Local Government Infrastructure Services

Council of Mayors South East Queensland

SMART STREET LIGHTING FEASIBILITY REPORT

Executive Report November 2016

In partnership with

DATA 61 CSIRO

IPWEA INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALIA

This report was produced by LGIS and sponsored by Local Buy Industry Development Fund

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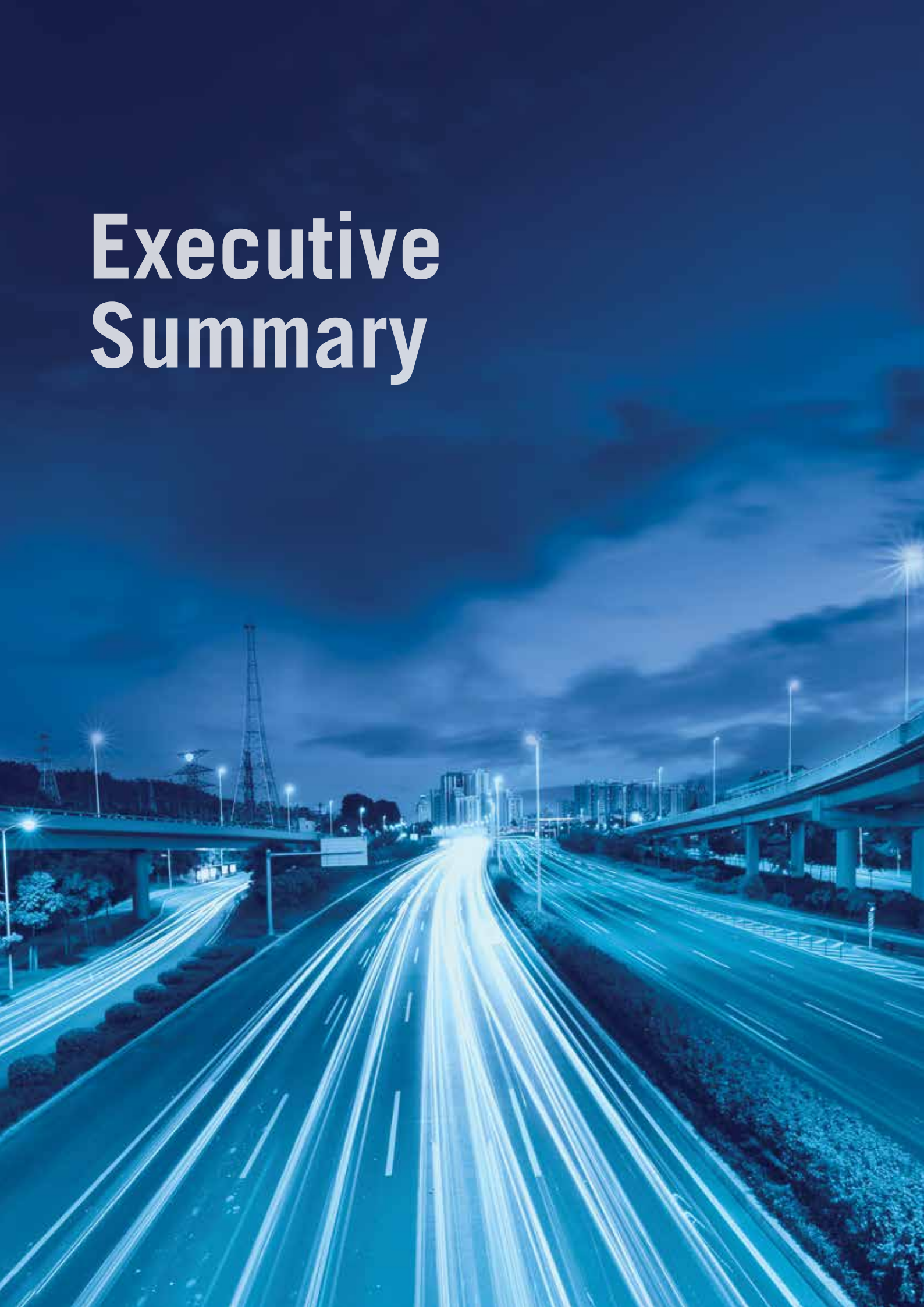


A NOTE FOR READERS:

THIS DOCUMENT

This document is the overarching feasibility report. Detailed research and technical documents are contained in an additional document called *Supporting Document*.

INNOVATION AND TIME

This feasibility provides a 'snap-shot'. The Smart Street Lighting market is subject to rapid changes in technology and innovation in increasingly shorter time frames. Therefore, it is important to view the report within this context.

ENERGEX

For the purposes of clarity, this feasibility report has been drafted on the assumption that Energex is responsible for a majority of South East Queensland's Street Lights. Therefore, only Energex has been used in the annalysis which LGIS deems appropriate from a regulatory and technical perspective.

SMART

For the purposes of this report LGIS has utilised the phrase 'Smart Communities' instead of 'Smart Cities'. This change reflects the true potential of this innovative technology, it provides far reaching benefits well beyond cities. It can be found in towns, suburbs, precincts and estates. LGIS has also used the term 'Smart Communities infrastructure' instead of terms such as 'Internet of Things'. This is because not all 'Smart' solutions require the internet, yet all should serve the community. LGIS aims to ensure that all innovative solutions are part of the 'Smart' conversation.

> **The real opportunity for cities, industry and other stakeholders is to tackle challenges together, to develop common solutions, and use technology to transform our cities and improve citizens' lives.**
>
> **Antoni Vives i Tomàs - Deputy Mayor Barcelona**

Based on international and Australian evidence, Smart Street Lighting can be a prudent investment which has the capacity to drive a number of transformative outcomes for the region and its communities.

Exstensive research and stakeholder engagement has allowed LGIS to identify a set of issues, concerns and barriers that are currently preventing this investment. Lessons learned from workable solutions across the globe in regions including North America, South America, Europe and Asia, highlight that similar feasible outcomes would be implemented in Australia and, in particular South East Queensland.

LGIS has identified three cornerstone arguments that give reasonable assessment that support investment in Smart Street Lighting as a prudent long term investment for local government today:

1

THERE IS A COMPETITIVE MARKET WITH MATURE, LARGE PARTICIPANTS.

The Smart Street Lighting market is competitive across the globe. LGIS has identified well developed products and services ready for immediate deployment with a number of large market participants such as Telstra, General Electric, Cisco, Citelum, Schreder, J & P Richardson.

2

THE MARKET IS SUPPORTED WITH A RANGE OF DE-RISKING STRATEGIES.

A range of investment safe-guards including warranties on equipment and luminaire fail rates, insurances and other de-risking strategies are readily available to support investment into Smart Street Lighting. This market-led risk management approach ensures the investment can be made in a low risk environment as compared with other new emerging infrastructure technologies.

3

THE AUSTRALIAN GOVERNMENT IS ACTIVELY PURSUING A CHANGE TO THE STATUS QUO.

The Australian Government, in partnership with the Institute for Public Works Engineering Australasia, will soon release a roadmap document to assist in driving a change of Street Light management towards Smart Street Lighting solutions. The combined work of these entities creates a viable path towards investment which is highly beneficial to local governments.

CONCLUSIONS

LGIS has identified the following conclusions based on the outcomes of the feasibility assessment:

1

Q: Is Smart Street Lighting feasible within South East Queensland?

A: Smart Street Lighting can have significant and positive benefits for local government's management of Street Lighting.

Whilst Energex is the key Street Lighting provider, local governments are responsible for the provision of lighting for their communities. It is essentially a council service. Investment in Smart Street Lighting provides local governments the ability to improve this service by creating a community-centric approach to street lighting, such as improving safety during extreme weather events, to increasing lighting levels within precincts hosting sporting and community events and much more. Smart Street Lighting examples across the globe demonstrate a range of benefits for local governments in how they provide this essential service to their communities.

2

Q: Are there clearly identified benefits resulting from investment in Smart Street Lighting?

A: Smart Street Lighting when coupled with LED light replacements can produce significant savings.

Global case studies demonstrate the efficiency and savings gained from Smart Street Lighting. Within other areas of local government business, water, fleet management, waste management, there is a wide acknowledgement that data assists in driving improved asset management decision making. Whilst there are demonstrated savings from the replacement of energy inefficient lighting, there are also demonstrable savings to be found from improved asset management practices underpinned by the data garnered from Smart Street Lighting platforms. There is little data gathered from Street Lights at present and LGIS believes that the step-change to gathering data will improve asset management effectiveness and shift operations towards predictive based maintenance. The efficiency dividend is evident in the implementation of other Smart devices in other asset classes and these benefits could be realised through Smart Street Lighting too.

3

Q: Does Smart Street Lighting have a role to play in the Smart Communities and related Smart Communities infrastructure?

A: Smart Street Lighting is the key asset which will support a Smart Communities infrastructure environment with improved community outcomes.

There is clear and compelling evidence highlighting the advantages to Street Lighting as the key asset in realising Smart Communities infrastructure benefits for communities.

Local governments will play a key role in community interaction with Smart Communities technologies (from Smart Watering in parklands, Smart Parking in dense city areas, CCTV in parklands, Smart Flood Monitoring in urban and rural communities to name a few). Investment in and effective management of Smart Street Lighting will: drive the Smart Communities infrastructure offering, set long-term strategy, develop standardised specifications, drive economies of scale, manage core asset infrastructure, and expand customer and community services.

LGIS has identified that there are opportunities for further services and revenues may be derived from other government tiers and agencies and the private sector.

4

Q: Do current conditions provide a positive, efficient and timely introduction of Smart Street Lighting to South East Queensland?

A: There is no framework that will enable Smart Street Lighting and wider Smart Communities infrastructure offerings throughout the region.

Local governments do invest in Smart Street Lighting. In greenfield sites across South East Queensland local governments can seek to implement Smart Street Lighting. This positive move is undertaken with the full knowledge that councils will be responsible for providing these services long-term. It is also undertaken without the capital and operational benefits of wide-spread regional based investment and therefore contains some financial and operational risks. This approach is limited to new development sites and leaves the vast majority of lighting in existing urban, city and commercial precincts untouched.

