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Prepared for
Local Government Association of SA

Local Government transition to Sustainable Public Lighting

Discussion Paper

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GUIDE FOR THE LGA & ITS MEMBERS TO TRANSITION TO MODEN ENERGY EFFICIENT PUBLIC LIGHTING

1. **Selection of location/streets/suburb for lighting upgrade projects.**
   Considerations:
   Make sure that the lighting technology to be replaced is predominantly energy in-efficient, especially if it is Council owned (ie, CLER, 'Energy Only' or metered installation).
   Ensure if the lights are ETSA owned (ie, SLUoS) that they are more than 15 years old, otherwise an undepreciated value payout ~$100, applies to each light. Many 80W Mercury Vapour (MV) lights are ≤ 15 years old, as they have only been used as the standard light from the mid 1990's.
   Collaborative work with ETSA to determine which 80W MV lights are over 15 years old, will significantly reduce the capital contribution required from Councils towards upgrade projects.
   As a rule of thumb, factor in an extra ~10% of lights in each location to bring lighting levels up to the current Australian Standard AS/NZ 1158. Most streets more than 10 years old do not comply with current lighting standards. Where lights are in areas with underground power-lines this requires 10% more columns at ~$1,000 each with installation and wiring.
   Careful selection of a slightly larger lamp (Wattage), when re-designing the lighting layout can sometimes overcome the issue and retain the same number of lights. The 42W CF was chosen by ETSA over the 36W CF, for this reason. In most cases the 42W CF or 56W LED will replace an existing P class road light without the need for an extra light, if existing lighting meets standards.
   Competitive tendering for such work (through ETSA if SLUoS lights) is the only way to obtain low cost change over of assets including: re-design, project management, procurement, installation and disposal. Such quotes can be verified and used to apply for project grants.

2. **Lobby ETSA to change the standard lamp from 80W Mercury Vapour.**
   Considerations:
   ETSA offers new lighting options due to consistent customer (ie, Councils, developers & DTEI) demand for a luminaire and lamp type, not simply because it is available.
   The selection of technology and luminaire style by customers will be determined by the ability to pay increased lighting maintenance tariffs (SLUoS) or operating costs (if CLER) which exceed the savings from reduced Energy Use (billed by the retailer).
   Light Emitting Diode (LED) and Compact Fluorescent (CF) lamps have similar energy efficiency gains, but higher purchase price and spares costs determine maintenance tariffs/costs.
   LGA and its member Councils to encourage ETSA, to make the choice of the 42W CF lamp in a standard luminaire or an economically priced 56W LED luminaire, its standard not only for new subdivisions but for all P class road lighting upgrades.
   For a luminaire to be selected as standard by ETSA (SLUoS) it must be reliable, robust, reasonably priced, meet all standards and be aesthetically acceptable to customers.
   High priced luminaires would mean much higher maintenance tariffs for all customers, consequently these lighting and column choices should be avoided or remain as Council owned.

3. **Encourage Developers to select Energy Efficient lighting technologies for new residential and industrial subdivisions (URD & UID).**
   Considerations:
   Since mid 2010, several light fittings with 42W CF lamps have been approved by ETSA for both CLER and SLUoS ownership in new subdivisions. ETSA has no influence over developer choices.
   The total combined tariff ie, maintenance and energy, for CF lamps is in the order of 22% more than for the equivalent MV lamp, due to the higher cost of lamps and electronic control gear.

Councils that do not want to take on the maintenance of more lighting assets should encourage developers to select a luminaire and column from ETSA's approved SLUoS list, or if in general demand and not yet on the list, follow the procedure on ETSA's web site for approval.
By setting a standard of energy efficiency now, Councils will have a finite number of lighting assets to transition to energy efficient technology in the future.
The use of new lighting technology does not pose a technical problem for developers, as the spacing and number of lights is determined at the time of design to the lighting standard.
Some developers are selecting the 42W CF lamp in highly priced luminaires such as the Elypt, which must then be transferred to Councils as CLER lighting.

4. **Request Default Retailer (AGL) to Gazette energy tariffs for Energy Efficient lighting.**
   Considerations:
   ETSA first issued interim maintenance tariffs for CF and Metal Halide (MH) lamps in mid 2005, and is yet to develop tariffs for LED lamps, but customers are still waiting on retail energy tariffs.
   Once a technology and lamp wattage is selected, energy tariffs can be developed from the AEMO un-metered load table, which is based on energy consumed by a lamp type over a year.
   By considering the sum of all tariffs and the differences involved, a Council can determine if it can not only afford the contribution toward the upgrade project but the ongoing difference in the sum of annual tariffs and in the case of Council owned lights any extra maintenance costs.
   For an accurate business case to be developed, Councils and the LGA must obtain energy tariffs.

5. **Encourage ETSA to upgrade obsolete lights to energy efficient technology.**
   Considerations:
   Obsolete lights are those where either the lamp or luminaire is no longer supported by the manufacturer and so when it fails it must be replaced with an alternative luminaire. One of the lamps which falls into the obsolete category as of late 2010, is the 26W Low Pressure Sodium (LPS) but this lamp is relatively energy efficient, so there is no energy reduction gained by conversion, but the energy consumption would be held at the current levels if a modern energy efficient light was used, not increased by replacement with the standard light ie, an 80W MV.
   At present there is one ETSA approved energy efficient lamp, the 42W CF available as ETSA owned (SLUoS) or Council owned and ETSA maintained (CLER).
   LED lights will soon be available which meet all necessary standards, in a number of sizes for both P and V class roads.

