Transitioning to Safe and Sustainable Public Lighting

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A collaborative project between the following partners:

Prepared for
Marion City Council

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About Ironbark Sustainability

Ironbark Sustainability is a specialist local government consultancy that works with councils around Australia by assisting them to reduce energy and water usage through sustainable asset and data management and on-the-ground implementation.

Ironbark has been operating since 2005 and brings together decades of technical and financial analysis, maintenance and implementation experience in the areas of energy & water auditing, and public lighting technologies and management.

Ironbark provides public lighting support nationally including technology advice, technology approvals, business cases and project management. Ironbark delivers strategic and specific advice and support for the establishment of effective environmental management systems for government and business clients. We pride ourselves on supporting our clients to manage their operations more sustainably.

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Glossary

Term	Definition
AER	Australian Energy Regulator. Responsible for regulating pricing for electricity in the National Electricity Market (exc. WA and NT), including street lighting
CEEP	Community Energy Efficiency Program
CEFC	Clean Energy Finance Corporation (previously Low Carbon Australia)
CFL	Compact Fluorescent lamp
CCTV	Close Circuit Television
COAG	Council Of Australian Governments
Colour temperature	The measurement of light colour expressed in Kelvin (°K). The lower the Kelvin rating the "warmer" or more yellow the light is. The higher the Kelvin rating the "cooler" or more blue the light is.
CRI	Colour Rendering Index
DOI	Department of Industry (the former Department of Climate Change and Energy Efficiency or DCCEE, and then the Department of Resources, Energy and Tourism or DRET)
DNSP	Distribution Network Service Provider, also known as Energy Distribution Business (EDB) also known as distributors.
EE	Endeavour Energy (NSW DNSP)
ERF	Emissions Reduction Fund
Lamp	The light bulb in a luminaire
LED	Light emitting diode
Luminaire	The lamp, fitting and control gear of the light
MAV	Municipal Association of Victoria
MV	Mercury Vapour lamp
SA	South Australia
SAPN	SA Power Networks
Street Lighting	Street lighting found in residential streets and main roads
TN	TasNetworks (Tasmanian DNSP)
T5	Efficient lineal fluorescent lamp
UV	Ultraviolet (light)
WDV	Written Down Value

Table 1: Glossary

1 Executive Summary

Throughout Australia and the world street lighting upgrades are being delivered. From Brisbane to Hobart, through outer Sydney, large parts of Victoria and parts of WA, lights have been changed. And councils are reaping the financial and environmental rewards.

The size and impact of these projects cannot be underestimated. Nearly 80 Australian councils are in the process of completing (or have already completed) their single greatest energy reduction project ever, as well as their single greatest greenhouse gas reduction project ever.

However, for many councils this has been challenging, and in many areas **too** difficult to deliver. In South Australia only very low numbers of public lights have been changed to safer and more energy efficient alternatives.

In SA, councils have said the main barriers to delivering an improved street lighting system are:

1. Financial **cost** (capital and operating)
2. **Expertise** and time to deal with the complexity of street lighting
3. Delays and frustrations in working with **external stakeholders (especially SAPN)**

Within this report an analysis of a preliminary business case to replace all street lights in SA to more energy efficient and safer lights demonstrated that the range of potential savings can vary significantly.

This range of savings could be tightly narrowed by clarifying (and reducing) the value of the old assets that are proposed to be replaced (the Written Down Value) and the long term LED maintenance costs.

The business case is not the only issue to be considered. Public lighting provides an important community benefit. Replacing public lighting to more cost effective options should be balanced by the benefits derived from safe and sustainable lighting.

"Safe" lighting can be considered lighting which:

- Maintains a consistent level of light throughout a space
- Allows objects (both moving and stationary) to be easily identified by the human eye
- Maintains light output over time
- Reduces environmental impacts from the materials
- Minimises glare
- Is reliable
- Is perceived to be safe

"Sustainable" lighting is lighting which:

- Maximises energy efficiency
- Minimises or avoids the use of harmful substances in construction

- Minimises operating and maintenance costs
- Reduces unwanted light spill
- Improves the amenity of public spaces
- Is locally designed, assembled and/or manufactured

The design of a large scale replacement program will need to ensure these considerations are included in the design and choice of lighting technology.

1.1 Key recommendations

In order to ensure South Australian councils are the next success story in the wave of public lighting replacements, the key recommendations from this report are as follows:

1) Negotiate with SAPN to achieve (under the CLER and SLUoS tariff structures)[1]:
   a) Transparent and reasonable capital costs (including negotiating on written down values and early retirement fees for the current assets)
   b) Transparent maintenance tariffs
   c) Improved service and communications to councils
2) If 1) above is not successful within a set timeframe then investigate options for:
   a) Releasing an EOI to third party providers to understand the options for state-wide change, including where the third party maintains the assets (that are owned by councils) and where the third party funds the large replacement program and maintains these assets over the contract period (to be defined).

In parallel with these activities:

- Establish a support program for all councils in SA to progress a bulk replacement program. This would include bulk procurement (if relevant) and would typically include the following supported steps (as used in the Victorian and Western Sydney projects outlined in Section 6.1.2)
  1. Prepare business case (either at a regional or individual council basis[2])
  2. Funding and/or financing (if relevant)
  3. Define council's requirements for the project (including developing a design for the program that ensures adequate levels of safety are being maintained or improved)
  4. Procure the bulk change
  5. Project Management and Finalisation
- Investigate options to introduce external funding to the program. This can include through SAPN, a third party provider or financier or through federal or state grants.

[1] As the majority of street lighting assets are currently owned by SAPN the simplest approach is to progress *Scenarios 1 and 2* initially.

[2] This would be based upon the readiness of the council or region to consider a project. Typically this varies and a flexible approach (the option of regional or individual) is preferred.

2 Introduction

Throughout Australia there is somewhat of an energy efficiency revolution occurring with local governments installing energy efficient street lighting such as LEDs to replace old inefficient and expensive technology.

Lights are being changed over in their hundreds of thousands and it has only been in the last few years that these projects have exploded into the mainstream. Given that street lighting is the single largest source of greenhouse gas emissions from local government, more councils from all around the country are looking to use proven and successful models that deliver real action on the ground.

As well as a great opportunity there are a great many barriers to local governments implementing these projects in areas where they have not yet been delivered.

The City of Marion (in partnership with 8 other SA councils and the LGA (SA)) appointed Ironbark Sustainability to complete a report and consultation process. The aim is:

"to identify critical pathways to transition to safe and sustainable public lighting in South Australia; to identify the current risks, impediments and solutions to transition to safe and sustainable public lighting within South Australia; and to develop a preliminary business case based on whole-of-life considerations."

This report is the summary of the outcomes from this process.

2.1 This report

This report is structured in the following manner

- *(Section 3)* What councils think
- *(Section 4)* Current public lighting practices in SA
  - lighting types and numbers
  - current management structures; and
  - current negotiations between councils and SAPN
- *(Section 5)* What is "Safe and Sustainable" lighting?
- *(Section 6)* Delivering Safe and Sustainable Lighting (including case studies)
- *(Section 7)* Scenarios for SA councils to transition (to more safe and sustainable lighting)

At the end of these sections a summary and conclusions is provided with some key recommendations.

3 What councils think

In 2010-2011, Ironbark Sustainability developed the Federal Government's *National Strategy on Energy Efficiency on Street Lighting*. As a part of this process, Ironbark collated information on barriers to improving street lighting energy efficiency in Australia.

The main barriers that were identified included:

1. Financial **cost** (most commonly capital cost)
2. **Expertise** and time to deal with the complexity of street lighting
3. Delays around lighting approvals and working with **external stakeholders**

The strong response (over 200 respondent organisations) to the survey is consistent with the complex nature of sustainable street lighting. It also reflected the situation at a time when there had been a lack of widespread action despite significant attempts by local government throughout Australia over the previous decade.

Street lighting has a complex management structure involving large distribution companies, state and national regulators, manufacturers and councils.

There are imbalances of expertise and power within these structures that make it difficult for some councils to get the outcomes they desire.

To put it simply, distribution businesses own most of the lights and councils pay for most of the electricity and maintenance costs. Councils had sought to have more energy efficient lights to reduce energy bills and greenhouse gas emissions, but this is not a priority for the distributors. There are issues around split-incentives. Projects involve large capital costs; street lighting bulk changeovers are expensive; it is not uncommon for a changeover to cost several million dollars.

