

Environment Development and Transport Committee

Report title:	Streetlighting Review
Date of meeting:	8 March 2019
Responsible Chief Officer:	Tom McCabe – Executive Director, Community and Environmental Services
Strategic impact Street lighting energy accounts for a significant proportion of the Council's total energy use. The Council has made a commitment to reduce its total Carbon Emissions by 50% (from 2008 base line), by 2020. Therefore, managing the Council's Street Lighting portfolio plays a significant part in contributing to achieving that target. As well as the environmental benefits, there is also a considerable financial impact as the revenue cost for highways related streetlighting energy use is around £2.1m per year. Despite a change in the Council's policy in 2016, growth in the number of street lights as a consequence of new developments continues to be a significant issue as does the potential general increase in wholesale energy prices.	

Executive summary

The County Council is responsible for 52,960 street lights, 7,440 illuminated signs, 1,960 illuminated bollards, and 620 beacons such as zebra crossing beacons. All street lighting operations, including upgrade and maintenance are covered within a 25-year Private Finance Initiative (PFI) contract, let to Amey in 2008. The PFI contract excludes electricity costs which are paid directly by the County Council.

In 2014 and 2016, EDT Committee discussed a broad range of street lighting options and approved the introduction of new technology including computer-controlled LED (light emitting diode) street lighting and the removal of redundant lighting on main roads. As a result, currently there are 9,876 LED streetlights, with a programme of upgrades currently underway to install a further 13,500 LED's on residential roads in Norfolk.

This report provides an update on initiatives that have cumulatively saved over £3m in energy costs and approximately 19,000 tonnes of CO2 emissions since 2008.

This report updates Committee on the following:

- The existing approach to streetlighting in Norfolk;
- The management of streetlighting by using new technology, including LED & CMS;
- Change of policy with regard to the design standards used;
- Options for future environmental and financial improvements.

Recommendations:

- 1 Members discuss the progress made in delivering environmental benefits and financial savings by introducing new technology and other streetlighting initiatives.**
- 2 Members approve the adoption of the latest streetlighting design standards for use in the Norfolk Streetlighting PFI contract.**

1. Existing approach to streetlighting in Norfolk

- 1.1. The PFI contract started in 2008 and was based on the improvement of lighting through the replacement of columns and streetlights with traditional units, mainly high-pressure sodium (white light). Since then a number of changes have been made which have helped reduce energy consumption.
- 1.2. The current approach to street lighting is based around:
 - Reducing energy consumption through initiatives such as part night lighting, dimming and trimming, and removal of redundant lighting;
 - Reducing energy consumption through removal;
 - Implementation of new Technologies such as LED / Central Management Systems (CMS) which are more energy efficient;
 - Only adopting new streetlights on developments if there is a defined Highway need.
- 1.3. This approach has been delivered through a number of initiatives:
 - Part night lighting (PNL) has been introduced to 18,649 street lights;
 - 5,235 residential street lights in the PFI core investment period were changed to LED (with part night lighting where appropriate);
 - 4,000 main road street lights have been changed to LED with CMS;
 - The next phase to change 13,500 residential street lights to LED is currently underway.

2. Management of streetlighting by using new technology

- 2.1. The County Council has invested significantly over the last five years into technological advances and implementing invest-to-save opportunities where there is a clear business case.
- 2.2. The first phase of this approach was to change residential lights in the core investment period to LED lights. 5,235 LED's have been installed in residential roads, some with PNL. The benefit of doing this was that it maximised the energy saving and we did not have the cost of revisiting the area at a later date for PNL.
- 2.3. The second phase was to change 4,000 main road streetlights to LED, many with a Central Management System (CMS). CMS allows the lamps on street lights to be controlled and dimmed. This is more effective on LED units with dimming possible down to 0%. CMS has been installed on the main road streetlights where we have installed LEDs and a dimming profile applied. This dimming generates up to a 48% energy saving. The annual savings from this initiative have been £110,000 in energy costs, 850,000 kWh in energy and around 460 tonnes of CO₂. In addition, to these figures are the reduced maintenance cost from installing LED's.
- 2.4. A third phase to install 13,500 residential street lights to LED is currently underway. The programme of installation is expected to be completed in summer 2020. The annual savings from the introduction of this initiative is expected to be around 1,528,930 kWh on energy, £162,372 on cost and 827 tonnes of carbon emissions per year. An additional annual saving due to reduced maintenance costs are estimated at £204,000, bringing the total predicted annual saving to around £366,000.