6. **LGA and Councils to determine and negotiate a CLER service arrangement for LED technology.**
   Considerations:
   The maintenance provided for the CLER tariff, is first call out when a light is reported as faulty, change of lamp and cleaning of the lens. This service would need to change for LED technology.
   LED panels have an expected life of 10 to 12 years between replacement cycles. This is considerably longer than bulk lamp replacement cycles which are approximately every 3 years. The most significant cost element in a CLER tariff is labour for first call out, random lamp failure between bulk lamp changes and planned bulk change. As the cycle of lamp change would extend out to 10 to 12 years, the component with the next shortest life for an LED light is the control gear at about 5 to 6 years. At this time it is not certain whether a bulk change or change on failure, would be the most cost effective strategy in terms of labour. The CLER service should include both the change over of control gear and replacement of LED panels on failure.
   Where either the customer or provider is unclear on costs an interim tariff can be negotiated.

Executive Summary

The transition of existing public lighting assets to more energy efficient technologies is a means by which local Government can significantly reduce their GHG emissions. Public lighting of residential street (P class roads) in South Australia represents between 20 and 45% of Councils emissions and should be addressed with the assistance of grants available through the Commonwealth Government *Low Carbon Communities* initiative funded by the Renewable Energy Future Fund.

For transition of lighting technology to be costed, funded and undertaken to meet pollution reduction targets such as 30% reduction by 2020, the process of selecting projects and technologies should commence in early 2011. Selection of projects should be done in conjunction with fully costed business cases with a full understanding of all tariffs and how they will change, plus transition capital costs.

There are a number of elements which make up the total public lighting cost of Councils such as lighting services, energy transport and consumption and ownership of lighting assets. All factors must be taken into account when planning a transition in technology on such a scale in one decade. The establishment of negotiated tariffs for provision of energy efficient lighting by ETSA Utilities, performance levels and reliability with Service Level Agreements should be commenced, with the assistance of the LGA.

Grants to assist these projects require co-funding and defined environmental outcomes. The application for funding will need to meet a number of criteria and be well presented with evidence of the required outcomes and benefits. The LGA can assist with the application process and reporting on project status which is a requirement of such government grant schemes. Grants assist with transition, not operating costs, so it is vital that the total lighting cost is determined, as increases will apply in most instances.

Reliable and cost effective energy efficient street lighting technology and equipment is now available in Australia in both Compact Fluorescent and LED products. New technology is always more expensive when it is first introduced, but as evidenced with other recent electronic equipment advances the prices fall after production volumes and competition increase. With the revised rules for the basis of negotiated tariffs for lighting services, the benefits will eventually be realised and passed on to Councils.

Projects for transition to energy efficient lighting upgrades should be carefully selected in most cases in negotiation with ETSA Utilities, in order to reduce capital change over costs, selecting assets over 15 years old, those which offer the greatest energy reduction benefit and where possible selecting the technology and lamp wattage which reduces the number of extra lights required to meet current lighting standards.

1. Drivers for Change to Energy Efficient Street Lighting

A national Local Government GHG audit in 2006, found Public Lighting to be the single largest source of greenhouse gas emissions, typically accounting for 20 to 45% of emissions (DEWR Lighting the Way: Local Government Guide to Energy Efficient Public Lighting, Feb. 2007). This is due in part, to the initiatives already undertaken by some Councils, which have started to address other significant energy issues such as energy efficiency of buildings and public facilities, vehicle fleet and waste. Local Governments across Australia are now considering replacement of energy inefficient street lighting to further reduce electricity consumption and GHG emissions. Some Councils in SA have included in their strategic plans, a goal of reducing GHG emissions by a minimum of 30% by 2020. ACC has a more stretching target of 50% reduction in GHG emission and carbon neutral by 2020, achieved in part by incrementally replacing all inefficient public lighting.

2. Carbon Pollution Reduction Scheme (CPRS)

The Commonwealth Department of Climate Change and Energy Efficiency released a White Paper in December 2008, detailing the Carbon Pollution Reduction Scheme (CPRS). This initiative is unlikely to go ahead in the way proposed at that time but it outlined the medium to long term targets for reducing carbon pollution in Australia. The Government accepted the findings of the Garnaut Climate Change Report and detailed (Policy position 4.2) a "target range for emissions reduction to be achieved by 2020 will be from 5% to 15% below 2000 levels." If the atmospheric concentration of greenhouse gases could have been stabilised at 450 ppm CO_2-e, this report considered this level could control climate change.

3. Funding Opportunities and Grants

The Commonwealth Government plans to reduce pollution in communities, through the *Low Carbon Communities* initiative, which has approved budget funding through the Renewable Energy Future Fund (REFF), ALP media release 18/8/10, http://www.government-grant.com.au/2010/11/low-carbon-communities-initiative/. One area to be funded by grants of up to $500K, are relatively small projects to upgrade street lighting. The benefits stated being: reducing pollution (including GHG), reduced energy bills and reducing demand on distribution networks. The benefit in relation to Demand Management does not apply to public lighting, but other uses, when the supply network is under peak demand.

These grants could be pursued once the co-funding by local communities requirement can be met. Councils may need to contribute to projects as with other capital works through rate income allocation and could also seek State funding where it becomes available. These issues should become clear once the details of the grants become available.

When the Minister for Climate Change, Energy and Water announced the initiative prior to the last Federal Election, the LGA offered to assist SA Councils in obtaining their fare share of this funding and to deliver on the objectives of the programme (LGA media release 18/8/10). Coordination and assistance with preparation of applications by Councils for the grants, could achieve greater success in gaining these grants, as would assistance with standardised project information for reporting purposes, required as standard conditions of grants.

4. Roles and Responsibilities for providing lighting

4.1 Councils

The Australian/New Zealand Standard 1158 (AS/NZ 1158) is considered to specify the requirements for public lighting, but is not legally binding. There are Codes for public lighting in NSW and Vic but not elsewhere. In SA the Local Government Act 1999 Clause 7 b & f, requires Councils to provide services and facilities that benefit its area. These requirements are identified in AS/NZ 1158.3.1. and separated into at least 5 categories, depending on factors such as pedestrian use, bicycle use, crime risk etc. The difference in P class road categories can be seen when comparing metropolitan to rural streets where only intersections have lighting in areas such as the Adelaide Hills. In summary, where public lighting is installed it must meet the standard at the time of design and installation and when an asset is upgraded.

