REGENERATION AND ENVIRONMENT SCRUTINY COMMITTEE – 14TH FEBRUARY 2017

SUBJECT: LED LIGHTING FEEDBACK REPORT

REPORT BY: CORPORATE DIRECTOR - COMMUNITIES

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1. PURPOSE OF REPORT

1.1 This report reviews the impact of recent investment to change from the existing higher energy conventional luminaries to LED (light emitting diode).

1.2 Scrutiny Committee to review the current methods of measuring and monitoring the energy savings.

1.3 Scrutiny Committee to review the use of LED light sources with reference to the Council's expectations with regards to light pollution and maintenance as outlined within this report.

1.4 For Scrutiny to review the LED feedback information relating to public responses within this report and comment on the existing methods of addressing these public concerns.

1.5 For Scrutiny to review and comment on the correlation between LED light sources and crime/accident figures in residential areas.

2. SUMMARY

2.1 Caerphilly County Borough Council (CCBC) has a current lighting stock of approximately 27,500 units, which have been subject to a number of energy saving measures (inter-urban part-night lighting, replacement of conventional bulbs with low-energy alternatives, dimming etc) since 2009.

2.2 The MTFP (Medium Term Financial Plan) 2015-16 EN5 saving looked for an energy saving of £450k (£290k from the LED lighting and £160k from part night lighting) over 2015-16, 2016-17 with the combination of an investment of £980k in LED (Light Emitting Diode) replacement gear-tray technology and part-night lighting measures. The installation started in September 2015 and has been completed. A total of 9,450 lighting units converted to lower energy ratings (compared with the original proposal of 8,000 units). This installation had realised £96k by the end of March 2016 with an additional £190k in energy savings forecast by the end of March 2017.

2.3 The energy savings have been measured and monitored in energy, CO_2 tonnage savings and financial terms. The savings show that, with the current figures, there is a positive correlation between the projected energy savings and those predicted in MTFP 2015-16 EN5.

2.4 Whilst this installation has taken place, comments / complaints have been logged and responded to, which has assisted in understanding the issues of the LED change and the potential issues for any future schemes. The comments are limited to around 100 over the

last 13 months (a very modest number over this period of time) with their nature being limited to the LED units being either too bright or too dim. It is deemed that the existing feedback mechanisms for the public are sufficient for this or similar schemes.

2.5 Although the links to crime and accidents have been shown not to have a demonstrable link to LED Street Lighting (refer to background paper: London School of Hygiene & Tropical Medicine in partnership with University College London - published in the Journal of Epidemiology and Community Health - July 2015), figures for these have been sourced and reviewed.

2.6 Accident figures for night-time collisions for the first six months, since installation of the LED gear-trays, show a slight increase from the five year mean, which has no statistical significance, so further data will need to be gathered before any firm conclusions can be drawn.

2.7 The local crime figures provided by Gwent Police (from April 2014 to November 2016) shows that there is no noticeable increase in crime after the installation of LED gear-tray lighting in Sept 2015.

3. LINKS TO STRATEGY

3.1 The report links directly to the Council's priority to ensure that communities are safe, green and clean places to live and to improve residents' quality of life by reviewing, renewing and installing lighting energy saving technologies.

3.2 The proposal also links to the Council's Strategic Equality Objectives – **Safer Caerphilly** namely SEO1 - Tackling Identity Based Hate Crime and SEO3 Physical Access, as detailed further in Section 6 of this report.

3.3 This proposal has a contribution to make in improving sustainability with more effective lighting and the reduction in energy usage for these lighting replacements. As noted in the Single Integrated Plan - A **Greener Caerphilly** which aims to: improve local environmental quality (G01) and reduce the causes of and adapt to the effects of climate change (G02)

3.4 The report supports the **Prosperous** and **Safer** themes of the 'Caerphilly Delivers' in the single integrated plan.

