3 August 2018

Submission prepared for Orana Regional Organisation of Councils (OROC)

in relation to

Essential Energy's Public Lighting Proposal for the Regulatory Period 2019 – 24 Specifically Attachments 16.1 – 4, 17.4, 17.4.1 and 17.5

Energy and Management SERVICES

NEWCASTLE | BRISBANE | SYDNEY

Prepared for

OROC

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1 Engagement

Energy and Management Services Pty Ltd (EMS) are engaged by the Orana Regional Organisation of Councils (OROC) on behalf of the Local Councils listed below to respond collectively to the proposal submitted by Essential Energy in relation to public lighting. Specifically, we refer to the following Attachments to Essential Energy's Regulatory Proposal, submitted to the AER on 3 April 2018 including:

- Attachment 16.1.4 – Indicative Public Lighting Pricing Schedule;
- Attachment 17.4 – Public Lighting Proposal;
- Attachment 17.4.1 - Asset Management Plan – Public Lighting Services; and
- Attachment 17.5 – Public Lighting Model.

Clients for whom this submission is prepared:

- Orana Regional Organisation of Councils (OROC) which encompasses the following local Councils:

  Bogan Shire Council
  Bourke Shire Council
  Brewarrina Shire Council
  Cobar Shire Council
  Coonamble Shire Council
  Dubbo Regional Council
  Gilgandra Shire Council
  Mid-Western Regional Council
  Narromine Shire Council
  Walgett Shire Council
  Warren Shire Council
  Warrumbungle Shire Council

2 Introduction

Energy & Management Services has been engaged by the Orana Regional Organisation of Councils (OROC) to provide analysis and a response to the Essential Energy (EE) Regulatory Proposal currently before the Australian Energy Regulator (AER). The analysis and response are limited to aspects relating to the proposal for the provision of Public Lighting in particular the proposed charges to ensure that they align with the efficient delivery of Public Lighting Services.

While Essential Energy is required to comply with several legal obligations regarding the provision of Public Lighting Services this report will principally address:

- The efficiency and effectiveness of the Public Lighting Proposal and the Asset Management Plan supporting the proposal, Section 6;
- The proposed change to a component cost system, Section 7;
- OPEX Quantitative Inputs to the Charging Model, Section 8;
- CAPEX Quantitative Inputs to the Charging Model, Section 9;
- Poor Performance of 70W High Pressure Sodium Luminaires, Section 10; and
- Tariff Model – Additional Requirements, Section 11.

In addition to providing a response to the AER of Essential Energy's proposal it is also intended as a useful report for Councils to use in discussions with Essential Energy through the Street Light Consultative Committee and directly as required.

3 Executive Summary

This submission details a review of the collective documents that incorporate the Essential Energy 2019-24 Regulatory Proposal for Public Lighting. The report has identified details that will assist the AER to make their determination of Essential Energy's Proposal and approval of efficient tariffs for Public Lighting Services. The two focus areas are:

- The Asset Management practices of Essential Energy in relation to Public Lighting including areas for improvement which are contributing to higher than necessary tariffs; and

- Input errors to Attachment 17.5 – Public Lighting Model, which have been identified that are contributing to higher than necessary tariffs.

Further the report is intended to support the engagement of Councils with Essential Energy to influence improvements in Asset Management practices relating to Public Lighting through the Essential Energy Street Light Consultative Committee (SLCC).

Areas for improvement in Asset Management practices aside the report has identified material errors in inputs and assumptions relating to maintenance charges that if approved would result in annual over charging of $3.0M as summarised in **Table 1** below:

Table 1 – Maintenance – Errors in Inputs and Assumptions

Reference	Error in Inputs and Assumptions	Annual Adjustment $
AER 2	Costs associated with the removal of control wire and choke boxes – stranded assets	$457,000
AER 3	Reduction in CAT V Night Patrol charges – error in historical costs used to establish future charges	$418,000
AER 4	Correction of spot replacement labour hours for increased defects per mobilisation – error in Model compared to Proposal	$818,000
AER 6	Invalid "Other Maintenance" material costs – error of misallocation and double charging	$227,000
AER 7	Correction to "Other Maintenance" labour hours for increased defects per mobilisation – error in Model compared to Proposal	$537,000
AER 9	Potential invalid "Bulk Works" material costs $467,446 ($310,885 Direct) – error of misallocation and double charging[1]	TBD
AER 11	Correction of 70W HPS lamp failure rate - overstated	$558,000
	Total Annual Overstatement of Maintenance Costs	**$3,015,000**

Capital issues that affect charges are less significant than for maintenance and are summarised in **Table 2** below:

[1] Essential Energy have been requested to provide details of the inventory used to establish the direct cost of $310,885 per annum. There is a need to validate that these costs are consumables and not capital items recovered through capital tariffs

Table 2 – Capital – Financial Errors in Inputs and Assumptions

Reference	Error in Inputs and Assumptions	Capital Adjustment $
AER 1	The useful life of wood poles & steel columns on rag bolts at 35 years is under stated	TBD
AER 10	• Design costs for pole & column replacement have been charged which Essential Energy does not incur • Require Essential Energy to clarify the intention for Tariff Class 3 and 5 and validate that incorporating these into a new Capital tariff does not disadvantage customers	$369,000

Less tangible observations that the AER should consider are detailed in **Table 3** below:

Table 3 – Less tangible observations for AER consideration

Reference	Observations for Consideration
AER 5	The AER should note that the Essential Energy proposed charges for the same services are higher than that proposed by Endeavour Energy – Figure 9
AER 8	"Other Maintenance" costs have been applied assuming that all technologies and types have the same "Other Maintenance" failure rate of 4.77%. This failure rate should be applied by technology and type and in particular reviewed for new LED installations
AER 12	• The AER should require Essential Energy to amend the Proposal Tariff model to be clear the financial year that all costs are represented in • The AER should require that Essential Energy prepare a Proposal cost impact schedule for each Council based on current inventory

Street Light Consultative Committee

During the prior Regulatory Determination Essential Energy established a Street Lighting Consultative Committee (SLCC) to assist with communication and to comply with consultation requirements under the Public Lighting Code. As at the 1st of August 2018 the most recent meeting of the SLCC was held over 9 months earlier on the 26th of October 2017. Given the improvement opportunities identified in this report the SLCC should be more active in the management of the Public Lighting assets. Anecdotal evidence from Councils is that the SLCC has not been as effective as it could be. It is possible that this is due to Councils not able to participate fully due to lack of expertise in the management of Public Lighting. **Table 4** summarises the SLCC initiatives for Councils to pursue with Essential Energy.

Table 4 – Summary of initiatives for SLCC

Reference	SLCC Initiative Summary
SLCC 1	• Improve the Enterprise Asset Management System (WASP) to capture failure data • Improve customer performance reports to provide component/part & failure data • Provide customer performance reports in Excel format
SLCC 2	• Enhance AMP to detail the basis of assumptions regarding the LED installation targets
SLCC 3	• Review adequacy of 95% uptime on CAT V luminaires • Provide customers with specific CAT V Night Patrol results
SLCC 4	• Audit and provide control reports to improve consistent reporting of costs and work
SLCC 5	• Review poor performance of rectification of CAT V luminaires found by Night Patrols • Amend Customer Asset Reports to be in Excel format and provide grouping of defects at single attendance
SLCC 6	• Update the existing Public Lighting Management Plan (last reviewed 2011) • Update default luminaire replacement table
SLCC 7	• Review the contract model for bulk lamp replacement to ensure that the contract model is efficient
SLCC 8	• Urgently consider a change to twin arc lamps in 70W HPS luminaires which based on the Proposal tariff model will save customers an estimated $558,000 per annum • Where Essential Energy cannot meet demand for bulk replacement with LED technology at an efficient cost allow Councils to engage local Accredited Service Providers

It is apparent from the scale of the identified areas for improvement in Asset Management practices and errors relating to the charging model inputs that the Street Light Consultative Committee may not be working effectively. A possible solution to improve the operation of the SLCC and provide benefits for both Essential Energy and Customers would be for Essential Energy to provide a modest allowance for a suitably experienced Subject Matter Expert (SME) appointed by the Councils. The SME would require Asset Management skills and operational experience to represent customers and work co-operatively with Essential Energy. Further an open book approach is recommended such that errors in the recording of costs and work can be readily audited and validated by the SLCC appointed SME to ensure that the asset is managed in the best interests of Councils.

The expense of such a resource would be a minor cost and could be easily funded from the Corporate Overheads of 50.36% applied to the direct costs of providing the Public Lighting service. Based on evidence in this report the cost of the resource would provide significant value and benefit to all parties.

4 Essential Energy Background

Essential Energy is the Distribution Network Service Provider for approximately 95% of NSW including all regional and rural areas excluding the Greater Sydney, Hunter and Illawarra areas.

Public Lighting is operated as a monopoly service by Essential Energy that encompasses, operation, inspection, maintenance and replacement of public lighting assets. Essential Energy could undertake construction of these services however in the Essential Energy franchise area this activity is almost exclusively undertaken by Accredited Service Providers and gifted to Essential Energy for long term operation and management.

Essential Energy's Public Lighting customers are Road authorities, including Local Government Authorities and the Roads and Maritime Services who are responsible for assessing the need to install public lighting and determining the lighting levels required for the public lighting installation.

The Public Lighting Inventory owned and operated by Essential Energy on behalf of its road authority customers totals approximately 160,000 luminaires and associated support structures. **Figure 1** below from their Asset Management Plan details the main technology types across the population. Clearly the emerging LED technology at only 9.44% penetration provides significant potential opportunity to improve efficiency.

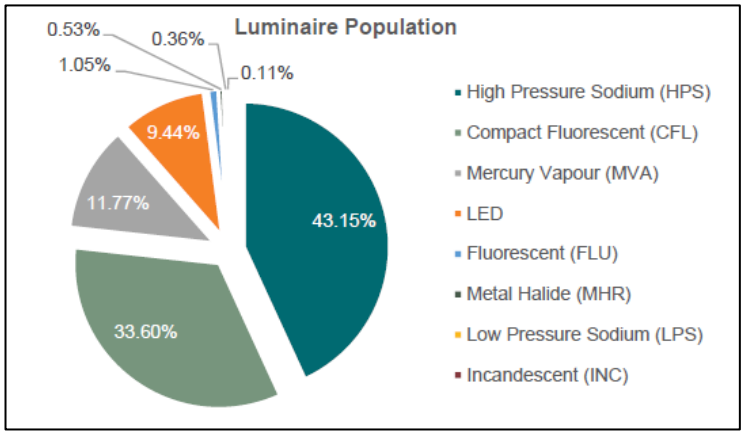


Figure 1 – Luminaire Population by technology

5 Obligations

While Essential Energy is required to comply with several legal obligations regarding the provision of Public Lighting Services this report will principally address:

- The efficiency and effectiveness of the Public Lighting Proposal and the Asset Management Plan supporting the proposal, Section 6;
- The proposed change to a component cost system, Section 7;
- OPEX Quantitative Inputs to the Charging Model, Section 8;
- CAPEX Quantitative Inputs to the Charging Model, Section 9;
- Poor Performance of 70W High Pressure Sodium Luminaires, Section 10; and
- Tariff Model – Additional Requirements, Section 11.

For reference the main obligations are set out below:

a) National Electricity Laws – Commonwealth Legislation;
b) National Electricity Rules – determined by the Australian Energy Market Commission (AEMC);
c) Determinations of the Australian Energy Regulator (AER) including determinations for monopoly Public Lighting charges determined under Alternate Control requirements where user charges are required to be cost reflective;
d) Electricity Supply General Regulation (2014) – mandates penalties for failing to achieve repair times;
e) NSW Public Lighting Code – a non-mandatory code currently under review;
f) Essential Energy Public Lighting Management Plan which is a requirement of the NSW Public Lighting Code.

