

**Environment, Communities and Fire Select Committee**

**20 June 2019**

**Street Lighting LED Conversion Programme and Central Monitoring (CMS) Programme**

**Report by Executive Director of Place Services and Environment and Director of Highways, Transport and Planning**

**Summary**

A study of WSCC street lighting equipment has identified a cost effective project to convert the street lighting throughout West Sussex (Approximately 64,085 units) to LED lanterns, introduce a Central Monitoring System (CMS) and adjust the current dimming policy over a 6 year conversion programme.

The change to LED lanterns will reduce the current annual electricity consumption by 9,325,907 kWh when fully implemented and lead to a reduced maintenance requirement.

The cost to implement the proposal is estimated at £26.561m which includes a capital cost of £20.940m and financing (interest) charges of £5.621m over the 25 year borrowing period.

The reduction to annual electricity consumption is estimated to save £82.842m over the same period and maintenance savings of £7.329m are also expected. These reductions equate to a combined estimated gross saving of £90.170m over the period.

The net saving is £63.609m and the total capital expenditure and financing cost is paid back within 13 years.

The possibility of utilising interest free loan funding through the Salix scheme has been explored and it is considered likely that this will proceed. Indications are that it may be possible to secure around half of the funding required, which would lead to a reduction of between £2m and £3m in interest charges.

The reduction in electricity consumption will generate a significant saving in the street lighting carbon emissions of an estimated 2,864 tonnes per year. This reduction is a 17% decrease in WSCC overall carbon emissions, making a significant contribution to WSCC targets.

An added benefit of the LED lantern design is the reduction of upward light emissions which supports the darker sky policy. However, this cannot be quantified as the upward light will be affected by reflections off the road surface and other objects.

The implementation of CMS introduces flexibility into the way dimming of street lights can be controlled. This will enable WSCC to have multiple step changes and accurately control the dimming levels and switching times for part night lighting.

During the development of the programme a new dimming strategy will be defined and new policy agreed.

The Full Business Case was approved at Capital Asset Board on 28 March 2019.

### **The focus for scrutiny**

It is suggested that Members consider the implementation of the Street Lighting LED conversion programme, the associated ongoing cost saving and the future proofing and flexibility of installing a central monitoring system (CMS).

## **Proposal**

### **1. Background and Context**

- 1.1 Since April 2010 WSCC street lighting has been maintained under a Private Finance Initiative (PFI) contract with Tay Valley, which included an initial replacement phase to bring the end of life equipment up to the current industry standards. When the contract was developed and awarded LED and central monitoring system technologies were unreliable and therefore the decision was made to design the replacement schemes using traditional technology. Since the start of the contract street lighting technology has advanced significantly with trials across the UK and within West Sussex proving the reliability and performance of the new LED and CMS units

The following is a table identifying where the main quantity of LED lanterns in West Sussex is installed.

Angmering	24
Arundel	18
Billingshurst	19
Bognor area	92
Burgess Hill	18
Chichester	207
Crawley	175
Fernhurst	108
Midurst area	474
Petworth	177
Rogate	66
Pyecombe	89
Worthing	54
Southwick	82
Shoreham	31
Lancing	107
Littlehampton area	39
Henfield	29
Findon	40
Horsham	58
Linchmere	22

- 1.2 It is now considered a viable option to install LED's, thus allowing the potential to replace traditional lighting with this LED equipment. The new LED's generate the same light output with considerably less energy usage, they also have a greatly extended life compared to the traditional lanterns that require a lamp change every 4 years. There are currently approximately 2000 LED lanterns in use around West Sussex, with the majority of the South Downs National Park converted to assist in achieving the dark sky policy. These LED units have achieved the same lighting levels as the traditional lanterns and have had no reported issues or associated maintenance concerns.
- 1.3 Conversion to LED lighting will produce a reduction in electrical consumption, carbon emissions, and will increase the duration between routine maintenance visits. These will generate a revenue spend saving and the reduction in visits will reduce the need for traffic management and the resultant traffic delays
- 1.4 Central Monitoring System (CMS) technology is now widely used throughout many local authorities. This enables the street lights to be remotely monitored and controlled by the service provider, Tay Valley, using web based programmes. This allows dimming and part night lighting to be implemented or altered without future site visits, and the associated costs. These improvements will generate a revenue expenditure saving and the reduction in visits will reduce the need for traffic management and the resultant traffic delays.