4.2 DTEI

The transport authority which in SA is part of DTEI, has duties to light highways for safety of road users. V class roads are separated into 5 categories identified in AS/NZ 1158.1.1 depending on the characteristics of the type of road and the type and amount of traffic which it carries. Certain arterial roads have some lighting provided by DTEI for historical reasons, but Councils are responsible for the road, so these costs are passed on to Councils from DTEI.

The relevant authority determines the classification and sub category of road under AS/NZ 1158 and the design of lighting must meet the standard at the time lighting is first installed. The requirements of the standard are not retrospective unless the road is upgraded in same way, such as the addition of a new lane, round-about or traffic lights.

4.3 ETSA Utilities

ETSA Utilities owns and operates the majority of public lighting on P class roads and a significant portion on V class roads in SA. In areas where overhead power lines exist the lights are directly connected to the low voltage network on the poles thereby avoiding the unnecessary clutter of separate light columns and underground wiring. In subdivisions where utility services are underground, developers choose the lighting columns and luminaires based on the desired amenity for the subdivision and determine upfront if the lights are to be vested to ETSA Utilities or the Council on completion of works. Where light fittings including columns are included on ETSA Utilities approved list they are wired according to ETSA's requirements and fused in the luminaire for maintenance by licenced power line workers. Where lights are not standard types due to cost or decorative styling, they are wired to AS/NZ 3000 standards, fused at the base of the column for Council ownership and maintenance by licenced electricians.

As the choice of lighting affects the future ownership, cost of operating and maintaining lighting in subdivisions, the design is part of the Development Application approval process through Local Government. Where developers choose to vest their assets to ETSA Utilities, there are thorough audits of the quality and workmanship of the installation prior to hand over and payment of developer rebates (ref. section 17).

Where Councils require individual infill lights, due to road alterations or for security reasons the lights selected by ETSA Utilities usually are the same as those already in a street in order to maintain design standards such as colour and illumination level plus efficiency of bulk lamp change maintenance. For the last decade, Councils requesting infill lighting have specified that it is for security reasons only, to avoid the cost of a complete redesign and upgrade of lighting in affected streets. Should an upgrade to energy efficient lighting be requested of ETSA Utilities the lights must either be of equivalent or higher

lumen output than existing lights and not be considered an upgrade to current lighting to avoid a complete redesign, with the additional lights that may require. This is an important liability issue for both Councils and ETSA Utilities and has a cost impact on transition to energy efficient lighting and ongoing annual total tariff.

5 Negotiated Service Level Agreements

There have been attempts over recent years for ETSA Utilities (ETSA) and ACC to negotiate a service level agreement for public lighting services. As the issue of disputed service tariffs has been finalised, the process of negotiation can recommence. A means of starting this process would be for stakeholders to develop a standard SLA, which could then be used as a pro forma for the basis of negotiations for all Councils. A standardised approach would be easier to audit, report on and review. The service levels monitored by ESCOSA are a given, but other services such as monitoring lamp depreciation and services in addition to the standard CLER services may be included in individual SLAs, such as replacement of control gear, PE cells and other common components carried by ETSA for its SLUoS lights.

6 Better Understanding of Tariffs and Performance Levels

One of the past criticisms of the public lighting service tariffs in South Australia has been a lack of understanding of what is and is not included in the tariffs, what are the obligations on asset owners to meet the Australian Standards for light performance over the life of the asset and who should monitor performance of lights. The service tariffs and options are described on ETSA Utilities' website:

http://www.etsautilities.com.au/public/download.jsp?id=482&page=/centric/customers/lighting_services/public_lighting.jsp (sections 4.1.4 & 4.2.3)
http://www.etsautilities.com.au/public/redirect.jsp?id=2488

The performance of SLUoS and CLER lighting in terms of reliability is monitored by ESCOSA and the service standards are, repair of at least 95% of faulty lights in metropolitan areas of Adelaide and major regional centres within 5 days and rural areas within 10 days of receiving a reported fault. Guaranteed Service Levels (GSLs) are reported quarterly to ESCOSA. Where the service standards have not been met a $20 penalty is paid for each light not repaired within the standard, to the first member of the public to have reported the fault and the sum of penalties paid is reported quarterly to ESCOSA. Where a fault is not the lamp in the case of CLER or metered lighting, ETSA Utilities is not liable for the performance and refers the fault to the asset owner, the Council or DTEI, who have their own performance standards for maintenance. SLUoS lighting is expected to have at least a 25 year life, is financially depreciated in the first 15 years and maintained until the asset is no longer supported by the manufacturer or the cost of spares make the light financially unviable.

The issue which is not monitored proactively is the depreciation of light output in those lamp types not included in cyclic bulk change. The original design of a lighting layout allows for lumen depreciation over the expected life of the lamp, as specified by the manufacturer. Light output depreciation in some lamps near end of expected life, may be as high as 30% which deteriorates even further with time. When the lumen output is below standard the lamps should be changed. At present low light output if reported, is treated as a faulty light and rectified within the GSL timeframes. This situation could be addressed by annual monitoring of light output of these lamp types or extension of the bulk change programme to include these lamps, whichever is the most cost effective solution.

These factors could be explained in more transparent terms in a single document, which could then be referenced in future Service Level Agreements.

