principal Engineer Electrical & Furniture, City of Sydney Council, Australia LED and Controls: getting the job done in an American city – Wayne Martin, City Engineer, City of Harrisburg, Pennsylvania, USA

	<ol style="list-style-type: none"> ACT's new business model for 79,000 street lights – Brook Dixon, Director, Regulatory Reform, Australian Capital Territory (ACT) Q&A from delegates
12:20pm – 1:20pm	Lunch, Exhibition and Networking
1:20pm – 3:00pm	<p>Smart Cities and their DNA Sponsored by Aldridge Traffic Systems</p> <ol style="list-style-type: none"> Interoperability: The Next Challenge for Smart Street Lighting <i>Joint presentation</i> Christophe Orceau, Innovation Partner at Kurrant, Founder & previous CEO, of Streetlight.Vision Antoine Kassis, Managing Partner at Kurrant, previous head of Citelum APAC & Director of Smart Cities for Asia-Pacific at Silver Spring Networks Queensland adaptive lighting trials: A major road journey – Greg O'Dea, Principal Technician (Lighting), Road Operations, Engineering & Technology Branch, Queensland Department of Transport and Main Roads The City of Ryde (Sydney) smart controls experience – Anthony Ogle, Manager Asset Systems, City of Ryde How Intelligent and Adaptive Lighting Is Driving Modern Lighting Programmes – Will Gibson, Founder and Chief Commercial Officer, Telensa Q&A from delegates
3:00pm – 3:30pm	Afternoon Tea, Exhibition and Networking
3:30pm – 4:35pm	<p>Community Benefits of Smart Cities Sponsored by Aldridge Traffic Systems</p> <ol style="list-style-type: none"> Global experience in connected street lighting as first step towards smart cities – Dr Peter Zink, Road & Street Segment Manager, Phillips Lighting Global Systems, Germany Beyond Lighting: Smart future city initiatives – John Fox, Managing Director, Lucy Zodion, UK The benefit of Australian standards in the roll-out of advanced street lighting technologies – Varant Meguerditchian, General Manager, Stakeholder Engagement, Standards Australia

4. Q&A from delegates

4:35pm –
5:40pm

STATE of the STATES (incl NZ): Speed Data

Sponsored by J & P Richardson Industries

Panel presentations from leading programmes in 8 States plus NZ, followed by panel discussion

1. **Queensland** – Clinton Parker, Director, Business Solutions, Local Government Infrastructure Services (LGIS), Local Government Association of Queensland (LGAQ)
2. **Australian Capital Territory** – Brook Dixon, Director, Smart City and Regulatory Reform
3. **Victoria** – Noel Twyman, Public Lighting Asset Manager, Powercor Australia
4. **New South Wales** – Graham Mawer, Next Energy SSROC
5. **Tasmania** – Liam Seymour, Engineering Officer – Hydraulics, City of Launceston
6. **Northern Territory** – Ben Dornier, Director of Corporate and Community Services, City of Palmerston
7. **South Australia** – Andrew Legrand, Public Lighting Project Manager, Local Government Association of South Australia
8. **Western Australia** – Martyn Glover, Director Technical Services, City of Nedlands, WA
9. **New Zealand** – Robert Brodnax, Group Manager Planning and Investment (Acting), NZ Transport Agency, New Zealand (via video-link)
10. **Panel Interview** “*What is the State of the States?*” Moderator – Bryan King, Co-author of SLSC Roadmap, Director, Strategic Lighting Partners (SLP), New Zealand

6:45pm –
10:30pm

Pre Dinner Drinks in the Conference Trade Area
Silver Spring Networks Conference Dinner