## **2. Proposal**

- 2.1 The implementation of a LED conversion programme will give the opportunity to deliver the following improvements:
  - Reduction in the frequency of maintenance, which will reduce the amount of visits and traffic management required. This will have a direct effect on the amount of disruption to the highway network, and will reduce the monthly revenue spend
  - The reduction in energy used will generate a revenue cost saving from the point the conversion has been implemented and will contribute to WSCC carbon emission saving targets.
  - Due to the design of LED lanterns there is a cleaner cut-off of light ensuring the light is directed where required, this will reduce upward light emissions in support of the darker sky policy. However this cannot be quantified as the upward light will be affected by reflections off the road surface and other objects.
- 2.2 The introduction of LED lamps will be combined with the implementation of a Central Monitoring System (CMS) enabling the street lights to be remotely monitored and controlled. This allows dimming to be altered and part night lighting to be implemented without future site visits, and the associated costs. The CMS will check that street lights are dimming correctly, using the correct amount of energy and identify faults, such as a partial or full lantern

failure. These improvements will generate a revenue expenditure saving and the reduction in visits will reduce the need for traffic management and the resultant traffic delays.

- 2.3 There are additional features within CMS that could be investigated once the full system is installed and validated. This could include using the system as a communication network and utilising the CMS capability of incorporating smart city applications such as air pollution monitoring, weather monitoring and traffic counting.
- 2.4 The delivery of the scheme will be through the current Street Lighting PFI contract, with the required amendments to the contract being implemented using the High Value Change (HVC) process and a Deed of variation.
- 2.5 The full business case recommends permission is given to proceed with the implementation of the LED conversion programme and implementation of the central monitoring system (CMS) including : -
- a) stakeholder consultation for the implementation
  - b) legal changes to the street lighting PFI contract
  - c) budget of £20.940m is allocated to this income generating initiative within the Capital Programme

### 3. Resources

#### 3.1 Revenue consequences of proposal

The cost to implement the proposal is estimated at £26.561m which includes a capital cost of £20.940m and financing (interest) charges of £5.621m over the 25 year borrowing period.

The reduction to annual electricity consumption is estimated to save £82.842m over the same period and maintenance savings of £7.329m are also expected, as set out in the table below:

	Current Year 2019/20 £m	Year 2 2020/21 £m	Year 3 2021/22 £m	Year 4 - 25 2022/23 to 2024/25 £m	Total £m
Energy Cost Reduction	-0.133	-0.430	-0.745	-81.534	<b>-82.842</b>
Maintenance Cost Reduction	-0.024	-0.073	-0.122	-7.109	<b>-7.329</b>
<b>Gross Saving</b>	<b>-0.158</b>	<b>-0.503</b>	<b>-0.867</b>	<b>-88.642</b>	<b>-90.170</b>
Repayment of Capital	0.138	0.280	0.425	20.097	<b>20.940</b>
Interest Payments	0.083	0.163	0.239	5.136	<b>5.621</b>
<b>Total Financing Cost</b>	<b>0.221</b>	<b>0.443</b>	<b>0.664</b>	<b>25.233</b>	<b>26.561</b>
<b>Net Saving</b>	<b>0.064</b>	<b>-0.060</b>	<b>-0.203</b>	<b>-63.409</b>	<b>-63.609</b>

The net saving over the period is £63.609m and the total capital expenditure and financing cost is paid back within 13 years.

A net saving is achieved in all years, with the exception of the first year where a net cost of £64,000 is projected. This is considered to be at a level that can be managed within the Highways and Infrastructure budget.