These same issues of degradation of lumen output with lamp age, will affect energy efficient lights. In the case of compact fluoro, the lamps can be bulk changed at appropriate intervals, which is the point at which individual replacement becomes less viable and it is estimated for CFs with electronic control gear, to be at 6 yearly intervals. The issue of lamp life for LEDs is a little more complex, as 10 to 12 year life of the LED panels assumes random loss of individual diodes. If diodes fail in rows the lumen output on the road may be patchy and require early panel replacement if diode rows are angled for wider coverage.

Consequently, tariffs and service levels for new lighting technologies will need to be introduced on an interim basis, until actual performance and maintenance data becomes available, not based on accelerated laboratory data and present day bulk purchase costs.

7 Lighting Tariffs & Associated Costs

The tariffs for public lighting are made up of 4 principal components: (i) purchase & installation, (ii) maintenance, (iii) energy delivery and (iv) energy consumption. The first two components purchase & installation and maintenance in the case of CLER, is borne by the Council or developer and in the case of SLUoS by ETSA Utilities and the developer. In the case of CLER a small amount of maintenance is undertaken by ETSA Utilities being attendance to reported faulty lights, lamp replacement and lens cleaning and included in the tariff. All other maintenance and repairs of CLER and metered lighting are the responsibility of the Council or DTEI.

The other two components energy delivery (NUoS network use of system) and energy consumption are both billed by the retailer with the delivery component then transferred back to the distributor ie, ETSA Utilities in the on-grid areas. DTEI subsidises the cost of lighting in off-grid rural and remote towns. These tariffs are dependent on the load of the light and gazetted annually by law in SA, as un-metered tariffs by AGL, regardless of which retailer has the energy contract. Public lighting on the whole is considered by AEMO to be 'type 7' metering or in other words, an un-metered load. To remove inconsistency across Australia, there will soon be a table of common un-metered energy consumption by fixture, tabled by AEMO for the reference of retailers and consumers.

To complete the picture, in SA the lighting bill (maintenance and energy) for Councils is estimated to be in the order of $20M pa ($12.5 CLER & SLUoS services + $7.5M Energy delivery and consumption) plus maintenance of CLER and maintenance and energy of metered lighting such as on Expressways, Freeways and Highways. In total the expenditure on public lighting across SA is in the order of $22M pa (energy data source 'LGA monthly retail accounts reports', metered lighting energy and CLER maintenance estimated).

The principal savings which can be attributed to Energy Efficient lighting technology are in the reduction in energy transported and consumed, that is, the two elements billed as the retail component. If all lights across SA were replaced with energy efficient lighting the visible reduction would be in retail charges, but not necessarily as much as may initially be expected, as those areas with significant numbers of old fluorescent lights would see little benefit. The component that would reduce would be energy delivery (NUoS) and energy consumption ie, the $7.5M to approximately $4.5M.

The tariffs for provision of services (CLER & SLUoS) will initially increase due to the cost of new technology until economies of scale lower the capital cost and cost of spares. There are some components of the energy efficient technology which will remain high, such as control gear for CF, which is in the order of $110 compared to $25, for technology used to control Sodium and Mercury Vapour lamps. The difference in control gear costs is so significant, that it more than outweighs other operating benefits such as extended or double life of the CF lamp over current lamp types. The difference in lamp costs is significant ie, $14 (42W CF) to $6.40 (80W MV), but once labour to change the lamp is added the cost over 6 years is approximately the same. Nevertheless, the cost of compact fluoro lamps is expected to fall considerably once international production levels increase and at that time SLUoS and CLER tariffs should be adjusted to reflect this benefit. Tariff reduction would apply retrospectively, unless a Council chooses to contract this benefit away, to reduce the level of capital contribution to the upgrade project.

The T5 compact twin linear fluoro has been trialled across 10 Council areas in SA for the last 2 years and although as energy efficient as the 42W CF the style and construction of the luminaire has not proven to be popular aesthetically or as reliable and robust as the standard luminaire used for the 42W CF.

Metal Halide lamps are considered energy efficient and due to the white light emitted are ideal where CCTV cameras are present. The principal Councils using these lamps are ACC and Pt. Adelaide Enfield. The SLUoS and CLER tariffs for these lights have not yet been finalised as there have been batches where early failure rates have been high and where light output has diminished well before expected, prompting early replacement of lamps as if they had failed. Luminaire costs are comparative to current costs and therefore tariffs are likely to be economic if lamp reliability can be addressed consistently.

As any conversion of lighting to energy efficient technology would involve a variety of existing lamp types and wattages it is necessary to include all of the above elements into the business case for determination of costs and benefits. To enable such an analysis to occur, all tariffs and up front costs must be known. Tables of tariffs and component costs are provided as an example in attachment 1.

8 Tariffs for Compact Fluoro Lights

Interim SLUoS and CLER tariffs for compact fluoro lamps (26, 32 & 42W) were first published by ETSA in June 2005 and finalised in January 2010. Respectively the interim tariffs were $86.20 and $45.30, but after an increase in the initial capital cost of the luminaire by the supplier, due to the cost of electronic control gear, the SLUoS tariff was increased to $103.25 whilst the CLER tariff remained the same.

The SLUoS tariff is for 42W CF lamps in ETSA's standard luminaires, whilst Councils or developers choosing more expensive or decorative luminaires eg, the Sylvania Elypt, should apply the CLER tariff.

The retail tariff for this lamp has not yet been gazetted specifically by AGL, and consequently the tariff for a 40W Fluoro lamp of $27.15 is being applied to the 42W CF lamp.

From the table in attachment 1, it is apparent that the total cost of a 42W CF is currently more expensive than an 80W MV, in the case of SLUoS 22% and CLER 18%. These cost differentials should reduce as tariffs are adjusted, when the cost of luminaires and spare parts reduce.

9 Tariffs for LED Lights

LED luminaires are being or about to be trialled by a number of Councils and DTEI across Adelaide. The popularity of this technology is due to proven energy saving which is equivalent to compact fluoro ie, in the order of 65% and the modern styling and appearance of the light.