Nevertheless, given that energy efficient alternative street lights can use up to 77% less energy than current inefficient technology, many councils around Australia have found that there is a clear return on the capital investment, and that after the initial capital outlay, energy and maintenance savings mean that projects can become cash flow positive within as little as four years. In South Australia, this is still to be clarified and the various possibilities are outlined in Section 6 of this report.

3.1 Drivers for South Australian councils

Ironbark has undertaken a range of processes to understand the desires and requirements of councils involved in the *Transitioning to Safe and Sustainable Street Lighting* program. These approaches have included:

1. An initial survey with all stakeholders
2. A workshop with all council stakeholders including the explicit question, "what would be an awesome outcome from this program"
3. Phone conferences with 6 of the 9 councils (the other 3 were unavailable)
4. Individual discussions and follow-ups with relevant staff at councils

Before outlining the responses to these approaches it is worth noting that the original brief for this work clearly stated some common goals, perhaps the most important being:

(to) identify critical pathways to transition to safe and sustainable public lighting in South Australia

Within the survey, workshops and conference a range of questions were posed; the key questions were:

1. *What are the main drivers for your council to be involved in this project?*
2. *What would be an ideal outcome of this project for your council?*
3. *What are the biggest challenges that you and your council encounter around public lighting?*

The remainder of this section provides a summary of the outcomes of these questions and (in Section 3.2) examines whether these are common nationally.

3.1.1 What are the main drivers for your council to be involved in this project?

Councils were consistent in their responses to this question. They wanted:

- To achieve cost savings, (by reducing future rises and current costs)
- To save energy and greenhouse emissions
- To improve public value (safety, reduce risk etc.)
- To share knowledge with other councils
- To work more effectively with SAPN

However, from the workshops and phone meetings the most common response was that councils wanted "*to know what we are paying for*".

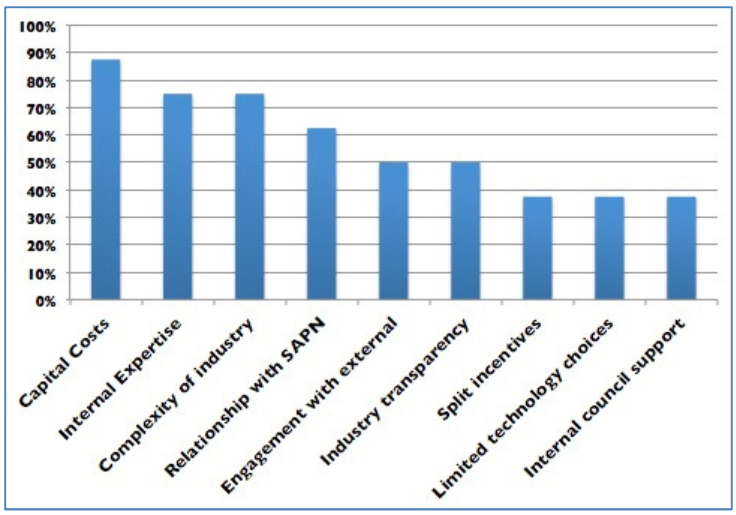
3.1.2 What would be an ideal outcome of this project for your council?

As well as similar responses to those in question 1, the following common outcomes were identified:

- Want information to take to the council and "*make it (safer more sustainable street lighting) happen*".
- "*We have no money and want to have next to nothing rate increases*" (and "*do the project*")
- Have a good methodology and approach for council to take forward
- A clear program to replace all lighting with LEDs
- Clear business case with options around preferred ownership model to transition to safe and sustainable street lighting
- Improved relationship of all councils with SAPN
- All councils considering all public lighting issues in decision making, not just energy savings.
- Efficient response to upgrade/extension requests

In the survey the councils were asked "What are the biggest challenges that you and your council encounter around public lighting?" *Figure 1: Biggest Challenges for councils around public lighting* summarises the responses to this question and shows that 'capital costs', ' internal expertise' and 'complexity of industry' are the three biggest challenges for councils wanting to deliver more sustainable street lighting for their communities.

Figure 1: Biggest Challenges for councils around public lighting



3.1.3 How would you describe your relationship (or your council's relationship) with SAPN?

SAPN are an important player in regard to safe and sustainable street lighting. They own many of the public lighting assets, provide services, and are, in effect, the default/monopoly provider in most areas of public lighting services for unmetered lighting. Councils responses to this question (and in the many conversations we have had with them) combine frustration (largely around transparency of costs/service and communications) and a view (or hope) that relationships with SAPN will improve. Here are the specific responses that were most common:

- (we) Expect response times of 12 months
- Lack of response. Lack of transparency.
- SAPN provide a reasonable service but there could be improvements.
- Historically I don't think that this has been great, but this may be improving!
- They ignored my requests
- A level of conflict/scepticism
- Sometimes fraught
- It appears SAPN are trying to improve communication and stakeholder management

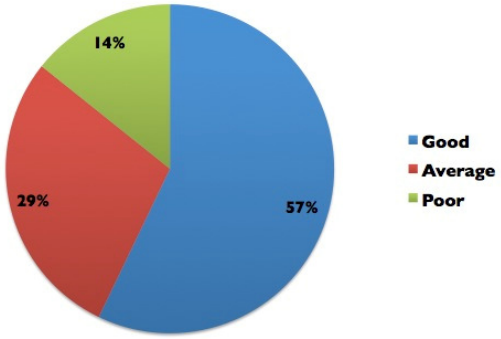


Figure 2: Council relationship with SAPN

Interestingly despite this frustration councils viewed their relationship with SAPN as good (57%) and only 14% saw the relationship as poor, as illustrated in *Figure 2: Council relationship with SAPN*.

3.2 Are these views common nationally?

Councils have clearly reflected many common challenges and opportunities in public lighting around the country.

In 2010-2011, Ironbark Sustainability developed the Federal Government's *National Strategy on Energy Efficiency in Street Lighting*. As a part of this process, Ironbark collated information on barriers to improving street lighting energy efficiency in Australia and the main barriers that were identified included:

1. Financial **cost** (most commonly capital cost)
2. **Expertise** and time to deal with the complexity of street lighting
3. Delays around lighting approvals and working with **external stakeholders (especially DNSPs)**

On 25th September 2014, Ironbark held a webinar titled *How to Change Your Street Lights: The Barriers Have Been Overcome,* with 60 attendees from councils throughout Australia. The webinar included presentations from panelists who have successfully delivered projects, and examined the common threads across projects[3]. Ironbark surveyed all attendees before the webinar and asked, "what is the biggest barrier to implementing energy efficient street lighting for your council?" The results were entirely consistent with the 2010-2011 *Strategy* and the 2014 results are illustrated in the graph on the right.

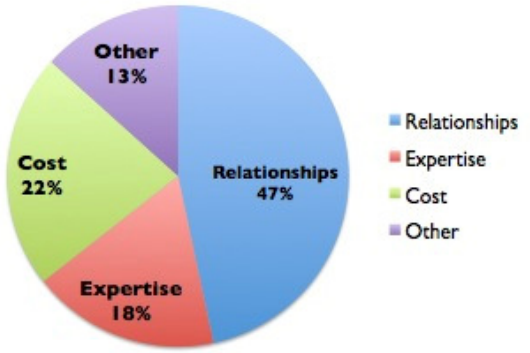


Figure 3: Street lighting barriers (Sep. '14)

Finally, in May 2015 the Eastern Alliance for Greenhouse Action (EAGA) released a short report summarising the findings of a retrospective benchmarking and evaluation study of street light bulk change projects that have been successfully completed by Victorian councils. Again, the results from the EAGA benchmarking report were clear about the common barriers – relationships, expertise and capital costs[4].

South Australian councils are experiencing and have communicated very similar issues to councils in other states.

3.3 What is SAPNs view

The view from SAPN is interesting. In candid discussions they have indicated:

- They have been burnt by prior interactions (with some councils). SAPN have been "*treated as the punching bag*" (sometimes for good reason and other times because vested interests have painted a (too) rosy picture of the alternatives)
- Wants to look forward to a more productive and collaborative relationship (they are "*in listening and developing mode*")

[3] Panelists included Heidi Hamm from South Gippsland Shire Council who discussed their regional street lighting project, which was completed in June 2014 and Marc Cassanet from Wyndham City Council who talked about their LED rollout as a part of the Lighting the West partnership. Wyndham is one of the largest (and fastest-growing) councils in Australia and the installation of over 12,000 lights has begun.