Wide-scale wholistic invest in Smart Street Lighting will require agreement with Energex. LGIS has identified a number of issues with this in regards to realising long-term Smart Street Lighting and Smart Communities services.

In September, Energex commenced an inter-organisational Smart Street Lighting working group which aims to traverse internal silos to develop strategies and options for this innovation. This is a positive move and one which should be supported by local governments as there is much to be gained from such a step.

LGIS questions, however, if this will result in the type of strategy, offering and investment required to realise Smart Street Lighting for the region due to three elements:

ENERGEX'S CORE CAPABILITY IS FOCUSED UPON DISTRIBUTING ELECTRICITY, NOT STREET LIGHTING, ACROSS THE REGION.

Distributing electricity makes up 97% of their business, with 3% coming from the operations of Street Lighting. Energex's business is under significant pressure through disruptive technologies and changes in demand.

LGIS believes that it would require a significant paradigm shift from within the organisation (and the Australian Energy Regulator) to deliver effective wholesale Smart Street Lighting offering. This position is not a critisism of Energex but for Smart Street Lighting. The strengths of Energex are not aligned with the delivery of a transformative, disruptive, data-driven innovation across the region.

ENERGEX IS UNLIKELY TO DEVELOP A FIT FOR PURPOSE, COMMUNITY-CENTRIC LIGHTING APPROACH UTILISING SMART STREET LIGHTING.

Smart Street Lighting is transformative on many levels, one of which provides a flexible and adaptive lighting environment which can be used to provide regional, precinct and community-centric approaches to lighting. This is different to Energex's narrow offering and requires a generic approach to providing services to local governments based on commercial outcomes and requires them to deliver a much wider offering and operationally support this.

ENERGEX IS UNLIKELY TO INVEST IN WIDER SMART COMMUNITY OFFERINGS

To realise the full potential of Smart Street Lighting and its Smart Communities potential, significant capital investment is required. This capital would need to be linked to a strategic-based offering, and if commercially-focused, wide enough to realise other revenue streams and growth potential. In recent years, Energex has not invested any significant capital into updating legacy Street Lighting.

Energy Queensland has not made a statement regarding its long term strategic plans for Street Lighting. LGIS does not believe the entity is likely to invest in this offering in the next regulatory period, meaning this innovative approach may not be realised until after 2025.

RECOMMENDATIONS

The key recommendations of this report have been informed by LGIS's experience as an innovation enabler for local governments. These recommendations are all focused upon providing a tangable and cost effective approach towards the realisation of Smart Street Lighting, and associated Smart Communities infrastructure for South East Queensland.

SMART STREET LIGHTING WORKING GROUP

Council of Mayors South East Queensland support and endorse LGAQ and LGIS establishing a Smart Street Lighting working group with the view to working with Council of Mayors South East Queensland, Energy Queensland, Energex and the Australian Energy Regulator to develop a framework for potential investment in Smart Street Lighting

ACTIVITY

A coherent strategy for Smart Street Lighting investment requires collaboration — agreement between Energex, state and local governments.

A framework must be developed to support this. The framework would aim to, at the very least, open formal dialogue between the stakeholder groups.

The only significant risk is that whilst in the search for a common position through a framework, pervasive barriers and issues of the management and regulation drag negotiations through another regulatory period.

It is essential that the Queensland Government and Australian Government proactively support an investment strategy aimed at providing a platform for innovation and improved community outcomes.

NOTE

Over previous years a number of individual local governments have approached Energex to explore different options for the adoption of Smart Street Lighting. This approach is an ad-hoc response to a lack of strategy to bring about innovation. It is critical that this 'piece-meal' approach is replaced by co-ordinated and unified regulation, strategy and policy.

Council of Mayors South East Queensland, LGAQ and LGIS based working group would force a collective approach to such interactions and benefit from a joint position.

ASSET TRANSFER TASKFORCE

Council of Mayors South East Queensland support and endorse LGAQ and LGIS to develop an Asset Transfer Taskforce to engage with Energy Queensland to explore the potential transfer of Street Lights to local government management across Queensland. Also, in South East Queensland in partnership with the Coucil of Mayors South East Queensland as the initial test of the model.

The Asset Transfer Taskforce would establish whether there is a commercially viable approach that benefits all local governments across the region.

ACTIVITY

This transfer of management to the local government tier of government would likely:

- Produce long-term savings from more efficient management of assets.
- Realise Smart Street Lighting in South East Queensland
- Ensure a locally relevant approach to Street Lighting services, acknowledging that not all local government areas, communities and precincts are the same.

Appropriate governance and management structures should be utilised to ensure any risks associated with transition are effectively managed.

As the region's lights are largely serviced by sub-contractors, there is significant local market knowledge as well as national and international expertise available to ensure best-practice Street Lighting operational management.

NOTE

Based on initial discussions with Energy Queensland regarding future Street Lighting Strategy a transfer of assets would require a state-wide transfer to the local government tier of government.

LGIS and LGAQ are well placed in partnership with councils and Council of Mayors South East Queensland to bring all local governments together and manage stakeholders such as the Queensland Government, Australian Energy Regulator and Energy Queensland to explore transfer options and ensure that any change of management maximises the benefit to all local governments, regardless of size and location.

SMART READY MANDATE

Council of Mayors South East Queensland support LGAQ and LGIS assisting councils in making future investments LED smart ready.

ACTIVITY

It is costly to undertake a retrofit of a luminaire that is not Smart ready. This non-strategic approach would diminish future opporational and economic benefits of any replacement program.

Risks are that the current control technology (NEMA 7 pin receptacles) become quickly superseded and made redundant.

This risk is low as it is likely that low-cost solutions will be made available to incorporate legacy technology. This is because NEMA is a North American organisation which is a region with the largest scheduled rollouts of Smart Street Lighting technology currently.

NOTE

LGAQ and LGIS are able to support local governments wishing to invest in Smart ready LEDs through bulk procurement, rollout and negotiation with Energex.

LGIS is able to support local governments through a model utilising best practice measures. This approach was developed in Canada to support local governments in the region of Ontario where a central entity provides local governments with the bulk savings and reduced risks derived by a central co-ordinating body.

The Feasibility Analysis

COUNCIL OF MAYORS SOUTH EAST QUEENSLAND

LGIS was engaged by the Council of Mayors South East Queensland (COMSEQ) to explore the feasibility for investment in Smart Street Lighting for the region.

The drivers for the feasibility exercise were:

COMMUNITY SAFETY

Looking at ways that Smart Street Lights could assist in increasing public and road user safety and improve perceptions around night time lighting and public amenity.

SAVINGS AND EFFICIENCY

With Street Lighting comprising of up to 50 per cent of many local government electricity bills, exploring whether Smart Street Lighting can provide significant cost savings to local governments.

SMART COMMUNITIES INFRASTRUCTURE

The feasibility was also tasked with how Street Lights can be part of wider platform to communicate and manage Smart Communities infrastructure, such as parking meters and CCTV infrastructure. amenity.

GLOBAL LEADERSHIP

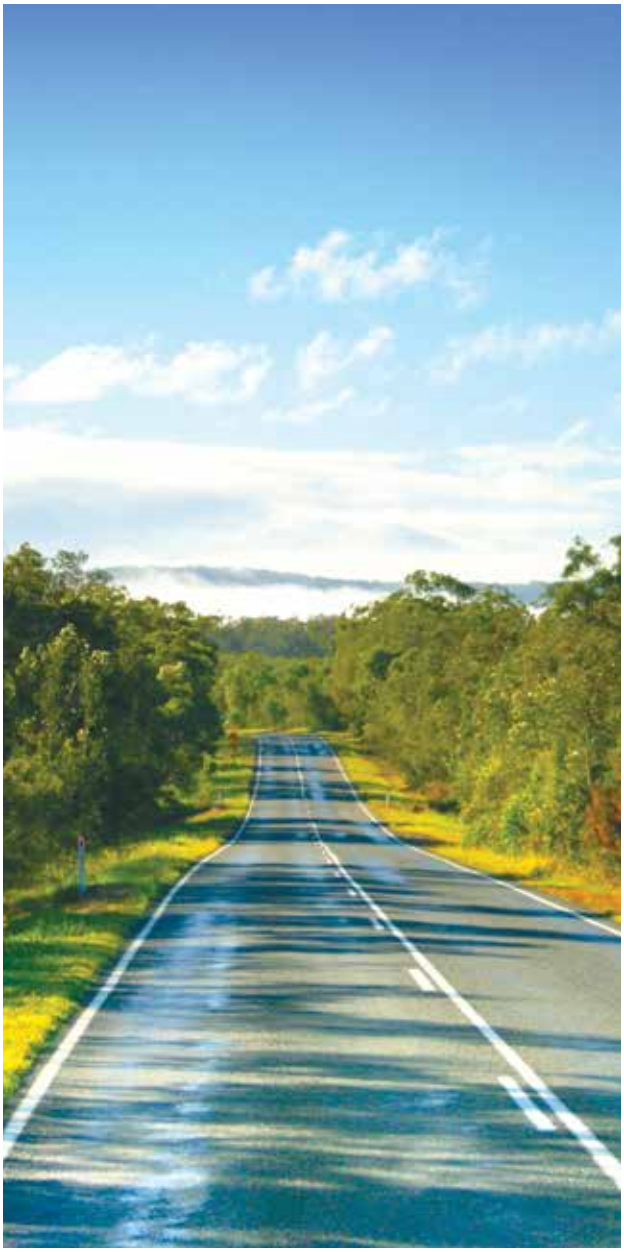
Explore whether a regional approach to Smart Street Lighting, and incorporation of other devices specific to the needs of communities within the region, may drive global leadership.

FIT FOR PURPOSE

Determine if Smart Street Lighting can deliver a transformative approach to lighting infrastructure that enables local governments to take a Master Planning approach to lighting and provides lighting approaches that reflects communities' needs.

The four key questions to answer:

1. Is Smart Street Lighting feasible within South East Queensland?
2. Are there identified benefits to investing in Smart Street Lighting?
3. Does Smart Street Lighting have a role to play in the Smart Communities and related Smart Communities infrastructure?
4. Do current conditions provide a positive, efficient and timely introduction of Smart Street Lighting to South East Queensland?