Energy savings are calculated based upon current average energy rates per kilowatt hour (£0.169) indexed for inflation in future years. The indexation applied is based upon the forward rate outlook for the corporate 'LASER' energy contract and reflects a mid to upper range inflationary scenario in line with current experience. This translates into an average increase of 6% per annum.

Maintenance savings have been calculated based on the reduction to routine lantern replacement due to the increased life expectancy of LED lanterns.

Capital borrowing costs are calculated over 20 years for each of the six annual phases of the rollout (25 years in total) and are based on the Public Works Loan Board 20 year annuity rate (2.38%).

An expanded annual savings table can be seen in Appendix 1.

- 3.2 Sensitivity analysis has been undertaken to understand the impact of changes to assumed energy savings and borrowing costs. Modelling based upon more modest energy cost increases (reflecting the LASER outlook low range scenario, averaging 2.4% per annum) and increased borrowing costs (current 2.38% plus 2%) has confirmed that the savings generated would continue to cover the repayment of the capital outlay and financing charge and provide a residual net saving
- 3.3 The possibility of utilising interest free loan funding through the Salix scheme has been explored and it is considered likely that this will proceed. Indications are that it may be possible to secure around half of the funding required, which would reduce the PWLB borrowing requirement and lead to a further saving of between £2m and £3m in interest costs. The finalised replacement schedule will be submitted to Salix for approval and confirmation of the amount of loan funding available.
- 3.4 The Capital Programme approved by Full Council in February 2019 includes the full budget allocation of £22 million for this programme as an income generating initiative. This is funded by Corporate Borrowing. The estimated Capital funding required for this scheme is £20.940m which is being recommended for approval in a decision report to the Cabinet Member for Highways and Infrastructure.
- 3.5 Capital consequences of proposal

The capital cost of the proposal is estimated at £20.940m.

The Capital Programme approved by Full Council in February 2019 includes a provisional budget allocation of £22m for this programme as an income generating initiative.

The budget will be reprofiled as set out in the table below:

	Current Year 2019/20 £m	Year 2 2020/21 £m	Year 3 2021/22 £m	Year 4 to 6 2022/23 to 2024/25 £m	Total £m
Capital Budget	0.000	3.700	3.700	14.600	22.000
Change from Proposal	-3.490	-3.490	-3.490	-10.470	-20.940
Reprofiling Required	3.490	-0.210	-0.210	-3.070	0
Budget Remaining	0	0	0	1.060	1.060

The £1.060m balance of budget remaining will be removed from the programme and the borrowing requirement reduced accordingly.

## Factors taken into account

### 4. Issues for consideration by the Select Committee

- 4.1 Select Committee is asked to consider the implementation of the Street Lighting LED conversion programme, the associated ongoing cost saving and the future proofing and flexibility of installing a central monitoring system (CMS).
- 4.2 The Select Committee is also asked to consider the impact on Carbon emission reduction, benefits to the darker sky policy and future proofing towards 'smart city technology'.

### 5. Consultation

- 5.1. The Capital Programme approved by Full Council in February 2019 includes the full budget allocation of £22 million for this programme as an income generating initiative. This is funded by Corporate Borrowing.
- 5.2. Consultation and communication strategies will be developed to inform WSCC stakeholders of the programme and obtain feedback prior to start of the 'on street' changes.
- 5.3. Consultation on a previous proposal for Crawley in December 2017 resulted in some negative feedback from residents and members. However, LED technology has advanced significantly and trials across the UK and in West Sussex have proved the reliability and performance of the new LED and CMS units. It is considered, therefore, that a comprehensive communications plan will address any remaining concerns.
- 5.4. This communication plan will cover the points raised in December 2017 around the following questions and responses: -

Q1 There could be a potential health risk from the glare and blue-rich light from LED's which has the potential to damage the eye and disrupt sleep.

R1 Prior to installing new LED's the selected roads will go through a full design review to ensure that the correct level of lighting is maintained and WSCC are not over lighting the area. This will ensure WSCC get the maximum benefit from energy reduction.