[4] Report can be downloaded from http://eaga.com.au/projects/street-light-benchmarking-evaluation-study/

- Aiming to provide an LED solution that works for all councils
- Would prefer to work collectively with councils, but willing to work one on one

To date, no large scale replacement projects (greater than 5,000 units) have been completed in South Australia. SAPN has been assessing new lighting types and has indicated publicly their interest in sustainability on their website: *"Overtime SA Power Networks aims to provide more sustainable lighting choices for councils and DPTI to meet a target of a 30% reduction in greenhouse emissions from street lighting by 2020."*[5]

3.4 Conclusions

Councils have said the main barriers to delivering an improved street lighting system are:

1. Financial **cost** (capital and operating)
2. **Expertise** and time to deal with the complexity of street lighting
3. Delays and frustrations in working with **external stakeholders (especially SAPN)**

However, overall their relationship with SAPN is good and many see SAPN are trying to improve. A comment provided by a council asset manager which resonated with many representatives was:

> *"If SAPN can offer (1) the service councils want in a timely fashion, at (2) a transparent cost that is reasonable then councils will probably stay with them."*

The logical conclusion to the above statement is that if they cannot achieve this then councils will not want to remain under the current management structure.

[5] SAPN website December 2013

4 Current public lighting practices in SA

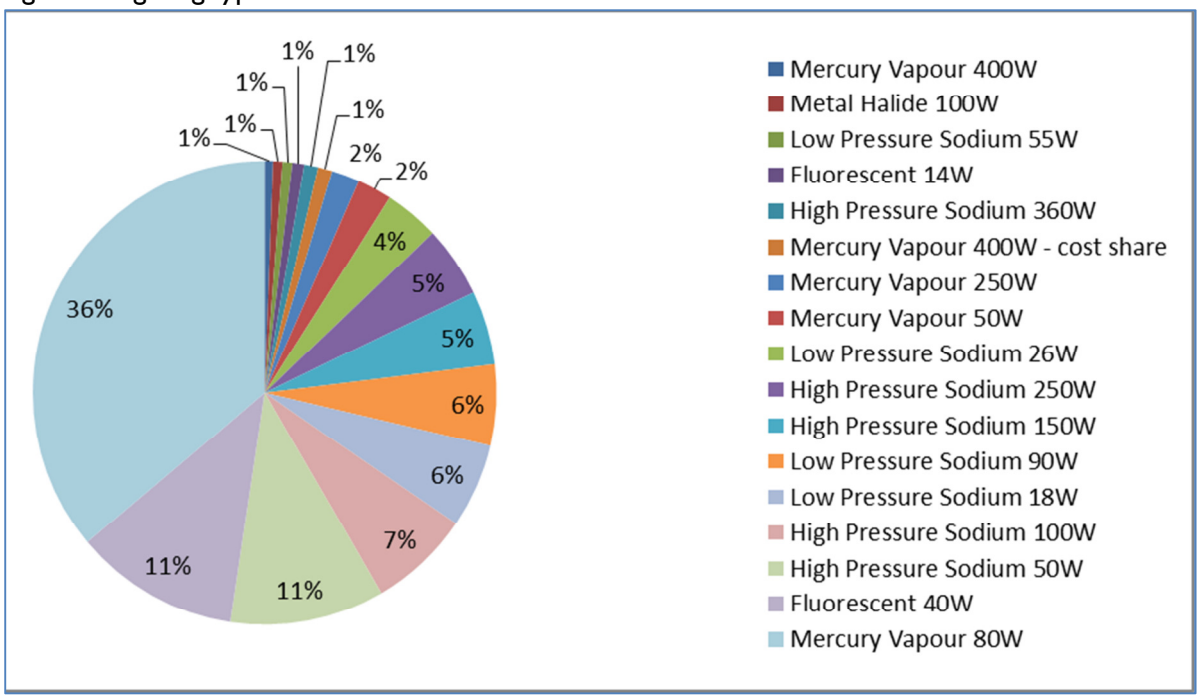
This section describes how public lighting is managed. It is structured in the following manner:

- Lighting in SA
- The structure of public lighting SA
- Negotiations between councils and SAPN

4.1 Lighting in SA

In 2013 Ironbark collated the number of unmetered public lights (managed by SAPN) in SA for the LGA. Figure 4 below provides a summary of these lights[6]. There are around 230,000 street lights in SA. Around 36% of all lights are 80W MV's, 11% are 50W Sodium and a further 11% 40W Fluorescents and the remainder a wide variety of other lighting types.

Figure 4: Lighting types above 1% of volumes in SA



In this previous work summary of the opportunity to replace light with various options (T5, CFL or LED) was outlined. If the LED light was used to replace the lights listed in the table then almost 620,000 tonnes of greenhouse gases and 42 million kWh of electricity would be saved. Data like this is useful – however, technology has been moving rapidly so savings are bow expected to be larger and only LEDs are the technologies being considered for future large scale sustainability programs.

In Section 7 (the Options Analysis) these numbers have been reviewed and revised for the councils involved in this project. Table 2 below summarises the total number of street lights for the councils involved in this research project with a breakdown of the number that are minor road lights (86%) compared to major road lights (14%).

[6] Based on data provided in February 2011 and an average annual increase from 2001-2011 used to extrapolate light numbers to 2015. Numbers are estimates only.

Table 2: Total lights numbers within 8 (of the 9) councils in this project by road lighting category

	Light numbers	% of total numbers
Sum of minor road lighting	70,205	86%
Sum of major road lighting	11,317	14%
Total Lights	**81,522**	

4.2 The structure of public lighting in SA

In SA there are three types of public lighting services currently provided by SAPN[7]:

- **Street Lighting Use of System services (SLUoS):** the provision of public lighting assets and the operation and maintenance of those assets where the DNSP retains ownership of the assets;
- **Customer Lighting Equipment Rate services (CLER):** the replacement of failed lamps in customer-owned street lights where the customer retains ownership of the assets and is responsible for all other maintenance; and
- **Energy Only services (EO):** the maintenance of a database relating to street lights and recording and informing customers of streetlight faults reported to the DNSP, where customers retain ownership of the assets and are responsible for all maintenance (including replacement of failed lamps)

The majority of lights considered in this project[8] are SLUoS with 92% of all lights under this management arrangement. In contrast EO provides only 2% of total light numbers, with the remainder managed under the CLER tariff structure.

Table 3: Total lights numbers within 8 (of the 9) councils by tariff class

	Light numbers	% of total numbers
Total SLUoS	74,805	92%
Total EO	1,578	2%
Total LED	81	0%
Total CLER	5,058	6%
Total Lights	**81,522**	

For these 8 councils the system has operating costs of around $9m p.a., of which 56% is for energy and 44% for maintenance (see **Table 4** below). Electricity is paid to an electricity retailer of which approximately 56% of costs are network costs (charged to the electricity retailer by SAPN). The maintenance costs include varying levels of service from SAPN, including the simple allowance for

[7] *Delivery of Public Lighting Services in South Australia*, September 2014, Wallmans
[8] Data has been included for Marion, Pt. Augusta, Pt. Pirie, Whyalla, Charles Sturt, Onkaparinga, Salisbury and Playford councils

local government to access the electricity network (then councils fund and maintain the street light assets themselves), under the Energy Only tariff, to a fully capital funded and maintained service, under SLUoS. These tariffs are paid to SAPN, with other charges associated with contracting other service providers additional to this under the EO tariff.

Table 4: Total public lighting cost and energy use for the councils involved in this project (2015)

Maintenance	Energy		
	kWh	$	tonnes Co2-e
$3,895,422	30,225,214	$4,953,198	21,762.2

4.3 Negotiations between councils and SAPN

This section provides comment on the success or otherwise of negotiations between councils and SAPN. In particular it discusses the following negotiations:

1. Between SAPN and the LGA for maintenance tariffs
2. Between SAPN and individual councils around maintenance tariffs for LED luminaires

4.3.1 LGA and SAPN Negotiation

The following summary has been informed by David Hitchcock (LGA) and cross referenced with relevant comment from the Australian Energy Regulator (AER) and SAPN.

SLUOS pricing in SA is a "Negotiated Distribution Services" under the National Electricity Rules (NER), which is regulated by the AER. Nationally this is unusual; in most other states this negotiation is optional (i.e. councils and the local DNSP can come to an agreement outside of the regulatory determinations[9] (by the AER)), but the parties usually defer to the regulatory process (technically street lighting is classified as an alternate control service in all other jurisdictions under the NER and the AER regulates the pricing of these services).