LGIS has utilised a range of key activities to explore answers to these questions including:

- engaging with council asset managers
- engaging individual stakeholders at local, state and federal government levels
- engaging with Energy Queensland, Energex and Ergon
- financial modelling
- partnering with technical specialists
- researching global case studies
- engaging directly with street lighting managers globally
- running scenarios regarding ownership, risk
- engaging with Queensland University of Technology
- partnering with CSIRO (Data 61) and Institute of Public Works Engineering Australasia
- engaging the market through a request for information process.

SMART STREET LIGHTING

Key Points

- Smart Street Lighting is globally viewed as the coupling of LED lights with Smart controls.
- LEDs provide better lighting outcomes more efficiently than traditional lighting technologies.
- Smart Street Lighting provides local governments with greater control over the way Street Lights are utilised for positive community outcomes.
- Smart Street Lights are the best enabling infrastructure for Smart Communities infrastructure for local government and other government and private sector uses.

Across the globe, most Smart Street Lighting solutions center upon the removal of old lighting technology and the installation of efficient LEDs coupled with Smart control systems.

Street Lighting, as with a number of other public lighting services provided by local government, is a legislated responsibility. Street lights are ubiquitous in cities and towns today. They provide amenity, safety, enable social and community activity, and much more.

The majority of South East Queensland's Street Lights are not smart. The 300,000 plus Street Lights deployed in the region are mostly antiquated high-pressure sodium (which emits a yellowish light) or mercury vapor technologies. The transition to more efficient lighting, in particular light emitting diode (LED) technology, is slow, ad-hoc and likely to take decades based on current practices.

TRADITIONAL TECHNOLOGY

LUMINAIRE

Also known as a Light, Fixture, Lantern or Light Fitting

LIGHT SOURCE

Also known as a Lamp, Bulb or Globe
High pressure sodium, mercury vapour, metal halide

POWER SUPPLY

Also known as Control Gear, Magnetic Ballast or Choke (either electronic or ferro-magnetic)

LED TECHNOLOGY

LUMINAIRE

Also known as a Light, Fixture, Lantern or Light Fitting

LIGHT SOURCE

Also known as light emitting diode (LED) Module. Equivalent of a Lamp, Bulb or Globe

POWER SUPPLY

Also known as Control Gear, Driver or Converter

LEDS AND CONTROLS = SMART STREET LIGHTING

This combination of LEDs and Smart controls combines the benefits of a more efficient light technology (consuming less energy and requiring less servicing) and the flexibility of a control system which provides the capability for adaptive lighting conditions and improved asset management through a range of data being provided.

Whilst there are a range of configurations found across the globe, typical features of Smart Street Lighting, include:

GENERAL LOW ENERGY CONSUMPTION:

LEDs provide significant energy savings by delivering the same or enhanced quality light at lower wattages than current lighting technology.

DIMMING CAPABILITY:

Due to their high light output, LED lamps can be dimmed as much as 50 percent when first installed with minimal compromise in light output.

LIGHTING CONTROL:

Lighting operators can schedule lamps to dim as circumstances allow, such as at low traffic times, in unpopulated areas the middle of night, etc. Whilst Australia has low lighting levels compared to other developed countries there are areas where lighting can be dimmed or switched off. The city of Brittany, France, for example, dims its street lights by 60 percent between 11 p.m. and 5 a.m. to save energy. A similar activity happens in Auckland and recent trials by QUT and Ergon dimmed lights 50% between midnight and dawn.

REDUCED BURN TIME:

With on/off scheduling capabilities, operators can easily modify street light operation to coincide with changing sunrise/sunset times, reducing lamp burn time

STREET LIGHTING TECHNOLOGY

LEDs are the preferred Street Lighting technology across the globe. Below is a comparison of current Street Lighting technology.

MERCURY VAPOUR (MV)

DETAILS

Suitable for all roads, can be identified by their bluish light colour.

151,250 MV lamps installed in the Energex region of South East Queensland of which Energex owns 147,631.

ISSUES TO NOTE

Of all the lights in common use, mercury vapour lamps pose the biggest environmental and safety risk because of the presence of mercury inside the lamp.

- The Minimata Convention, a global treaty to reduce mercury, requires MV lamps to be phased out by 2020. Australia signed the Minimata Convention on 10 October 2013 and is yet to ratify this agreement.
- The use of mercury vapour lamps for lighting were banned in the EU in 2015
- Generally, one of the more inefficient Street Lighting technologies
- No brightness control so they are not suitable for adaptive lighting applications

HIGH PRESSURE SODIUM (HPS)

DETAILS

Suitable for all roads, can be identified by their yellowish light colour.

ISSUES TO NOTE

- High power HPS lamps are efficient
- Can cause poor visual definition of objects (rendition)
- No brightness control so is not suitable for adaptive lighting applications

FLUORESCENT

DETAILS

Used for minor roads and public space lighting
Includes linear (long straight tube) and CFL (compact with spiral or looped tube).

ISSUES TO NOTE

- Contains some mercury
- Reasonably efficient

LIGHT EMITTING DIODE (LED)

DETAILS

LEDs offer high quality light with good colour rendering and high efficiencies.

Long life span, dimming capability and instant light when turned on.

ISSUES TO NOTE

LEDs are not only chosen for their capability to be more efficient, providing energy efficiency of up to 50 per cent against other technologies, there are also other advantages for LEDs, including:

- Dim capability via control system
- They can reduce light pollution
- The light is instantly bright
- They are designed for a 12 to 20 year life with occasional optical cleaning
- Have a low failure rate with survey information from United States municipalities indicating that the failure rate for LED lights is cumulatively less than 1% over the five plus years of experience to date.

SMART CONTROLS AND DATA

Smart Street Lighting infrastructure operates from a technology perspective in much the same way as most Smart Communities infrastructure.

The light is fitted with controls, sensors, and communications components. The communications components emit a radio frequency (RF) to a receiving solution, called a gateway.

Gateways can be placed at a distance to Street Lights with some being able to be up to eight kilometers away.

Gateways can take communications data signals from hundreds of devices and turns this into data.

Open platform communications platforms means that device makers can easily create solutions that can use the existing communications infrastructure without seeking approval from its developers. Communications protocols are publically available for any device maker to be integrated into their solution.

Whilst gateways collect the RF communications, another component is required to take the signal into the Internet environment, hence this is often called Internet of Things infrastructure.

Taking this data into the internet environment is called ‘backhaul’. Ways of ‘backhauling’ into the internet environment can vary and usually include utilising mobile telecommunications or fibre optic cable solutions.

Once data is in the Internet environment this is where the full advantage of connected infrastructure is on display.

Data can be stored and used later to inform long-term strategic planning or data can be used right away to inform an operator or perform an automated task.

This is the central coordinating point of data. Data flows from the device to the software interface and back utilising the internet as the central exchange point. This data allows relationships and patterns not previously seen to support improved business outcomes.

While there is much discusion around cyber security, there are established strategies to mitigate any operational issues.

Through the Internet connection software is then utilised as the interface. Operations can be automated or driven to control lighting conditions, monitor performance, manage operational and maintenance actions, and do analysis on asset management and more.

The software interface can come in many forms and can be utilised on PCs, tablets and smart phones.

Smart Street Lighting offers better management over lighting in local government communities through a number of approaches:

TRIMMING

Trimming is 'tuning' the full output for the life of the luminaire to exactly meet required design lighting levels.

CONSTANT LIGHT OUTPUT

Gradually raising power levels over time to keep lighting delivery at compliance levels as the LEDs age.

DIMMING

Dimming lighting in off-peak hours in response to greatly reduced traffic or pedestrian volumes.

OFF-PEAK SHUT-OFF

Turning off lighting completely in off-peak hours, for example, in rural communities where there is community support for minimising lighting late at night.

BRIGHTENING

Raising lighting levels during special events or in response poor weather or to emergency situations.

Smart Street Lighting – adaptive lighting scenarios.

Smart Street Light Lighting offers a number of improved options for local governments' management of lighting in their communities. Imagine the following Smart Street Lighting scenarios:

GAME DAY

Areas around Milton train station, the Paddington Tavern, Roma Street and Countess Street are awash with people. It's game night and people are off to Suncorp Stadium to watch Queensland defeat New South Wales at the State of Origin. The lighting levels are raised in these precincts to give the community a safer environment to enjoy the game.

DISASTER STRIKES

A storm strikes South East Queensland with heavy rain and major flash flooding in communities from Lockyer Valley to Redlands. Local governments quickly increase lighting levels to counter the effects of rain and flooding on visibility on roads and pathways.

FRIDAY NIGHT

The night comes alive in Fortitude Valley, Surfers Paradise, The Esplanade, Maroochydore. Revellers are out and about at all hours. Lights are raised as the hours precede to provide comfort, atmosphere and safety as more and more people flow in and out of these entertainment precincts.

THE FAIR

It's a community fair in Springwood, Redbank Plains, Newtown. Roads have been closed and local vendors are running stalls in the street. The Street Lighting levels are raised to provide safety and atmosphere for the precinct.

DIMMING

Whilst Australian lighting standards specify one of the lowest levels of light in the developed world, there are dimming scenarios which could be explored for certain communities. One option is sensor based activation which is a solution that is maturing. It's after 3 am in Beaudesert, Kilkoy, Gatton. Street Lights have turned to sensor based activation which means pedestrian and vehicle movement (detected by sensors) activate light levels to rise on the street. A lone car travels through the town's streets and the lights far in front of the vehicle alight and only dim once the vehicle is well clear.

SMART STREET LIGHTING AND SMART COMMUNITIES

As Smart Street Lighting platforms have matured so too have a range of other digital outdoor infrastructure elements as part of the wider Smart Communities drive.