6 Asset Management Plan and Public Lighting Proposal

Essential Energy has submitted their Public Lighting Proposal - Attachment 17.4 and Asset Management Plan (AMP) – Public Lighting Services – 17.4.1 as a supporting document to their submission. This section deals with both the Proposal and AMP as most issues are common across both documents. On review the following matters are worthy of note:

6.1 Failure Recording

The AMP includes a short table of failure rates for common luminaires on page 9. These rates align only with a sum of failure rates for lamps and PE Cells in the Tariff Model. They exclude the allowance for ballast failure at 0.44% and the failures allowed for "Other Maintenance" in the tariff model that average 4.77% across the population.

The "Other Maintenance" implied failure rate or attendance rate of 4.77%[2] has been applied to the whole population regardless of technology indicating that the failure rate by technology and luminaire type cannot be determined.

Customers receive monthly and annual performance reports via the Essential Energy Public Lighting Portal. These reports do not provide confidence that Essential Energy is accurately recording the type and cause of defects by luminaire technology and type. The Council reports are only in PDF form which does not aid analysis. The defects recorded are limited to:

- Change luminaire maintenance tasks (assumed to be luminaire replacement);
- Fit wire guard;
- Minor maintenance tasks;
- Standard maintenance tasks;
- Service replace connector;
- Investigate maintenance tasks;
- Repair maintenance tasks;
- Light not working maintenance tasks.

The current defects and work recorded are not helpful in managing the performance of the asset as:

- The component/part failure are not recorded;
- The work undertaken is not recorded;
- The cause of the failure is not recorded.

[2] In the Tariff the model the "Other Maintenance" failure rate is applied is a dollar amount rather than a failure rate

While a full Reliability Centred Maintenance and Failure Mode Effects and Criticality Analysis approach may not be warranted, as a minimum some reasonable data to address what failed and why and what work was conducted is imperative to make informed decisions. Failure to capture such data results in poor decision making, inaccurate apportionment of charges and higher whole of life costs which are passed onto customers.

Essential Energy should:

- Make appropriate configuration changes to their Enterprise Asset Management System to allow capture and reporting to customers of appropriate failure data;
- Improve the customer performance reports to provide the data discussed above; and
- Provide customers with performance reports in Excel format to aid analysis rather than in PDF.

SLCC 1 - The Street Light Consultative Committee should work with Essential Energy to:

- *Have appropriate configuration changes made to the Enterprise Asset Management System to allow capture and reporting to customers of appropriate failure data;*
- *Improve the customer performance reports to provide the data discussed above; and*
- *Provide customers with performance reports in Excel format to aid analysis rather than in PDF.*

6.2 LED Lighting

While Essential Energy came under some criticism at the prior regulatory determination for being slow in the uptake of new LED Technology in the case of CAT P installations this has been dealt with and an LED option is now available with some 15,000 installations in service. Regarding CAT V there is at this stage commitment only to a future CAT V LED option. It is not yet available and should be pursued particularly for new installations.

On submission, April 2017, the AMP notes 9.44% (~15,000) of luminaires currently being of LED technology with a target of 25% by July 2019. This will require the replacement of an additional 25,000 mostly CAT P luminaires which may be challenging over the short period if agreements with Councils are not already in place.

Further the AMP sets a target of 90% of luminaires installed at June 2024 being of LED technology. This would require that:

- All CAT P luminaires are replaced including some 50,000 medium efficiency CFL technology luminaires with an average age of only 5 years which were almost all funded by Councils; and
- Approximately 24,000 CAT V luminaires are replaced which would be largely of HPS technology.

The AMP having a goal of working towards higher efficiency LED technology is acknowledged as appropriate however the AMP lacks the evidence of how this will be achieved, at what cost and for what benefit. The AMP should be enhanced to include this detail to ensure that the targets for LED technology are realistic and that Public Lighting Customers can make informed decisions.

Given Essential Energy's historical rate of LED installation the targets for LED installation of 25% in 2019 and 90% in 2024 are considered doubtful. In circumstances where Essential Energy can not meet demand for LED installation and at an efficient cost consideration should be taken to allowing Council's to undertake bulk replacement with local Accredited Service Providers.

SLCC 2 - The Street Light Consultative Committee should request that Essential Energy:

- *Enhance the AMP to include detail of how the LED target installation rates will be achieved, at what cost and for what benefit to ensure that the targets for LED technology are realistic and that Public Lighting Customers can make informed decisions.*
- *Where Essential Energy cannot meet demand for replacement at an efficient cost allow Councils to engage local Accredited Service Providers to undertake the works*

6.3 Poles and Columns

The AMP shows a marked increase in the replacement of poles/columns in FY 17. **Figure 2** below is extracted from the AMP and shows the number of pole replacements increasing from around 250 per annum to 500. The reason given is due to the age of the assets however given the long-lived life of the assets and the wide range of ages in service such a step change seems unlikely. Essential Energy should validate this data and ensure that there has not been a change in methodology of allocating dedicated supports. The replacement of

dual use “Pot Belly” columns which fulfil the dual purpose of Service pillar and column are not dedicated and should be excluded. This may be a possible explanation for the large step increase.

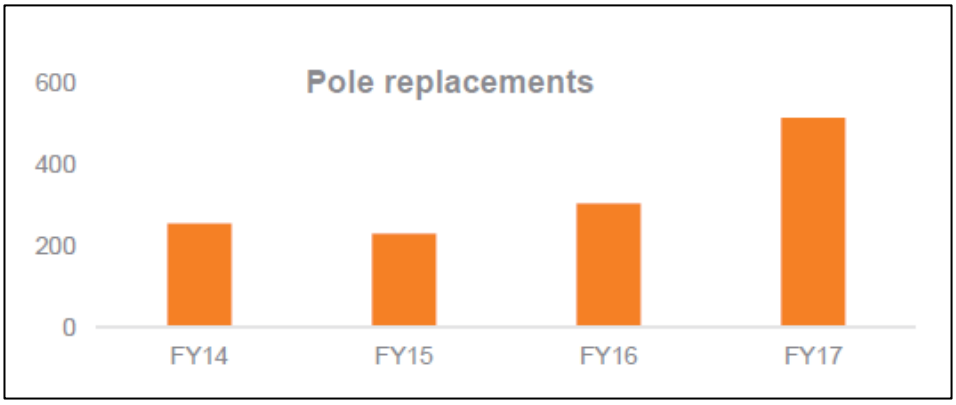


Figure 2 – Dedicated pole/column replacements

The claimed useful life of 35 years for dedicated poles and columns seems low and should be reviewed. It may reflect the average age of those currently being replaced but it likely understates significantly the average life that the in service assets will eventually attain. The dedicated poles and columns in service should not be allocated a single average useful life as there will be a marked difference in the three main types of wood, direct buried steel and steel on rag bolts.

AER 1 - The AER in considering the Essential Energy Proposal should consider:

- *Requesting Essential Energy to substantiate the useful life of 35 years for all Streetlight poles and columns as this understates the average useful life of wood poles and columns of the current design fitted to rag bolts*

6.4 CAT V Lighting – Uptime of asset base

The AMP notes a target uptime for CAT V installations of only 95%. This figure should be reviewed. As an average it would mean that for some periods (just prior to a patrol) the fleet will approach only 90% functioning or 1 in 10 faulty which, particularly for CAT V installations would be considered unacceptable.

Essential Energy conduct a six-monthly night patrol of CAT V luminaires as a strategy to achieve the up-time target. The date and results of these night patrols should be submitted the following month to the Customer through the Street Lighting portal along with the standard monthly reports presently provided.

SLCC 3 - The Street Light Consultative Committee should jointly review with Essential Energy:

- *The appropriateness of the average uptime target of 95% for CAT V lighting*
- *A specific report submitted following the twice annual CAT V Night Patrol that clearly sets out the date of the patrol, the uptime % of the CAT V installations, the specific defects identified and their rectification period*

6.5 Unplanned Failure

The AMP notes failure rates for the common luminaire technologies and sizes. In the main these appear to be reasonable however the failure rate of 14.29%[3] for the 70W High-Pressure Sodium is excessive. The AMP does not address any strategy to deal with this high failure rate nor identify the cause. While the like technology in 150W, 250W and 400W have failure rates of around 5% it indicates a potential problem with the quality of the 70W lamps for which there should be an initiative in place to address.

Section 10 details performance issues with the 70W HPS 70W luminaires in more detail as this is the most common luminaire in the fleets of the OROC Councils and the use of this high failure rate in the model results in an excessive tariff.

6.6 Defect Volumes

The graph of defect volumes represented below in **Figure 3** from the AMP does not provide confidence that in all years the tasks are presented on an equal basis.

[3] The total failure rate for the 70W HPS is 14.29% for lamp & PE Cell, 0.44% Ballast and 4.77% Other Maintenance for a total failure rate of 19.5% per annum

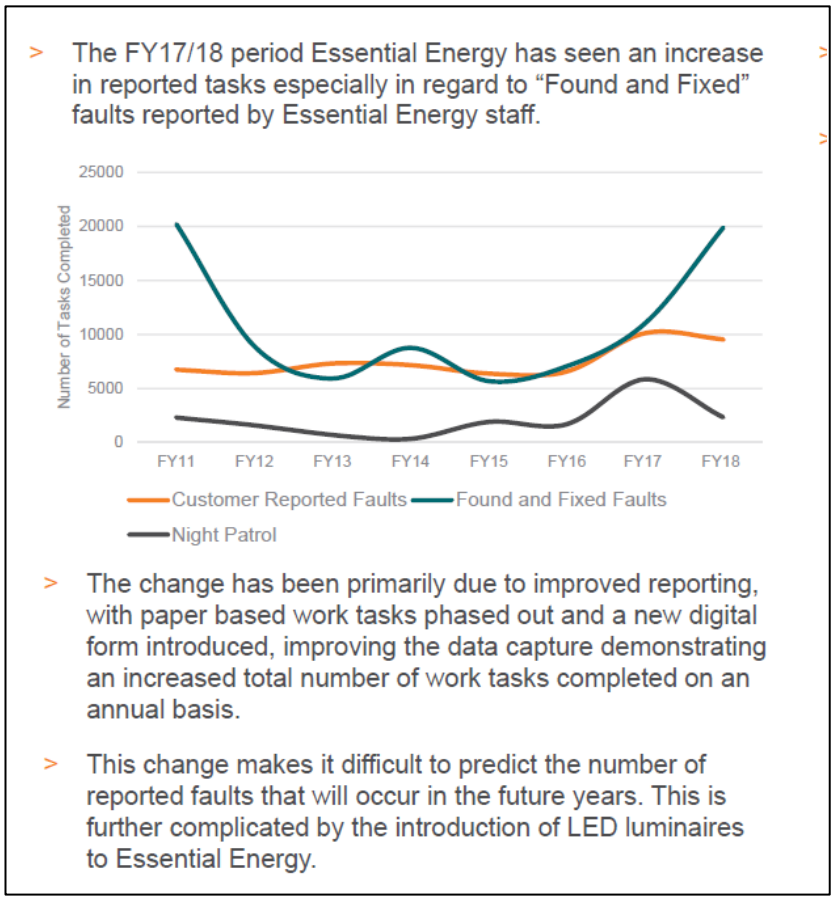


Figure 3 – Number of Tasks Completed

While the AMP suggests the spike in tasks completed in FY18 is due to improved reporting due to the introduction of a digital form, FY11 had a like number of found and fixed tasks. A better understanding is required of the step change to determine what is driving the variation in tasks if the inputs to the tariff model are to be robust. Given that there is a category for “customer reported faults” and “night patrol” it is likely that the “Found & Fixed” faults are only those relating to incidental activity undertaken while attending a customer reported fault, night patrol fault or bulk lamp replacement and hence have no impact on cost as they were historically being incurred in any case. Incidental activity may include replacing seals, cleaning, saddling wiring etc.