8:30am – 8:50am	Conference highlights so far (MC)
8:50am – 10:15am	Electricity Networks Embracing Change Sponsored by Telensa <ol style="list-style-type: none"> Challenges of leading an electricity utility to convert more than 600,000 street lights to LED and controls – Scotty Hutto, Lighting Services Business Unit Manager, Georgia Power Company, USA The experience with the deployment of 30,000 LED's – Phil McKee, Street Lighting Engineering Manager, Ausgrid Can Electricity Networks change or should Councils take control? – Paul Brown, Managing Director, Ironbark Sustainability Can Electricity Networks change or should Councils take control? – Craig Marschall, Managing Director , Trans-Tasman Energy Group Q&A from delegates
10:15am – 10:45am	Morning Tea, Exhibition and Networking
10:45am – 12:25pm	Finance and Legal: Win-Win Sponsored by Philips <ol style="list-style-type: none"> Financial viability of Councils taking over responsibility for street lighting in South Australia <i>Joint presentation</i> John Comrie, Consultant, JAC Comrie Pty Ltd, Local Government Financial Consultant Andy Legrand, Public Lighting Project Manager, Local Government Association of South Australia \$250m in waiting: How to finance LED Lighting and Controls projects – Melanie Madders, Associate Director – Corporate & Project Finance, Clean Energy Finance Corporation Illuminating the path – dispelling the legal myths regarding council provision of public lighting services – Carolyn Vigar, Partner – Public law and regulation, Wallmans Lawyers, Australia Modernising the public lighting system: its more than just lights! – <i>Joint presentation</i>

	<p>Ren Niemann, Partner – Procurement & Commercial, McCullough Robertson Lawyers</p> <p>John Kettle, Partner – Regulatory, McCullough Robertson Lawyers</p> <p>5. Q&A from delegates</p>
<p>12:25pm – 1:20pm</p>	<p>Lunch, Exhibition and Networking</p>
<p>1:20pm – 2:55pm</p>	<p>Improving Road Safety and the Environment Sponsored by Light Source Solutions</p> <ol style="list-style-type: none"> 1. Strong international economic and safety research evidence exists for road lighting: an opportunity missed? – Dr Rune Elvik, Senior Research Scientist and editor of the English editions of “The Handbook on Road Safety Measures”, Norwegian Institute of Transport Economics, Norway 2. Spotlight on “Just Right” for Road Lighting – Dr Ron Gibbons, Director, Centre for Infrastructure-Based Safety Systems, Virginia Tech Transportation Institute, USA 3. Relationship between night time lighting levels and reaction times and potential ability to avoid crashes – <i>Joint presentation</i> Dr Gillian Isoardi, Scientist & Lecturer, Queensland University of Technology and Prof. Joanne Wood, Professor of Optometry and Vision Science, Queensland University of Technology 4. Improving Road Safety and the Environment – Dr Kellie Pendoley, Director, Pendoley Environmental, Australia 5. Q&A from delegates
<p>2:55pm – 3:30pm</p>	<p>Afternoon Tea, Exhibition and Networking</p>
<p>3:30pm – 5:30pm</p>	<p>International Best Practice Sponsored by Schreder Australia</p> <ol style="list-style-type: none"> 1. The Abu Dhabi Lighting Manual – A world leading specification for advanced performance – Trevor Leighton, Technical Director Australia / Regional Technical Officer, Schröder Australia Pty Ltd 2. Leading the Roadway Authority Way with NZTA M30 specification – Julian Chisnall, National Traffic & Safety Engineer, New Zealand Transport Agency (NZTA)

3. **Pathways for progress in Public Lighting Standards** – Bryan King, Director, Strategic Lighting Partners (SLP), New Zealand
4. **Applying International Street Light Energy Standards to Australia and New Zealand** – Steve Coyne, Director & Consultant, International Energy Agency (IEA) agent, Light Naturally Pty Ltd
5. **The benefit of Australian standards in the roll-out of advanced street lighting technologies** – Varant Meguerditchian, General Manager, Stakeholder Engagement, Standards Australia
6. **The contribution of lighting professionals to the SLSC Programme** – Trent Dutton, President IESANZ
7. **Key international insights to assist Australia to leapfrog ahead in Street Lighting and Smart Controls (SLSC)** – Nancy Clanton PE, President, Clanton & Associates, USA
8. **Closing forum of TOP presentations as voted by delegates** – Moderated Q&A by Robert Fuller with SLSC Advisers in attendance Conference Wrap-up

5:30pm

Conference Closes

5:45pm – 11:00pm

TECHNICAL TOUR 1:

Street Lighting Night Tour to Sunshine Coast

An expert-guided night tour with round-trip tour coach transport to the Sunshine Coast to view a LED and IoT/controls evaluation facility, a LED cycleway demonstration and a leading-edge LED street lighting residential subdivision. Networking and learning with site representatives, smart lighting specialists and peers on the practicalities and intricacies of LED public lighting and controls

8:00am – 1:00pm

TECHNICAL TOUR 2: Street Lighting Half-Day Tour Brisbane

A half-day technical tour by coach around the Brisbane region visiting a luminaire photometric test lab, a smart controls and Internet of Things (IoT) demonstration site, and visits to various noteworthy Brisbane region LED public lighting sites.