Globally, a city's street lighting infrastructure is being increasingly recognised as the likely enabling platform for much of this new infrastructure. Four characteristics make Street Lighting particularly important to the future Smart City:

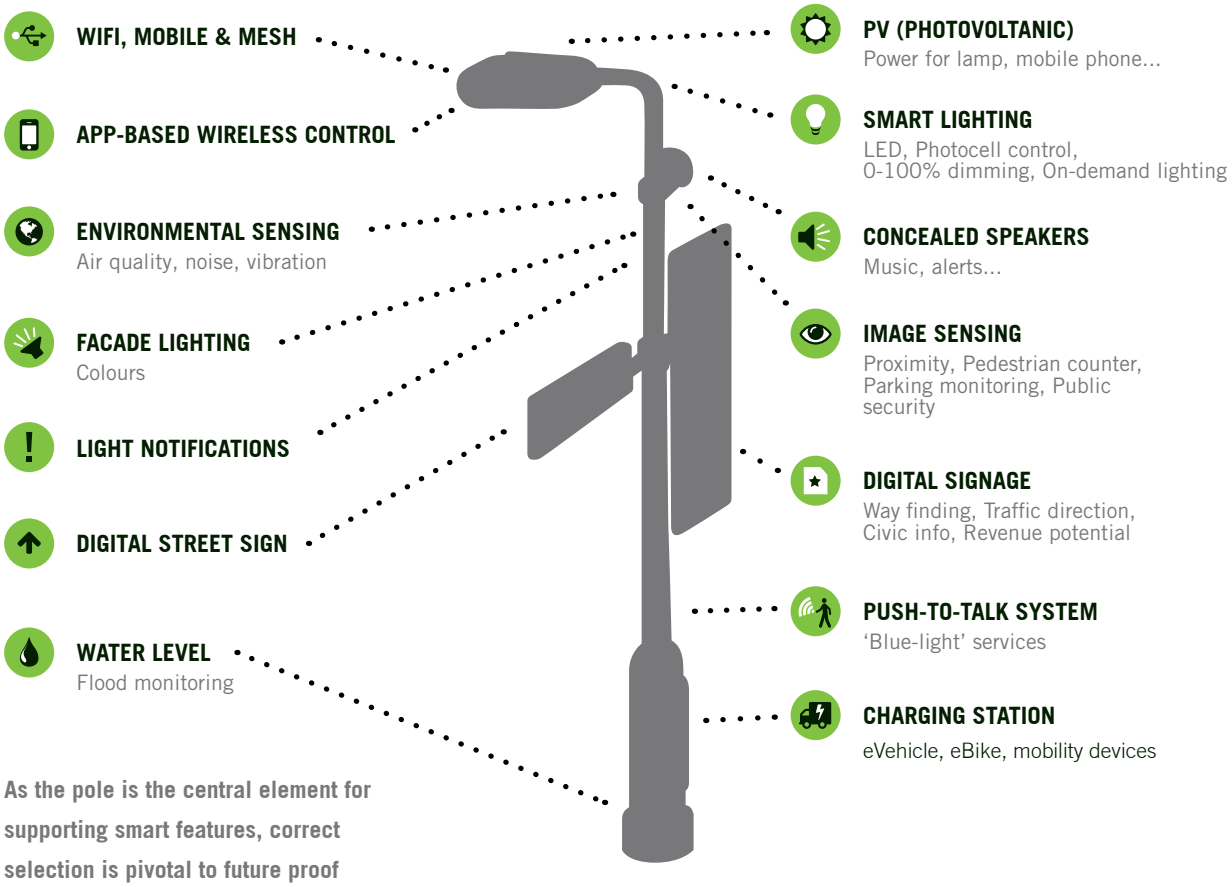
1. Street lighting is ubiquitous in nature, located every 30 to 80 metres along almost every urbanised street in Australia

2. Being up in the air, away from buildings and above the road surface makes Street Lighting ideally situated for a range of Smart Communities communication devices, sensors, cameras and other Smart Communities infrastructure

3. Street Lights already have a support structure and a supply of electrical power which is a key benefit

4. Street Lights are currently managed by an organisation which could, with a commercial focus, be a Smart Communities delivery agency with the capability to support the specification, marketing, delivery and services management of Smart Communities infrastructure devices and solutions.

The Smart Pole



As the pole is the central element for supporting smart features, correct selection is pivotal to future proof capability and functionality.

There are many ways Smart Street Lighting can act as a Smart Communities infrastructure platform for sensors and critical infrastructure. The most important ones are those which will enable local governments (and other utilities and government agencies) to deploy devices to capture data to support existing management of community services and infrastructure, including:

- Traffic controllers and transportation sensors essential for monitoring and implementing active traffic management strategies
- Parking vacancy sensors and cameras to support Smart Parking solutions
- Environmental sensors to detect and respond to motion, noise, temperature, rain, flood, humidity, air quality, gas leakages, vibration etc.
- Utility metering and leakage sensors for electricity, water and gas
- Speakers and messaging billboards - Music and/or emergency broadcast speakers
- Electric vehicle charging stations
- Public safety, security and intelligence
- Enhanced communications – including enhanced mobile phone capabilities and a variety of Smart Communities infrastructure communications options such as WiFi, LiFi, LoRa and others.

These Smart Communities infrastructure technologies will not only dramatically improve the

information available to local governments, but some of the new services they will enable for the community could also provide new sources of revenue.

Cities such as Copenhagen, Barcelona, Glasgow, San Diego and Los Angeles and others are all implementing Smart Street Lighting projects that support other Smart Communities infrastructure.

Integrating Smart Street Lighting with broader Smart Communities infrastructure make strong commercial sense. While developments in this area are rapidly evolving, such services will reduce overall costs for distribution network entities or local governments and may offer the potential for new independent revenue streams.

OPEN DATA

There is a global movement towards providing Open Data. When Smart Street Lighting and Smart Communities infrastructure data is involved this may provide a positive role on local economies. If local governments are able to collect large amounts of this 'Smart' data and release it to the community in quality and meaningful ways, then this may open up new local industries.

The opportunities are for small, agile businesses to provide wider, additional and unique services to their local community. This could come in the form of value adding to existing services, or solving a problem for local government or the community utilising unique insights from the data, or it could be joining the data dots to understand one significant solution many communities need.

There is a global trend towards Open Data and evidence shows that Smart Street Lighting data coupled with other Smart Communities infrastructure data can play a vital role in stimulating a new economy.

CASE STUDIES

Key Points

- Global case studies which cover a range of environmental, regulatory, economic and cultural conditions provide confidence that Smart Street Lighting technology can be applied in Australia and South East Queensland.
- The similarity of savings outcomes found across the globe demonstrate that any barriers to implementation within South East Queensland are not based on technological or financial elements, rather, are a mix of legislative, policy and operational management issues.

There are a substantial number of Smart Street Lighting implementations across all regions – local, national, and international. Many of these Smart Street Lighting projects are driven not only from a desire to curtail energy costs and reduce greenhouse gas emissions, but also to enhance public safety, provide a better lighting service, and offer a platform for the growing Smart Communities infrastructure devices.

An important element of this Smart Street Lighting feasibility report has been the collation of more than 20 case studies which provide a snapshot of approaches being undertaken within different regions across the globe. These case studies are included in the Supporting Information document found at www.lgis.com.au

So what do the case studies tell us about what local governments in Australia and internationally are doing in relation to Smart Street Lighting?

Case studies indicate that Smart Street Lighting projects are:

- increasingly implementing scalable, future-proofed solutions that can deliver innovative services
- generating savings from the combined installation of LEDs and control management solutions
- maximising savings by using control management systems and data to better inform asset management operations
- provides technology as a basis to learn from and incorporate sensors that create further efficiencies as other technologies become mature
- building pathways to Smart Street Lighting by installing Smart ready LEDs to future-proof Smart Street Lighting investment.

In the Australian context, there are a range of Smart Street Lighting projects which are either trials, precinct based scale projects, or strategies to delivery full-scale roll outs. Some of these include:

- Ipswich –12% of fleet to be transitioned to Smart Street Lighting
- Brisbane Airport
- Townsville
- Queensland indigenous communities with integrated CCTV for improved security
- Sunshine Coast – purchasing Street Lights and retrofit to Smart Street Lighting
- Adelaide – central city hub, with associated Smart Parking and adaptive lighting controls (less light where possible, more light where necessary)
- Melbourne – 16,000 Street Lights changed to Smart ready Street Lighting
- City of Sydney – 5,700 Smart Street Lighting and a range of Smart Poles.
- Northern Territory – Street Light assets will be transferred to local governments in 2018 with a number planning Smart Street Lighting retrofit programs.

The following summary case studies have been included to provide a view of Smart Street Lighting implementations in various locations across the globe, including:

- Auckland, New Zealand
- Los Angeles, United States of America
- Paris, France
- Oslo, Norway
- Florida, United States of America.

AUCKLAND, NZ

ENTITY

Auckland Transport

TYPE

Full Smart Street Lighting implementation

ELEMENTS

- Replacement of 44,000 high pressure sodium Street Lights with Smart LEDs
- Controls utilised to manage the Street Lighting
- Central management software to monitor and operate.

ASSET OWNERSHIP

Local government owned

PROJECT COST

Value of work is around $82 million (NZ).

DRIVERS

Policy changes by Auckland Transport that mandated LED use

BENEFITS

- Expected net savings of $32 million over a 20-year life of lights
- Control management system expected to achieve a further 15-20% in energy savings through:
  - Daily reporting of faults to improve maintenance response planning and better manage costs
  - Control management system allows light levels to be controlled to reduce energy costs.

LOS ANGELES, USA

ENTITY

Los Angeles, USA

TYPE

Ongoing full Smart Street Lighting implementation

ELEMENTS

- 170,000 LEDs
- 54,000 have Smart Street Lighting controls
- Remote monitoring system
- Radio frequency mesh for communications

ASSET OWNERSHIP

Local government owned

PROJECT COST

$57 million project cost

DRIVERS

High energy usage, High energy costs

BENEFITS

- 60% reduction in energy consumption
- 68,000 MWh/year energy savings delivering $9 million (UDS) savings per year
- $2.5 million (USD) per year maintenance savings
- Reduction of 40,500 tons of CO2 per year
- Whiter lights, perception of improved lighting and visibility
- Reduction in streetlight repairs (70,000 in 2010 to 46,300 in 2012)
- Failure rate for LED 0.2% compared to 10% for HID`

PARIS, FRANCE

ENTITY

City of Paris

TYPE

Full Smart Street Lighting implementation

ELEMENTS

- Smart LEDs
- Wireless networking connecting more than 200,000 streetlights and traffic lights
- Each control has a meter built-in, to monitor the electricity usage at each device which helps with preventative maintenance and energy-savings goals.