The assumption that the change to a digital form makes it difficult to predict the number of reported faults in the future seems invalid as the customer and night patrol faults are reported separately and should be well

recorded. It is possible that the increase in customer reported faults and night patrol faults may be associated with a step change in the failure rate of the HPS 70W installations which is a common luminaire in the fleet.

SLCC 4 - The Street Light Consultative Committee should request that Essential Energy:

- *Conduct an audit and review of reporting practices to ensure reporting is consistent between locations and periods and that control reports exist to identify exceptions that require intervention*
- *As part of the audit ensure that source codes, customer reported, night patrol and find & fix are being appropriately used*

6.7 Defect Rectification Performance

The AMP shows evidence of prompt rectification of defects. Once reported by customers the average repair time is 4.3 days. Of concern though is the rectification period for CAT V luminaires post a night patrol. Data for the largest Council in OROC, Dubbo Regional Council for the reporting period FY 16/17[4] indicates the average days to repair at 29.05.

Source	Repair Count	Total Days to Repair	Average Days to Repair
Found and Fixed	844	383	0.45
Night Patrol	772	22,426	29.05
Public Reported	807	2,805	3.48
Summary:	**2,423**	**25,614**	**10.57**

Figure 4 – Defect Rectification Dubbo City Council – FY 16/17

The Night Patrol CAT V repair days improved in the FY17/18 to 14.78 days however this still exceeds the requirement of the Public Code of an average of 8 days.

[4] Data is for the original Dubbo City Council only

Source	Repair Count	Total Days to Repair	Average Days to Repair
Found and Fixed	2,240	3,692	1.65
Night Patrol	173	2,557	14.78
Public Reported	432	2,235	5.17
Summary:	**2,845**	**8,484**	**2.98**

Figure 5 – Defect Rectification Dubbo Regional Council – FY 17/18

The evidence for Dubbo in the annual reports provided by Essential Energy would indicate that the 4.3 day average is not being achieved for the most important luminaires being CAT V.

The rectification period for found and fixed defects is short indicating that this was in the main incidental work associated with attending a reported fault. As Essential Energy staff work during daylight hours it seems odd that in the case of FY17/18 the vast bulk of defects were found & fixed and not subject to reporting from customers or night patrol.

The legend for the report is detailed below in **Figure 6** and shows that Found & Fixed are essentially faults found and repaired on the same day. It is likely that these are an additional task completed at the same time as attending a fault and as such there is doubt that these should be considered additional attendances increasing the failure rate.

Source Legend & Supplimentary Information	• **Found & Fixed :** Faulty lights found by Essential Energy staff and fixed on the same day • **Night Patrol :** Faulty lights found by Essential Energy staff while performing Night Patrol • **Public Reported :** Faulty lights reported by the public and logged through Supply Interruptions • Report includes completed and closed tasks only • Excludes routine (bulk) Luminaire & Lamp maintenance

Figure 6 – Defect Rectification Report Legend

The AMP and Proposal explain that new processes have been introduced to increase the bundling of work increasing the average repair time from 4.4 to 5.84 days resulting in the average number of tasks being

completed on a single day increasing from 1.48 to 2.74[5]. This bundling of work will reduce mobilisation costs reducing the average repair effort and should be supported provided that the savings are passed onto Customers. The matter is further considered in the review of the tariff model at Section 8.4.

SLCC 5 - The Street Light Consultative Committee should request that Essential Energy:

- *Review the performance by customer of rectification periods for CAT V installations following Night Patrol activities and aim to rectify these defects in accordance with the Public Lighting Code requirements*
- *Amend the monthly Street Light Business Asset Reports such that:*
    - *Reports are in Excel Format not PDF*
    - *Reports group defects for single attendances at an installation*

6.8 Technology Obsolescence

The AMP sets out a prudent plan to deal with technology obsolescence of the following luminaire types:

- Mercury Vapour – 19,000 in service, only 20% reduction over 5 years
- Incandescent – Full replacement only 150 in service
- Low Pressure Sodium – Full replacement only 640 in service
- Compact Florescent – Approximately 60,000 in service but with an average age of only 5 years will remain in service at this stage and EE will negotiate with customers to limit new installations of this technology

The AMP states that Low Pressure Sodium, Fluorescent, Incandescent, and Mercury Vapour luminaires have the oldest average age and are targeted for priority replacement with LED technology due to their age and design. It is noted that there is a disconnect between the technology obsolescence with the AMP target of 25% LED by June 2019 and 90% LED by June 2024. This can not be achieved with the obsolescence strategy for CFL luminaires detailed in the AMP as these alone amount to 34% of the in-service fleet.

[5] ATTACHMENT 17.4 PUBLIC LIGHTING PROPOSAL | 2019-24 | Apr 2018 – Section 5.1

6.9 Replacement on Failure

The AMP does not list a default replacement schedule for the existing installations when failure occurs. While in CAT V installations variation needs to be minimised to prevent driver distraction there should none the less still be a replacement strategy for each technology in both CAT P and CAT V circumstances. In the case of CAT P this can likely be an LED option in standard cases.

The Public Lighting Management Plan 2010 was last revised in March 2011 with a luminaire replacement table as displayed in **Figure 8**. Essential Energy should consider updating the table to indicate that in all CAT P lighting situations that an LED replacement be installed on failure of the existing luminaire such that the fleet is rationalised over time.

EXISTING LUMINAIRES	CURRENT STANDARD LUMINAIRES
• 80W Mercury Vapour • 50 & 70W High Pressure Sodium • All Low Pressure Sodium of 55W or less • Linear Fluorescent Lighting	42W 'Suburban Eco' Compact Fluorescent (New) or 70W 'Urban' High Pressure Sodium
• 150W High Pressure Sodium • 250W Mercury Vapour • 90-135W Low Pressure Sodium	150W 'Roadster' High Pressure Sodium
• 250W High Pressure Sodium • 400W Mercury Vapour • 150-180W Low Pressure Sodium	250W 'Roadster' High Pressure Sodium
• 400W High Pressure Sodium • 700W Mercury Vapour • 310W Low Pressure Sodium	400W 'Roadster' High Pressure Sodium

Figure 8 – Existing table of luminaire replacement

CAT V replacement is more problematic with spot replacements needing to remain like for like unless whole banks of luminaires are to be replaced with LED technology.

SLCC 6 - The Street Light Consultative Committee request that Essential Energy:

- *Consult with customers, review and update the existing Public Lighting Plan*
- *Amend the existing table of luminaire replacement to be reflective of current and prudent Asset Management practice*

6.10 Forecast Expenditure and Revenue

The Proposal at Section 10 details the forecast revenue. The assumptions of the fleet in service for each year are not available to determine if the revenue path is appropriate. In particular it is not known if the revenue is a reflection of the current inventory or the ambitious LED inventory target of 90% by 2024. The revenue path and its effect on customers can therefore not be established.

The AMP at page 14 shows a table of operating and capital expenditure. As with the revenue forecast in the Proposal the assumptions of the fleet in service are not available to determine if the expenditure is appropriate. In particular it is not known if the expenditure is a reflection of the current inventory or the ambitious LED inventory target of 90% by 2024. The expenditure path and its effects on customers can therefore not be established.

6.11 Safety Programmes

The AMP lists four safety initiatives including:

- **Removal of public lighting control wire** – the control wire is a stranded asset since luminaires have for some decades now been operated by individual PE cell. The tariff model includes an allowance for the removal of 20km per year at $15,000 per km ($22,500 with overheads) built into the maintenance charge for each luminaire. This amounts to a contribution from public lighting customers of some $2.26M over the regulatory period and will only remove an estimated 5%[6] of the lighting control wire that is in service. Full removal over time of all control wire at the proposed rate will cost customers $45M. For such a large expenditure the AMP does not evidence the risk nor that the proposed approach is the most prudent method to mitigate the most risk.

[6] Essential Energy provided the estimate of 2,000km of control wire at a meeting to review the tariff model on the 30th of July 2018

It is argued that this approach is not appropriate for the following reasons:

- Prior to embarking on the removal of control wire an audit should be conducted to identify control wire still energised and arrange for disconnection[7] as this will provide greater risk reduction than high cost removal of a small fraction of the in-service asset;
- The street light wire is a stranded asset that should be the responsibility of Essential Energy not Councils. Essential Energy receive a return on and of assets and it is expected that this allows for the risk of stranded assets;
- The Street light wire is owned by Essential Energy not a responsibility of Councils;
- There is no guarantee that Essential Energy will undertake the works however they will have recovered the revenue from the Councils;
- If accepted by the AER, then the cost should be reviewed as the estimate of $22,500 per km is excessive and evidence of the cost should be requested from Essential Energy. Corporate Overheads aside it equates to approximately 6 employees full time for a week to remove a control wire typically from 20 poles per km.

- **Redundant Choke Boxes** – these redundant choke boxes are components left in service due to poor workmanship at the time that the luminaires were replaced. Removed at the time of luminaire replacement the cost would have been nil. Although this is a minimal annual cost at $4,060 plus Corporate Overheads (total $6,100) it should be a cost borne by Essential Energy as it is essentially a clean-up of poor execution at an earlier point in time.

- **Redundant Control Boxes** – These are prudent to remove but could be dealt with at no cost when maintenance is next performed on the associated pole. The tariff model makes no allowance for the work, so it is not a concern to customers.

- **Pot Belly and triangular columns** – The proposed solution to replace pot belly columns which are shared assets with separate pillars and steel columns is a prudent approach but only at the time that the pot belly column requires replacement due to condition. There should be no bulk replacement of these columns until they are assessed as not fit for service based on condition. Essential Energy need to be

[7] Disconnection of energised control wires may require the reconnection of some luminaires to the street mains. This should be done at the next bulk lamp change where both street mains and control wires coexist and the luminaire is connected to the control wire

clear on the tariff which will apply for the new dedicated column which should be from the AER approved tariff model.

AER 2 - The AER are requested to consider rejecting the inclusion of the following safety programmes in the Essential Energy Tariff Model Proposal:

- *The removal of the stranded public lighting control wire at an annual cost of $451,080*
- *The removal of stranded choke boxes at an annual cost of $6,100*

7 Public Lighting Proposal – Component Charging System

Essential Energy at Section 7 of their Public Lighting Proposal have proposed a new component charging system. The move by Essential Energy to a component-based charging system is an appropriate approach as:

- It simplifies the number of variations in the tariff classes
- In the case of end of life replacement, it allows for components to be on the correct tariff class being capital and maintenance recovery. Examples include:
    - When a luminaire is replaced on a dedicated column which typically has a longer life the column can remain on a maintenance recovery only tariff while the luminaire can move to a capital and maintenance recovery tariff;
    - When a column is replaced, and the existing luminaire is reinstalled then the column can move to capital and maintenance recovery while the luminaire remains on its existing tariff class.

Previously where components were replaced it was not possible to charge the correct capital recovery which leads to billing errors of over and under recovery. A high-level review of the amended methodology has been conducted and it appears to be an appropriate approach.

8 OPEX Charging Model – Quantitative Inputs

A review has been undertaken of the quantitative inputs detailed in Attachment 17.4 – Public Lighting Proposal AND Attachment 17.5 – Public Lighting Model.

8.1 Asset Lives

The standard asset life listed for supports at 35 years understates the expected useful life of wood poles and columns installed on rag bolts. It is considered appropriate for direct buried steel columns. The Essential Energy 2015/16 RIN – Category Analysis sheet 5.2 Asset Age Profile, lists wood and steel distribution poles with an economic life of 53.8 years while the public lighting poles and columns are erroneously listed in the RIN with an economic life of only 20 years.

The 35 year standard life should be reviewed in light of this conflict particularly so for the new capital tariffs to be approved in the coming period where current Essential Energy Standards require that columns are fitted to rag bolts encased in concrete which will have an extended life over direct buried steel columns. A service life of 50 years would be more appropriate.