8:00am

MASTERCLASS: “How to deliver the future we want”

The Masterclass will address three headline issues all underpinned from the Roadmap recommendations:

- What does the future LED/Smart controls/Smart city look like for your city / your region?
- What are the barriers which currently exist that stop you from achieving this?
- What can be changed that will facilitate you to achieve this vision?

8.30am – 9.00am

The SLSC Roadmap

9.00am – 10.00am

The experience from overseas

10.00am – 10.15am

Morning Tea

10.15 am – 11.15am

Key Roadmap Recommendations: how do these apply or impact on the industry.

11.15am – 12.15 am

Talk to the experts about your council/organisation issues

12.15pm – 1.00 pm

Group Discussion on the report back

1:00pm

Combined lunch with Technical Tour group 1.00pm

4. Highlights of Speaker Presentations

DAY 2

Wednesday 15th March 2017

Margaret Sewell – Department of Environment and Energy

The Department is encouraging voluntary street lighting standards and smart controls. A Practice Note is being prepared: More Sustainable Lighting, with COAG and ALGA.

- To increase energy productivity by 40% by 2030;
- To facilitate LED uptake and smart control technology;
- To create safer roads and environmental improvements;

Financial support for street light upgrading is available through the Clean Energy Finance Corporation. Applications are open from local government.

10% of street lights in Australia are LED – Victoria and Tasmania are leaders

The Roadmap to progress LED installation in Australia, with its 15 recommendations, is unique internationally.

Robert Fuller – IPWEA

IPWEA was asked to provide guidance to the industry

- It produced a Practice Guide Note (Roadmap) in 2015 to provide leadership;
- It was based on the assumption that Australia and NZ were too small internationally to be unique; didn't want states to do different things. IPWEA aimed to identify world's best practice with a vision adopted to stand as an equal on the world stage.

Graham Mawer – Next Energy, Co-author of Roadmap (ref SLSC website)

- Transition to LED lighting/smart controls is happening now. Entire networks are being replaced.
- UK is a leader with 25% LEDs. Auckland's has a Silver Springs designed network - 50,000+ units to reduce costs and revitalise cities.
- Canberra is now out to tender for 79,000 units.
- Madrid 225,000 units – a city financially stressed, to cut costs.
- Chicago (Georgia Power) 600,000 units.
- India has a national streetlight project underway to replace 2-3 million units.
- Huge LED replacements are happening everywhere, providing a 3-5 year payback.
- Smart controls the norm, with innovative delivery models and government coordination.
- Local Government Practice Notes feed into standards.
- Standards Australia – standards are consensus based, not evidence based.

Godfery Bridger – Co-author of Roadmap, NZ

The SLSC Roadmap analyses what is currently happening in Australia and NZ.

Why convert street lights to LED? Street lights can save 30% of the injuries and fatalities at night. They have a cost/benefit ratio of 4.

Globally, Australia and NZ have some of the lowest street light levels and could save up to \$100m pa in the cost of motor accidents. There is extensive research that clearly

demonstrates street lighting is critical in reducing fatalities – up to a 78% reduction is possible with better lighting. Light pollution can be seen from space – Australia's urban areas have high levels of light pollution.

LEDs provide the best lighting and blue/white light is best for keeping drivers awake.

LED colour can be varied; vision is best in white light.

Use of computers to control street lighting has been slow on the take-up.

The "Humble Lamp Post" can be multipurpose – from flood control to powering bikes, audio monitoring (in LA used to locate gunshots), plus street lighting. Sensors are available to read water, electricity and gas meters within range.

In Europe 75% of street lighting is older than 25 years. What will it cost to convert all street lights to LED? Current conversion estimates for Australia are \$423 million but there would be a 25% reduction if undertaken comprehensively, plus other benefits.