Interim tariffs for LED lights have not as yet been developed by either ETSA Utilities or AGL and therefore interim tariffs will need to be negotiated with those Councils undertaking trials, or alternatively metered power supplies will need to be installed.

SLUoS and CLER tariffs offered by ETSA Utilities will need to be developed from a different set of assumptions as the luminaire price in bulk supply is likely to be 2 to 3 times that of a standard luminaire for an 80W MV lamp. The maintenance regime is also quite different. LED panels last 12 to 15 years which should mean only one planned replacement of the LEDs in a 25 year period, compared to 6 to 8 bulk globe replacements. The LED panels will be much more expensive than equivalent Mercury or Sodium Vapour lamps. The control gear on the other hand may need to be replaced at shorter periods than current technology ie, 4 to 6 year cycles instead of 10 to 12 years for existing lights. Trials have just commenced and this is an unverified reliability factor, dependent on the maximum temperature reached by a capacitor in the control gear and how long it remains above 50 □C when operating.

10 New Service Level Requirements & Tariffs

LED lights require fewer maintenance visits, but much higher initial capital outlay and higher spare part costs. To develop a CLER tariff, as Councils or developers are responsible for the initial supply and installation cost, ETSA would only need to schedule planned maintenance visits at about 25% of the current frequency, so the tariff should be very low especially if Councils agreed to carry supplies of the LED panels, as is now the case with ACC and Metal Halide lamps. It is therefore worth Councils opting for an Energy Only tariff for LED lights and dropping the CLER arrangement, unless the CLER tariff is very low, as it would not be viable for the limited maintenance required over the asset life.

ETSA Utilities is considering various makes of LED lights for a standard SLUoS offering. The luminaire and light source as with all other lights selected, must be robust, very reliable, safe and economic. The final selection must allow for a tariff to be developed which covers all costs for the life of the asset and such a change in technology is likely to involve significant numbers of lights, not small trials.

11 Energy Efficient Lighting Technology Information

For lighting asset owners or managers to make informed decisions it is important to have access to information on trials under local conditions and be able to verify information. For example some of the early Compact Fluoro lamps would not start under very cold conditions experienced during trials in the ACT and Tasmania, or lumen output was significantly below specification. To enable the sharing of information the Commonwealth Department of Sustainability, Environment, Water, Population and Communities set up a web site www.environment.gov.au/settlements/local/publiclighting/ where Councils and electricity distributors could detail and share information on local greenhouse actions through public lighting. This site has various reports on the issue and a calculator to enable Councils to compare energy use of current technologies with alternatives. The Victorian Government set up a similar site for its Councils referred to as the 'tool box' of information www.energy-toolbox.vic.gov.au/publiclighting/. Other sites were established by private organisations in Victoria funded by member Councils and just as importantly the lighting manufacturers. Philips for example, set

up fact sheets on energy efficient technologies for domestic customers and for Councils the results of international public lighting trials www.lighting.philips.com.au/au/en/Portal?xml=knowledge/.

In 2007, the Commonwealth Government established a laboratory in NSW for testing new energy efficient lighting technologies, enabling products being brought into Australia to be tested to our criteria. Often new technologies and products developed overseas could not be tested in manufacturers' private laboratories due to suitable test equipment simply not being available or for fear of the possibility of product design confidentiality breach. Lights for V class roads require vibration testing due to their greater weight, but LED luminaires can not undergo this testing, as there is no suitable equipment in Australia. Consequently for the time being, some overseas test certifications for new technologies must be relied upon.

As the technologies and quality of products are still advancing, it is important for government to assist Councils financially and thereby share not only the cost of reducing pollution but also the risks. The announcement of grants prior the last Federal Election was a welcome move in the right direction.

12 Other Energy Saving Technologies

There are several other means of reducing energy required to operate Public Lighting suggested in the Sustainable Public Lighting Report and with the imminent roll out of fibre to the home as part of the NBN project, some of these technologies could be enabled economically:

1. The ability to remotely control of street lights from a central operations centre may be able to more accurately switch lights, but the operation of individual PE Cells is considered consistent and reliable in most Australian cities. The savings in energy would be minimal at best. Darwin, having the highest lightning strike rate of any city, works on a system of individual control of lighting for greater reliability, which may also prove to be beneficial in towns in our lighting prone areas of the Lower Mid North and Riverland.

2. The ability to dim lights from a control centre with dimmable control gear when traffic is not present, is another means of saving energy, but this increases costs and complexity of equipment and there is increased liability for traffic issues. Lighting is also provided for the benefit of pedestrian security, plus a deterrent to vandals, property theft and other crime. If street lighting levels were reduced then supplementary security lighting may be required thereby negating any GH benefits.

3. For safety reasons when PE Cells fail, they default to the 'on' position, resulting in lights operating day and night ('All Day Burner'), which are reported by the public as faulty lights and repaired in a few days along with any other 'Single Light Out' (SLO). Energy savings of centrally monitoring lights would only be significant if an effective reporting system did not exist.

Electronic PE Cells offer the advantage of reduced energy draw by the unit itself and longer lamp life. The energy savings are in the order of 5% but the units are considerably more expensive than the existing PE Cells, with about the same 10 year life expectancy. Longer lamp life applies to existing lamps but has not yet been proven with CF or LED lights.

Active reactor control gear can significantly save energy (up to 23%) by reducing energy at start up and when other network load is low, but this technology is not suitable for the new energy efficient light technologies which have electronic control gear with soft starting. The cost per luminaire is in the order of $350 -$500 and consequently is not viable as an upgrade option for existing lights.

Induction lamp technology is as energy efficient as LED technology, the prototype products seen in Australia have been aimed at arterial rather than residential roads (V not P), but the development of market ready equipment is still a considerable way off and appears at this stage to be cumbersome and not sturdy enough for our conditions.