AER 1 (Repeated) - The AER in considering the Essential Energy Proposal should consider:

- *Requesting Essential Energy to substantiate the useful life of 35 years for all Streetlight poles and columns as this understates the average useful life of wood poles and columns of the current design fitted to rag bolts*

8.2 Bulk Lamp Replacement

The bulk lamp replacement proposed at a 4 yearly cycle is considered prudent. Essential Energy have confirmed that the diffuser cleaning listed as only every 2nd cycle at Section 6.3.2 of the Proposal is an error as diffusers should be cleaned each 4 years to maintain light output in accordance with AS 1158 Public Lighting.

The Proposal at Section 6.3.2 explains the delivery strategy for bulk lamp replacement including:

"We secured this service through an open market tender and it is the most efficient available"

The direct contract cost of the programme per lamp change is detailed in the model as $[confidential] direct and $[confidential] with Corporate Overheads applied. It is accepted that a competitive market process was undertaken to establish the contract rate which may be an efficient practice in the more highly populated centres where skilled contract resources are available. However, it is likely a more expensive process in lower density more remote country towns with small luminaire populations where contractors must mobilise to undertake the work incurring relocation and travel/accommodation costs for the Contractors workforce. Relocation and travel/accommodation costs for a contract workforce could be avoided in the lower density/more remote country towns by using local Essential Energy staff to conduct the work at marginal cost.

In locations where the delivery strategy is proposed to use Contract resources local Councils should be involved in the strategy decisions to confirm the most suitable contract model leveraging off local Accredited Service Providers where available. **Table 5** below compares the use of day labour resources with the contract rate.

Table 5 – Base build comparison of day labour and contract for the bulk lamp programme

EE Daily Shift Cost - Labour & Plant	Amount	Comments
Normal Time Labour	$40.03	OPEX Input Sheet C5
Labour Oncost	56.19%	OPEX Input Sheet C9
Normal labour Oncosted	$62.52	OPEX Input Sheet C47
EWP Hourly Rate	$19.73	OPEX Input Sheet C31
Crew Size	2	
Total Hourly Cost - Labour & Plant	$144.78	
Daily Shift Hours	8	
Subtotal EE Day Labour Shift Cost - Labour & Plant	**$1,158.21**	
Traffic Controllers	2	OPEX Input Sheet C35
Traffic Controller Hourly Rate	$62.52	OPEX Input Sheet C36
Traffic Control Allowance % of shifts	27.5%	10% CAT P & 80% CAT V - OPEX Input Sheet C41 & C42
Traffic Controller Costs - Average Across Shifts	$275.09	OPEX Input Sheet C5
Total Daily Shift Cost EE Resources	$1,433.29	
Cost per Lamp Change – Day Labour & Plant	**$44.79**	Assumes 32 per shift
Contract Shift Cost - Labour & Plant	**Amount**	
Contract Rate	[Confidential]	OPEX Input Sheet C13
Bulk Replacement Hours per Lamp	[Confidential]	OPEX Input Sheet C25

Lamps Replaced per Shift	[Confidential]	
Total Daily Shift Cost Contract Resources	[Confidential]	

The base build of day labour resources at $[Confidential] per lamp change is [Confidential]% less than the contract rate of $Confidential. It is likely that this base build understates the margin between contract and day labour resources at the more remote depots requiring more relocation and travel/accommodation cost. Using a contract approach in the higher density depots and day labour in the more remote lower density depots should result in a total reduction is costs where:

- The contract rate drops in higher density, less remote areas; and
- In lower density and more remote areas the utilisation of day labour resources could be increased with the work conducted at marginal cost likely less than that calculated in the base build of **Table 5**.

It is recommended that when next Tendered the programme be restructured such that only the higher density areas use contract resources and the more remote lower density areas leverage local day labour to increase utilisation and reduce costs. This could be managed in a transparent way by seeking multiple price zones from Tenderers and evaluating against internal costs.

SLCC 7 - The Street Light Consultative Committee request that Essential Energy when next running a market exercise for bulk lamp replacement:

- *Seek Tender prices across three pricing zones being remote, rural towns and regional centres*
- *Compare Tendered contract rates against a base build by day labour and engage the lowest cost delivery option*

8.3 CAT V Street Light Patrols

At Section 6.3.3 the Proposal states that the cost of twice yearly night patrols was determined based on recorded costs for FY17 averaged over the number of assets to be inspected. The Tariff Model has an entry with no other explanation of $360,860 which equates to $9.77 per luminaire per annum plus Corporate Overheads to be a total of $14.68. This is the claimed cost of Night Patrols for approximately 37,000 luminaires inspected twice per annum or 74,000 inspections.

Evaluation of the $360,860 shows that it would require, based on the Essential Energy Tariff Model, the resources detailed in **Table 6** below to amount to the stated expenditure.

Table 6 – Resource Calculation of Tariff Model CAT V Night Patrol Rate

Item	$ Direct	Comment
Essential Energy Cost Claim	$360,860	Opex Input Sheet – Cell C73
CAT V Luminaires	36,950	Opex Input Sheet – Cell C73
Annual Cost per Luminaire	$9.77	
Labour Rate Normal Time – per hour	$40.03	Opex Input Sheet – Cell C5
Labour Oncost Overtime	20.00%	Estimated for Overtime
Overtime Penalty Rate 2x	2	Assumed worst case double time
On Costed Overtime Rate at Double Time	$96.07	
Ute,Van – per hour	$5.28	Opex Input Sheet – Cell C32
Total Hourly Cost Labour & Plant – per hour	$101.35	
Hours to Expense $360,860	3,560	
Number of Essential Energy Depots	100	
Patrols per annum	2	
Hours per Patrol per Depot	**17.8**	**Excessive Hours**

If the CAT V night patrols in FY17 that established the base of $360,860 were conducted from the 100 Works Depots twice annually then the average patrol time per Works Depot would have been 17.8 hours. It is considered that this overstates the required resources by a very significant magnitude.

Table 7 below details the estimated base build to establish a comparison with the Essential Energy Tariff Model allowance.

Table 7 – Base build of CAT V Night Patrol Rates

Item	$ Direct	Comment
Labour Rate Normal Time	$40.03	Opex Input Sheet – Cell C5
Labour Oncost Overtime	20.00%	Estimated for Overtime
Overtime Penalty Rate 2x	2	Assumed worst case double time
On Costed Overtime Rate at Double Time	$96.07	
Ute,Van	$5.28	Opex Input Sheet – Cell C32
Total Hourly Cost Labour & Plant	$101.35	
ICAT V Luminaires Inspected one Cycle	36,950	Opex Input Sheet – Cell C73

Minimum OT Hours	2	AS per EE Enterprise Agreement
Inspections in First 2 Hours	120	Allows for mobilisation and is minimum OT charge (2 hours)
Minutes per inspection after 2 hours	0.50	
Depots Patrolling	90	
Average Patrol Hours per Depot per Patrol	4.6	
Total Patrol Hours per Night Patrol	410	
Total Patrol Hours two Night Patrols	819	
Total Cost CAT V Patrols – 2 per Year	**$83,053**	
Average Cost per Luminaire per Year	$2.08	Excluding Corporate on Costs

Table 6 shows the back solved 17.8 labour hours per Depot per Night Patrol results in a direct charge of $9.72 per luminaire per annum compared to the base build in **Table 7** averaging 4.6 labour hours per Depot per Night Patrol and $2.08 per luminaire per annum.

The Annual Streetlight Business Asset Report was reviewed for the then Dubbo City Council for FY17 to establish reporting patterns. Although the CAT V lighting patrol is scheduled twice per annum defective luminaires with source code “Night Patrol” were reported across 15 different days summarised below:

- 14th July 2016 – 177 defects;
- 20th November 2016 – 210 defects;
- 27th April 2017 – 255 defects; and
- Across 9 different days in June 2017 – 127 defects

The reporting pattern does not align with the stated objective of two patrols per annum for CAT V lighting.

Analysis of the luminaires found to be defective shows that of 772 defects reported with a source code of “Night Patrol” only 111 defects were for CAT V luminaires with 661 defects for 70W & 50W HPS and 42W CFL luminaire types which are CAT P.

It is evident that for FY17 night patrols have been conducted on all luminaires not just CAT V and the assumption in the Proposal that the $360,860 incurred in FY17 is for the patrol of CAT V luminaires only is incorrect resulting in a significant overstating of the night patrol costs in the Proposals Tariff Model.

There is a material difference between **Table 2**, the claimed cost and the base build in **Table 3** of some $277,807 per annum direct and $417,710 when Corporate Overheads are applied. The AER should request that Essential Energy provide detailed analysis of the methodology to calculate the CAT V Night Patrol charges as they are excessive and appear to include the Night Patrol of CAT P lighting.

AER 3 - The AER in considering the Essential Energy Proposal should:

- *Consider the argument above in section 8.3 and reject Essential Energy's proposed cost of $543,000 (including Corporate Overheads) per annum to conduct CAT V Night patrols*
- *Request that Essential provide a base build for the undertaking of CAT V only Night Patrol*
- *Should Essential Energy not provide an efficient base build for the CAT V Night Patrol costs substitute the claimed $360,860 (Direct) in the model with the $83,053 calculated in **Table 7** above saving customers $417,710 when Corporate Overheads are included*

8.4 Defects per Trip

At Section 6.3.6 the Proposal discusses moving to a 16 calendar day cycle of repair times.

> *"We propose to re-align our internal rectification timeframes with the Public Lighting Code recommendation of 12 business days (or 16 calendar days). Moving to 16 calendar days provides greater flexibility to field employees, with the ability to bundle tasks on a weekly basis in higher-volume depots or a fortnightly basis for lower-volume depots, while still being able to achieve the overall defect completion objectives of 12 business days and an average of eight business days. This change is projected to improve the average number of daily tasks completed by field staff from 1.48 to 2.74."*

And further;

> *"Our proposed network charges reflect a forecast time for attending to each spot repair, taking into account the low volume of tasks completed across our depots."*

Allowing for the batching of work which reduces costs by increasing the average repairs per mobilisation is a prudent approach and should be supported. However, it is apparent at Section 6.3.7 of the Proposal the

calculation in the table to arrive at the average repair time of 1.9 labour hours (114 minutes) has been prepared on the basis of 1.5 streetlights to repair in “one run” not the proposed 2.74.

Table 8 below sets out the Proposal’s inputs to calculate the average repair time and labour hours per job. The column titled EE is for 1.5 repairs per mobilisation as extracted directly from the Essential Energy Proposal. Using average defects per trip of 2.74 as proposed by Essential Energy the correct time per job reduces from 0.95 hours to 0.81 Hours and from 1.9 to 1.62 labour hours.

Table 8 – Average Repair Time and Labour Hours per Job[8]

Item	EE	1.5 Jobs		2.74 Jobs		1 Job	2 Jobs	3 Jobs	Additional Information
No. of streetlights to repair (quantity)	1.5	1.5		2.74		1	2	3	The number of streetlights being repaired and/or replaced in one "run".
No. of field staff working together	2	2		2		2	2	2	The number of field staff working together as a crew to complete the streetlight repair tasks.
			weight		weight				
Time to mobilise (mins)	10	10	1	10	1	10	10	10	Time taken to prepare the team and truck before leaving the field service centre.
Travel time to site (mins)	10.3	10.3	1	10.3	1	10.3	10.3	10.3	Weighted average time taken to travel from the field service centre to the faulty streetlight(s).
Time to repair luminaire (mins each)	25	25	1.5	25	2.74	25	25	25	Weighted average time taken to replace or repair the luminaire.
Travel time between streetlights (mins)	15	15	0.5	15	1.74		15	15	Weighted average time taken to travel between two faulty streetlights requiring repair.
Time to repair luminaire (mins each)							25	25	Weighted average time taken to replace or repair the luminaire.
Travel time between streetlights (mins)								15	Weighted average time taken to travel between two faulty streetlights requiring repair.
Time to repair luminaire (mins each)								25	Weighted average time taken to replace or repair the luminaire.
Travel time from site (mins)	10.3	10.3	1	10.3	1	10.3	10.3	10.3	Weighted average time taken to travel to the field service centre from the faulty streetlight(s).
Time to demobilise (mins)	10	10	1	10	1	10	10	10	Time taken to demobilise the team and truck after arriving back at the field service centre.
Time taken to complete the task (hours)	1.43	1.43		2.25		1.09	1.76	2.43	Total time taken to complete the number of streetlight repairs/replacements.
Average time taken per streetlight to complete the task (hours)	0.95	0.95		0.82		1.09	0.88	0.81	Average time taken to complete one streetlight repair/replacement.
Average labour hours per repair	1.9	1.90		1.64		2.19	1.76	1.62	Average labour hours to complete one streetlight repair/replacement.