Bryan King –Co-author of Roadmap, NZ

The Roadmap provides SLSC Model Specifications for LED luminaires and control systems.

- The Roadmap proposes a structure tailored to local needs and is not a standard; it needs to be harmonised with current practices.
- It shows how to save money, reduce risks, lower tendering costs, be transparent and fair.
- It is structured around needs and is outcomes based.
- It supports life cycle costs and encourages innovation.
- It is a living document with updates that draws on international work.
- The goal is selecting the right luminaires for specific applications.
- User participation is essential.

Ed Ebrahimi – Los Angeles City

Los Angeles is the 2nd largest US city of 4 million; the power utility is owned by the City.

There are 219,000 streetlights, 400 different styles; LED conversion is 80%; remaining 20% are decorative (heritage) lights; there has been a 63% energy saving; maintenance has been reduced 50%; crime also reduced.

The 6th Street Bridge over the LA River has no poles and wireless remote monitoring.

Lighting doesn't just serve community, it shapes it, lighting up over imagination. Street lights are information beacons; GPS is built-in with meter grade accuracy (2% or less), cellular communication from each node with streetlight diagnostics, sensors and on/off ability.

Solar powered street lights have been used, especially on bikeways where power supply is difficult. There is vandalism if batteries are located low down within the pole. Everything should be fully integrated within the pole.

Every pole generates revenue; banners provide income; solar power is sold to the grid at 15c/kWh. There are 32 units of electric vehicle (EV) charging stations installed. The Mayor wants 1,000 EV charging points installed.

There is a Street Light App for the public to report outages.

Decorative style light fittings are retained - the City is working with lamp manufacturers to update style types. Lamps can be fitted with louvers to control light throw.

Supply specifications require no increase in weight when light fixtures are up-graded so that existing poles are retained.

Peter Martin – Auckland Transport

Auckland has 100,000 streetlights and uses 5gWh of energy pa. It is currently installing 3000 new lights pa. It moved to LED lights for energy savings and achieved the benefit of improving safety and reduced costs. Conversion of 70,000 light fittings has been completed, all connected to central management. Light uniformity is a challenge where poles exist. Before and after images clearly illustrate the difference. The future is seen as an opportunity and also an obligation.

Paul Gowans – City of Sydney

Sydney started with a target to reduce carbon emissions by 70%. Lighting was the biggest energy user. The City now has installed 7,000 LEDs. It has experimented with control systems. The LED failure rate is 0.4%. Installation of LEDs has resulted in a 47% energy saving and 2,414 tonnes of CO² emissions reduction annually. New smart poles are required for the light rail – these will be multipurpose, including mobile phone towers with asset monitoring capability.

Wayne Martin – City Engineer, Harrisburg, Penn, USA

Harrisburg has a population of 50,000 with 2,000 commuters each day. In 2011 the City filed for bankruptcy – the first in US to do so, with \$1.5 billion in debt. Each family owed more than their income. The receiver prepared a recovery plan, which included a recommendation to convert to LED street lights. Controls were added for maintenance benefits. Conversion was done quickly, with one crew installing 72 fixtures a day. An investment grade audit was undertaken, which found the City was being billed for energy not used. Now the City has actual usage of each street light and only pays for power used. Public feedback was sought on light fixtures before selection. The public can see mapped areas of light fitting conversions. Streetlight outages were not reported in low incomes areas. Now they are. Power pulses were used to change the colour of bridge lighting when the City could not afford new wiring. Adding sensors to the network resulted in no dimming because there was no financial benefit. However SWAT teams have access to dimmers when carrying out night operations.