ASSET OWNERSHIP

Local government owned

PROJECT COST

Cost estimate between €500-€700 million (EURO)

DRIVERS

Reduce overall lighting energy consumption by 30% from 2004 levels by 2020

Optimise operational gain through distribution networking. Implemented to provide an intelligent lighting systems that offers increase energy efficiency, lower operational cost, extend equipment lifespans, enhance citizen safety and quality of life.

BENEFITS

- Scalability and future-proofing:
  - Offers open, standards-based solution that allows future smart city applications such as traffic management, environmental sensors, smart parking, EV charging, electricity metering, and water conservation.
- Up to 70% energy cost savings
- Wireless networking allows operators to know if lights are off/on, working/not working.

OSLO, NORWAY

ENTITY

City of Oslo

TYPE

Full Smart Street Lighting implementation

ELEMENTS

- 65,000 LEDs
- Light output remotely accessed and controlled using Internet-based interfaces
- System provides maintenance data such as bulb replacement requirements
- System manages the streetlights and uses wireless networking to communicate with the city's monitoring centre
- City monitors and controls the lamps via enterprise monitoring software
- Communication over existing powerlines using power line technology.

ASSET OWNERSHIP

Local government owned

PROJECT COST

18 to 20 million Norwegian kroner (around $3 million AUS)

Expectation that savings will pay for the new system, with an overall ROI within 5 years

DRIVERS

- Control lighting and reduce electrical costs
- Become more energy efficient and environmentally friendly
- Improve driver and pedestrian safety

BENEFITS

- 62% energy reduction
- $1.3 million (USD) savings annually on electricity costs
- Ability to remotely pinpoint malfunctioning/dead streetlights lowers maintenance costs
- Ability to vary street lighting levels enables emergency personnel or construction crews to work more effectively
- Scalable and future-proofed: the open architecture of the system

FLORIDA, USA

ENTITY

Florida Power and Light

TYPE

Full Smart Street Lighting implementation

ELEMENTS

- 500,000 distribution networked lights
- Standards-based Smart infrastructure
- Software to control and manage lights
- Distribution network is leading modernisation.

ASSET OWNERSHIP

Distribution network owned

PROJECT COST

Cost not publically available

DRIVERS

- Lighting maintenance and operational improvements
- Smart grid distribution network enhancements.

BENEFITS

- Smart Street Lighting used to connect distribution systems, detect outages, and analyse data streams for grid health insights
- Greater energy efficiency
- Scalable and future-proofed: platform will enable multiple applications and services as needed in the future.

BENEFITS & RISKS

Key Points

- Replacing current lighting technologies with LEDs can conservatively produce energy use savings up to 50%
- LED are low maintenance Street Lights compared to other lighting technologies and produce conservative maintenance cost savings of up 50%
- Smart Street Lighting can improve community outcomes from better lighting services management, potential to reduce crime, and capability to identify hazards
- LEDs can improve alertness and driving safety than mainstream legacy lighting by providing superior ability to discern colours, objects and people
- Smart Street Lighting is a key enabler of Smart Communities infrastructure with the potential for revenue generation.
- Risks for Smart Street Lighting implementation are centered upon technology selection, performance and capital lock-in.

BENEFITS

Street Lighting is an important community service which can consume up to 50 per cent of a local government's energy budget. Understanding the operational details of Smart Street Lighting and comparing those benefits and costs to traditional lighting lays the foundation for building a business case to deliver Smart Street Lights.

The hard dollar savings in energy and operational costs make the case for replacement and implementation of Smart Street Lighting provide additional community value as well.

All savings from Smart Street Lights are dependent upon the costs, regulations, strategies, asset management approaches and range of services that the distribution network operates with to provide the Street Lighting service.

LGIS has identified a number of wide-ranging benefits around the deployment of LEDs and smart controls, essentially Smart Street Lights, which can be summarised as follows.

FINANCIAL, ENERGY AND ENVIRONMENTAL

- Smart Street Lighting can reduce energy use for Street Lighting by up to 50 per cent. In some cases, such as Los Angeles and Oslo, higher savings have been achieved with 63 and 62 percent, respectively.
- With the up to 50% reduction in Street Lighting energy use there is also associated Greenhouse Gas savings.
- There are reported results indicating for a further saving of up to 20% on energy and associated Greenhouse Gas if smart controls are included and proactive maintenance implemented.
- Global case studies show that connecting LEDs with Smart controls and management solutions, can deliver an indicative payback period of 6 years.
- LED lamps can have light output enhanced in areas of high traffic, with examples in Auckland of high lighting levels for areas around sports grounds pre and post matches and high tourist areas.
- Further environment benefits include the elimination of the mercury (used in many current Street Lights) reduction of obtrusive Street Light, reduction of upward light waste and consequent sky glow, and reduced impacts on Australia's ecology when smart controls are used to improve control lighting outputs in environmentally sensitive areas.

ASSET MANAGEMENT

- LEDs have a life span of up to 20 years, enabling lower energy and operations costs.
- In order to take full advantage of LED technology, these LEDs are best transformed to Smart Street Lights with associated smart control devices.
- Up to a 50% reduction in the Street Lighting maintenance due to the improved reliability of LEDs and through the better asset management capabilities using smart controls.
- Legacy high-pressure sodium and mercury Street Lights are not as energy efficient as LEDs and current Street Light bulbs have a short life span (around 5 years), resulting in expensive operations. By example, maintenance crews can replace up to 20 per cent of current Street Light bulbs each year.
- Currently, operators detect light outages either when a community member calls to report it or when patrols detect outages during periodic inspection. Smart Street Lights provide continuous, accurate status information to operators, enabling them to automatically identify outages immediately and reduce outage impacts to public safety and an operator's liability.
- Proactive maintenance: street light management software also provides predictive information, alerting operators to lamps approaching end-of-life, so replacements can be scheduled proactively. Distribution Networks that periodically conduct manual surveys of their lights can eliminate this cost entirely for even greater ROI.
- This automated outage detection can provide reduced repair and maintenance costs through more precise preventative and corrective maintenance processes.
- The data from Smart Street Lighting gives operators remote access and advanced functionality, including the ability to dim street lights and control their runtime by scheduling them to switch on/off as conditions (such as shorter/longer days or weather impacts) warrant.

COMMUNITY

- A material reduction in road crashes (and consequent fatalities and serious injuries) at night by increasing lighting levels which can improve driver reaction times through widespread use of high quality white light together with higher levels or reliability.
- A reduction in the fear of crime and in actual street crime at night depending on conditions.
- Supporting a Smart Communities platform – improvements in the delivery of community services, productivity, disaster resilience and liveability by using Street Lights as an enabling platform for transmitting community-wide data and establishing connectivity with other devices in the public domain.
- Night-time Enhancement – enhancing the amenity, ambience, and safety of streets, parks, and the business prospects of entertainment and tourist precincts at night.

SMART LIGHTING CAN DELIVER BENEFITS TO LOCAL GOVERNMENTS

- Communications infrastructure used in Smart Street Lights can be used as a backbone communications platform for other Local Government managed infrastructure including Smart parking meters, traffic lights and traffic management systems.
- Economic: potential driver for new wider innovation 'spin offs' as a consequence of installation of Smart Communities' communications infrastructure.
- Data capture: public mobile data can be captured to assist in urban planning and commerce investment.
- Emergent technologies: Potential for Smart Street Lighting to play a navigational and locational support role for autonomous cars.

RISKS

Each Smart Street Lighting installation, particularly when implemented on a precinct by precinct basis, have different configurations to meet the needs of the community. So, this means that risks can vary.

LGIS has identified a number of high-level risks and mitigation approaches for deployment of Smart Street Lighting.

TECHNOLOGY OBSOLESCENCE

Innovation is driving rapid change in technology and with this comes a risk that local governments may invest in technology which will quickly be superseded.

ENSURING THE FINANCIAL CASE

Should the technology be a cost saving efficiency measure, the investment should have a reasonable payback period. The shorter payback period means that should further innovations arise, which greatly improve the efficiency and cost savings of the current technology solution. A further investment can then be made to facilitate the transition away from business as usual at an optimal time to realise savings.

INVEST WITH THE MARKET

During the process of stakeholder engagement for this study a number of concerns were raised regarding investing in Smart controls to make LEDs Smart ready.

LGIS is strongly of the view that investment with the market supports decision making and mitigates risk as it will be for the market to support or adapt technology investment.

TECHNOLOGY SELECTION

Selecting technology is difficult and can create decision making inertia.

DIMENSIONS TO INVESTING IN TECHNOLOGY ARE COMPLEX

To make sound technology selections LGIS recommends a number of measures need to be adopted to mitigate risk and improve chances of good technology selection:

- Identify which local governments and corporations are current buyers of technology in the market.
- Determine the volumes of market penetration in relation to the overall potential market.
- Assess the technology endorsed or supported by multiple government agencies.
- Consider if the technology aligns with any market-based or national standards.
- Consider impacts of capital lock-in.

A WORKING EXAMPLE

LGIS is of the view that a NEMA 7 pin receptacle be utilised as the standard LED Smart Control device. These devices are widely utilised in North America, the largest market investing in Smart Street Lighting currently. Moreover, NEMA is the National Electrical Manufacturers Association and is the US's largest single electrical trade association which set standards for devices and equipment utilised by North American and other countries' utilities.

Following this organisation with regards to control devices, and this market, forms the basis of a prudent investment selection as it reduces risks of obsolecence.

OVERSTATEMENT OF OUTCOMES

Vendors can overstate potential outcomes which can reduce return on investment.

FACTUAL KNOWLEDGE FROM DIRECT EXAMPLES

LGIS has sought, through a review of global case studies, to engage directly with project and asset managers responsible for the delivery of solutions and ongoing management. These officers are able to provide the insights beyond a vendor's stated marketing outcomes and technical specifications to the proper outcomes of the technology solution. Most importantly, it provides knowledge regarding what other elements are required to change, such as operational management, to realise such outcomes.

TECHNOLOGY TRIALS

Designing and implementing trials are a way of providing organisational and community confidence in the technology.