Further analysis of the Tariff Model shows that the average labour hours per spot replacement actually used in the Tariff Model is higher again at 2.2[9]. The difference is material in that the labour and plant costs reduce from $180.96[10] per spot replacement to $133.26 using the correct average labour hours as detailed in the Essential Energy Proposal to increase to 2.74 defects per mobilisation. Using an unweighted[11] failure rate from the Tariff Model for all lighting excluding LED this amounts to an annual saving to customers of $818,000[12].

[8] Table 2 – The EE column is from ATTACHMENT 17.4 PUBLIC LIGHTING PROPOSAL | 2019-24 | Apr 2018. Additional columns for 1.5, 2.74, 1, 2 & 3 Jobs added for clarity

[9] Essential Energy – 17.5 Public Lighting Model - 20180430– Opex Input Sheet – Cell C24

[10] Essential Energy – 17.5 Public Lighting Model - 20180430– Opex Input Sheet – Cell C51

[11] Adequate data not available to calculate a weighted failure rate

[12] 160,000 luminaires x (1- 9.44% LED) X 7.87% unweighted failure rate x ($180.96-$133.26) x (1+50.36% Overheads)

For OROC Councils the most common luminaire is a 70W HPS. The annual maintenance charge on this luminaire reduces from $93.88 to $79.90 when the labour and plant hours are corrected in the model with savings to OROC Councils alone in the order of $119,000 per annum.

AER 4 - The AER in considering the Essential Energy Proposal should:

- *Accept Essential Energy's proposed batching of tasks over a 16 calendar day period increasing the average defects per mobilisation from 1.5 to 2.74*
- *Confirm based on Essential Energy's proposal that for an average mobilisation of 2.74 defects to repair the correct labour hours required is 1.62 per repair*
- *Reject the Essential Energy claim of 2.2 labour hours per repair at cell C24 in the "OPEX Input" sheet of the Tariff Model and replace with 1.62 labour hours*
- *Using an unweighted average failure rate of 7.87% (from the Proposal Tariff Model) for lamps, PE Cells and ballasts for discharge lighting only the reduction in labour and plant for each spot replacement equates to an estimated annual saving to customers of $818,000*

8.5 Spot Repairs - Mobilisation, Task and Travel Time Allowance

Mobilisation, Time to Complete a Maintenance Task and Travel Times are discussed in the Proposal at 6.3.6.2 and 6.3.6.3. The proposal includes a detailed listing of the time to carry out the actual task and travel times including:

- Mobilisation – 10 minutes;
- De-Mobilisation – 10 minutes;
- Travel to site – 10.3 minutes;
- Travel from site – 10.3 minutes;
- Time to repair luminaire – 25 minutes;
- Travel between sites – 15 minutes.

The particular times aside, for the activities, perhaps the most relevant point to make here is that such a base build tends to overstate the cost of the activity, particularly so when it is essentially infill works undertaken as an adjunct to the core operation. No Essential Energy Depot is of the scale to permanently occupy a specialist Public Lighting crew and for most Depots the number of repairs are very few per week. The average Depot

has approximately 1,600 luminaires and even with a nominal failure rate as high as 10% the attendances will typically be in the order of 3 per week.

In such circumstances the base build overstates the cost because invariably the cost of mobilisation and travel will be overstated as the work is conducted at opportune times when travelling to and from other work.

Figure 9 below details the comparative maintenance only charges between Endeavour Energy's Proposal and Essential Energy's for the three most common luminaires in the Essential fleet being 70W and 250W HPS and 42W CFL.

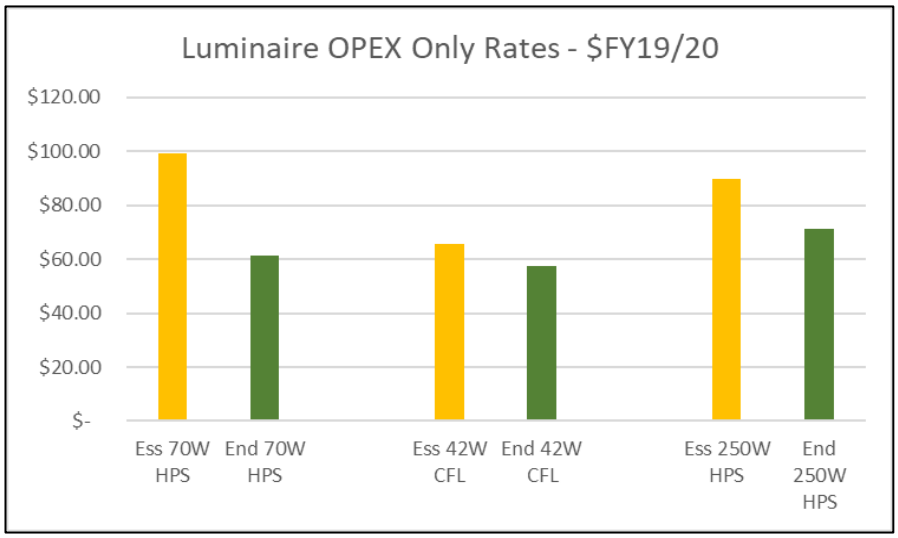


Figure 9 – Comparison of Essential luminaire maintenance only charges to Endeavour Energy[13]

It is likely that the difference in the pricing between Essential and Endeavour is driven by high time allowances in the Essential Tariff Model which even if theoretically correct will overstate the required effort in practice.

It is recommended that the AER consider if the high effort allowances are driving the difference in tariffs between Endeavour and Essential and consider if the base build is overstating the actual cost.

[13] Endeavour Energy – 14.09 Public Lighting Pricing Model – March 2018 - Sheet "Tariffs Mapped"

AER 5 - The AER in considering the Essential Energy Proposal should note that:

- *Essential Energy is proposing materially higher maintenance only charges than Endeavour Energy*
- *Evidence and argument in this report provides detail of why Essential Energy's proposed rates are higher than a peer providing the same services*

8.6 Other Maintenance Charges

Not directly addressed in the Proposal but embedded in the Tariff Model, "OPEX Input" sheet is a base build for "Other Maintenance" which totals $1,510,439 direct ($2,271,096 including Corporate Overheads) and is allocated at the rate of $14.46 per luminaire per annum including Corporate Overheads. This cost has two components:

a) A listing of materials totalling $155,124[14] direct which from notations in the spreadsheet has come from inventory of types "Street Light", "Poles" and "Pole Maint". These will be categories of inventory booked to a particular cost code or cost codes; and
b) A calculation of "Callouts non-lamp and non-PE Cell related" and it is assumed non-ballast and ignitor. These Callout costs for labour and plant amount to $1,355,315 direct[15].

The other maintenance charges are for the cost of additional visits and repairs to luminaires not associated with failure of Lamps, PE Cells and Ballasts which are dealt with separately within the charging model in the "OPEX Calc" Sheet.

If the callouts claimed totalling 7,489 which amount to additional attendance of 4.77% per annum are accepted the "Other Maintenance" charges are overstated by at least $508,000 direct and $754,000 with Corporate Overheads applied as dealt with below:

[14] Essential Energy – 17.5 Public Lighting Model - 20180430– Opex Input Sheet – Cell C351
[15] Essential Energy – 17.5 Public Lighting Model - 20180430– Opex Input Sheet – Cell C358

Other Maintenance Charges - Materials

The “OPEX Input” sheet contains a list of inventory expensed in FY17 of types “Street Light”, “Poles” and “Pole Maint” booked to a particular cost code or codes which are additional to the inventory for the bulk lamp replacement programme and spot luminaire repair for lamp, PE cell and ballast failure. The total cost is $155,124 direct. A review of the materials used and listed in the table has been undertaken to determine the appropriateness for this cost allocation and is summarised in **Table 9** below:

Table 9 – Reconciliation or “Other Maintenance” Material Costs

Category Description	$ Direct	Allocation Comment
Poles Not Street Lighting	$82,259	Poles by size, capacity and description are not used for Public Lighting
Timber Poles General	$2,286	Timber poles that could have been used for Public Lighting but are recovered through a capital tariff - double charging
Timber Pole Treatment	$2,261	Pole treatment costs are otherwise charged in the model - double charging[16]
Luminaires, Outreach & Columns	$64,255	Whole Luminaires and Columns that are recovered through a capital tariff - double charging
Subtotal - Invalid "Other Maintenance" Costs	**$151,061**	$227,135 after Corporate Overheads are applied
Add Valid "Other Maintenance" Costs	$4,063	Valid and accepted parts for luminaire repairs
Total claimed, "Other Maintenance" Costs	**$155,124**	

Table 9 shows that of the direct allocated $155,124 only $4,063 is a valid charge of parts for luminaire maintenance with $82,259 being misallocated distribution poles[17] and $66,802 being double counting as the materials are capital in nature or otherwise allocated in the model. A full listing of the materials is detailed in Appendix A.

[16] Essential Energy – 17.5 Public Lighting Model - 20180430– Opex Input Sheet – Cell C58

[17] Examples of misallocated distribution poles include 21m long transmission poles and urban substation poles

AER 6 - The AER in considering the Essential Energy Proposal should require that:

- *The invalid maintenance costs detailed in Table 5 of $151,061 be rejected and only the valid costs of $4,063 be approved.*
- *Essential Energy revise Cell C351 in the "OPEX Input" sheet, replacing $155,124 with $4,063 resulting in a total reduction with Corporate Overheads to Customers of $227,135 per annum*

Other Maintenance Charges – Labour and Plant

These charges relate to "Callouts non-lamp and non PE Cell related" and it is assumed non ballast related as these are separately included in the "OPEX Calc" sheet with allowances for failure rates and in the case of lamps failure rates specific to particular luminaires. This is a significant cost allocation for labour and plant of $1,355,315 direct.

The cost is derived from multiplying the standard attendance rate of $180.96 from cell C51 in the "OPEX Input Sheet" and by an entry in cell C356 of "12,732/1.7" returning 7,489 callouts. The "Other Maintenance" labour and plant costs are overstated as set out below:

a) The charge is calculated using the standard attendance rate of $180.96 from cell C51. As detailed in Section 8.4 (Defects per Trip) the model has used the average labour hours per spot replacement of 2.2[18] when the correct hours per attendance is 1.62 as derived in **Table 8** using the "Defects per Trip" of 2.74 from the Proposal as submitted. The difference is material in that the labour and plant costs reduce from $180.96 per spot replacement to $133.26 using the correct average duration as proposed by Essential Energy:

"We propose to re-align our internal rectification timeframes with the Public Lighting Code recommendation of 12 business days (or 16 calendar days). Moving to 16 calendar days provides greater flexibility to field employees, with the ability to bundle tasks on a weekly basis in higher-volume depots or a fortnightly basis for lower-volume depots, while still being able to achieve the overall

[18] Essential Energy – 17.5 Public Lighting Model - 20180430– Opex Input Sheet – Cell C24

defect completion objectives of 12 business days and an average of eight business days. This change is projected to improve the average number of daily tasks completed by field staff from 1.48 to 2.74."[19]

The overcharge based on the claimed 7,489 attendances is a material $357,225 direct per annum increasing to $537,123 when Corporate Overheads are applied. The AER should reduce the allowance for "Other Maintenance" Callouts in alignment with the Proposal by Essential Energy of attending an average of 2.74 defects per mobilisation.