Brook Dixon – ACT

Canberra is upgrading its 80,000 streetlights, in accordance with the Digital Canberra Action Plan 2014- 2018. Leading cities have an evolution of smart city plans. The ACT Government has a Digital Strategy 2016 – 2019. There should be a Smart City Strategy in place before changing street lights to LEDs. In Canberra's case, Wi-Fi was the driver. It is best located on light poles. 300 access points were required with 24 hour power. These provided platforms for a smart city eg. smart parking to mobile phones to reduce time looking for car spaces. This provided the ability to collect data – it found parking over-stays but it was never about revenue. It was about leveraging technology to make the city more liveable. Partnerships for smart cities were found to be very useful especially in the planning phase. However business as usual is an impediment to smart city planning. Old business models handicap bringing street lighting into the modern age. Street lights require a communication system – make clear you want to use it for other things. What does it mean for people on the street? Canberra was the first city in the world to regulate ride-share before Uber entered the scene. New business models unlock billions of dollars – you don't need additional funding to install smart city fixtures; use maintenance funds. Consider alternatives before replacing

streetlights. Consider the city as an innovation lab; create a dialogue with the Commonwealth and State Governments and the community.

Streetlights are assets and should be valued according to their potential.

Smart business models are a game-changer. Strong leaders are needed.

Ask community what level of lighting it wants. Regulations are a constraint.

Ensure specifications are future-proofed eg. they could control autonomous cars if required (it is not yet decided whether these will be guided from the ground or satellite).

Chrisophe Orceau – Kurrant

Interoperability – what does that mean?

Only 2% of street lights are smart controlled in Europe. Oslo was first in 2006-7. It employs light point controllers via an open system, which includes Phillips. It uses power lines and a wireless system, with both star and mesh networks. There is central control over different systems with the same software. TALQ 2012 is the data language.

Now there is one network with multiple applications, owned by the provider, amortised by different projects. It is a hybrid network, like in Canberra.

Greg O'Dea – Queensland Department of Transport and Main Roads

There is a Central Management Systems (CMS) for monitoring LEDs.

Dimming variations are being conducted on statistic tests while retaining road safety to investigate adaptive lighting. 24/7 power to CMS nodes is highly desirable.

LEDs are being compared to High Pressure Sodium (HPS) lighting fixtures.

Anthony Ogle – City for Ryde

Ryde owns a network of poles and circuits. It is progressively acquiring poles and smart controls with the installation of underground power.

The City's Macquarie Park is a brand new hub (like Silicon Valley) with an area rate.

Optus has its HQ there. LED street lights have been in for 2 years, with wireless control provided through Silver Spring. Macquarie University is also there.

The City of Ryde has on-ground applications experience, with integrated understanding of governance (IT, IP, legal), information and hardware. It does not check the lighting provided.

It sets a high lighting requirement to save checking fees. It sees potential for motion sensing eg. lighting increases when people enter parks. It wants to share relevant information with the public but there are privacy issues to consider. It sees there is money to be made by Council in the multiple use of its lighting infrastructure, like ads on bus shelters.

What is the Telco's vision? – to get Council onto a payment plan.

Bill Gibson –

Telensa is #1 in connected street lighting. It grew from an ultra narrow band wireless network by asking the question: "What else can it do?"

Initially it got involved with on/off switching and monitoring. It now uses the lighting column for much more – control, monitoring and maintenance, energy measurement and smart cities. In Australia power is provided 90% by utilities, 10% by Councils; in the UK 100% is by Councils; US is a mixture of public and private suppliers.

The case for LEDs is compelling. For future proofing, include smart controls.

90% of world's street lights will be converted to LEDs over the next 10 years.

There are five time dimensions: 1. Scheduled night time (switch on/off, dimming, trimming) 2. Lifetime 3. Override (dynamic dimming, events, emergencies) 4. Multi-media (colour, audio, signs, displays) 5. Utilities (smart grid, demand response eg. remote control of air conditioning).

Dimming – fixed or controlled (more flexible). The public doesn't see the difference. Increased light output can compensate for dirt build-up and dimming over time, to provide consistent illumination. Dynamic lighting can also be provided according to traffic flows – with videos based in the cloud.

Better diagnostics avoids truck rollouts - very important in Australia because of greater distances between assets. Monitoring, allows policing of contractors.

Energy metered vs. unmetered vs. quasi-metered. If energy is unmetered, it allows future monetarised measurement. Knowledge is power. If you can measure it, you can manage it.

Dr Peter Zink – Philips

Cities face challenges – cities use 75% of global energy. 40% of a city's power bill is lighting. Public lighting is everywhere, only 1-2% is smart connected.