3.5 The recommended course of action contributes to the following Well-being Goals within the Well-being of Future Generations Act (Wales) 2015:

- *A prosperous Wales*
- *A resilient Wales*
- *A Wales of cohesive communities*
- *A globally responsible Wales*

4. THE REPORT

4.1 Background to Street Lighting

4.1.1 There is no statutory requirement on local authorities in the United Kingdom to provide public lighting, the Highways Act 1980 (Sections 97 & 98), empowers local authorities to light roads (Highway Authorities may provide lighting for the purposes of any Highway or proposed Highway for which they are or will be the Highway Authority), it does not place a duty to do so. Although Highway Authorities do have a duty of care to the road user, and an obligation to light obstructions on the highway, this does not imply a duty on the Highway Authority to keep all lighting operational. The Council has a statutory duty under the Highways Act to ensure the safe passage of the highway (as far as reasonably practicable) and this includes any lighting equipment placed on the highway.

4.1.2 To date a number of measures have taken place to reduce street lighting energy consumption in CCBC.

4.1.2.1 In 2009-10 CCBC implemented part-night lighting (switched off between mid-night and 5.30 am GMT – as agreed by the Council in 2009 for implementation in 2010 onwards) for the majority of the inter-urban roads (between towns and villages); approximating to 5,000 units in total.

4.1.2.2 In 2012-14 areas were nominated for low energy lighting trialled in selected areas around the county borough; approximating to 4,000 units in total.

4.1.2.3 In 2012-14, Central Management System (CMS)/ Dimming schemes were installed in trial areas, to approximately 5,000 units in total. This works by dimming the lights (via the CMS) to realise energy savings. The threshold for this power reduction is 50%, after this point a visible difference is perceived by the naked eye, more efficient energy savings can be attained with the recent and effective ranges of lighting technologies, such as LED replacements.

4.1.2.4 There are also ancillary apparatus, which include lit signs and bollards. These are of marginal cost to the annual energy budget, amounting up to £10k each; with traffic lights having a figure of £50k per annum. Though these are not seen as a priority (as more significant savings can be realised with street lighting replacements), the older/life expired ancillary units are gradually being replaced by modern energy efficient LED versions, as finances allow.

4.1.2.5 In 2015-16 a capital investment of £980k was made for replacement of approximately 8,200 lights with LED gear trays (replacing the lighting elements only) and increasing the number of lights affected by the part night lighting policy. Failure to agree an increase to the part night lighting resulted in a proposed whole year saving of approximately £290k for 2016-17. The remaining reduction of £160k has been achieved by reducing the Lighting Maintenance budget by this amount (agreed at the Cabinet meeting 30th March 2016).

4.1.2.6 There has been an additional installation of the LED gear-trays which has taken around seven months to complete. This being sourced from the capital funding previously allocated for part night lighting, which has been utilised to replace life expired sodium residential lanterns (approximately 1250 units). Installation began in August 2016 and was completed in December.

4.2 Effects of LED Street Lighting

4.2.1 As explained in the previous section, there has been a two stage installation of the LED gear-trays taking place over a fifteen month period, which has given the time parameters for data to be compiled and an assessment to be carried out on the following:

- Energy reduction
- Environmental savings
- Financial savings
- Material saving
- Maintenance costs
- Light pollution
- Public response
- Possible future trends in accident occurrence
- Possible future trends in crime

4.2.2 **Energy Reduction:** with large scale usage this is expressed as the standard unit of measurement of the kilo-watt hour (kWh). This provides the energy rating, as it combines both power (kW) and time (h). So if you switched on a 100 watt light bulb, it would take 10 hours to use 1 kWh of energy (100W x 10h = 1,000 = 1 kWh).