This regime provides councils and the Department of Planning, Transport and Infrastructure (DPTI), as public lighting customers, with opportunity to negotiate service levels and charges with SAPN.

History

In 1998 councils sought advice on a service level agreement with ETSA Utilities (now SAPN). The impetus for this was based on *"concerns about the current arrangements for public street lighting"*[10]. At that time "*The Public Lighting Steering Committee"* was formed and "*charged with reviewing issues and progressing options for Local Government".*

The current negotiation framework

The high level framework for negotiation for the work is fairly simple:

1. Negotiation
2. Arbitration

[9] For example see http://www.ironbarksustainability.com.au/newsletter-articles/councils-stunning-6-million-omr-savings-in-45-minutes/

[10] From "Background Paper – Service Level Agreement for Public Street Lighting", available on the LGASA website at http://lga.sa.gov.au/webdata/resources/project/Background_Paper_-_Service_Level_Agreement_for_Public_Street_Lighting.pdf

If these two steps do not result in an agreed outcome then mediation or other dispute resolution process can be mandated by the AER, but ultimately a determination will be made by the AER if the parties cannot resolve the terms of access.

This process is currently underway for the 2010 to 2015 period (and beyond) and has been underway since negotiated services were first introduced in 2010.

The current negotiation process

The objective of the negotiation process with SAPN is to establish regulatory compliant and cost reflective SLUOS charges for 2010-2015, together with a transparent process for establishing year-on-year SLUOS increases beyond 2015.

The Local Government Association (LGA) is negotiating, in partnership with the State Government (DPTI) and LGA consultants.

Following receipt of a public lighting costing proposal from SAPN, the LGA and DPTI submitted concerns with regulatory compliance in establishing depreciation methodology and determination of actual versus accrued costs to SAPN.

SAPN and the LGA (and DPTI) have a fundamental difference (dispute) in view of the process SAPN has undertaken in calculating and establishing public lighting costs as required pursuant to the Australian energy rules and regulations.

In 2012 attempted mediation between DPTI/LGA and SAPN did not proceed.

In December 2013The LGA and DPTI formally lodged an application for a determination on this matter from the AER. The AER recommended the parties enter a voluntary arbitration process which has been agreed by all parties.

Arbitration results in a binding outcome with limited avenues for review. The current process is a non-binding expert determination. Should this process fail to reach an outcome between the parties, ultimately the AER will determine the matter.

How does this compare to jurisdictions where successful large scale projects have occurred?

Section 6 Delivering Safe and Sustainable Lighting provides further detail on successful approaches to delivering a transition to safe and sustainable lighting. However, to provide some comment and context around the above negotiations it is useful to consider the approach in Victoria.

In Victoria there are several organisations pushing for similar outcomes to that described above. During the AER's 5 year price review period many council groups advocate to the AER to reduce costs. This regulated process keeps the process clear and unambiguous with the outcomes accepted. Where this has not been accepted (by councils) any challenges (including to the Australian Competition Tribunal) have largely been rejected. So "the umpires' decision" holds sway.

In SA this process can only be accessed after laborious (and currently unfruitful) negotiations and arbitration. In the current Victorian determination the AER has determined that all underground estates (around 40% of lighting) will now be "negotiated", this means that in future similar outcomes may occur there.

The movement to large scale lighting replacement programs has occurred independently of this process and has been built through collaborative work between councils, the state (to a lesser extent), individual DNSPs and the council representative body, the MAV. The approach from the start was to create a "win-win" and has involved all parties working to achieve a common outcome.

The role of the MAV was critical in introducing scale and to accelerate the roll out of the program. Their role was prompted by councils calling for their constructive involvement in street lighting. Their approach was to offer a service to deliver street lighting bulk replacement projects to councils which included the following support:

1. A panel of approved material (lights) suppliers that all councils could access. This had the effect of reducing some of the capital cost barriers to large scale projects
2. Procurement support for delivering the projects
3. Access to relevant expertise to assist councils navigate the process and negotiate with DNSPs[11]

It is clear that keeping the maintenance pricing negotiations (where conflict typically occurs) separate from the move to large scale replacements (where agreement commonly can be reached) should be implemented wherever possible[12].

4.3.2 Individual council and SAPN Negotiation

Without going into great detail, there are councils around the state that are working with SAPN to deliver safer and more sustainable street lighting. Most of these outcomes have been small in scale, but point to outcomes that could be "scaled up". Some examples are described below:

LED maintenance tariff

Some councils (e.g. City of Charles Sturt) have negotiated a maintenance tariff provided to them by SAPN for LED lighting. This means that in some cases, LED technology has been used in new estates. This is important because negotiating maintenance agreements with SAPN for new technologies in one of the items required in order to 'roll out' street lighting on large scale. It should

[11] The MAV engaged Ironbark Sustainability through a competitive process to fulfill this role. Please note a conflict of interest

[12] There is some cross over which cannot be avoided. Specifically negotiation of new maintenance tariffs (e.g. LEDs) and confirmation of the Written Down Values (i.e. the value of the old asset base that is being retired when a replacement occurs) are required to progress large scale replacements.

be noted that the actual inputs to the tariff and the service being delivered under it should be independently assessed prior to any large scale program.

LED lighting trials

SAPN, with the support of the City of West Torrens, have been delivering a controlled trial of shortlisted LED luminaires and trials of lighting control systems. The outcome of this trial were delivered to councils in February 2015 and from a technical perspective SAPN *"were impressed with the level of lighting"* provided by the luminaires. In addition *"it was evident that controllability was becoming more feasible"* and (our comment) presumably, could be considered in future large scale projects.

Before After

Figure 5: LED lighting trial (photo courtesy of SAPN)

5 What is "Safe and Sustainable" lighting?

Before discussing solutions, business cases and next steps it is important to discuss lighting, and what does *Safe and Sustainable Lighting* mean.

5.1 "Safe" lighting

"Safe" lighting can be considered lighting which:

- **Maintains a consistent level of light throughout a space.** Safe lighting provides light which is spread evenly onto roads and public spaces, and avoids patches of dark and light which are common with traditional lighting methods and technologies. Results from an LED changeover in Los Angeles show a measurable reduction in street crime and vandalism after LED street lighting was introduced[13].
- **Allows objects (both moving and stationary) to be easily identified by the human eye.** This property of lighting is measured via the Colour Rendering Index (CRI) and relates to the colour of the light emitted. Broadly speaking, a whiter or "cooler" light improves facial recognition and helps motorists and pedestrians react quicker, thereby reducing the chances of accidents. In contrast, a more yellow or "warmer" light reduces the ability to accurately perceive objects. This is also an important consideration where CCTV is deployed as a safety measure, again, to assist with facial recognition. This aspect of lighting is also linked to what is known as colour temperature (measured in degrees kelvin). Whiter or "cooler" lights are in the range 4000-6000°K (above 5000°K start to appear bluish), whereas more yellow or "warmer" lights are generally below 3000°K. There is also balance to be struck between energy efficiency (i.e. higher temperatures in the blue range (above 5000°K are more efficient) and the ability of drivers to see pedestrians (too blue or too yellow (below 3000°K) results in lighting where it is hard to see colour and contrast). International trends are towards a mid-range colour temperature of 4000°K (neutral white).

Figure 6: Hoover Street, Los Angeles, before (left) and after (right) LED deployment on main road. Better quality (white light) and distribution (little or no patches of light and dark) is clearly evident.

[13] *Towards More Sustainable Street Lighting Practice Note*, Institute of Public Works Engineering Australasia (IPWEA), July 2014

- **Maintain light output over time.** The light output of traditional street lights is typically maintained by a regime of visor cleans and lamp replacements throughout their service life. While the design of street lights factors in dirt build up on visors and reduction in light output of the primary light source over time, the light output from some technologies drops off very quickly, resulting in a big difference in light output at the start of its service life compared to the end of its service life. This behaviour results in significant differences in light output between lights at the beginning and end of their service life, and from light to light in a given street. Safer lighting maintains a more consistent light output over time, and minimises fluctuation in illumination from light to light, and street to street.
- **Reduces environmental impacts**. Some traditional light technologies are manufactured using harmful substances such as lead and mercury. These substances risk being introduced into the environment during a light's service life, and must be carefully disposed of when a light is retired. In addition, some lighting technologies emit ultraviolet (UV) light. Overexposure to UV light can accelerate the degradation of certain materials, and also have detrimental health impacts. Safe lighting therefore minimises the use of hazardous substances in construction, and does not emit UV light.