For vision, ambient light (colour, etc) enhances quality. Lighting and ICT are converging. LEDs can provide 50-70% energy savings; if managed, this can be increased to 80% saving. Remote control and fault tracking has been improved with Apps for technicians in the field. Monitor, Manage, Measure, with plug and play systems - commissioning, auto location, auto data upload.

Evolving applications - street light management, security management, traffic control. As data flows between software, a traffic accident changes the level of lighting and traffic signals. City Touch light management for big and small cities eg. Seisburg.

John Fox – Lucy Zodian, UK

Urbanisation, environmental degradation, resource scarcity, ageing population – these are pressures on all cities. They are unsustainable and technology can assist. There will be evolution to smart cities that use communications to enhance the scope and performance of urban services to reduce resource use to engage more wholly and beneficially for society. Now people expect to know how long to wait for a bus when they arrive at a bus stop. This eliminates waste. Councils must consider people as more than consumers. Citizens must be engaged eg. with Apps to report failures. This requires citizen centre thinking – consumers should be the architects of the system. This is a paradigm shift.

Most Councils in UK don't understand smart cities, see the publication "Our enlightened future: The journey to smarter cities", which identifies the barriers – leadership, finance, collaboration, confidence. Finance is not really a problem - government grants are available. Most of the problems are with collaboration and confidence.

Highways, lighting, parking, public transport, traffic - management is currently in silos. Integration is difficult with different data protocols.

Varant Meguerditchian – Standards Australia

There is no technical expertise in Standards Australia – volunteers agree on standards. There are around 7,000 standards; 25% deal with energy; safety and performance are also important areas. There is the potential to cover interoperability and more eg. risk, security, innovation, others. There is an "Internet of Things" protocol. There could be a standard for conversion of Mercury Vapour (MV) and Compact Fluorescent (CF) lamps to LEDs.

Scotty Hutto – Georgia Power, USA

The presentation explains the challenges of a utility company converting more than 600,000 street lights to LEDs, both regulated lights and unregulated (area) lights.

When customers demand information on LEDs, everyone in the company must be trained. Proper illumination design is critical – LEDs have a sharp cut off.

Customer demand forced the power company to change – it had to change or competitors would be brought in or eminent domain would result (government take-over).

LEDs allowed more accurate billing. Prices were kept same or lower – there was reduced energy cost, with funds diverted to capital works.

The aim was to install 10,000 light fittings a month. The tariff covered the fixture and power cost - 4,000K blue/white lights on main roads, 3,000K yellow in residential areas.

The adopted meters had a Digital Addressable Lighting Interface (DALI) and TALQ standard management interface.

Phil McKee – Ausgrid

Ausgrid customers are Local Councils. The company distributes electricity in the Sydney–Newcastle area. The Australian Energy Regulator (AER) imposes a price cap.

Lighting comprises 70% residential, 30% main roads. Since September 2013, LEDs are the default light fittings installed.

The company trialled three LED light fittings and asked customers (residents) to evaluate them. Residents preferred LEDs to CF and MV lamps.

To satisfy residents, LEDs were increased from 22 to 28 watts.

Paul Brown – Ironbark Sustainability

Only 5% of Councils want ownership; most want improved timeliness, cost and quality. Councils should control – collaborate and define clear outcomes.

In Australia, they are always married to the Distribution Network Service Providers (DNSPs).

Craig Marschall – Trans Tasman Energy Group

In Australia “Councils pay but have no say”. The distributors (DNSPs) own the street lights and prices are regulated. There is no requirement for US National Electrical Manufacturers Association (NEMA) seven pin connections. Technical specifications and prices are determined without Council involvement.

Councils own the street lights in Tasmania and SA. Elsewhere they are owned by the DNSPs. This won't change while the DNSPs make money by selling power for street lighting.

The DNSP's entire focus is “beat the regulator” (AER).

John Comrie – Local Government Financial Consultant

Why would Councils want to buy into ownership of street lights? He has looked at Councils collaborating to create an entity responsible for such a service. It is permitted by SA legislation. There is no reason why it could not be done.

Melanie Madders – Clean Energy Finance Corporation (CEFC)

Street lighting upgrades fall within the CEFC ambit for investment. The focus is on cities to create better built environments. Street lighting is the largest source of local government greenhouse gas emissions.