A table can be drawn up with comparisons made for the energy savings based on readings taken this year with projected figures up to March 2017 against readings taken before the main LED gear-tray installation (so in 2014-15). This can be segregated over three time periods:

- Comparing January to September 2016 against January to September 2015 – this gives an actual reading of the energy savings for the most recent nine months (Column A in table below)
- Comparing January to December 2016 against January to December 2015 – this gives predicted energy savings for the end of the calendar year (Column B in table below)
- Comparing March 2016 to March 2017 against March 2014 to March 2015 – this gives the projected energy savings for the first 12 months of the MTFP savings (refer to 2.2) (Column C in table below)

	A	B	C
Energy Saving (kWh)	1,558,861	2,100,000	2,531,000

4.2.3 **Environmental Savings:** The standard measurement of environmental impact is in Carbon Dioxide tonnage (CO_2 t). This means the predicted amount of the CO_2 is calculated for producing a set amount of energy. Working out the amount of CO_2 produced, as a by-product of energy generation, is a ready measure of the burden placed on the environment. The formula for this is:

CO_2 t = kWh x DEFRA conversion factor / 1000

The 'conversion factor' changes annually due to the mix of fossil fuels used by the power stations.

To express such a figure as an energy saving, gives a convenient scaling of the amount of ecological benefit gained by the environment.

Using the same format of table as produced for 4.2.2, the following figures can derived:

	A	B	C
Saving (CO_2 t) as of 2014	770	1,000	1,250

These rates are linked to the year that the MTFP was set in 2014 (ref. 2.2).
As energy becomes greener this factor has reduced from 0.49426 in 2014 to 0.41205 in 2016. CO_2 t savings, as predicted in 2014, are therefore higher than in 2016; this gives the following results:

	A	B	C
Saving (CO_2 t) as of 2016	642	865	1,042

4.2.4 **Financial savings**, this is the most prominent indicator of energy saving as it has a direct effect on budgets. Unlike the other two units above (kWh and CO_2), it is an inconsistent unit of measurement as unit prices for energy can go up as well as down. To mitigate this inconsistency from 2014 to 2016, the price per kWh is fixed to October 2014; this being the rate set at the time the MTFP was formulated and approved.

Using the same format of table as produced for 4.2.2, the following figures can derived:

	A	B	C
Saving (£) @ October 2014 rates	179,000	242,000	290,000

At the time of the MTFP (ref 4.1.2.5.), the unit rate per kWh was £ 0.11525, since then it has reduced to £0.10546, therefore the figure to be realised in March 2017 will be closer to £288,000.

As can be seen the projected savings from the MTFP 2015-16 EN5 (£290,000 from LED lighting – refer to 2.2), are currently on target for being achieved by March 2017, despite the drop in energy prices, due to the additional LED lighting investment released by the funds budgeted for part-night lighting (ref. 4.1.2.6.).

4.2.5 **Materials Savings** – the basis of LED lighting is for a current to pass through oppositely charged silicon diodes to create light, it therefore does not rely on the use of significant amounts of heavy metals or rare (and expensive) Nobel gases, as is the case with conventional sodium lighting. The material costs for LED lighting therefore presents a low-cost, more environmentally friendly and sustainable alternative to conventional street lighting.

4.2.6 **Maintenance Costs**, the average life span for a conventional (sodium) light is 3 to 4 years, LED units range from 10 to 15 years. Therefore there is a clear advantage of moving to LED technology in that the replacement of the lighting units are less frequent by a factor of 2 to 4.

The use of this more modern technology means that the lighting head design is more effectively profiled to resist severe weather conditions, is composed of more resilient materials and lighter in weight (reducing the loading risk), so presenting a more sustainable and resilient unit when compared to conventional types.

This has to be balanced with factors such as LED being a relatively new technology (so not as tried and tested as conventional units) and other components such as the column, electric cabling and lamp housing are still subject to aging and failure.

4.2.7 **Night-time light pollution** is the combined light from streetlights, office buildings, stadiums and other structures that brightens night skies and drastically limits the visibility of stars and potentially affects nocturnal wildlife.

Outdoor LEDs illuminate streets more efficiently than conventional (sodium) units, consisting of individual point light sources; they are more directional, meaning that they focus light, so illuminating the highway only and not the surrounding areas. Sodium lamps are gas-filled bulbs that emit light in all directions; more than half of that light must be redirected downward by reflectors or lenses, reducing the lamps' illumination efficiency.