- **Minimises glare**. Safe lighting minimises glare, thereby increasing visual comfort for people with certain kinds of vision impairment. Reduced glare also assists security agencies using cameras for law enforcement (less glare is better for cameras that require clear contrast).
- **Is reliable.** A key feature of safe lighting is lighting that has low failure rates and requires minimal maintenance. This reduces the occurrence of black spots where lights have failed.

Along with the technical parameters outlined above, public perceptions of safety are also an important consideration, and are often directly linked to the lighting of public spaces. Even though improved lighting should not be viewed in isolation as the answer to all crime and accident-related issues, improved illumination can play a role in addressing public perceptions of a lack of security or safety.

5.2 "Sustainable" lighting

Sustainable lighting is lighting which:

- **Maximises energy efficiency.** Sustainable lighting maximises the light output per unit energy consumption. LEDs are increasingly the preferred choice in this regard. While at higher wattages high pressure sodium lights continue to be competitive, they are increasingly being superseded by LEDs.
- **Minimises or avoids the use of harmful substances in construction.** Many traditional light technologies use hazardous substances in their construction, which pose a risk to humans and the environment. Sustainable lighting minimizes the use of such substances. Common traditional light technologies like mercury vapour and sodium lights contain mercury and lead, whereas better options like LEDs do not.
- **Minimises operating and maintenance costs**. Through maximizing energy efficiency sustainable lighting reduces the on-going operational costs relating to power consumption.

Sustainable lighting also reduces on-going maintenance costs by, for example, increasing reliability (and therefore reducing the need for spot maintenance) and by-passing the need for routine component replacements throughout their service life (e.g. LEDs no longer require lamp replacements at regular intervals).

- **Reduces unwanted light spill.** Unwanted light spill into areas that do not need to be lit (e.g. private properties adjacent to road reserves) reduces the overall energy efficiency of a given lighting scheme. Modern lighting technologies such as LEDs have the unique capacity to deliver light exactly where it is required (i.e. onto the road reserve) and avoid spilling light where it is unwanted. This can reduce negative feedback from residents about public lighting schemes.

- **Improves the amenity of public spaces.** Sustainable public lighting improves the amenity of public spaces, thereby increasing the use of these spaces by members of the public. This is achieved by producing a better quality of light (i.e. improved colour rendering and colour temperature), a more uniform distribution of light, and reduced glare. With improved amenity, the use of public spaces increases, thereby increasing the safety of areas through natural surveillance ("eyes on the street"). While the benefits of this type are not necessarily easily quantifiable, they are worthy objectives.
- **Is locally designed, assembled and/or manufactured**. Sustainable lighting is lighting that supports the local economy, and ensures, wherever possible, that a lighting technology is designed, assembled, manufactured and maintained locally.

Local lighting standards, as well as requirements for compliance and enforcement of Standards can impact negatively on the relative sustainability of a public lighting scheme, particularly in terms of maximising energy efficiency. For more comment on this, see Section 5.3.

5.3 Australian Lighting Standards

When it comes to lighting standards, the Australian Standard for street lighting (AS/NZS 1158 series) specifies recommended minimum light levels for different public spaces, depending on the nature and use of that space.

Location	Main roads (cd/sqm)	Secondary (cd/sqm)	Residential (Ave. lux)
Australia [14]	0.8	0.3	0.85
IES[15]	0.6 to 1.2	0.4	6
UK[16]	2.5	1.1	2
New York[17]	N/A	1.7	2
Singapore [18]	6.7	3.3	No data
Abu Dhabi[19]	2.0	1.4	5

Table 5: Minimum lighting levels in different countries and jurisdictions

The role of lighting standards is important because the levels of lighting required for different applications define the types of lights that can be used. Table 5 shows how the minimum lighting standards (for street lighting) in various jurisdictions can fluctuate widely. Australian residential lighting is among the lowest in the developed world at under half that of the US and the UK. In main and secondary roads the standards are similar to those proposed by the Illuminating Engineers Society (IES), but still lower than many other jurisdictions. This has implications for options to reduce costs and improve sustainability for technology solutions like dimming. Dimming has a much lower level of opportunity in Australia as the lighting are already very low compared to international standards.

For each of the lighting applications above, the columns refer to the following:

- **Main/arterial roads** refers to freeways, highways, motorways or grade separated junctions (flyovers).
- **Secondary/collector roads** are less important than freeways and highways and refer to streets with 2-3 lanes.
- **Residential roads** refer to local roads, residential areas or pedestrian areas.

An objective of any project looking to implement a "safe" lighting scheme may therefore be to achieve compliance with the minimum recommended light levels. However it should be noted that compliance with the recommended light levels for street lighting outlined in the Australian Standards is not a legal requirement.

Also, individual councils may have a stated policy objective to achieve a given standard, others may not. For example, rural councils will typically find the majority of its street lighting does not meet the Standard, whereas a typical inner metropolitan council will have only a small percentage of its street lights not meeting the Standard. Depending on the context, the desire to achieve the Standard will differ, as well as the cost and benefits of doing so. Therefore while perceptions of safety may be consistent in different municipalities, the drivers to achieve these goals may differ.

[14] AS/NZS 1158.3 and AS/NZS 1158.1

[15] IESNA Lighting Handbook, Reference & Applications 9th Edition

[16] Code of Practice for the Design of Road Lighting BS 5489-1:2013

[17] New York City Department of Transport Street Design Manual

[18] Singapore Land Transport Authority (LTA): Guidelines To Submissions Of Design Drawings For Public Street Lighting And Zebra Crossing Beacon Lighting System

[19] *The Abu Dhabi Sustainable Lighting Strategy*, Martin Valentine, World Future Energy Summit, 16th January 2013

Australian Standards and LEDs

One of the hurdles for LED street lighting at the moment is the simple fact that the Australian Standards (AS/NZS 1158.6) does not cater for LED technology. Since 2012, WG6 (Working Group AS/NZS 1158.6) has been working on an amendment to the Standards so that LED street lights are an accepted technology. This amendment has now been drafted, public comment has been accepted and a final Standard is due for release some time in 2015.

5.4 Technology options

The existing street lighting stock for South Australian councils consists of a combination of the following lighting technologies:

- T8 and T10 fluorescent
- Compact fluorescent
- Low pressure sodium
- High pressure sodium
- Mercury vapour
- LED

Table 6 below provides a comparison of some of the key technical characteristics of the above lighting technologies.

Table 6: Technical comparison of different light types

Technology Type	Light Colour	Colour Temperature (deg. K)	Typical Wattages (W)	Colour Rendering Index (CRI)	Lamp life (yrs)	Lamp Life Efficacy (Lumens/Watt)	Capital Cost	Maintenance
Low Pressure Sodium	Amber	1800°	18 - 140	0	2	80 - 180	Low	Poor to good
LED	Multiple colours	2000° - 6000°	Up to 400	up to 95	10 to 20	60 -150	High	Good to excellent
High Pressure Sodium	Yellow	2000° - 2700°	50 - 1500	25	4 to 8	90 - 130	Low	Poor to good
T5 fluorescent	Multiple colours	2700° - 6200°	8-100	70 - 90	42342	60 - 100	Low	Average to Good
CFL	Multiple colours	2700° - 6200°	5 to 200	85	1.4 - 2.3	50 - 72	Low	Poor
Mercury Vapour	White	3500° - 4000°	50 - 1000	60	3 to 4	36 - 58	Low	Poor

For the sake of further comparison, Table 7 below details the key advantages and disadvantages of the different lighting technologies in terms of some of the safety and sustainability characteristics discussed in 5.1 and 5.2 above.