Solar powered lighting is viable where lighting is required and the cost of a network connection is greater than the capital required for the stand alone unit with battery storage. The GH benefit is in the order of 90% when taking into account the energy used to manufacture and maintain the asset and once a price is put on carbon emissions, a full business case could determine the viability of any installation.

13 Obsolete lighting assets

The term obsolete to many Councils, means old technology, but to the asset owners, means equipment which is no longer supported by the manufacturer or by non genuine parts. As older luminaires can no longer be repaired economically or when lamps are discontinued by the suppliers, the light is usually replaced with what ever is the standard luminaire at that time. This situation presents an ideal opportunity for Councils and ETSA Utilities to agree on an energy efficient light, rather than the 80W MV lamp in a standard luminaire replacement, with a design standard check to AS-1158 as is required when changing to a light of different wattage and lumen spread on the road.

Manufacture of the 26W LPS lamp has recently been discontinued, due to low uptake internationally. The 18W LPS lamp is still in demand in a number of countries and its production will continue for some years to come. ETSA Utilities has placed its last order for 2,000 26W LPS lamps before production ceases at the end of 2010. Discussions between ETSA Utilities and affected Councils have already commenced on the replacement of 26W LPS lamp. As this old lamp is relatively energy efficient, replacement with the 42W CF is not an improvement in GHG reduction, but replacement with 26W or 32W CF would be acceptable with little cost increase in service or energy tariffs. This strategy is the most likely outcome, as either of the lower wattage CF lamps can be a direct replacement without any requirement for redesign, unless the Council requires the affected streets to be brought up to current lighting standards.

14 Future of Mercury Vapour Lights

At this time in Australia, there is no directive to cease using mercury vapour lamps. There are recycling facilities in most States, for safe removal of mercury from lamps. There is mercury in not only mercury vapour lamps, but all types of fluorescent lamps. For this reason, some Councils in the eastern states have facilities for residents to dispose of household CF lamps. The efficiency of mercury vapour and some other lamps is the issue, similar to incandescent globes, which was the reason for phasing out that technology, not reliability or safety. Should the Commonwealth government require the phasing out of MV lamps, it would be a major exercise in all States. To control costs such a project should be undertaken over a period which would allow for replacement near end of lamp life, would need to consider compatibility of replacement technology with existing luminaires especially those which relatively new and due to the costs have some form of subsidy or grants for asset owners.

The initiative which can be taken now, is to set a minimum standard for the efficiency of public lighting, which would require new installations to use some form of energy efficient light and to request of ETSA Utilities that its standard light for P class roads, for replacement of obsolete, damaged or infill lighting should be of an energy efficient technology, such as the 42W CF or 56W LED.

15 Lighting in New Subdivisions

Since late 2009, Councils have had the ability to specify to developers of new industrial (UID) and residential (URD) subdivisions that the 42W CF energy efficient light is used in the lighting design. ETSA Utilities listed several luminaires for this lamp as SLUoS lighting and more expensive luminaires as CLER options. Surprisingly only a few Councils, such as Charles Sturt at the Cheltenham RC/Actil site and Burnside at the Glenside Hospital site, have actively promoted this transition of lighting. The only hurdle to Councils is the cost increase over the current standard lighting, which is in the order of 22% in ongoing total tariffs. Councils could therefore require energy efficient lights in subdivision planning applications.

16 Redesign of existing street lighting to meet current standards

The Australian Standard (AS-1158) for street lighting requires a design check or redesign of the lighting in a street if something changes, to ensure that lumen output and spread on the ground, still meet the minimum standard. The standard for lighting was upgraded in about 1998 requiring more lumens on the road and in 2001 requiring less upward glare and consequently the lighting in many streets does not meet the current standard. Standards are not retrospective but must be adhered to when upgrade work is to be undertaken. Part of any light replacement project where the lighting layout was designed to the old standard must therefore include a redesign or check, not simply a one for one replacement of lights. In addition where street design has been altered by the addition of roundabouts or extra turning lanes, a lighting design check must be undertaken.

When selecting the 42W Compact Fluoro lamp for SA (as opposed to the 26W or 32W) the wattage and lumen output was taken into account, to minimise the number of extra lights required in streets as standard, as its output is slightly greater than an 80W MV lamp. Similarly, with the investigation of LED lights, the 28W and 56W are being considered for replacement of the 80W MV lamp.

Even so, in many situations there will be a requirement for an extra ~10% of lights in streets to meet the current Australian Standard. The cost of this upgrade will be determined by the existing assets ie, where overhead power lines exist the addition of an extra light on an existing power pole is relatively in-expensive, but where the assets are underground the cost of retrofitting an additional column and underground wiring is an estimated $5,000 per extra light. All housing sub-divisions in SA have had underground electricity distribution since 1983, and so those Council areas where there was significant development in the 1980's and 1990's will require proportionately greater funding to upgrade lighting to current standards. Columns as a material item cost in the order of $1,000, but installation, electricity connection and earthing cost significantly more, especially if trenching across roads or underground boring is required and poor conductivity soils exist.

The redesign process on a project scale, in itself would cost no more than $30 per light, but the resulting cost of ~10% average extra lights across an area increases the cost of the upgrade work considerably

and adds a 10% additional load to the energy consumption thereby depleting the net energy savings from 65% to 55% and projected savings in GHG emissions and energy costs.

17 Capital contribution for early luminaire replacement

The removal of ETSA Utilities owned luminaires that are less than 15 years old requires a contribution to the capital cost component of the unrealised SLUoS tariff. This contribution is on average between $80 and $120 per light. There is no such contribution when replacing CLER, metered or Energy Only lights as they are owned by the customer (Council or DTEI). Councils would have their own financial treatment for depreciation of capital expenditure, which would apply to their individual asset registers. If a particular project or area can be shown to have a significant number of SLUoS lights which were approaching the 15 year threshold, then the capital contribution would be much less than the average. ETSA Utilities keeps records of the age of all lighting assets which it installed or were vested to it by developers as part of URD or UID subdivision asset ownership hand over.