Early versions of LED street lights have worsened light pollution by giving off more blue and green light than the conventional sodium lights they normally replace. So like the conventional sodium lighting, it appeared to wash out the night sky and was linked to many negative consequences, such as disrupted night and day cycles of nocturnal animals and altering their hunting interactions and internal physiology.

More recently, lighting companies have introduced LED streetlights, with coatings on the LEDs, which provide a warmer-hued output together with flat or concave configurations to direct more of the light downwards; this has reduced the blue/ green lighting and the reflected light issues.

All of the LED gear-tray and LED lantern replacements installed in CCBC since 2014 have utilised warm (sub 4000K LEDs) and been on the flat configuration and so directing their light towards the highway rather than dispersing it.

4.2.8 **Public Response**, there has also been an exercise carried out to segregate and compile the comments and complaints related to the LED conversion of street lighting since its instigation in September 2015, these can be summarised as follows:

Customer services

Number of complaints that LED lighting is too bright	29
Number of complaints that LED lighting is too dim	41
Number of commendations	4
Total number of comments/ complaints via Customer Services	74

Social Media

Total number of negative comments (too dim)	33

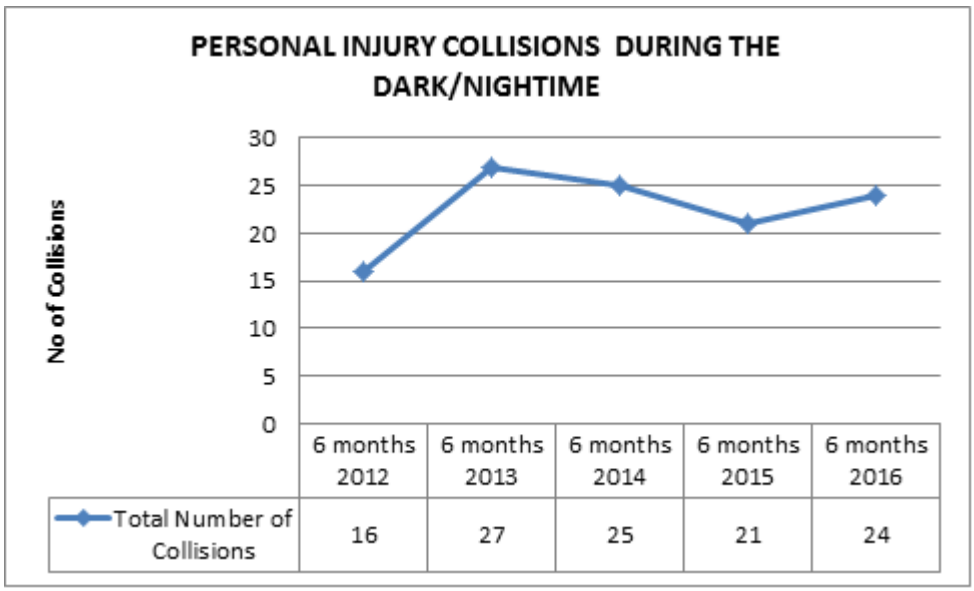
This gives a total of 107 for comments and complaints from September 2015 to date, of which 104 are concerning the light intensity when compared with the conventional sodium (yellow) street lighting units. It must also be noted that the number from Social Media (33) is very low and was usually in response to a posted article rather than arriving independently. To give a degree of context, other council services such as refuse collection, dog fouling etc. typically number in the hundreds over similar time periods.

The perception of the different lighting types leads to a comparison, where the conventional Sodium (yellow) lights floods the surrounding area with a dispersed light eg buildings and trees, whilst the lighting of LED units is primarily directed towards the highway only. In instances where the LED lighting has received a complaint about the brightness, the deployment of mini-shields or a minor alteration in the street light head can be used to alleviate the issue.