- 2.5. Once this current phase has been completed, 23,376 or 44% of the County’s highway lighting asset will be LED. The table below illustrates the significant financial savings and environmental benefits since the start of the PFI contract.

Year	Energy savings	Total Energy savings - kWh	Total Emissions savings – in Tonnes	Reduced maintenance costs	Comments
2008/09	£84,369	1,053,732	570	£0	Start of Core Investment Period - replacing old SOX (Low Pressure Sodium) units with SON-T (High Pressure Sodium) units.
2009/10	£83,773	1,248,294	675	£0	
2010/11	£100,303	1,701,746	921	£0	
2011/12	£112,721	1,694,745	917	£0	
2012/13	£266,292	3,603,175	1,949	£4,533	Completion of Core Investment Period. Start of first phase LED rollout
2013/14	£377,619	4,598,612	2,488	£20,281	
2014/15	£422,618	4,829,591	2,613	£43,597	
2015/16	£444,608	4,959,576	2,683	£61,667	
2016/17	£517,281	5,294,827	2,865	£88,443	Start of second phase LED rollout to main roads
2017/18	£654,228	5,983,949	3,237	£125,709	
2018/19	TBC	TBC	TBC	£132,516	Start of third phase LED rollout to residential roads
Total	£3,063,812	34,968,248	18,918	£476,747	

Table 1 – Savings since the start of the Norfolk Streetlighting PFI

3. Change of policy with regard to the design standards used

- 3.1. The 25 year Norfolk Streetlighting PFI contract started in 2008. At this time, as well as there not being any LED technology available, the national streetlighting design standards were different.
- 3.2. The previous streetlighting design standard BS5489 was amended in 2013 to take account of the new developing LED technology and other technological advances.
- 3.3. As the PFI contract is based on the 2003 version of BS5489, there needs to be a formal change to the contract to reflect this new design standard revision. It should be noted that the principles of the new standard have been applied to the more recent improvements / investments by Norfolk County Council, however, this formal contract change will ensure that all sides fully comply with the latest requirements and that there is full clarity.

- 3.4. It is recommended that the 2013 British Standard is applied only where existing Norfolk County Council policies on lighting allow or require lighting. Previously approved policies specify that highways in Urban Areas will generally be lit whilst highways in Rural Areas will not generally be lit, except where problems of road safety exist. Further to this there is also the 2015 policy to stop adopting lighting on new residential / retail developments unless there is a highways safety need. To clarify, the road being part of a traffic route (ie a higher use, non-estate road) or the inclusion of an introduced obstacle constitutes a highway safety need.
- 3.5. Within this new streetlighting design code there is more flexibility around the standards of lighting required in different circumstances, known as the lighting classes. To achieve consistency and clarity in Norfolk, the report in Appendix B has been produced. This provides a recommendation as to what lighting classes should be adopted in Norfolk and explains the justification for doing so. It is recommended that the proposal summarised in Appendix B is implemented in full as this offers further energy savings by reducing energy costs as well as positively impacting on the environment through further carbon reduction and reduced light pollution in Norfolk.

4. Options for future environmental improvements and financial benefits

- 4.1. As highlighted above, the next phase of LED installation will be complete on site in early 2020. At that time, 44% of the County's highway lighting asset will be of the most energy efficient LED type. However, that still leaves just under 30,000 lights of the old high-intensity discharge lighting such as low or high pressure sodium.
- 4.2. The next phase of potential upgrades would be the 15,000 remaining non-LED lanterns which are on Traffic routes. As explained in 3.4, a Traffic route is a higher use, non-estate road. As these tend to be the higher classification roads (A, B and well used C class roads), these tend to be the higher level light units that are the next highest use of energy. Any improvements to this lighting asset will deliver reduced electricity consumption and therefore deliver cost savings and cut carbon emissions.
- 4.3. Being located on traffic routes and given the higher usage of electricity (when compared to residential lights), as part of any LED upgrade, it would also be prudent to install a CMS (Central Management System). As highlighted above, previous use of this system in Norfolk has achieved up to 48% savings in energy.
- 4.4. Given the location of these lights on traffic routes it would also be prudent to future proof the new lanterns to include sockets for the latest digital technology. This will help with any new emerging Smart Cities technology (such as sensors to help monitor and improve traffic flows, monitoring pollution levels or real time temperatures, rollout of Wi-Fi or extension of existing Long Range Wide Area Network (LoRaWAN) networks etc). This will need to be explored further with the Council's Information Management and Technology (IMT) team and the additional cost for future proofing sockets are not included in the cost estimate below.
- 4.5. The estimated cost of upgrading all 15,000 traffic route lights to LED with CMS is estimated at £10.5m based on a detailed business case. Although a significant investment, if all 15,000 traffic route lanterns are upgraded, the reduction in energy is estimated to be approximately 5m kWh per year, the energy cost saving is estimated at £820,000 per year (at current market rate) and carbon emissions