Table 7: Commentary on different light types

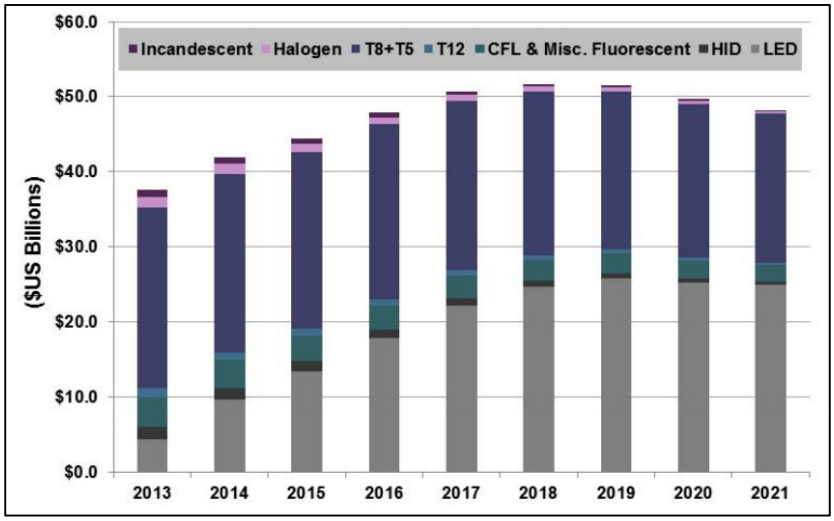
Technology	Use	Advantages and disadvantages
LED	Becoming more common internationally. Still low numbers compared to other technologies however usage potential is envisaged to increase as technology advances.	Relatively higher initial costs. Long life and increasingly good quality means it is being used for low wattage light replacements. Over time the ability to compete with higher wattages (e.g. over 400W sodium) is being delivered. Do not contain lead or mercury, and do not emit UV radiation. Directional light.
High Pressure	Very common throughout the world.	Low CRI (colour rendering index) with yellow lights

Sodium		means it is less effective at reducing accidents than white light. Has been the most energy efficient light for the past 20 years but now challenged by LED. Contains mercury and lead. More affordable than LED.
Mercury Vapour	Very common up until 1990's. Banned in many jurisdictions,	Very energy inefficient, UV radiation and contains mercury. Banned in many jurisdictions due to mercury and inefficiency.
Low Pressure Sodium	Common in some jurisdictions (e.g. SA)	Very low CRI, yellow light means generally not recommended for streets. Highly energy efficient. Contains mercury and lead.
Compact fluorescent (CFL)	Common for low lighting levels	Low life / burnout, dimmer in cold weather (failure to start), contains mercury.
T5 fluorescent	Common in Australia, India, Africa	UV radiation, contain mercury, diffused non-directional light

LED and the rapidly changing face of the lighting industry

Whilst it is still a relatively new technology, there is little doubt that LED lighting is the way of the future. As a general rule, LEDs lead the way in lamp life and lamp life efficacy. LED lighting also allows more flexibility around controls (for example dimming and other smart controls), and can produce a white light source that is considered preferable from a safety and amenity point of view.

Figure 7: Global commercial lighting revenue forecast (2013-2020)[20]



The graph above shows the revenue forecasts for commercial lighting globally as predicted by the US Department of Energy. The percentage of the market that LEDs provide is predicted to rise from 12% in 2011 to 63% in 2020.

[20] Solid State Lighting Multi-Year Plan, April 2014, US Department of Energy

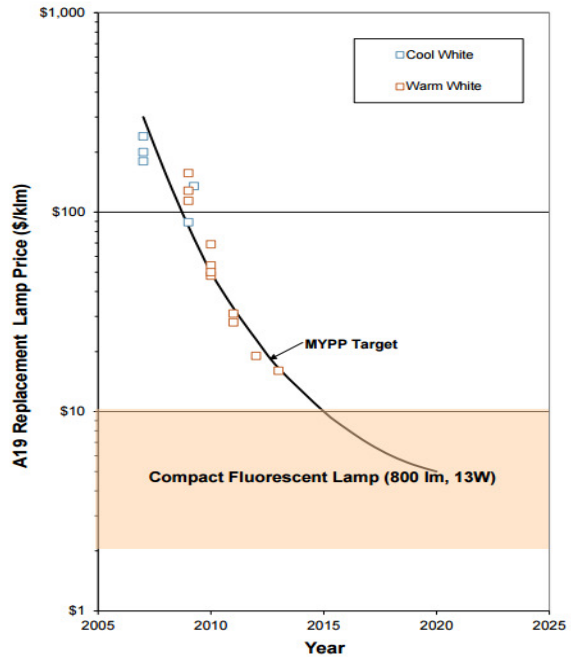


Figure 8: LED replacement lamp price projection (60W Incandescent equivalent)[21]

Combined with this LED prices are expected to fall (see Figure 8). The key reasons for the decrease in prices are technological advancements and increased competition. Firstly, LED lighting is considerably more efficient than traditional lighting technology, which means that consumers can significantly reduce energy use. LED is also considerably advanced from an on-going maintenance perspective. The life of LEDs (10-20 years) is substantially longer than older technology such as High Pressure Sodium (4-8 years) or Mercury Vapour (3-4 years).

Secondly, prices are also falling through basic market forces. All large lighting manufacturers are spending significant money and resources on research and development and marketing of their LEDs. As competition increases, prices are decreasing. These trends point to LEDs being the main source for lighting by 2020.

However, in the short term choosing lighting types is more complicated as traditional sources are still very competitive for some applications (like sports grounds), where LEDs are only starting to compete with traditional sources. LEDs are making fast technical progress but have not yet proved to cover all applications in the area of general lighting. But for this project focus on public lighting, we can predict that LED will fulfil almost all types of application.

[21] Solid State Lighting Multi-Year Plan, April 2014, US Department of Energy

6 Delivering Safe and Sustainable Lighting

Throughout Australia and the world street lighting upgrades are being delivered. From Brisbane to Hobart, through outer Sydney, large parts of Victoria and parts of WA, lights have been changed. And councils are reaping the financial and environmental rewards.

In Hobart and Glenorchy councils, 3,500 lights have already been changed over while the City of Sydney's LED changeover covers street and park lighting and have seen thousands replaced. Councils in the Essential Energy area of NSW have replaced tens of thousands of lights and projects in the City of Adelaide have resulted in large numbers of LEDs installed and significant savings.

The size and impact of these projects cannot be underestimated. Nearly 80 Australian councils are in the process of completing (or have already completed) their single greatest energy reduction project ever, as well as their single greatest greenhouse gas reduction project ever.

On the following pages there are three case studies of projects that are underway to change unmetered street lighting to more efficient and long lasting options.

In some areas, we are now witnessing councils successfully implement changeovers through fully contestable tenders for every step of a bulk changeover – materials (the lights themselves), labour (installers) and even the project management of the installation – as well as negotiations with various DNSPs across Australia around contestability of ownership and maintenance of street lighting.

6.1.1 How is this working?

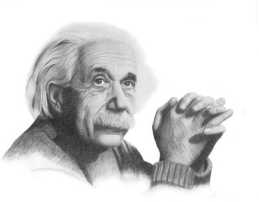
The traditional barriers that councils face of **cost**, **expertise** and **relationships**, have been overcome for these projects and in these jurisdictions. Let's explore this a little more:

Overcoming the Capital Cost Barrier

The cost of undertaking a street lighting bulk changeover can run into the millions of dollars. However over the past few years dozens of councils have been successful in receiving funding through the Federal Government's competitive Community Energy Efficiency Program (CEEP) which matched council contributions. On top of this, there is further potential funding available through state-wide energy efficiency schemes and financing options through the Clean Energy Finance Corporation.

We've also seen costs come down dramatically through bulk procurement of materials and through more contestability in some jurisdictions. Introducing transparency into the capital side of the project cannot be under estimated.

Overcoming the Expertise Barrier



As more projects have been implemented, key players have learnt more. There is now a handful of staff at councils, in local government support consultancies and local government associations around Australia whose sole role is specifically on energy efficient street lighting.

With tens of thousands of lights already changed in many jurisdictions many more stakeholders have "learnt the ropes".

Overcoming the Relationships Barrier

Collaboration works. Arguing doesn't.

Every successful project in Australia has been the result of cooperative dialogue and relationships between councils, DNSPs and other key stakeholders.

This is not to say there are not disagreements along the way (and sometimes the best strategy, for a short period of time, is "good cop, bad cop", or "good council, bad council") but in instances where councils and DNSPs have put down their gloves to work together, we've seen real action every time. And councils and DNSPs have benefited.

In jurisdictions and projects where key stakeholders are still fighting the only people who benefit are lawyers and consultants.

It's taken over a decade of hard work, small wins and occasional setbacks but there is now a clear and simple model that is proven to work.