Throughout the core investment programme (CIP) WSCC has received complaints regarding disrupted sleep caused by light spillage from the newly installed white conventional lanterns which replaced the yellow lights. When investigated the light levels in the properties were below the recommended lux levels and the issue was associated to the change in colour from yellow to white. The suggested issue regarding additional glare from LEDs may simply be the change from a yellow to white light source as experienced and recorded by WSCC during CIP. However as WSCC has already converted the majority of residential street lights to white light the change to LED will be less noticeable and WSCC would expect less controversy with this conversion.

As there are no plans to move any columns the light source will still be in the same location and by using a LED lantern this reduces the spillage of light (the lantern design achieves a cleaner cut off of the light) and hence the upward and rearward lighting is minimised. This actually reduces the potential for light to be directed into residential windows and as per the current lighting additional shielding can be installed as required.

The blue light part of the spectrum is more prominent in lighting that is higher in the colour spectrum e.g. in 'Cool white' LED over 4000k. WSCC are proposing to use up to 4000k which is neutral white light where there is less blue light emitted. In comparison moonlight has a correlated colour temperature of 4000k so the light source selected is no worse than that of moonlit.

There are some independent reports that put the blue light issue in perspective. For example the Scientific Committee on Health, Environmental and Emerging Risks SCHEER preliminary opinion on Potential risks to human health of Light Emitting Diodes (LEDs) report is a literature review and focussed on interior lighting which is much more of a concern, as the lamps are brighter and closer. It is agreed that intense levels of blue light can be proven in the lab to have an influence on people's health. This though is well beyond any level that anyone would be exposed to from street lighting. To have an effect someone would have to be within a metre and spend hours exposed to a high power street light. Standing under a street light would have no effect as the levels would be too low. There is no proven evidence that the amount of blue light involved in street lighting has any influence on people's health.

Q2 There is a risk that LED lighting can damage local ecosystems because more insects are attracted to LED blue light.

R2 LED's do not emit ultraviolet light which is the main attraction for moths and insects therefore there is no evidence that introducing LEDs effect the ecosystem.

Q3 Information regarding the colour temperature of the lighting that would be installed and how this compares to the existing lighting provision.

R3 As mentioned above in R1, WSCC are planning to use up to 4000k in all roads, this compares with the below: -

Son 2100k currently used on main roads

Cosmo 2850k mainly used on residential areas

PLL 4000k currently preferred choice in residential areas

5.5. West Sussex Public Health team have been in discussion with Public Health England (PHE) regarding changes to street lights to LEDs. These discussions raised a number of points which have been addressed below: -

- a) PHE agreed with our recommendation of using LED's below 4000k, they did suggest that in rural areas there may be an opportunity to reduce lower. - WSCC will consider this during the design stage especially where rural areas are not using the current white light lanterns.
- b) The way dimming of LED Street lighting is implemented needs to be considered, as the early LED lanterns were known to have caused migraines due to a strobing effect. PHE advised that to avoid flicker (including strobing) the LEDs need to be either direct current (DC) or very high frequency >15kHz, with a modulation of <8%. - WSCC have selected lanterns that are the latest generation and use DC dimming which removes any possibility of a strobing effect.
- c) Issues have arisen when LED lanterns have failed and the new replacement lantern is a slightly different colour, PHE suggested that consideration is given to add a clause in the contract that if x% of lanterns in a road are changed the complete road must be changed. - WSCC will consider this when implementing the deed of variation to the contract.
- d) PHE identified some points from lessons learnt with other authorities, these included: -
  - LED's have a cleaner cut off and direct light where required, this characteristic has generated complaints from members of the public not being able to see their front doors to insert their key. - WSCC will consider this in the design stage but will need to balance the issue against lighting unwanted areas ie bedroom windows.
  - Consideration must be taken to the possibility of blinding motorist from the new LED's - The issue is more relevant when using the existing lantern and replacing the light source with LED's. WSCC proposal changes the complete lantern which has been designed to limit the potential blinding effect and has the ability to add shielding
  - Other authorities have found that once the conversion commenced some of the conversion kits couldn't be installed on the older

equipment. – WSCC has been through the core investment programme which replaced the columns to modern types, this and the plan to preplace the lantern eliminates this as a concern.