AER 7 - The AER in considering the Essential Energy Proposal should require that:

- *Essential Energy correct cell C24 in the "OPEX Input" sheet from 2.2 labour hours to 1.62 labour hours which will change the labour and plant cost per spot repair at cell C51 from $180.96 to $133.26*
- *This will result in an annual reduction in charges to customers of $537,123 based on the claimed 7,489 "Other Maintenance" attendances*

b) The "Other Maintenance - Callouts non lamp and non PE Cell related" is material in the proposed maintenance component of the Luminaire tariffs at $1,355,315 direct amounting to $14.46 per luminaire per annum when Corporate Overheads are included. The allowance has been applied as a simple fee equal across the luminaire population regardless of technology and amounts to an additional attendance rate of 4.77% per annum. This lifts the unweighted[20] average failure rates in the "OPEX Calc" sheet for lamps, PE Cells and ballasts from 7.86% to 12.63% per luminaire per annum. This is a material addition and of concern in that it has not been applied based on technology to drive appropriate investment decisions.

The additional failure rate has been applied equally to new LED technology which would be expected to have lesser incidences of these additional attendances compared to an aged fleet which is likely driving the additional attendance rate. The AER should request EE to:

- Provide more evidence around the establishment of the 7,489 additional attendances;

[19] Essential Energy – 17.4 Public Lighting Proposal – Section 6.3.6.1

[20] Adequate inventory detail was not available to calculate a weighted average failure rate

- Require that they be applied as a minimum by technology performance rather than be averaged across the fleet; and
- Request that Essential Energy consider the appropriateness of this charge being allocated at such a high rate to new LED technology.

AER 8 - The AER in considering the Essential Energy Proposal should require that:

- *Essential Energy conduct analysis of the "Other Maintenance" tasks and apply the correct failure rates across technology and type rather than at an equal 4.77% across all tariff classes*
- *Essential Energy review the appropriateness of the "Other Maintenance" failure rate of 4.77% for modern LED installations*

8.7 Bulk Works Additional Material Usage[21]

The "OPEX Input" Sheet contains an allowance for materials used by Contractors undertaking the bulk lamp replacement programme. The allowance is $310,885 direct ($467,446 including Corporate Overheads) applied as $1.98 direct per luminaire installed per annum. This equates to an allowance of $7.92 direct in additional materials per bulk lamp change which seems excessive. The Tariff model in the "OPEX Input" sheet contains the notation:

"Total Cost of Tasks (CPI'd 17/18 to 18/19 @ 2.3%
Done over 234 tasks"

The allowance has been applied equally across the fleet regardless of technology, asset age and service history. There is a risk that these costs were for luminaire replacements conducted by the bulk lamp replacement contractor where the luminaire was faulty. Such replacements would be attached to capital tariffs resulting in inclusion of this cost being double charging.

The AER should request Essential Energy to:

[21] Essential Energy have been requested to provide details of the inventory used and the 234 tasks referenced in the note contained in the tariff model. As at the 1st of August the details were not available for analysis.

- Provide more evidence around the establishment of the $310,885 direct cost and the 234 tasks completed that have driven this cost;
- Require that the cost be applied as a minimum by technology performance rather than be averaged across the fleet; and
- Request that Essential Energy consider the appropriateness of this charge being allocated at such a high rate to new LED technology.

AER 9 - The AER in considering the Essential Energy Proposal should require that:

- *Essential Energy submit a listing of inventory for review by customers to ensure that the claimed cost of $467,446 is valid and does not contain misallocated expenditure similar to the "Other Maintenance" material cost claim detailed at Section 8.6*
- *Councils are provided with the opportunity to review the materials claimed to identify any misallocation*

9 CAPEX Charging Model – Quantitative Inputs

Essential Energy is changing to a component pricing model which will improve the accuracy of tariff application where part of an installation, the pole, outreach or luminaire is replaced. A high-level review of the capital calculation sheets in the model has been undertaken and it is considered a reasonable approach with the exception being the application of design charges for pole replacements as detailed in Section 9.1 below.

The capital charging model sensibly groups and weights various inputs to minimise the otherwise high number of capital tariffs that would result. The weighting between similar options to create normalised rates appears reasonable.

At a meeting to discuss the tariff charging model on Monday the 30th of July Essential Energy indicated an intention to incorporate the existing capital tariffs of type 3 and 5 into the new capital tariff charge. This change is not evident in the Proposal or tariff model. If the existing type 3 and 5 tariffs are to be merged into a new capital tariff Essential Energy should be required to provide this analysis to ensure that customers are not disadvantaged by the change.

9.1 Design Charges for Pole and Column Replacement

Essential Energy is no longer active in the design and construction of contestable public lighting with all new installations designed and constructed by Accredited Service Providers and gifted to Essential for operation and maintenance on behalf of public lighting customers. The application of design fees in the capital model in these circumstances is inappropriate as the only new poles and columns to be installed by Essential Energy are simple like for like replacements which except in the rarest of circumstances require no design effort.

The "CAPEX Input" Sheet contains an allowance for design costs for poles and columns of 5.03[22] hours and $518.88[23] direct capital. With Corporate Overheads applied this is a capital cost of $737.07. Design charges in the tariff model are only applied to poles and columns. The application of a design charge for poles and columns increases the annual capital charge by $40.55 for poles and columns on a capital recovery tariff.

The Public Lighting Asset Management Plan submitted as a supporting document to the proposal shows approximately 500 poles replaced in FY17. At the rate of 500 poles per annum this requires the "recovery on and of" an additional capital amount of $369,000 per annum that Councils will be funding through annual capital charges for design effort that is not undertaken in replacement circumstances.

The AER should request that Essential Energy provide evidence that the design effort is a real expense incurred and if as is expected it is not then the design costs should be removed for pole and column replacement from the capital tariffs.

AER 10 - The AER in considering the Essential Energy Proposal should:

- *Require that Essential Energy submit evidence that design costs are incurred when replacing dedicated Public Lighting Poles and Columns*
- *Reduce the design allowance ($369,000 annual) in the capital tariff calculation for pole and column replacement in so far that the design costs are not demonstrated as being incurred*
- *Require Essential Energy to clarify the intention for Tariff Class 3 and 5 and validate that incorporating these into a new Capital tariff does not disadvantage customers*

[22] Essential Energy – 17.5 Public Lighting Model - 20180430– Capex Input Sheet – Cell G43

[23] Essential Energy – 17.5 Public Lighting Model - 20180430– Capex Input Sheet – Cell G45

10 70W HPS – Lamp Failure Rates

This Section details performance issues with the 70W HPS luminaires in more detail as this is the most common luminaire in the fleets of the OROC Councils and the use of this high failure rate in the Tariff Model results in an excessive tariff.

The AMP notes a failure rate of 14.29% for the High-Pressure Sodium 70W luminaire. After back solving the failure rates in the AMP, Proposal and the Tariff Model the failure rates for 70W HPS can be summarised in Table 6 below:

Table 10 – 70W HPS Luminaire Failure Rates

Component	Failure Rate	Comment
Lamp	13.2%	Lamp and PE Cell combined 14.29%
PE Cell	1.09%	Common across all luminaires and PEC Cells
Ballast	0.44%	Common across all discharge lighting
Other Maintenance	4.77%	Common across all technologies and luminaire types
Total	**19.5%**	

The lamp failure rate is excessive and if correct is a reflection of the quality of the lamp being used rather than a reflection of efficient operation of the technology. By comparison 150W, 250W and 400W HPS lamps of the same HPS technology in the Tariff Model have applied failure rates of 4.12%, 4.21% and 3.83% respectively.

The high failure rate of the 70W HPS lamp warrants further analysis. A comparison of 70W and 250W HPS maintenance only proposed rates for Essential Energy and Endeavour Energy is shown in Figure 10.

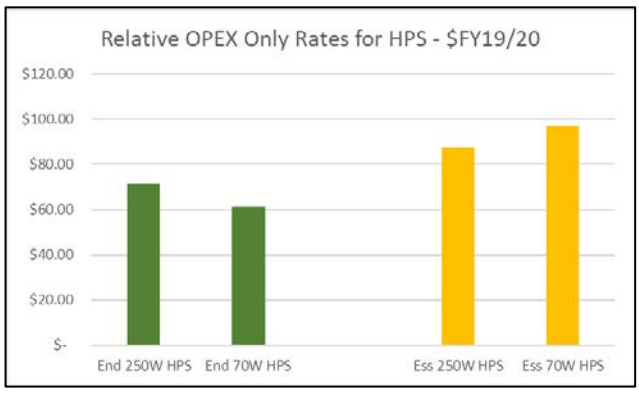
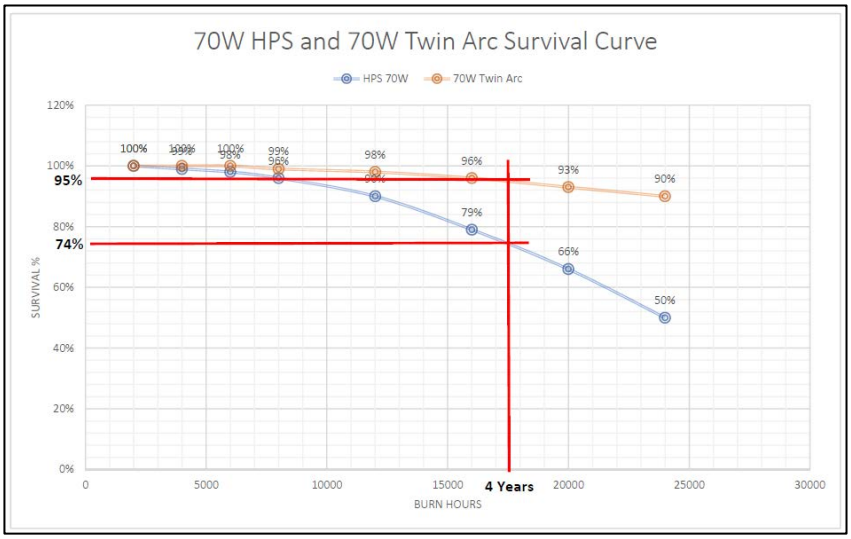


Figure 10 – Maintenance only rates for HPS luminaires – Essential Energy and Endeavour Energy

For Endeavour Energy proposed maintenance only tariffs in **Figure 10** shows what would be expected in that the CAT P (70W) luminaire with less traffic control costs and a slightly lower cost lamp has a lower annual charge than the CAT V (250W) luminaire.

By comparison the Essential Energy CAT P (70W) luminaire is shown to have a higher proposed annual charge than the CAT V (250W) luminaire. Even though in the case of Essential Energy the CAT V luminaire carries an additional annual charge for traffic control of $15.26 (with corporate overheads) over the CAT P luminaire, the CAT P luminaire tariff is $9.25 higher due to the high failure rate allocated to the 70W lamp.

Figure 11 below shows the survival curve for Sylvania 70W High Pressure Sodium SHP Standard lamps maker code SHP 70W/CO/E E27 SLV and Gerard code 673260. With a 4 year bulk lamp replacement cycle the burn hours are 17,500 and lamp survival is shown in **Figure 11** as being 74% inferring, with a 4 year bulk lamp replacement cycle, an annual failure rate of 6.5%. At 6.5% the failure rate is much lower than that used in the Proposal Tariff Model of 13.2%. For comparison the survival rate of the 70W Twin Arc lamp which can be installed in the standard fittings is also shown. The survival rate is vastly different.