It also provides insights on a precinct by precinct level into various outcomes which may be achieved through the technology solutions and test the platforms' flexibility, particularly for Smart technology.

LGIS recommends that multiple vendors are engaged for trials and this is conducted as part of an Expressions of Interest process to test vendors' commitment and customer management process alongside technology solutions.

CONTRACTUAL TERMS

Procurement processes for selection of innovation partners is difficult. It often requires understanding complex variables with technology solutions in their infancy.

One shining light approach amongst this is the ability to leverage the uncertainty into contractual terms. By example, LED vendors claim luminaire lives of up to 20 years with no requirement for significant maintenance and very low failure rates. Luminaire suppliers have put forward a ways to support these claims with performance based warranties and guarantees, particularly centred on fail rates and life expectancy of assets. In large bulk replacement scenarios LGIS suggests bank guarantees and insurances can also be utilised to reduce residual risks.

TECHNOLOGY SOLUTIONS PERFORM BUT DO NOT PRODUCE EFFICIENCY OUTCOMES

Technology is implemented and is performing to specifications however pervasive efficiency and savings are not being met.

OPERATIONAL MANAGEMENT

Data related to the current management of Street Lights is lacking. It is data that should be used to drive and influence change management and must be a key component to influence and realise benefits.

CHANGE MANAGEMENT

Technological change is likely to impact on operational management and performed functions. This will necessitate significant changes to work methods and approaches.

This requires a change management process that protects the intention of the technological solution and ensures that strategic decision making utilises new operational management methods.

BARRIERS TO SMART STREET LIGHTING REALISATION

Key Points

- There is a lack of engagement and long-term regional strategy for Smart Street Lighting in South East Queensland.
- Street Lighting condition data is lacking to make effective investment decisions, particularly on an old asset fleet.
- Residual costs of the existing and old Street Lighting assets distort the costs of upgrading to other solutions.
- Asset management savings (O&M) provide significant savings however are difficult to realise under the current management arrangements.
- Attaching Smart Communities devices to poles is costly
- There are unrealised savings in upgrading to Smart LEDs under the current management arrangements.
- There is a lack of metering arrangements which suit Smart Street Lighting and its additional savings.

There are many issues and barriers which are dampeners to realising Smart Street Lighting investment in South East Queensland. Some of these have a number of complex elements underpinning them which LGIS has addressed below.

Some of these issues and barriers are highly pervasive, however, none are insurmountable. LGIS has addressed the critical barriers which require long-term strategy and strategic coordination, positive stakeholder dialogue, policy change and general willingness to commit to an innovative outcome.

Barrier: Lack of engagement and long-term strategy

Although Street Lighting was pivotal to the creation of electricity supply in Queensland, the core business for distribution networks now is the transportation of electricity to customers. Today, public lighting revenue represents less than 3% of the distribution network's annual revenue. While approximately $36 million per year may be relatively small to a distribution network's revenue, public lighting is a substantial cost to local governments in South East Queensland.

Local governments are seeking better Street Lighting outcomes at a time when the distribution network's business is under disruption and requires significant organisational effort to address unprecedented change within the energy markets.

Globally, there are a handful of cases where distribution networks own the lights or where a partnership between local government entities and a distribution network exists and has led to the realisation to Smart Street Lighting. However, these distribution networks have had a long standing proactive approach to innovation and a long-term strategy that is developed in partnership with their customer base.

OUTCOME:

In September, Energex commenced an inter-organisational Smart Street Lighting working group which aims to traverse internal silos to develop strategies and options for the innovation. However, with a lack of long-term strategy for Street Lighting beyond 5-year activity applications to the regulator, it is unlikely that a proactive strategy for implementing Smart Street Lighting will be realised in time for the next regulatory period. This means that wide spread rollout by the distribution network may not occur until 2025.

Barrier: Asset condition and data

It is the distribution network's responsibility to manage the Street Lighting assets in the most efficient and effective manner. For a large, complex and highly-regulated asset base, it is essential to manage these assets within in a best practice management framework.

The distribution network currently does not perform asset management of streetlights in accordance with best practice asset management ISO55001.Whilst they are moving towards being compliant before 2020, there seems to be a lack of significant data to assist with improving asset management performance.

By example, distribution networks retain information showing the original installation date of the light. Current data records show that more than half of the distribution network's lights are over 20 years old.

ALL PUBLIC LIGHTING IN SEQ BY LAMP TYPE

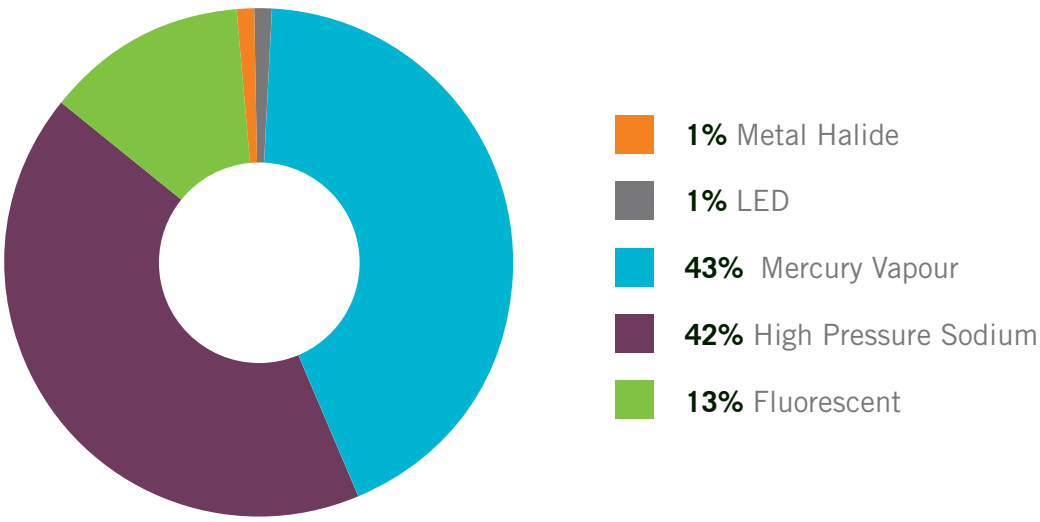


Figure 1. The current fleet is comprised of old lighting technology.

Data is poor and lacking and a significant audit would be required to understand the true age and condition of the existing fleet. By example, Sunshine Coast Regional Council undertook an audit which revealed more than 40% of the fleet having poor asset age information. Moreover, LGIS has gleaned from Sunshine Coast Regional Council's experience an understanding that because the existing assets are old the distribution network is hesitant to provide guarantees regarding the weight bearing capability of some existing infrastructure.

OUTCOME:

Local governments will find it difficult to invest in Smart Street Lighting in an efficient and effective manner where a clear understanding of asset condition and asset performance is absent. Without this data the true reasonable value of aged assets and the corresponding performance capabilities can not be accurately determined.

Barrier: Cost of Street Lighting

In South East Queensland, transition to Smart Street Lighting or Smart LEDs is hindered by the residual value of the Street Lighting assets owned by the distribution network. This is best demonstrated by the chart below. The chart below shows that all Street Lights, whether Major (large) or Minor (smaller), have a similar O&M charge.

However, those lights owned and paid for by the network distributor have a significant additional charge which comprised of the pay down of the initial capital cost and its associated costs of capital.

LIGHTS OWNED & FUNDED BY DISTRIBUTION NETWORK

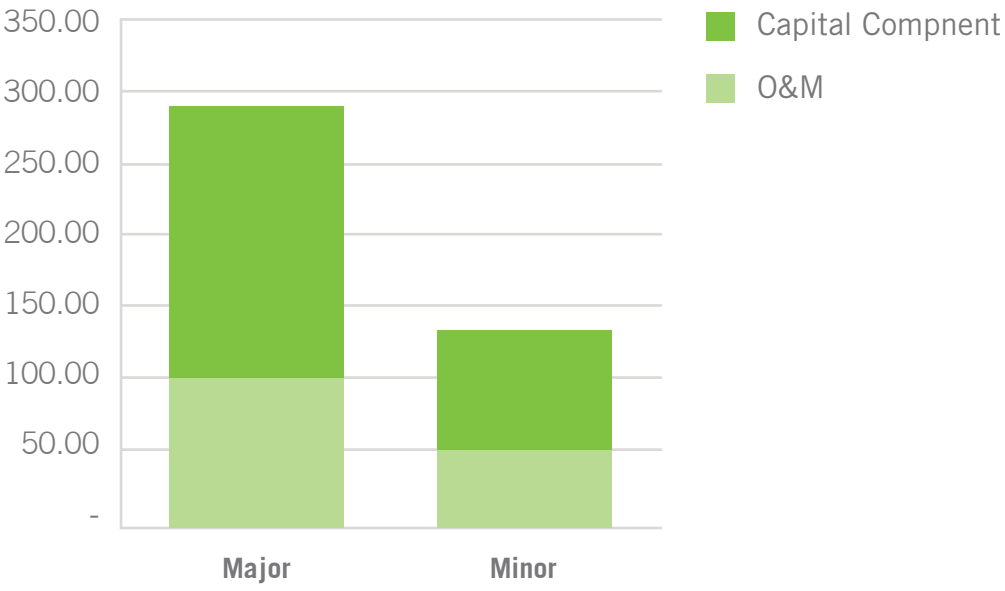


Figure 2. Annualised Services Charges $ per lamp

The reason that this cost, nearly 60% of the services cost, is high is due to the regulatory approach to assigning costs of capital.

This regulatory approach provides the distribution network is entitled to earn a return on the lights that they funded, until they are fully depreciated. The returns set by the regulator, distorts the true value of the aged fleet. This is in addition to costs of physical removal, disposal and replacement cost when upgrading the Street Lighting solution

OUTCOME:

Additional capital costs translate into additional residual values when attempting to replace old, obsolete Street Lighting infrastructure with new infrastructure, including Smart Street Lighting

Barrier: Asset management savings realisation

Implementing Smart Street Lighting is a costly investment. However, global case studies show that it is an investment that reaps a range of benefits, most notably energy and asset management savings which should translate into cost savings.