would be reduced by around 2,700 tonnes of CO2 per year. In addition, the annual saving due to maintenance would be £80,000, bringing the total annual saving to £900,000 at the current contract rates. The application of dimming profiles through CMS are predicted to bring an additional 20% saving to ongoing energy costs, over and above the £900,000. The payback period for this option would be 11.7 years.

- 4.6. An alternative funding scenario has also been considered. This option focusses on the Norwich Strategy area traffic routes only and would involve upgrading around 6,000 units to LED with CMS. The total estimated cost for this option would be £4.5m which would achieve an expected £409,000 annual revenue saving. The payback period for this option would be 11 years. Funding options are currently being explored and one potential option may be to secure funding through the Transforming Cities award for the Norwich area. If so, it could be further expanded to include non-LED residential areas too, generating further financial and environmental benefits.
- 4.7. The two options detailed in 4.2 and 4.6 are summarised in Table 2 below. It should be noted that funding for both options is not secured.

Option	No. of LED's	Approx Cost	Approx Annual Revenue Saving	Payback Period
A	15,000	£10.5m	£900,000	11.7 yrs
B	6,000	£4.5m	£409,000	11 yrs

Table 2: Summary of Improvement Options

- 4.8. Officers will continue to explore the options for future upgrades and if a realistic business case emerges, we will bring this back to Members for consideration.

5. Financial Implications

- 5.1. Street lighting is a significant energy user, accounting for a significant amount of the County Council's total use and costing around £2.1m each year for highway related lighting alone.
- 5.2. The Table in section 2.5 of this report details the financial and environmental savings achieved since the start of the Norfolk Streetlighting PFI contract in 2008. In total, to date cumulative financial savings of over £3m have been achieved in terms of energy reduction, nearly 35m KWh of energy savings have been achieved against the 2008 baseline, equating to a carbon saving of nearly 18,900 T. A further £500,000 has been saved through reduced maintenance costs for LED's.
- 5.3. As outlined in section 4, the next phase of initiatives would be the upgrade of 15,000 Traffic route streetlights to LED with CMS, combined with additional sockets for future proofing. This would cost £10.5m and as an invest to save initiative, would have a payback period of 11.7 years (given the annual revenue savings of £900,000).

- 5.4. An alternative option focusses on the Norwich Strategy area traffic routes only and would involve upgrading around 6,000 units to LED with CMS. The total estimated cost for this option would be £4.5m which would achieve an expected £409,000 annual revenue saving. The payback period for this option would be 11 years.
- 5.5. The funding sources for the options outlined in 5.3 and 5.4 above have not yet been identified. Options currently being explored are corporate invest to save funding, central government loans (such as Salix), or specific external funding opportunities such as Transforming Cities funding from the Department for Transport.
- 5.6. The extent to which each of the initiatives are able to deliver a cashable saving, as opposed to just mitigating the increased cost pressure to the service due to increasing energy prices, depends largely on the future prices in the energy market. This continues to be a significant pressure for the authority.