Lifetime data	
Average life (Nominal) (h)	24000
Average life (Rated) (h)	24000
Rated survival factor (%) at 2000 h 50Hz	100
Rated survival factor (%) at 4000 h 50Hz	99
Rated survival factor (%) at 6000 h 50Hz	98
Rated survival factor (%) at 8000 h 50Hz	97
Rated survival factor (%) at 12000 h 50Hz	90
Rated survival factor (%) at 16000 h 50Hz	79
Rated survival factor (%) at 20000 h 50Hz	66

Figure 11 – Survival Curve - Sylvania 70W High Pressure Sodium Lumalux lamp item 67504[24][25]

[24] Figure 11 HPS 70W data for SHP Standard SHP 70W/CO/E E27 SLV lamp – Gerard Lighting item number 67320

[25] Figure 11 70W Twin Arc data for SHP-S TwinArc SHP-S 70W TwinArc E27 SLV – Gerard Lighting item number 0020719

Section 10 has detailed three inconsistences with the high failure rate used for the 70W HPS lamps in the Tariff Model including:

- Other size HPS Technology lamps in the inventory have failure rates much lower at around 4%;
- Endeavour Energy tariffs show that 70W HPS (CAT P) maintenance is less expensive than CAT V contrary to the Essential Energy Tariffs where the CAT P tariffs are more expensive than CAT V; and
- Lamp survival curves derived from maker published data[26] of the lamp used by Essential Energy indicates a failure rate of 6.5% being much lower than the 13.2% in the Tariff Model.

It is argued that the high lamp failure rate of 13.2% for 70W HPS if correct is inefficient due to workmanship or quality and an alternate product should be sourced which will have a more appropriate failure rate of around 6.5%. This will result in significant savings to public lighting customers who should not be funding the poor performing lamp.

The population of 70W HPS Luminaires is estimated at 25,000. A reduction of the lamp failure rate from 13.2% to 6.5% reduces the annual maintenance charge from $93.88 to $71.58 for a total saving to customers of $557,500 per annum.

AER 11 - The AER in considering the Essential Energy Proposal should:

- *Reject the claimed failure rate of 13.2% for the 70W HPS lamp as being excessive and substitute with the makers published data of 6.5%*
- *Reducing the lamp failure rate in the Tariff model will reduce the annual maintenance charge on the 70W HPS luminaires from $93.88 to $71.58 saving customers $557,500 per annum based on an estimated population of 25,000 luminaires*

SLCC 8 - The Street Light Consultative Committee should hold urgent discussions with Essential relating to the lamp used for 70W and 50W HPS Installations including:

- *Replacing the current lamp with a Twin Arc lamp which costs only $[confidential] more to procure reducing the lamp failure rates in the tariff model from 13.2% to 1.72% and the annual maintenance charges based on the Proposal Tariff Model from $98.88 to $58.28*

[26] Published maker data for lamps is provided at Appendix B

11 Tariff Model – Additional Requirements

11.1 Financial Years in Tariff Model

The Tariff Model could be enhanced by more clearly stating the financial year that dollars are presented. Although not clear it appears that most sheets use $ FY17/18 while the “New Component SLUOS” sheet appears to be $ FY18/19. It is noted that the same applies to both Opex and Capex sheets. It is also noted that the first year of the regulatory determination will be FY19/20 so the tariff rates in the “New Component SLUOS” sheet will require further indexing.

It is recommended that for clarity an additional sheet be added to the Tariff Model to provide tariff charges for each financial year of the determination in nominal dollars of the respective financial years being FY20 to FY24.

11.2 Council Impacts Model

For the prior determination Essential Energy provided an Excel spread sheet that detailed impacts on each public lighting customer assuming a static inventory. Essential Energy should be required to provide an equivalent spread sheet for this determination as it is very difficult for customers to review the impact due to the complexity of the model and the associated variables.

AER 12 - The AER in considering the Essential Energy Proposal should:

- *Require Essential Energy to clarify in their Tariff model the FY that all amounts are presented in each sheet*
- *Request that Essential Energy provide a Council impact spreadsheet including the current inventory such that Councils can assess the impact on their Public Lighting charges by technology and type to assist them to make decisions regarding future technology use*

12 Appendix A – Other Maintenance Materials

Item ID	Description	Average of Standard Price $	In $ 17/18	Count of Items Used	Sum of Costs $	Sum of Costs $
132213	Pole Steel 21.0m x 40kN Tapered Multisided				12,713.84	
132211	Pole Steel 21.0m x 30kN Tapered Multisided				11,545.58	
132264	Pole Steel 18.0m x 24kN Straight Round				6,374.31	
132206	Pole Steel 15.5m x 12kN Straight Round Pin Pole				4,875.62	
132199	xxxx Pole Steel 14.0m x 16kN Urban Sub Pole				4,053.13	
132201	xxxx Pole Steel 14.0m x 16/8kN Recloser Pole				4,053.13	
132196	Pole Steel 12.5m x 16/8kN Rural Sub Pole				3,402.50	
132195	xxxx Pole Steel 12.5m x 16/8kN Urban Sub Pole				3,402.50	
132190	Pole Steel 12.5m x 12/6kN Straight Round Pin Pole				3,140.61	
132192	Pole Steel 12.5m x 12kN Recloser Pole				3,140.61	
132207	xxxx Pole Steel 15.5m x 24kN Straight Round Pin Pole				3,129.36	
132198	Pole Steel 12.5m x 24/12kN Pin Pole				2,176.94	
132200	Pole Steel 14.0m x 16kN Straight Round Pin Pole				2,026.56	
125580	Pole Timber 14.0m x 8kN Pre-Drilled CCA				1,775.93	
125370	Pole Timber 12.5m x 6kN Pre-Drilled CCA				1,761.61	
132194	Pole Steel 12.5m x 16kN Straight Round Pin Pole				1,701.25	
125860	Pole Timber 15.5m x 12kN Undrilled CCA				1,531.43	
125550	Pole Timber 12.5m x 8kN Pre-Drilled CCA				1,483.35	
132180	Pole Steel 11.0m x 13.5/6.75kN Pin Pole				1,411.74	
125670	Pole Timber 18.5m x 8kN Undrilled CCA				1,405.60	
125430	Pole Timber 18.5m x 6kN Undrilled CCA				1,113.02	
125610	Pole Timber 15.5m x 8kN Undrilled CCA				1,047.55	
125620	Pole Timber 17.0m x 6kN Undrilled CCA				970.83	
125340	Pole Timber 11.0m x 6kN Undrilled CCA				829.98	
125410	Pole Timber 15.5m x 6kN Undrilled CCA				828.63	
125790	Pole Timber 11.0m x 12kN Undrilled CCA				820.45	
125400	Pole Timber 14.0m x 6kN Pre-Drilled CCA				703.82	

125520	Pole Timber 11.0m x 8kN Undrilled CCA	[redacted]			526.23	
125310	Pole Timber 9.5m x 6kN Undrilled CCA	[redacted]			313.39	
	Subtotal - Poles Not Street Lighting	[redacted]				**82,259.49**
125250	Pole Timber 12.5m x 4kN Pre-Drilled CCA	[redacted]			875.69	
125220	Pole Timber 11.0m x 4kN Undrilled CCA	[redacted]			633.20	
125260	Pole Timber 14.0m x 4kN Pre-Drilled CCA	[redacted]			526.85	
125190	Pole Timber 9.5m x 4kN Undrilled CCA	[redacted]			250.28	
	Subtotal - Timber Poles General – Double Counting either not Public Lighting or in Capital Recovery Tariff	[redacted]				**2,286.01**
817475	Pole Treatment Termidor 2.5L	[redacted]			1,034.25	
817470	BD Bandage Pole Treatment Austplast	[redacted]			537.08	
817477	MSR-Termiticide Termidor Dry 15g	[redacted]			243.47	
817485	Applicator Termite Duster	[redacted]			225.06	
817510	Pole Treatment Rod Polesaver	[redacted]			220.97	
	Subtotal - Timber Pole Treatment - Double Counting	[redacted]				**2,260.83**
500966	Lantern 70W HPS B Nostalgia With PE Cell & Lamp	[redacted]			10,110.10	
500972	Lantern 70W HPS Kensington Heritage	[redacted]			2,937.59	
500970	Lantern 42W Compact Fluo Kensington Heritage	[redacted]			2,926.78	
130975	Anchor Base 4 Fin 17.0kNM 350mm	[redacted]			2,246.51	
130760	Column Flinders Heritage Al C/W Bollard Base - L/Rest	[redacted]			2,240.37	
130991	Anchor Base 4 Fin 32kNM 350mm	[redacted]			2,183.08	
130990	xxxx Anchor Base 4 Fin 24.7kNM 350mm	[redacted]			2,144.21	
131067	Column 7.5m x 1.5m Single With Arm Impact Absorbing Gal	[redacted]			1,887.44	
130950	Anchor Base 3 Fin 6.0kNM 210mm	[redacted]			1,822.99	
130940	Anchor 3A Ragbolt Cage Assembly	[redacted]			1,635.78	
502055	Lantern 70W HPS Style 3 Mod R Bourke Hill Classical	[redacted]			1,350.36	
131070	Column 9m x 1.5m Single O/R Tapered Round Rigid Curved	[redacted]			1,283.91	
500990	Floodlight 400W HPS Sylflood Asymetric With PE Cell & Lamp	[redacted]			1,276.40	
500992	Floodlight 400W Metal Halide Sylflood Asymetric	[redacted]			1,227.60	
131010	Column 9m x 1.5m Single O/R Tapered Round Impact Absorbing	[redacted]			1,203.01	
501014	Floodlight 250W HPS Sylflood Bi-Symetrical, PE Cell & Lamp	[redacted]			1,128.41	
131285	Bracket 6000mm S/Light OR CE5	[redacted]			1,125.83	
500964	Lantern 42W Compact Fluo B Nostalgia	[redacted]			1,012.61	
500982	Lantern 400W HPS Roadster & PE Cell & Lamp, No Fuse	[redacted]			1,006.63	
131068	Column 7.5m x 3m Single O/R Tapered Octagonal Curved	[redacted]			998.59	
130938	Anchor 2B Ragbolt Cage Assembly	[redacted]			953.44	
131065	Column 7.5m x 1.5m Single O/R Tapered Octagonal Curved	[redacted]			940.40	
501004	Lantern 250W HPS Roadster Aero, PE Cell & Lamp	[redacted]			837.84	

500978	Lantern 150W HPS Roadster Aero, PE Cell & Lamp				837.84	
500906	Lantern 42W Compact Fluo Aero Urban, Lamp & PE Cell				828.63	
509912	Floodlight 250W HPS Sylflood AS Asymetric				818.40	
500915	Lantern 70W HPS Style 5 B Nostalgia Pole Top				810.22	
131282	Bracket 4500mm S/Light OR CE4				806.16	
130936	Anchor 1CE Ragbolt Cage Assembly				804.08	
501016	Floodlight 250W Metal Halide Sylflood Bi-Symetrical				782.60	
509913	Floodlight 250W Metal Halide Sylflood AS Asymetric				776.25	
500974	Lantern 150W HPS Roadster With PE Cell & Lamp, No Fuse				742.70	
501008	Lantern 250W HPS Roadster, PE Cell & Lamp, No Fuse				742.70	
131150	Column 4.5m Prestige Green				723.49	
130855	Column 4.5m Prestigious Tapered Octagonal (Style 5) Green				663.91	
501000	Lantern 150W HPS Roadster With PE Cell Base				634.79	
502026	Lantern 70W HPS Urban With PE Cell & Lamp No Fuse				618.56	
510160	Lantern 400W HPS				610.73	
131280	Bracket 3000mm S/Light OR CE3				590.66	
500944	Lantern 42W Compact Fluo Mod R Bourke Hill Flared				531.88	
501970	Lantern 70W HPS Style 1 Aeroscreen				531.18	
500900	Lantern 42W Compact Fluo Suburban				521.73	
500958	Lantern 42W Compact Fluo Nostalgia, PE Cell & Lamp				518.46	
502025	Lantern 70W HPS Suburban-Igniter-Cell- Lamp No Fuse				479.26	
510165	LED 17W Lumin Cat P4/P5 Bowl				460.35	
131289	Bracket 3000mm S/Light OR CE7				428.64	
500960	Lantern 70W HPS Nostalgia				392.93	
131288	Bracket 2000mm S/Light CE6				372.18	
500910	Lantern 70W HPS Style 2 Nostalgia				361.73	
500984	Lantern 400W MH Roadster Aero				348.38	
500136	Lantern 400W HPS Optispan HPF w/- PE Cell Base				343.49	
510162	Lantern 400W HPS Aero Roadster				322.25	
131216	Adaptor Plate 50mm Estate S/L				319.27	
501333	Lantern 150W HPS Style 1 Aero Optispan				305.46	
510170	LED 18W Lumin With NEMA Cell				291.56	
131300	Bracket 3m Street Light Ext & Rise C/W 32mm Od Spigot				245.52	
510185	LED 22W Lumin Cat P3 Aero				239.38	
501018	Lantern 150W HPS Roadster Twin Arc				221.14	
131390	Bracket S/Light 2m x 1.5m Rise				218.72	
510205	LED 25W Luminaire Cat P4/5				153.76	