- Consideration should be given to the repair of the selected lantern and limiting future maintenance costs – WSCC have been in discussion with the PFI contractor and the selected lanterns all come with a free return to base replacement agreement up until 2035. In addition WSCC are selecting lanterns that can be made to compensate for the loss of a number of LED's in the lantern.

## **6. Risk Management Implications**

- 6.1 The key risk to WSCC is achieving the repayment of the capital outlay and borrowing cost and realising projected cost savings. Capital borrowing has been modelled over 20 years for each phase of the rollout and is based on the Public Works Loan Board (PWLB) 20 year annuity rate (currently 2.38%).

Savings calculated are based upon current average energy rates per kilowatt hour (£0.169) indexed for inflation in future years. The indexation applied is based upon the forward rate outlook for the corporate 'LASER' energy contract and reflects a mid to upper range inflationary scenario in line with current experience. This translates into an average increase of 6% per annum. Sensitivity analysis has been undertaken to ensure that should increases be more modest and reflect a low range scenario (averaging 2.4% per annum), the savings generated would continue to cover the repayment of the capital outlay and borrowing cost and provide a residual net saving.

The actual cost reductions will be monitored through the current PFI Monthly Meetings.

- 6.2 There is a risk that the legal changes required within the PFI contract to allow the changes to be implemented are agreed by all parties. Initial discussions with WSCC PFI Partners have indicated that they are willing to work with WSCC to use the High Value Change (HVC) process and a Deed of Variation to ensure the project proceeds. However following a review from the WSCC legal team it is confirmed that the Change will be complex and a number of points covered in the full business plan need to be carefully considered.

These are: -

- a) Implementing the new technology over a 6 year programme will require the contract risk profile to be assessed.
- b) CMS technology has changed and it is understood to have improved since the Project Agreement was executed in 2009. The Project Agreements signed by Hampshire County Council and Southampton City Council reflected the technology as at 2009 and the risk profile of that technology. Careful consideration should therefore be given to the appropriate level of risk transfer relating to the performance of CMS technology and it may not be appropriate to replicate the position achieved in the Hampshire and Southampton projects but, instead, seek to optimise the risk transfer based on the latest technology.

- c) The value of the change would constitute a HVC and would therefore require funder approval and legal, financial and technical advisory checks.
- d) A change of this scale will require careful consideration of the impact of the Change on the Project Agreement including the output specification and payment mechanism; and
- e) WSCC will need to ensure that it has its approvals pack in hand. This means council decisions, DfT approval (assuming any change to risk profile) constitutional documents, LGCA certificate and formalities certificate will be required.

6.3 The selection of the LED lanterns will need to be carefully considered to ensure that WSCC gets best value for money, a reliable unit and the most energy efficient solution. However the assessed risk is low as the units being considered have completed trials prior to selection and come with a manufacture replacement agreement. There are currently approximately 2000 LED lanterns in West Sussex, with trials of the latest versions and CMS in Chichester, Duncan Road and Walnut Avenue.

## 7. Other Options Considered

### 7.1

<b>Option 1</b>	Convert the street lights within West Sussex to LED. Part night lighting maintained Dimming regimes maintained No CMS Installed over a 6 year programme
Advantages	This will give a long term reduction in electrical usage with no change to the current light levels. Lower capital investment without CMS
Disadvantages	Future changes would be expensive as there will be a need for site visits and equipment changes. Energy usage could be reduced if dimming regime altered No remote monitoring/ management of equipment
Conclusion	The amount of work to change the existing assets would be the same as the other options but the return is less. <b>Discount</b>
<b>Option 2</b>	Convert the street lights within West Sussex to LED. Part night lighting maintained Increase dimming regime No CMS 6 year installation programme