6.1.2 Case Studies

On the following pages 3 case studies have been selected in 3 states. Each of these the programs are examples of the largest scale programs within either the state or the (in the case of WSROC) the DNSP area. The case studies are:

1. MAV Street Light program (Victoria)
2. WSROC "Light years Ahead Program"
3. Hobart and Glenorchy LED Light Replacement Program

CASE Study 1: MAV Street Light Program (Victoria)

Program Summary
The Municipal Association of Victoria (MAV) has been supporting councils through the energy-efficient street lighting procurement process by:

- providing technical and practical advice
- facilitating information sessions
- offering bulk purchasing options
- helping to manage the bulk change process for councils.

Dealing with barriers:

Cost
Capital cost negotiation with all Victorian DNSPs has reduced capital costs. These savings have led to reduced project costs of around $40m to date (around 30%). In addition a number of Victorian councils were successful is seeking funding or financing from federal bodies. This included an injection of funding through CEEP and also through the CEFC. Now most councils without external funding are still progressing the programs because of the ease of the project delivery and the fact *that almost everyone else has already done it (councils love to know what others are doing).*

Expertise
The MAV has engaged Ironbark throughout the program to assist in negotiating with DNSPs. In addition councils have been empowered to make decisions for their communities within the program (especially around safety). This has enabled councils to be able to work with DNSPs on an equal level and to know they are not being misled.

Relationships
Since 2004 councils and DNSPs have "sat in the room" together to overcome misleading information and work together to deliver the outcomes councils want. There has been no short cut to this process. Significant change occurred in 2011 when the MAV agreed to assist all councils. This made it easy for councils to commit budget and deliver the programs.

MAV PROCUREMENT

Timeframe
June 2011 to June 2016

Scale
On track to replace approximately 251,000 street lights. Negotiations are underway to plan for a major road lighting LED program.

	Location	Country	Total Lights
1	Abu Dhabi	UAE	600,000
2	Victoria	Australia	251,000
3	New York	USA	250,000
4	Los Angeles	USA	141,000

Outcomes
Projects that deliver savings of in excess of $471m and 1.7m tonnes of greenhouse emissions (over 20 years) are already funded.

In addition the MAV support has seen capital costs reduce by $45 million. Savings through negotiation of tariffs have led to direct savings of more than $10m on operational costs.

Relevance to SA:
CitiPower/Powercor are owned by the same parent company as SAPN. In addition the regulatory framework is similar (i.e. within the AER's jurisdiction). The main difference is that tariff in SA default to "negotiation" whilst in Victoria in the past it has been regulated (though this is now changing for some lighting). The role of the council representative body (the MAV) has been exemplary and provides a guide for how the LGA or regions can assist in overcoming barriers.

CASE Study 2: WSROC "Light Years Ahead Program"

Program Summary
The project will replace approximately 13,000 high emission mercury vapour street lights with low emission LED (or equivalent) lights. The project will be accompanied by community engagement and education activities to ensure energy savings are not only delivered through the street lighting upgrade, but also through Western Sydney residents' initiatives.

Dealing with barriers:

Cost
A total of $5.3 million will be contributed by the Australian Government (through the CEEP program), with a co-contribution of $2.6 million by participating Western Sydney councils. Capital cost negotiation has led to costs reduce by around $1.6m for the project

Expertise
Similar to many regions councils do not have the capacity to negotiate with the DNSP (through resourcing and knowledge). WSROC has collectively worked on behalf of 9 councils to secure the funding and plan and run the program. Without their support it is unlikely the program would have proceeded.

WSROC has engaged specialist external expertise throughout the program. In addition councils have been empowered to make decisions for their communities within the program (especially around safety). This has enabled councils to be able to work with DNSPs on an equal level and to know they are not being misled.

Relationships
Endeavour Energy (EE) has resourced communication and management of their council clients, as well as any DNSP in the country. This involves annual meetings with each council. There are proposed regional meetings (quarterly) proposed between EE and councils to discuss street lighting issues. EE have been willing to negotiate with councils during the program.

WESTERN SYDNEY Light years ahead

Timeframe
June 2014 to June 2016

Scale
On track to replace approximately 13,000 street lights to LEDs. WSROC Councils see this project as a first step in establishing a more sustainable street lighting network across the region. Following the initial roll out of the project, councils have indicated that they are prepared to consider re-investing those savings in continuing the rollout on an ongoing basis. Endeavour Energy has approximately 200,000 street lights in their area.

Outcomes
Light Years Ahead will deliver major savings for local residents of these councils, with an estimated savings in energy costs of around $1.08 million a year for Councils and an estimated saving in energy efficiency of around 77% per light.

Relevance to SA:
This example reinforces the benefit of a) negotiating on costs and b) regional projects.

CASE Study 3: Hobart and Glenorchy LED Street Light Program (Tasmania)

Program Summary
The program also involves replacing 80W MV street lights with new LEDs. Council is also negotiating tariff arrangements with TasNetworks (DNSP) and transferring the tariffs from the equivalent of SLUoS to CLER (using SA language).

Dealing with barriers:

Cost
Capital costs were high but offset by the project attracting a federal grant for part funding.

Expertise
The councils used the local DNSP (TasNetworks or TN) for the project delivery. Other than that councils have been working with TN directly with little external support. Capital costs have been much higher for this project than for other similar projects.

Relationships
Councils and TN are working closely on this project. Relations between councils and TN mirror those in other jurisdictions otherwise with historic poor communications and lack of clarity around service levels.

Timeframe
January 2014 to June 2015

Scale
Completed the installation on the project is to replace 3,400 80W MV street lights will be replaced with 18W LEDs. Discussions are underway to understand the options to replace more lighting in Tasmania (TasNetworks manage approximately 50,000 lights are in the state).

Outcomes
Savings will be around 2,500 GJ of energy and $150,000 p.a.

Relevance to SA:
TN is open to negotiating with the councils on tariff options. They are currently considering the following options for new LED lights:

1. TN funded/owned and maintained (similar to the SA SLUoS tariff)
2. TN maintained council funded/owned (SA CLER tariff)
3. Third party maintenance, council owned (SA Energy Only tariff)

Negotiations are still underway.

7 Options for SA councils to Transition (to more safe and sustainable lighting)

This section provides a summary of the key scenarios available to councils to deliver safe and sustainable street lighting as well as a preliminary business case on these scenarios.

The structure of the section is as follows:

1. Context for the Transition (covered in Section 7.1)
    a. Technology
    b. Scenarios (for specific options that have been considered for the management structures); and
    c. Models (the assumptions used for the preliminary business case analysis)
2. Preliminary business case outcomes and analysis (covered in Section **Error! Reference source not found.**)
3. Risk analysis (covered in Section 0)

The various scenarios and models available to councils are deliberately broad in order to demonstrate the range of potential outcomes (both good and bad) from the transitioning process.

7.1 Context for the Transition

In order to understand options that make sense we have been largely influenced by two factors:

1. the speed of technology change and the likely transition of most new lighting to that of LEDs in the medium term (next 5-10 years); and
2. the main *Scenarios* available to councils in terms of management structures for public lighting

For the Preliminary Business Case (and based on the above factors) we have then applied a range of *Models* to each *Scenario* in order to understand the range of possible business case outcomes.

7.1.1 Technology choice

We have assumed for the purpose of the *Scenarios* that councils will have access to more energy efficient (and safer) LED street lighting technology. This includes ignoring the challenges associated with limited luminaire choices (through SAPN) at the moment because we have taken the view that within the coming 5-10 years that energy efficient options will be readily available for *all* current street lighting choices. The table below provides an outline of the energy consumption used in the modelling for the different options (the current technology and a replacement LED option).

Light	Current Energy Consumption (W)	LED Replacement Energy Consumption (W)
Fluorescent 2x20	50	21.9
Fluorescent 40	50	21.9
Fluorescent 2x40	100	21.9
Fluorescent 4x40	200	21.9
Fluorescent 42	46.4	21.9
Incandescent Flood 500	500	150

Light	Current Energy Consumption (W)	LED Replacement Energy Consumption (W)
Incandescent Flood 750	700	250
Sodium 135	170	110
Sodium 18	29	21.9
Sodium 26	35.5	21.9
Sodium 55	80	*41*
Sodium 90	115	70
Mercury Flood 1000	1040	600
Mercury 125	142	41
Mercury 250	270	110
Mercury 400	430	200
Mercury Flood 400	430	200
Mercury 2x400	860	400
Mercury 50	65	21.9
Mercury 80	95.8	21.9
Sodium 100	120	70
Sodium 150	173	110
Sodium 250	273	200
Sodium Flood 360	396	320
Sodium Flood 400	440	350
Sodium 400	440	350
Sodium 50	60	21.9
Sodium 70	86	41
Fluorescent 2x14W	29.7	21.9

7.1.2 Management Structure

As outlined in Section 6 the main options for public lighting services under the negotiated services framework are:

- **Street Lighting Use of System services (SLUoS):** the provision of public lighting assets and the operation and maintenance of those assets where the DNSP retains ownership of the assets;
- **Customer Lighting Equipment Rate services (CLER):** the replacement of failed lamps in customer-owned street lights where the customer retains ownership of the assets and is responsible for all other maintenance; and
- **Energy Only services (EO):** the maintenance of a database relating to street lights and recording and informing customers of streetlight faults reported to the DNSP, where customers retain ownership of the assets and are responsible for all maintenance (including replacement of failed lamps)

For the purpose of the *Options* analysis these tariffs can be used to clarify the different options open to councils.