501814	Lantern 50W HPS Suit Twin Arc	[redacted]	[redacted]	[redacted]	144.24	
131277	Bracket 2000mm S/Light OR CE2	[redacted]	[redacted]	[redacted]	125.09	
131217	Adaptor Plate 150mm Estate S/L	[redacted]	[redacted]	[redacted]	106.45	
	Subtotal - Luminaires, Outreach & Columns – Double Counting in Capital Recovery Tariff	[redacted]	[redacted]	[redacted]		**64,254.60**
503213	Diffuser Suit 150, 250W Roadster Or B3000	[redacted]	[redacted]	[redacted]	298.00	
503216	Diffuser 250W Max Roadster Anti Glare	[redacted]	[redacted]	[redacted]	173.40	
290950	Contactor 240V 5.5kW S/L Ctrl	[redacted]	[redacted]	[redacted]	160.61	
290179	Cassette SUB/URB ECO 26-42CFL	[redacted]	[redacted]	[redacted]	143.83	
502860	Diffuser Mercury Vapour Optispec 250/400W	[redacted]	[redacted]	[redacted]	142.99	
503225	Diffuser Sylvania Urban Glare Shield Bowl	[redacted]	[redacted]	[redacted]	110.48	
290160	PE Cell D2 Suit RFI Towns Special Type	[redacted]	[redacted]	[redacted]	104.35	
524030	Lamp 360W HPS Eye Type Sunlux	[redacted]	[redacted]	[redacted]	104.01	
503280	Diffuser Suit Suburban 42W	[redacted]	[redacted]	[redacted]	101.28	
500127	Guard Wire Suburban Eco Anti-Vandal For 500900	[redacted]	[redacted]	[redacted]	99.68	
503218	Diffuser Suit Nostalgia Type Lantern	[redacted]	[redacted]	[redacted]	98.21	
524000	Lamp 220W HPS Eye Type Sunlux	[redacted]	[redacted]	[redacted]	97.19	
523880	Lamp 90W LPS Discharge Sox	[redacted]	[redacted]	[redacted]	93.09	
524750	Lamp 400W MH Tubular For Sentry Floodlight	[redacted]	[redacted]	[redacted]	91.92	
524740	Lamp 250W MH Tubular For Sentry Floodlight	[redacted]	[redacted]	[redacted]	91.92	
290190	PE Cell Suit Nightwatch Fitting	[redacted]	[redacted]	[redacted]	91.55	
131201	Adaptor Bracket St Light OR 4Way	[redacted]	[redacted]	[redacted]	88.30	
290460	Receptacle PE Cell	[redacted]	[redacted]	[redacted]	88.23	
503215	Diffuser Roadster Aeroscreen	[redacted]	[redacted]	[redacted]	86.70	
523730	Lamp 400W HPS Tubular	[redacted]	[redacted]	[redacted]	82.86	
503070	Diffuser 80/150/250/400W Acrylic Opnab Optispan	[redacted]	[redacted]	[redacted]	78.57	
131184	Spigot Adaptor S/Light OR 45Degree	[redacted]	[redacted]	[redacted]	75.80	
808750	Plug Pole Black 16mm 19-14mm Taper 30mm Long	[redacted]	[redacted]	[redacted]	73.66	
808754	Plug Pole 16mm Blue	[redacted]	[redacted]	[redacted]	73.66	
49750	Switch 10A PE Cell External Weatherproof	[redacted]	[redacted]	[redacted]	69.00	
500124	Guard Wire 250W Sylvania B3000 Luminaire	[redacted]	[redacted]	[redacted]	68.34	
523912	Lamp 150W HPS Elliptical	[redacted]	[redacted]	[redacted]	67.60	
503160	Diffuser Maxi B2222/E Acrylic	[redacted]	[redacted]	[redacted]	65.47	
131245	Bracket Nightvision Mounting Single Floodlight	[redacted]	[redacted]	[redacted]	60.36	
131275	Bracket 500mm S/Light OR CE1	[redacted]	[redacted]	[redacted]	56.78	
523762	Lamp 400W HPS Twin Arc Tubular	[redacted]	[redacted]	[redacted]	50.13	
64030005	Guard Wire 80W Sylvania Urban Luminaire	[redacted]	[redacted]	[redacted]	48.67	
290350	Enclosure 6 Pole	[redacted]	[redacted]	[redacted]	45.82	

290163	PE Cell NEMA 8000 Series - GE LED only				43.38	
510350	Lamp 70W HPS Elliptical "E"				42.78	
290360	Switch Changeover Day-Off-Night				41.21	
541415	Choke 150W HPS				38.87	
503234	Shield Full Glare Sentry Nightwatch				38.39	
500126	Guard Mesh For Sentry Floodlight				35.81	
290340	PE Cell Switch Type NEMA. Ultra Long Life				35.29	
524182	Lamp 250W HPS Twin Arc Tubular				33.25	
522290	Lamp 400W V GES Elliptical				31.30	
523610	Lamp 210W HPS Elliptical				30.89	
808752	Plug Pole Black 19mm 23-18mm Taper 30mm Long				29.16	
290165	PE Cell Switch Type D2				29.16	
131190	Spigot Adaptor 40-25mm S/Light				27.81	
523520	xx14 Lamp 110W HPS Retrofit - Elliptical Int/Ign				25.53	
290346	Shade Suit Photo Elec Cell				23.63	
808755	Plug Pole 16mm White				23.53	
522260	Lamp 250W MV Elliptical				23.14	
523792	Lamp 50W HPS Twin Arc Elliptical				21.48	
540880	Ballast 70W HPS & Capacitor				20.15	
523670	Lamp 250W HPS Tubular				19.95	
523580	Lamp 150W HPS Tubular GES				19.33	
523820	Lamp 70W HPS Elliptical				19.24	
540130	Capacitor 40 MFD 400W HPS				18.89	
523760	Lamp 400W HPS Elliptical				18.62	
540850	Ballast 50W HPS & Capacitor				18.27	
19165253	Lamp 250W HPS Elliptical				17.84	
61010055	Plug Shorting For Nema PE Cell Base				16.86	
520792	Lamp 150W HPS Twin Arc Tubular				15.86	
522780	Lamp 42W Compact Fluorescent				13.81	
523822	Lamp 70W HPS Twin Arc C/H Elliptical				11.76	
131195	Spigot Adaptor 50-25mm S/Light				11.57	
290170	PE S/Light Control D2 Base Only				10.68	
131220	Bracket Nightwatch Timber Mount				10.13	
522778	Lamp 32W Compact Fluorescent				9.38	
522620	Lamp 80W MV Elliptical				8.44	
86010010	Cement 20kg Bag Type A				8.17	
522590	Lamp 50W Mercury Vapour ES				8.16	

523640	Lamp 250W HPS Elliptical Sone	[redacted]	[redacted]	[redacted]	8.13	
523550	Lamp 150W HPS Elliptical Deluxe	[redacted]	[redacted]	[redacted]	7.01	
523790	Lamp 50W HPS Elliptical	[redacted]	[redacted]	[redacted]	6.32	
19175125	Lamp 125W Mercury Vapour	[redacted]	[redacted]	[redacted]	3.58	
520550	Lamp 25W 240V Ses Pilot Incandescent	[redacted]	[redacted]	[redacted]	3.28	
540460	Switch 40W Starter	[redacted]	[redacted]	[redacted]	0.59	
	Subtotal Valid "Other Maintenance" Costs					**4,063.10**
	Total Claimed "Other Maintenance" Materials Costs				**155,124.03**	**155,124.03**

13 Appendix B – 70W HPS Lamp Data Sheets

SYLVANIA

SHP Standard

SHP 70W/CO/E E27 SLV

0020555

Optical data

Luminous flux (lm)	5800
Luminous flux (Rated) (lm)	5900
Ambient temperature for maximum luminous flux (°C)	25
Colour temperature (K)	2050
CRI (Ra)	20
Adjustable chromaticity	N
Rated lumen maint. factor (%) at 4000 h 50Hz	96
Rated lumen maint. factor (%) at 6000 h 50Hz	94
Rated lumen maint. factor (%) at 8000 h 50Hz	93
Rated lumen maint. factor (%) at 12000 h 50Hz	91
Rated lumen maint. factor (%) at 16000 h 50Hz	90
Rated lumen maint. factor (%) at 20000 h 50Hz	89

Electrical data

Wattage (W)	70
Current (A)	0.98
Product Voltage (V)	90
Control gear required	Yes
Transformer required	No
Lamp Energy Label (class)	A
Energy efficiency level	A
kWh per 1000 hours burning time	77

Lifetime data

Average life (Nominal) (h)	24000
Average life (Rated) (h)	24000
Rated survival factor (%) at 2000 h 50Hz	100
Rated survival factor (%) at 4000 h 50Hz	99
Rated survival factor (%) at 6000 h 50Hz	98
Rated survival factor (%) at 8000 h 50Hz	97
Rated survival factor (%) at 12000 h 50Hz	90
Rated survival factor (%) at 16000 h 50Hz	79
Rated survival factor (%) at 20000 h 50Hz	66

Physical data

Max. Lamp Diameter (mm) - D	72
Weight (kg)	0.059

SYLVANIA

SHP-S TwinArc

SHP-S 70W TWINARC E27 SLV

0020719

ETIM Class	EC000821
E-number FI	4845528
E-number SE	8358106
E-number Norway	3800723

Optical data

Luminous flux (lm)	6000
Luminous flux (Rated) (lm)	6000
Ambient temperature for maximum luminous flux (°C)	25
Colour temperature (K)	2050
CRI (Ra)	20
Adjustable chromaticity	N
Rated lumen maint. factor (%) at 4000 h 50Hz	96
Rated lumen maint. factor (%) at 6000 h 50Hz	94
Rated lumen maint. factor (%) at 8000 h 50Hz	93
Rated lumen maint. factor (%) at 12000 h 50Hz	91
Rated lumen maint. factor (%) at 16000 h 50Hz	90
Rated lumen maint. factor (%) at 20000 h 50Hz	89

Electrical data

Wattage (W)	70
Current (A)	0.98
Product Voltage (V)	90
Control gear required	Yes
Transformer required	No
Drive current (mA)	0
Lamp Energy Label (class)	A+
Energy efficiency level	A+
kWh per 1000 hours burning time	77

Lifetime data

Average life (Nominal) (h)	55000
Average life (Rated) (h)	55000
Life T90	24000
Rated survival factor (%) at 2000 h 50Hz	100
Rated survival factor (%) at 4000 h 50Hz	100
Rated survival factor (%) at 6000 h 50Hz	100
Rated survival factor (%) at 8000 h 50Hz	99
Rated survival factor (%) at 12000 h 50Hz	98
Rated survival factor (%) at 16000 h 50Hz	96
Rated survival factor (%) at 20000 h 50Hz	93