The vesting process includes an allowance paid to developers by ETSA Utilities per allotment for items such as lighting. The allowance is based on the standard ETSA Utilities approved column, luminaire and lamp at that time, which are often not the same as that installed by the developer.

Light columns would not be included in the contribution calculation (unless being replaced for aesthetics), as they would be re-used for the replacement luminaire and the SLUoS tariff for the new energy efficient light would have a capital component for column maintenance or future replacement.

Any luminaire over 15 years of age which was to be replaced, would not have a capital contribution for undepreciated value. Unfortunately most luminaires with 80 W Mercury Vapour lamps are under 15 years of age, as this has been the standard lamp for P class roads since the mid 1990's.

18 Allowance for foregone planned maintenance

When the customer contribution towards a project is determined, it is only reasonable to expect and therefore request, assurance that any foregone planned maintenance such as Bulk Lamp Change Over and in the case of SLUoS lights, PE Cell replacements in the year of the planned upgrade project, are factored into the final costing. Planned bulk lamp change overs occur on about a 3 year cycle and PE Cells have about a 7 to 8 year life and may be replaced on every second lamp change. The material and labour components of the foregone maintenance would be in the order of $15 - $20 per light.

19 Transition Costs of Existing Lighting to Energy Efficient Technology

After discussions between ETSA Utilities and City of Charles Sturt, a proposal was developed in mid 2010 to convert all existing P class road (residential streets) lighting to 42W CF lights over two years. It involved approximately 10,500 lights of various ages and technologies, some 40% of which were on columns in subdivisions with underground services. Such offers would necessarily constitute a redesign of the lighting layout in all streets, removal of existing lights and replacement with energy efficient lights with an additional 10% of lights across an area and 10% extra columns (~$400K) in underground areas to meet the current standard. Councils with a higher percentage of overhead power-lines would have significantly lower costs in this respect. There would also be a capital payout on lights under 15 years old

(7,000 lights ~$600K). The Council also wished to consider conversion of its CLER lighting to SLUoS standards for transfer to ETSA Utilities (estimated cost of works $300K). The estimated capital contribution would be in the order of $1.4M for conversion of all existing lights including Council CLER assets, or $1.1M if only the SLUoS lights were converted. Such a capital contribution for either option would be too onerous for most Councils, when taking into account that the total ongoing lighting cost (service and energy) would increase by 38% pa. The tariff increase is higher than expected, due to the higher capital cost of new technology which is built into the service tariffs and the 10% increase in lights required to comply with current lighting standards. Targeted projects would be a better strategy.

Apart from the issues discussed above in relation to age of existing assets, there are significantly different service tariff bases in each State and Territory. In Victoria the tariff which is similar to SA's SLUoS is significantly lower, as unlike the South Australian model, in Victoria the Council pays the initial capital cost of the luminaire and installation. The Victorian tariff arrangement is more expensive for Councils at the time of installation but annual tariffs are then lower. Rebates from the DBs to land developers at the time of vesting are also somewhat lower, as the capital value of standard lighting is not included. In SA the only up front capital paid by a Council where extra lights are installed is for installation of columns in underground areas and long outreach brackets on dual lane carriageways, not for installation, standard fittings, luminaire or lamp. The SA tariff model gives clear authority to the asset owner, should the asset require upgrading or changing in some way but similar in total life costs.

The provision of grants and funding from the Commonwealth will need to account for the different ownership, capital contribution arrangements and lighting tariffs across the States. Retail tariffs can also vary between the States, but not to the same extent as service costs, as they are based on load profiles of the light types, with AEMO guidelines for consistency.

20 Council and DTEI Initiatives to Transition to LED Lighting

Both City of Charles Sturt and ACC have been trialling LED street lighting, from two manufacturers RUUD (Canada) and Unilumin (China). City of Charles Sturt installed a small trial of RUUD LED lights in early 2010, on walkways at West Lakes and is pleased with the look and performance. The Unilumin product has undergone significant redevelopment in consultation with ETSA Utilities and DTEI to meet Australian Standards and SA compatibility requirements. A joint SLUoS trial 112W or 168W LED is soon to be installed on Magill Road (V class road) and Department of Defence SA has ordered the Unilumin LED lights for its facility upgrades. The Unilumin luminaire 56W LED for P class roads (residential) is currently being modified after assessment by ETSA Utilities for CLER use by Councils. Both products have similar warranties, quality and performance but the Chinese product is more attractive economically as it is expected to be about half the price of other makes. Unilumin also has a smaller 28W LED luminaire available for other applications such as lanes, reserves and parking areas. Other manufacturers such as Sylvania and Phillips are developing LED luminaires, but have not yet prepared samples or pricing for Australia.

Recently the ACC has issued an RFI for an upgrade of ~400 street lights to LED technology, on main thoroughfares such as Morphett and Grote Streets. The ACC's aim is to reduce street lighting energy consumption by 50% by 2020, with the replacement of all inefficient lighting. The City of Charles Sturt has a similar goal in its strategic plan as do several other suburban Councils. The issue is, which energy efficient light to select, when to start and how to instigate change. ETSA Utilities, Councils and DTEI are all interested in working on these issues. http://www.etsautilities.com.au/public/redirect.jsp?id=2488

To meet targets of GHG reduction due to street lighting by 2020, there will need to be investment in new technology and allowance for higher tariffs, at least for the first 5 - 8 years, until the cost of the equipment reduces and is reflected in adjusted tariffs.