The replacement of Smart LEDs is the first step and whilst energy costs make up a small component (around 15%) of a typical Street Lighting bill they are realised with the replacement of the light.

By example, where a typical council replaces its older lighting technology with Smart LEDs an energy cost savings of up to 50% of energy savings is achieved. This will translate to around a 7% saving on the council's Street Lighting bill.

STREET LIGHTING COST BREAKDOWN

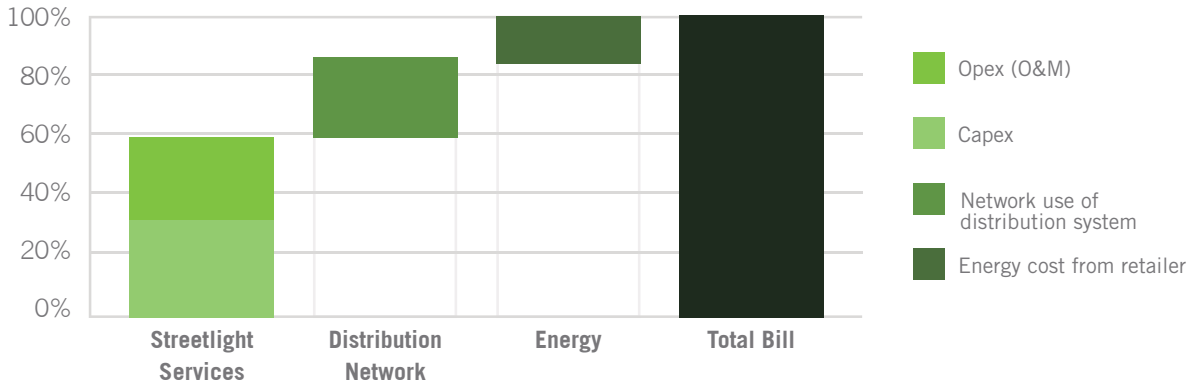


Figure 3. Breakdown of Street Lighting costs.

The other potential savings are on asset management derived from less servicing requirements of the Smart LED and the data provided by the Smart controls to reduce and improve maintenance.

Streetlight services comprise approximately 58% of the overall bill. Removing the significant capital cost revcovery and associated costs of capital (which comprise around 26% of a the bill) leaves 32% of the bill related to asset management (O&M).

A 50% reduction of asset management costs means local governments would receive around 10% savings on their Street Lighting bill. However, to realise this asset management saving requires large changes in practice of the distribution network, its sub-contractors and related process of the regulator.

This saving reflects the view that a change in management and operations towards a high-standard data-driven of asset management approach which is more accountable and efficient.

OUTCOME:

Whilst Smart Street Lighting provides significant potential savings in asset management, it is unlikely to be realised given the distribution network's current asset management approach. Moreover, it requires significant support and guidance from the regulator which has not improved asset management conditions for Street Lighting upon the distribution network to date.

Barrier: Potentialy costly attachment of smart devices to Street Lighting poles

The advantage of using Street Lighting as a platform for Smart Communities devices is clear. The Street Lights are up high, have a power source, and are located on secure platforms. Further, Smart Street Lighting provides the underpinning Smart Communities infrastructure, including communications solutions, data management and improved asset management approaches all which can support the management of smart devices.

Street Lighting poles comprise two types, those which are located on a distribution network pole (usually timber) or on a steel standalone pole. Of the distribution network owned lights approximately 55% are attached to the overhead distribution network poles, while the remaining 45% are on standalone poles.

PUBLIC LIGHTING POLE TYPES (OWNED BY THE NETWORK IN SEQ)

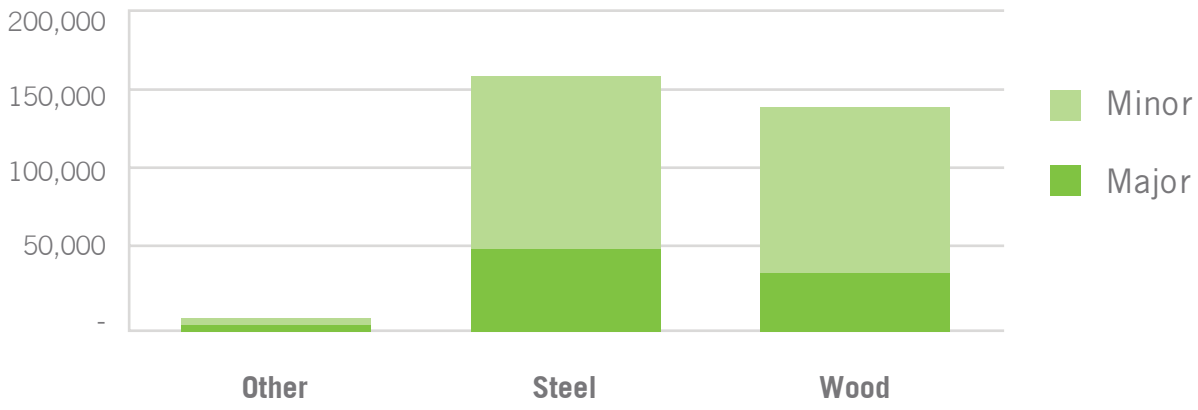


Figure 4. This graph shows the split over timber poles and steel poles.

Under the current management model, local governments would need to rent 'space' on poles to fully realise the opportunities provided by Smart Street Lighting. Renting 'space' on these assets may be costly.

It may be is costly because the regulator considers income from the rent of 'space' is unregulated income. This puts the distribution network in a distinct and unique position of being monopolistic-like, with a value proposition unavailable to the rest of the market. Negotiated contracts between the distribution network and the customer have no transparency and do not experience external market tension.

While the exact charges are unknown, it is known that charges can vary according to the capability of the customer to negotiate with the distribution network and the perceived commercial value of the equipment attached.

OUTCOME:

Renting 'space' on the pole provides an advantage to rolling out other Smart Communities devices but also other infrastructure which is core to providing Smart Street Lighting. There are strategies to circumvent this 'space' renting approach however they are also potentially costly and may not provide best value.

Barrier: Unrealised savings through distribution network management

LGIS has undertaken some preliminary high-level modelling to indicate the whole of life cost savings derived from bulk replacement of the existing lights with Smart LEDs.

This was undertaken against three scenarios: business as usual, bulk Smart LED replacement with the distribution network, and bulk Smart LED replacement through the transfer of asset ownership to a local government owned entity.

This analysis was undertaken to inform full business case modelling. From this prelimenary modelling LGIS has determined that there is enough material evidence to support a detailed business case investigation.

The below indicative modelling output shows that against the 'business as usual' scenario there are no savings on the whole of life costs of investing in Smart LEDs with the distribution network. This can marginally improve should sensitivities improve such as more efficient lighting performance or better purchase pricing.

Most importantly, a bulk Smart LED replacement project may have significant returns if it is undertaken through a local government entity. LGIS believes the reason for such a variance between these two figures largely points to the performance of capital within the regulatory environment that the distribution network operates within.

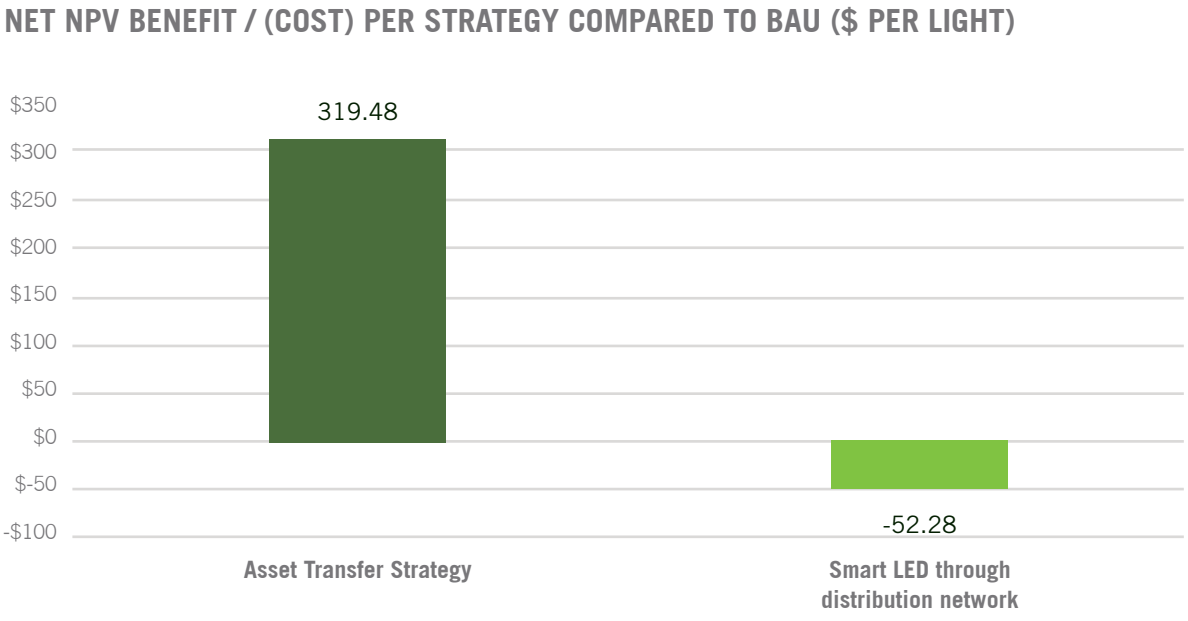


Figure 5. This Net Present Value analysis over 20 years of the impact of a Smart LED bulk replacement. (Asset transfer option assumes local government payout of the SLAB.)

Whilst there are a number of variables and sensitivities that need further exploration, there is enough prima facie evidence to suggest that there would be a cost benefit if the Street Lighting assets were transferred out of the distribution network's management and into a local government owned entity.

OUTCOME:

The poor performance of capital within the distribution network means that investment in more efficient technology, which should drive whole of life cost savings, is corroded. Full business case modelling is required to investigate fully.

Barrier: Low incentive for change by the distribution network

The regulator determines if the distribution network's expenditure on Street Lighting is prudent and efficient. Without open market competition to determine efficiency, the local government customer is unable to determine the reasonableness of price and lighting outcomes. Accordingly, they are unable to build an effective argument for adoption of new technologies, such as Smart Street Lighting.