7.1.3 Scenarios

The *Scenarios* considered in this analysis include:

1. **Electricity Distributor owned and maintained**
2. **Council owned, Electricity Distributor maintained**
3. **Council owned and maintained**
4. **Third party owned and maintained**

The characteristics of these options are outlined in Table 8 below.

Table 8: Scenarios used in the business case modelling

Scenario	Asset ownership	Maintenance provided by	Related SAPN tariff
1. Electricity Distributor owned and maintained	SAPN	SAPN	SLUoS
2. Council owned, Electricity Distributor maintained	Council	SAPN	CLER
3. Council owned and maintained	Council	Council or a third party	EO
4. Third party owned and maintained	Third party	Third party	EO

It is important to note that most of the street lighting assets are currently owned by SAPN it is possible (and even likely) that these lights will continue to be maintained by SAPN for the foreseeable future. This means that Scenarios 3 and 4 are currently a theoretical approach on scale at this point in time. They have been included in this analysis to understand the potential value in further assessing these options, however they are not ready to be delivered on scale.

7.1.4 Models

Depending on variables such as the rate of energy price increases, and the increase in maintenance tariffs, the savings of the transition will vary.

The different models consider a range of outcomes when choosing LED street lights to demonstrate to councils the possible range of outcomes from the project. There are nearly endless assumptions that can be applied, however to keep it simple we have specifically considered three distinct "models" that are applied to each of the "scenarios" described above:

- **High Cost, Low Savings.** Whereby the capital costs and ongoing operating costs are high.
- **Average Cost & Savings.** Whereby the capital costs and ongoing operating costs are average.
- **Low Cost, High Savings.** Whereby the capital costs and ongoing operating costs are low.

To give a sense of the likelihood of each model we consider the *Average Cost & Savings* model to be realistic. Some items could be achievable in the short term (e.g. reduced capital cost of the program) whilst some will take a little longer to negotiate (ongoing maintenance pricing). The *Low Cost, High Savings* model is ambitious, and, although similar outcomes have been achieved in other jurisdictions, this should be considered "optimistic". The *High Cost, Low Savings* model is pessimistic.

7.2 Risk Analysis of Scenarios

Consideration of which of the Scenarios to further develop will need to address more than just the possible financial outcomes. Consideration of risk and likelihood are essential ingredients to any decision making process.

This section provides some preliminary analysis of the types of risks that may occur for each Scenario.

Table 9: Risks associated with the different Scenarios

Scenarios	Timeframe	Regulatory	Negotiation with SAPN	Service provision
1. Electricity Distributor owned and maintained	**1 Year** Ready once technology allowed and offer tabled (by SAPN)	None	None required[22]. Tariff (and WDV) negotiation recommended	Available State-wide. Low transparency of costs currently
2. Council owned, Electricity Distributor maintained		None if negotiation successful	Required to confirm tariff and WDV inputs and costs	Available State-wide. Improved transparency of costs
3. Council owned and maintained	**3-20 Years**[23] (best and worst case)	Access to DNSP network (by contractors required)	Required for: • Asset sale • Network access	May not be available State-wide. Improved transparency of costs
4. Third party owned and maintained				

Table 10: Other risks with large scale replacement programs

Item	Risk Description	Comment
Technology	That LED lighting does not last as long as predicted. This may be particularly true with certain components (such as LED drivers)	Product selection is limited to SAPN choice for *Scenarios 1 and 2*. Ensure any choice allows for quality checks or warranties to cover life
SAPN Negotiation – WDV Costs	The price agreed for the Written Down Value will directly affect the business case	LGA and SAPN are in discussions relevant to this cost currently. This is one factor in the capital cost; if the business case stacks up from a financial, technical and risk perspective this should not prevent a project going ahead.
SAPN Negotiation – LED tariffs	Similarly the LED tariffs (especially SLUOS and modified CLER) will determine the success or otherwise of the large scale program	Transparent discussion on this item is required (especially to agree to service levels)

[22] Although the services provided by the DNSP are likely to remain negotiated distribution services at least throughout the regulatory reset period to 2020, for the purpose of delivering bulk replacement programs no new negotiations are "required".

[23] As many of the assets are currently owned by SAPN it is possible (and even likely) that these lights will continue to be maintained by SAPN for the foreseeable future. This means that Scenarios 3 and 4 are currently a theoretical approach on scale at this point in time.

Once councils are clearer on the direction they wish to take a risk management framework around the Scenarios should be implemented. This framework would consider the risks below and apply a management process to address consequence, likelihood and mitigations.

8 Summary and conclusions

There are over one hundred councils around Australia implementing energy efficient street lighting projects, with dozens already complete. However, in South Australia only very low numbers of lights have been changed to safer and more energy efficient alternatives.

The main barriers to delivering an improved street lighting system are consistent with previous barriers in other jurisdictions:

1. Financial **cost** (capital and operating)
2. **Expertise** and time to deal with the complexity of street lighting
3. Delays and frustrations in working with **external stakeholders (especially SAPN)**

Subsequently, lessons from other jurisdictions can be used by SA councils to ensure a more successful outcome from future work in delivering large scale lighting changes.

It is clear that keeping the maintenance pricing negotiations (where conflict typically occurs) separate from the move to large scale replacements (where agreement commonly can be reached) should be maintained as much as possible[24]. It is also clear that while there is the potential for a project that makes financial sense, the preliminary business case demonstrated that the range of potential savings can vary widely.

This range of savings could be tightly narrowed by clarifying (and reducing) a few key costs. In particular confirming the following inputs to the business case should be clarified or reduced:

1. Written Down Value
2. LED maintenance prices (from SAPN for SLUoS and modified CLER and from third parties for similar services)

The financial outcome from the business case is not the only factor to be considered. Lighting provides an important community benefit. Replacing lighting to more cost effective options should be balanced by the benefits of safe and sustainable lighting.

"Safe" lighting can be considered lighting which:

- Maintains a consistent level of light throughout a space
- Allows objects (both moving and stationary) to be easily identified by the human eye
- Maintains light output over time
- Reduces environmental impacts from the materials
- Minimises glare
- Is reliable
- Is perceived to be safe

"Sustainable" lighting is lighting which:

- Maximises energy efficiency
- Minimises or avoids the use of harmful substances in construction
- Minimises operating and maintenance costs

[24] There is some cross over which cannot be avoided. Specifically negotiation of new maintenance tariffs (e.g. LEDs) and confirmation of the Written Down Values (i.e. the value of the old asset base that is being retired when a replacement occurs) are required to progress large scale replacements.

- Reduces unwanted light spill
- Improves the amenity of public spaces
- Is locally designed, assembled and/or manufactured

The design of a large scale replacement program will need to ensure these considerations are included in the design and choice of lighting technology.

8.1 The Transition

Some obvious next steps announce themselves from the analysis in this report in particular in order to clarify the costs within the business case.

No matter which of the options that are progressed successfully above there are a number of activities that will assist in ensuring that a large scale replacement program can be delivered. Specifically:

- Establish a support program for all councils in SA to progress a bulk replacement program. This would include bulk procurement (if relevant) and would typically include the following supported steps (as used in the Victorian and WSROC projects outlined in Section 6.1.2)
    1. Prepare business case (typically at an individual council basis)
    2. Funding and/or financing (if relevant)
    3. Define council's requirements for the project (including developing a design for the program that ensures adequate levels of safety are being maintained or improved)
    4. Procure the bulk change
    5. Project Management and Finalisation
- Investigate options to introduce external funding to the program. This can include through SAPN, a third party provider or financier or through federal or state grants.

If the above can be implemented successfully there are not barriers to South Australian councils becoming the next success story in the wave of lighting replacements.