21 Third Party Contracting Options

Some overseas companies offer a fully outsourced and centrally monitored public lighting service, which can include upgrading of assets to new technology after an agreed life, and negotiated service levels for reliability and performance of various technologies eg, Citelum Australia. Such arrangements have been established in cities such as Paris where much of the power distribution network is underground and so synergies with the power company did not exist, but not as yet anywhere in Australia.
The outsourcing of lighting services by Councils is only possible where they own the assets, that is CLER, Energy Only or metered lighting. The proportion of lighting owned by Councils is in the order of 8-20% depending on the Council. The majority of lighting for 'P class' roads in SA is provided by ETSA Utilities and consequently the option to contract out the service would be assessed on the basis of potential savings, against using lighting maintenance as a 'fill in' work for an existing workforce. ETSA Utilities contracts out bulk lamp changes of SLUoS and CLER lighting to control its maintenance costs.

As Public Lighting is now considered a Negotiated Service by ESCOSA, the opportunity exists for SLUoS and CLER tariffs, services and performance levels to be negotiated by Councils and DTEI on an ongoing basis. This would be advantageous when considering new technology, as the decision to opt for CLER, Energy Only or metered lighting as opposed to SLUoS lighting would drive ETSA Utilities to provide the technologies that Councils require or incrementally loose assets and consequently unregulated income.

22 Summary and Conclusions

With the financial support through Commonwealth grants, it is now time to consider transitioning to energy efficient public lighting. The most appropriate type of asset for Councils to concentrate their attention on is 'P class' roads where the technology will benefit the local community. The selection of energy efficient technology for SA should be done in consultation with DCCEE, DTEI, Retailers and ETSA Utilities, as each Council must assess the total business case for the life of the asset, taking all costs and benefits into account, especially the sum of retail and service tariffs.

An assessment of technologies which are reliable, practical and robust, energy efficient and economically viable comes down to CF and LED lights with electronic control gear to extend lamp life. Other technologies such as centrally controlled and monitored lighting, may deliver further small incremental benefits but the high capital outlay is unviable. CF lights are already available for developers to use, and an economic LED light will be available in early 2011. Consequently Councils should insist on energy efficient lighting technology in the subdivision planning approval process.

To reduce transition costs to a minimum, lights which are not energy efficient and more than 15 years old and obsolete lights such as 26W LPS, should be targeted. Wherever possible, light technology should be selected during the re-design process, which does not result in the need for extra lights especially in areas using columns. This will retain the greatest benefit in energy efficiency and keep capital and operating costs to a minimum.

Attachment 1. Comparative total annual Lighting costs (current at 30/11/10)

		Tariffs			Total $ pa (excl GST)
Light Types	**ETSA**	**Charges**	**Retailer**	**Charges**	
	CLER	**SLUoS**	**Energy delivery**	**Energy use**	
Existing Light Types (P class roads)					
80W Mercury Vapour		59.10	18.26	29.42	106.78
	13.50		18.26	29.42	61.18
40W Fluorescent		77.70	10.25	16.90	104.85
	30.20		10.25	16.90	57.35
18W Low Pressure Sodium		70.10	5.94	10.19	86.23
	22.00		5.94	1o.19	38.13
50W High Pressure Sodium		75.30	12.30	20.10	107.70
	24.90		12.30	20.10	57.30
70W Mercury		None			N/A
	13.50		16.43	26.55	56.48
70W HPS		112.40	17.45	28.12	157.97
	26.20		17.45	28.12	71.77
Energy Efficient					
Compact Fluoro					
42W CF (Suburban Eco or B2001 Post Top)		103.25	10.25	16.90	130.40
42W CF (in Elypt luminaire)	45.30		10.25	16.90	72.45

NB: Replacing an 80W MV lamp (current standard) with a 42W CF saves 66% in energy consumption with corresponding GHG emissions reduction, but with a 22% cost increase. The purchase cost of energy efficient luminaries is expected to reduce as production volumes and competition increase, which will in turn warrant revised tariffs.

ETSA Utilities tariffs were held at 2009 levels for 2010 ie no CPI increase was applied, next increase is due from 1/1/11. AGL default energy tariffs are adjusted annually at 1st July.

Attachment 2. Acronyms and Terms

ACC	Adelaide City Council
AEMO	Australian Energy Market Operator
AGL	Default Retailer for SA
AGO	Australian Greenhouse Office
CCTV	Close Circuit Television
CF	Compact Fluorescent
CLER	Customers Lighting Equipment Rate – customer owns and repairs the luminaire and columns, ETSA maintains the lamp and cleans the lens, electricity from a public unmetered supply
CPRS	Carbon Pollution Reduction Scheme
DEWR	Commonwealth Department of the Environment and Water Resources
DTEI	State Government Department of Transport, Energy and Infrastructure
Energy Only	Customer owns and maintains the asset, electricity from an unmetered supply. The tariff covers use of ETSA's low voltage network and GIS records.
ESCOSA	Essential Services Commission of SA
ETSA	ETSA Utilities – electricity distributor for on-grid SA
GHG	Green House Gas
GIS	Geographic Information System
GSL	Guaranteed Service Level
HPS	High Pressure Sodium
LED	Light Emitting Diode
LGA	Local Government Association of SA
LPS	Low Pressure Sodium
Metered Lighting	Customer owns and maintains the asset, electricity from a metered supply
MH	Metal Halide
MV	Mercury Vapour
NUoS	Network Use of System
P class road	Road primarily used by pedestrians in a residential area
PE cell	Photo Electric cell – turns a light on and off
REFF	Renewable Energy Future Fund
SLA	Service Level Agreement
SLO	Single Light Out
SLUoS	Single Light Use of System or Standard Tariff – ETSA owns the light and column and is responsible for all maintenance, electricity from a public unmetered supply
UID	Underground Industrial Development
URD	Underground Residential Development
V class road	Road primarily for the use of vehicles
W	Wattage