Local governments wishing to introduce new Street Lighting technologies, are often prevented from making effective business cases because of the residual value of existing light technology in the distribution networks regulated asset base.

OUTCOME:

Without transparency of the systems and processes that the distribution network operates under, particularly in relation to asset management and long-term strategy, local governments are unable to make informed decisions towards change on the monopoly asset that is Street Lighting.

Barrier: Lack of metering solution softens returns of Smart Street Lighting

Street Lighting is connected to the distribution network as an unmetered supply, which means that the energy consumed by Street Lighting is not physical metered with no records of actual usage, costs are based upon a calculation of estimated consumption.

The calculation used to determine electricity consumption is based on estimated hours of operation using a calendar which predicts night-time hours and the approximate usage of a light based upon its size. This approach has does not accurately measure Smart Street Lighting solutions and their use of electricity. In essence, it dilutes some of the potential value of the efficiencies provided.

By example, where local governments may wish to adopt lower lighting levels early in the morning, the savings would not be realised under the current regulatory arrangements. Moreover, the value data which can indicate which lights are either not working or utilising less energy through a fault or improved performance would not be reflected in the metering.

OUTCOME:

Smart Street Lights provides full transparency through real-time energy use data and much more. Without an appropriate regulatory approach this data is less effective and savings derived from this data and the flexibility of the platform is not fully realised.

KEY THEMES

Key Points

- Precincts are the best way to view Smart Communities as they provide a focus for Smart Infrastructure and IOT technology solutions to align with community needs.
- Partnerships, between local governments, distribution networks, or technology providers, are the best way to deliver successful, efficient and low risk Smart Communities and Smart Street Lighting outcomes

SMART COMMUNITIES = SMART PRECINCTS = SMART INFRASTRUCTURE

Making the transition from city to smart city is a slow and disorganized affair, more often than not. Much of the time, the process begins with one or two 'smart' deployments – a 'connected' traffic light here, a smart parking scheme there. They're helpful in isolation, but not part of any overarching strategy.

Torri Martin - Chief Smart City Officer
City of Atlanta

This feasibility has come to the conclusion that the Smart Communities agenda should be viewed through individual precincts. The research indicates that this is the level at which people can connect within an area, and assets can be assigned based on the functions of the precinct and its community.

LGIS sees that the precinct is a perfect place to tie the activities of a community and link these with the essential infrastructure required to support these activities. Moreover, developers and planners view precincts as an ideal envelope for planning purposes, and can have a better chance of overcoming the barriers previously identified, particularly when considering highly complex areas such as CBDs, Airports, Parklands, retail areas, or mixed use locations like SouthBank.

STREET LIGHTING AND PRECINCTS

Lighting is one of the 15 priority technology solutions to be incorporated into the new Maroochydore city centre development. The aim is to fit out the priority development area with Smart Lighting incorporating LED and sensor technology, providing the opportunity to manage lights through sensors and switches that minimise energy consumption without compromising public safety.

Sunshine Cost Regional Council - Submission to regulator 2015

Street lighting is a key platform that enables the project economics to provide Smart Communities services to residents and businesses. The introduction of Smart Communities technology could add value for residents by providing new services based around street lighting, for example traffic flow monitoring, weather monitoring, CCTV, parking sensors and WiFi to support other infrastructure and services.

It is understood that Street Light solutions currently in place across Queensland provides varying degrees of functionality in relation to light quality, operational life, maintenance requirements, and controllability.

There is a growing recognition that Street Lighting services provided by distribution networks are currently isolated from other city and precinct management systems, such as traffic, water, security and public information systems.

This creates additional management and maintenance costs and fails to realise other potential societal benefits above and beyond their application for Street Lighting, including personal safety, road safety, and aesthetic enhancement.

Moreover, there is an emerging interest in the usefulness of other smart applications including

- smart parking
- smart water metering,
- smart electricity metering,
- CCTV,
- Public Wi-Fi,
- weather monitoring
- environmental monitoring
- emergency management
- smart waste management
- smart irrigation

All of which can be integrated with the communications infrastructure first developed for a Smart Street Lighting system.

Smart Lighting is the most logical asset to build out Smart City Infrastructure with power, backbone and connectivity every 25 metres in a City

Cisco, October 2016

PARTNERSHIPS

Global evidence demonstrates that with Smart Infrastructure partnerships are a key way to maximise high-quality outcomes, reduce risks of technology selection, and avoid capital destruction from poor investment.

Global case studies indicate that a variety of partnership elements are required to bring positive Smart Street Lighting outcomes. These mostly centre around the key risks of an upgrade project and include:

MANAGEMENT

Globally, many local governments either own or take on management of Street Lighting infrastructure from the distribution network to drive positive outcomes, however, in some instances the project is undertaken in partnership with the distribution network and deliver successful outcomes. The willingness of local governments and distribution networks to engage regardless of ownership based upon mutual benefits, which may include:

- local governments receiving improved lighting performance and efficiency, access to different options, and platforms for greater Smart Communities infrastructure integration
- the distribution network receiving increased revenues and the ability to enter into the Smart Infrastructure market.

LOCAL GOVERNMENTS

Local governments in Queensland are familiar with partnering for purchasing arrangements or services arrangements such as telecommunications supply or water management and retailing. Globally, success stories in Smart Street Lighting also indicate that when local governments work together they are able to drive better outcomes and reduce risks, particularly ones which involve investment in technology. Some global examples of where local governments have developed partnerships in Smart Street Lighting indicate that the improved scale supports a best price outcome, and also provides potential for wider options in technology.

FINANCE

Many of the key global examples of Smart Street Lighting have a funding component for investment in the technology. The combination of key local governments working together alongside a funding partner is also a significant insofar as a number of commercial packages can be structured to drive outcomes for local governments, some of these packages include:

- Design, upgrade and transfer – an approach whereby a 'fit for purpose' design for street lighting is undertaken, lighting is then upgraded to fit this design, and the asset transferred back to the local government.
- Energy Performance Contract – involves a contractor to design, install lighting and lock in long-term savings investment in an improved performance of lighting and efficiency, the savings are utilised to pay for the contractor and often to provide a payback and return on investment.
- Concession Agreement – similar to an energy performance contract however on a larger scale and suited to multiple local governments working in unison over longer terms such 20 years plus.

TECHNOLOGY

Utilising a single technological solution provides demonstrable savings in both upfront capital cost but also ongoing maintenance costs. However, there is also an aspect to the risk in investing in relatively new technology without some options to grow that investment.

'Open' Smart platforms, whereby devices from multiple providers can utilise the same communications approach and infrastructure, provide a basis for growth in investment and a basis for more integration.

PARTNERSHIP EXAMPLE

Ontario, Canada

More than 100 municipalities work together to run an LED light upgrade program which included Smart proofing by including Smart controls with the light. This project was facilitated by a central Local Area Service (LAS), which supports municipalities in joint programs. LAS partnered with companies to provide finance and lighting infrastructure.

The key partners:

100 MUNICIPALITIES
key advocate and demand driver

LOCAL AREA SERVICE
project coordinator

INFRASTRUCTURE ONTARIO
finance

REAL TERM ENERGY
LED lighting and smart controls provider

CREE
LED lighting and smart controls provider.

64%	Reduction annual electricity consumption (kWh)
59%	Reduction annual electricity costs
80%	Reduction annual maintenance costs (5yr average)
64%	Reduction total street lights expenditures
64%	Reduction average annual cost per fixture

CLOSING SUMMARY

Smart Street Lighting is a globally recognised innovation has demonstrable savings. The key findings and details outlined in this feasibility report indicate that the strategic ambitions of the region, and indeed the state, towards a more innovative government, business and community environment with the implementation of Smart Communities infrastructure, is not met by current practices.

This gap is an opportunity. It is an opportunity for collaboration amongst local governments, state government, and industry to drive innovation and empower community outcomes. Moreover, there is an opportunity to learn from global case studies to forge a best practice leading approach to Smart Communities infrastructure delivery.

At present, there are a number of management and regulatory barriers that hinders investment into Smart Street Lighting. Whilst there have been a number of trials across Australia there has not been a full transition to Smart Street Lighting. Sunshine Coast Regional Council has taken steps to take over management from Energex to realise their ambitions for Smart Street Lighting and an innovative community. The current barriers can readily be addressed and overcome.

Smart Street Lighting can be an enabling platform for wider Smart Communities infrastructure deployment. The entity that managers and operates the Smart Street Lighting infrastructure is in a strategically advantageous position as the most likely entity to develop, market and operate a range of Smart Communities infrastructure services beyond Smart Street Lighting. The feasibility indicates the potential benefits, and risks, for investment into Smart Street Lighting. However, what it merely touches upon is the wider opportunity for such a Smart Communities infrastructure business.

There is another component to Smart Street Lighting playing a role in driving innovation for the state. Countries such as Estonia and Israel, which have dramatically embraced innovation, have done so through a number of smaller companies playing a key part in solving problems which face their communities.

Partnership between various tiers of government and supported by private sector innovation can drive improved outcomes for the economy and community.

Implemented correctly, Smart Street Lighting will be a significant transition away from business as usual in the region's innovation economy. And a step towards another global technology base being established in South East Queensland.

ACKNOWLEDGEMENTS

LGIS wishes to acknowledge the support of this report from the following organisations

- LGAQ
- Council of Mayors South East Queensland
- Industry Development Fund
- Institute of Public Works Engineers Association (IPWEA)
- The Local governments of South East Queensland Council Officers
- Data61 a CSIRO organisation
- Telstra
- Energex
- Ergon
- University of Queensland
- Griffith University
- QUT
- Open Data Institute
- Australian Local Government Association
- Queensland Department of Transport and Main Roads
- Qld Government – State Development and QGCIO and DSITI
- Auckland Transport / City Council
- City of Amsterdam
- San Jose, California
- Local Government Association Ontario Canada
- City of Paris
- City of Copenhagen
- National Measurement Institute
- Various Industry bodies – Lighting; Adverting; Smart Communities and Communities

And LGIS wishes to thank all of the respondents to the Request for Information providing invaluable Smart Street Lighting information for local governments in Queensland.