Advantages	<p>This will give a long term reduction in electrical usage and will introduce a more aggressive industry approved dimming regime.</p> <p>Lower capital investment without CMS.</p>
Disadvantages	<p>Future changes would be expensive as there will be a need for site visits and equipment changes.</p> <p>No remote monitoring/ management of equipment</p>
Conclusion	<p>This wouldn't give the flexibility to react to future changes or remote control or fault find lanterns</p> <p><b>Discount</b></p>
<b>Option 3</b>	<p>Convert the street lights within West Sussex to LED. Part night lighting maintained</p> <p>Increase dimming regime over and above Option 2 as CMS enables unlimited change points and stepped dimming</p> <p>Install CMS</p> <p>6 year installation programme</p>
Advantages	<p>This will give a long term reduction in electrical usage and will introduce a more aggressive industry approved dimming regime.</p> <p>Introducing the CMS will enable WSCC flexibility over the future control of the street lights</p> <p>Most cost effective way of introducing CMS as the traffic management and site visit is required for the LED conversion</p>
Disadvantages	<p>Higher capital investment required for CMS.</p>
Conclusion	<p>The introduction of CMS will help future proof WSCC against the inevitable increase in energy costs and with smart cities being more and more predominant this would enable WSCC to have some infrastructure in place.</p> <p><b>Selected</b></p>
<b>Option 4</b>	<p>Convert the street lights within West Sussex to LED. Part night lighting removed</p> <p>New dimming regimes</p> <p>Install CMS</p> <p>6 year installation programme</p>
Advantages	<p>This will give a long term reduction in electrical usage</p> <p>Consistent approach to lighting across WSCC</p> <p>Introducing the CMS will enable WSCC flexibility over the future control of the street lights and this is the most cost effective way of introducing CMS as the traffic management and site visit is required for the LED conversion</p>

Disadvantages	<p>Removal of Part-Night lighting is a backwards step with other authorities now looking at introducing to save energy costs</p> <p>The new more aggressive dimming regime required to offset the part night lighting could introduce a complaints which may require the dimming levels to be decreased and hence less energy savings</p>
Conclusion	<p>The removal of part night lighting is not recommended as it's a backwards step, WSCC should be considering how to expand the use of part night lighting within the Crawley area</p> <p><b>Discount</b></p>

## 8. Equality Duty

- 8.1 An Equality Impact report (EIR) is not required as there will be no material impact of the proposal on individuals or identifiable groups as the project will be replacing an existing street lighting system with one that uses LED technology

## 9. Social Value

- 9.1 There will be no social value act implications as the project will be replacing an existing street lighting system with one that uses LED technology.
- 9.2 The main impact advantage to implementing the project is the reduction in carbon emissions. The carbon savings are significant, reducing the amount of carbon by an estimated 2,864 tonnes per year, a 49% decrease in the current street lighting carbon emissions. This reduction is a 17% decrease in WSCC overall carbon emissions, making a significant contribution to WSCC targets.

## 10. Crime and Disorder Implications

- 10.1 There are no implications as the project will be replacing an existing street lighting system with one that uses LED technology.

## 11. Human Rights Implications

- 11.1 There are no implications as the project will be replacing an existing street lighting system with one that uses LED technology.

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## **Appendices**

Appendix 1 – Expanded Annual Savings Table

## **Background Papers**

Scientific Committee on Health, Environmental and Emerging Risks SCHEER preliminary opinion on Potential risks to human health of Light Emitting Diodes (LEDs)

[https://ec.europa.eu/health/sites/health/files/scientific\\_committees/scheer/docs/sc\\_heer\\_o\\_011.pdf](https://ec.europa.eu/health/sites/health/files/scientific_committees/scheer/docs/sc_heer_o_011.pdf)

Street Lighting and Blue Light FAQ

<https://www.energy.gov/eere/ssl/downloads/street-lighting-and-blue-light-faqs>