6. Issues and Risks

- 6.1. Regarding the legal implications; the provision of new street lighting is a discretionary power, not a duty, and the Courts have held that no liability arises where a local authority decides to withdraw street lighting for reasons of economy. However if there are non-natural obstructions in the highway introduced by the Council, such as street furniture, crossings or traffic calming features, then reasonable care is required to see that they are not a hazard to users of the highway.
- 6.2. Street lighting forms part of the local street scene. As such, the provision of street lighting can be an emotive issue. Consultations with local communities were carried out in advance of implementing part night lighting and there was a split between those in favour and those against. Further resistance to initiatives have been encountered when consulting on and implementing the removal of redundant street lights.
- 6.3. Some of the initiatives we have implemented have required a change to the existing PFI contract. To date, we have been able to reach agreement about amendments to enable new approaches/trials and initiatives to be delivered which were not originally identified when the contract was let, for example, part night lighting. In addition the government (HM Treasury) is committed to reducing the PFI revenue cost to local authorities through a centrally co-ordinated savings programme. The code of conduct for operational PFI contracts seeks to foster agreement between local authorities and their PFI partners to deliver efficiencies and savings on a voluntary basis.

Officer Contact

If you have any questions about matters contained in this paper or want to see copies of any assessments, e.g. equality impact assessment, please get in touch with:

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The terminology of street lighting technology

LED

A Light-Emitting Diode (LED) is a semiconductor device that requires less energy, lasts longer and it also requires less maintenance than the lights that were originally approved for the contract. They are more expensive to buy although the price has reduced in recent years. They are now an economic alternative over the long term.

CMS

A Central Management System (CMS) is a method of remotely controlling street lights using computer software to determine the way the street light or groups of street lights operate. The software is usually hosted by a commercial organisation that provides the end user with a computer control interface via the internet. The end user can then readily program, at any time, how they want the streetlights to operate. The communication between the CMS and the street lights utilises the internet and the mobile phone networks.

Trimming

Trimming refers to turning on road lights later in the evening and switching them off earlier in the morning commonly by the use of photo electric control units (PECU). Trimming takes advantage of shorter warm up times and greater brightness of modern lanterns to reduce lighting hours at the start and end of the night.

Dimming

Dimming refers to reducing the light output of a lamp by adjusting the amount of energy supplied to it. The older types of lamps are less dimmable than modern LED ones because there is a threshold where if the energy is reduced, the lamp will extinguish. LED lamps are capable of being dimmed down to 0%. Some dimming was included in the original contract but dimming can be substantially increased with LED's and CMS.

Part Night Lighting

This is when the street lights are turned off during the night for a period of time. (12am to 5am GMT)

Briefing note**Review of Street Lighting Standards/Lighting Classes****Background**

As the Standards and best practise guidance documents have been updated to reflect the performance of modern lighting equipment. The standards written into the Norfolk Streetlighting PFI contract, development specification for street lighting works and Norfolk County Councils policy on environmental lighting zones are now largely outdated.

WSP were commissioned to review Norfolk County Council street lighting policies to see if any operational savings could be made by updating the development specification for street lighting works and PFI contract. The Norfolk County Council Electrical Services team have reviewed this along with further analysis of the 2013 British Standard for highway lighting.

Current Situation

The County Council's development specification for street lighting works and Norfolk County Council's PFI Contract with Amey both currently reference the following standards:

- BS5489-1:2003
- BS5489-2:2003
- BS EN 13201-2:2003
- BS EN 13201-3:2003
- BS EN 13201-4:2003

These are all now superseded. The current revision of BS EN13201 was released in 2015, the current BS5489-1 was released in 2013 and BS5489-2 in 2016. The standards (and associated best practise guidance) were updated largely due to the mass adoption of LED lighting across the public and private sector. Of particular note within the updated standards are the application of S/P ratios. S/P ratios allow the lowering of lighting levels to differing degrees dependant on how well a specified light source renders colour.

Proposal

The WSP report "NCC 5168 – Norfolk County Council – Street Lighting Policy Review" recommends that traffic route lighting classes are reviewed in line with the current BS 5489. This enables reduced lighting levels where appropriate. The application of BS5489:2013 also allows lower lighting levels on subsidiary roads while still being compliant with applicable standards. This is achieved through the application of Scotopic/Photopic ratios, where high quality white light sources, such as LED, provide good colour rendering values. Through these measures further energy savings can be made, reducing energy costs as well as positively impacting on the environment through further carbon reduction and reduced light pollution in Norfolk.

It is also recommended that the development specification for street lighting works is revised to ensure that its requirements align with savings initiatives implemented since the last update. In turn future developments which require lighting will be more efficient in their use of energy through the use of LED luminaires, 'Part Night Lighting' (where appropriate), Central Management System (CMS) Nodes and the application of current British Standard.