Upgraded LED lighting uses 56% less power and generates less emissions.

The CEFC has a local government finance program. It has found working with groups of Councils to be most efficient. It offers 10+ year loans, at a fixed rate; it is flexible as to the structure of loans.

Carolyn Vigar – Wallmans Lawyers

A legal framework applies to local government lighting projects. There is a need to separate fact from fiction regarding barriers – you must understand the legal framework.

Public lighting is core businesses for Councils, although it is not expressly mentioned in legislation. Local government services can be provided directly or contracted.

Councils need to have access to poles owned by DNSPs. DNSPs pass the risk on to customers (Councils). If Councils provide lighting, fewer restrictions apply because they are not subject to economic regulation. Lighting can be in separate ownership from DNSPs.

Councils need to comply with technical and safety laws. This is often used by DNSPs to retain control.

By connecting to others' infrastructure (poles), property law says ownership does not change. Pricing and service standards need to be negotiated where Councils use DNSP infrastructure.

Ren Niemann – McCullough Robertson Lawyers

Get the fundamentals right when modernising a lighting system.

What are you aiming to achieve? How do you monitor and measure?

Don't start with options – start with service needs and gathering information. What do I have? What do I need? What are the constraints? Risks? Opportunities?

Proceed with staged consideration, health checks, business cases, procurement options, test assumptions, look at lessons learned and how to future proof.

Street lights are akin to towers, with added features – “the humble lamp post”.

It is not about the light, it is about the entire infrastructure; the Internet of Things.

Any lighting/communication system will be a mix of dated and new assets with historical ownership – assets should be grandfathered, so assets return to Council ownership.

Light Fidelity (Li-Fi) is replacing Wireless Fidelity (Wi-Fi) because it is 100 times faster.

Dr Rune Elvik – Institute of Transport and Economics, Norway

Research has demonstrated conclusively that better lighting reduces fatal road accidents at night, particularly of pedestrians.

Reduced or no lighting increases accidents

Dr Ron Gibbons – Virginia Tech Transportation Institute, USA

What is a “just right” level of road lighting?

It is desirable to have non-uniformity in pavement lighting ie. some dimming is appropriate.

Adaptive lighting reduces energy use but it needs metering.

Crashes aren't a single event but a combination of three events – doing some extra thing, taking eyes off the road, then something happened to cause an accident. How to manage these three things? Roads can be defined into small sections for different lighting needs. There can be lighting on demand eg. it is possible to install a GPS in a car that turns on street lights as the vehicle progresses. There can be vehicle to vehicle (V2V) interaction, V2I, V2X.

Is lighting needed for autonomous vehicles? No. We are getting close to “just right”. We have to future-proof with controls. We should dim when a McDonalds store is bright enough to light the road. An image was shown of road lighting affecting soy bean growth in fields adjoining the road.

Dr Gillian Jsoardsi – QUT

Her research project: What is the capacity of drivers to detect objects on the road edge under different dimming levels? She tested 158W, 4000K. There were slower driver reaction times as light levels decrease.

Dr Kellie Pendoley- Biologist

Artificial light at night (ALAN) is increasing at 6% pa. Blue/white light confuses wildlife (eg. newly hatched turtles heading for the ocean are distracted by streetlights) and is of most concern to humans. Manage lighting to reduce adverse effects on people and wildlife.

Trevor Leighton – Schreder

There are challenges working in Abi Dhabi – uncertainty and misinformation, disruptive technologies, too many poor manufactures; bureaucratic barriers. Street lighting is manufacturer led. Roads are over-lit. The company achieved 80% energy saving. Lamp Lumen Depreciation (LLD) was 0.7%.

Julian Chisnall – NZ Transport Agency

Energy use in NZ is mainly renewable. Councils own the street lighting. The Christchurch earthquake gave LED lighting a boost. Refer: “M30 Specification and Guidelines for Road Lighting Design”. LED lighting has been fully accepted in NZ; discussion is now all about smart controls.

Bryan King – Consultant NZ

Public lighting standards are at a crossroads – what direction should they take? What do we light? Where? How much? When? How to measure? There are many options with adaptive controls. Why light? – for safety. Where do we light? – this should be activity based and tiered. How much light is needed? Are previous assumptions still valid? Do we need lights on all of the night? No. When there are lower traffic volumes, lighting could be dimmer.

It is not possible to measure performance of lighting. Measurement and verification of safety, lighting and energy outcomes can be undertaken. KPIs are needed for performance measurement. Currently these are not in Australian/NZ standards but should be. They are

in European standards. If they were included, this would establish performance compliance over the whole of asset life. At present there is no standard for lighting control systems.

Steve Coyne – Consultant International Energy Agency (IEA)

What international standards are relevant to Australia/NZ?

Reputable information is needed to maintain an orderly transition.

The IEA tries to coordinate activities.

Many country standards are technology neutral eg. BS EN 13201.

Dynamic Lighting is an issue not currently dealt with.

Trent Dutton – President, Illuminating Engineering Society of Australia and New Zealand

The IES advocates quality lighting by the lighting industry.

Nancy Clanton – Clanton and Associates, USA

LED is a no brainer. Harrisburg is broke and they are doing it. Do we have the right metrics? Law enforcement is likely to make decisions irrespective of cost eg. one button to blackout all lights within 1000m radius.

People hate non-uniform lighting of sidewalks.

When is lighting not needed? Nature reduces blue light at sunset.

Prioritise mapping. Do independent testing of lighting for pedestrians.

Automated vehicles won't hit a mobile phone if it contains a GPS to send out a signal.

Use photovoltaic (PV) paving to charge cars as they are driven. This is a potential income-source for local government.

Lighting glare ratings should be specified in town planning zoning.

Master Class

The aim of the Masterclass was to address three headline issues all underpinned from the Roadmap recommendations:

- What does the future LED/Smart Controls/Smart City look like from your city/your region?
- What are the barriers which currently exist that stop you from achieving this?
- What can be changed that will facilitate you to achieve this vision?

Conclusions from the conference:

- It is essential to include GPS in new light fittings
- Billing should be based on nominal wattage of fittings
- The database must be kept up to date
- Make sure there is a changeover to new billing from the outset of installation of new light fittings.

Conversion has a straight forward formula, where savings can be qualified easily.

Smart controls have to be GPS enabled. Any control includes metering.

Commercial areas are the priority for smart controls because non-resident landowners don't know when the lights are out. In residential areas, residents will tell you.

Installation of new light fittings costs about \$300 per unit plus \$100 for smart control.

Stay away from heritage fittings initially – options are increasing with hidden antenna, which will reduce costs.

There are liability issues when lights are out, so it pays to correct outages quickly.

Smart controls are not a straightforward economic investment. What price is put on a child's life?

Dimming is required to tweak levels so there is not over-lighting, not only to reduce energy use but to reduce carbon output and increase the life of the fitting.

Install fittings using 70% of their capacity initially, so that they can be increased over time.

Various sensor bundles can be added to "the humble lamp post". The sensors are smart controlled. Information stored in the database includes: picture image, when installed, maintenance, fixture details, warranty, etc.

Sydney's Botanic Gardens have smart poles that include Wi-Fi and security. It is a \$4 million network installed at no cost to the public because it was commercialised (privately owned). Although maintenance costs are low, smart poles are structures that still have to be inspected because there are liability issues if they fall. Pole inspections could be every 5 years.

How bright? US experience is 4,000K for main roads, less in residential areas - 3,000K or even 2,700K. Now lower levels are the same cost and efficiency that was not the case previously.

In Los Angeles, 70W luminaires were initially installed: they are now looking at starting again with 35W. Technology obsolesce after 7-10 years, not failure, dictates replacement.

Trees can interfere with radio communications. No tree trimming is permitted in Georgia, so more lumens are installed. Georgia Power offers clip on shielding of fittings if complaints about unwanted light arise – this was included as part of the supply specification. Georgia has one mesh and two star systems and use cell phone technology, with no gateways. Maintenance has changed – voltage has to be checked, rather than the light bulb. Cities own all data irrespective of who owns the poles and equipment. A Silver Spring network to measure electricity was adopted, that could accommodate lighting.

It is always important to first check if the objective can be achieved through the status quo.