Interaction with members of the public indicates that most accept that there is a need to reduce the energy use associated with street lighting and, following a short period of acclimatisation to the LEDs, few people have reported any ongoing concerns. Adjacent Authorities undertaking wide ranging LED installations have also received similar concerns in modest numbers.

4.2.9 **Possible future trends in accident occurrence**; for this to be assessed the figures for night-time accidents were taken over a five year period. Due to the installation date (September 2015 to December 2016) the most representative figures will be found over the first six month period of 2016 (1st January to 30th June), as the figures for the second half of the year have not been sourced and compiled at time of printing.

The results are summarised in the table below:

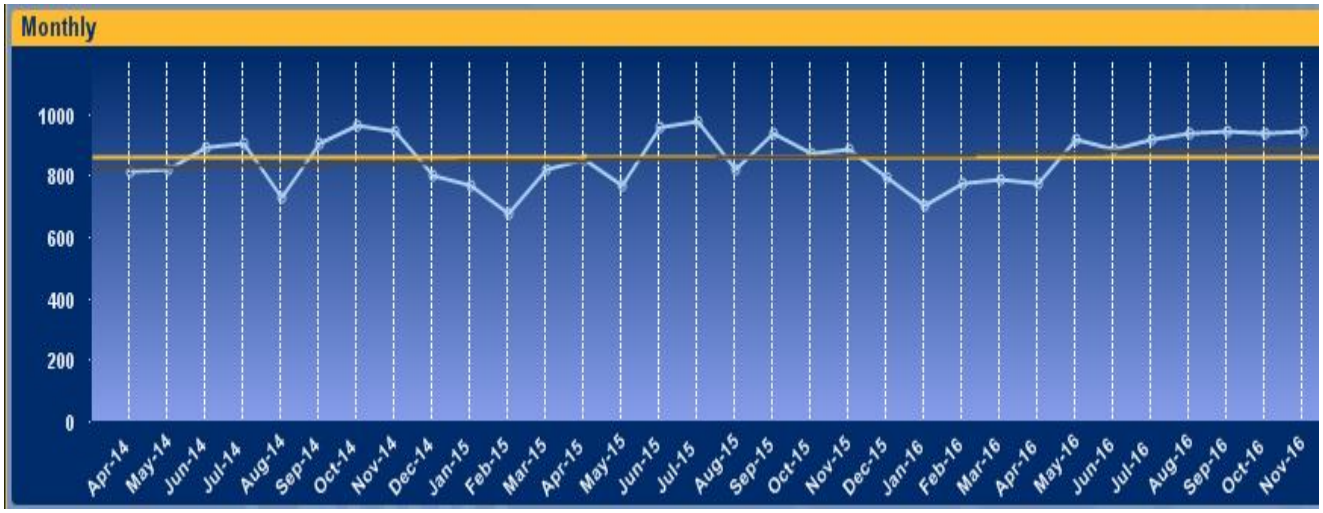


The figures compiled are taken from incidents that occurred in the dark, to focus on the possible issues associated with street lighting; although lighting conditions can be noted in the details of the Accident Statistics (Stats 19) formwork (filled in primarily by the Police), it is difficult to attribute the change in street lighting as a causation factor, as it is not currently included in the Contributory Factors section of this form. Street lighting was not especially noted in the Stats 19 forms received for the first 6 months of 2016. With this proviso, the 2016 figures can be seen to show a slight increase from the comparable data taken in 2015, though this is within 10% of the 5 year average of 23, so is not deemed statistically significant.

Going forward the possible effects of the change to LED street lighting on accident rates will be looked into in a separate exercise to be conducted by CCBC when a full 12 month set of figures (for 2016) becomes available.

Figures taken at this early stage are always going to be less representative of any possible effects and so an exercise of on-going monitoring is now in place to more accurately assess any negative or positive effects LED lighting has on this particular statistic.

4.2.10 **Possible future trends in crime** – A summary of the crime trend line (for CCBC) from April 2014 to November 2016 is shown below:



As can be seen, there is no noticeable increase in crime after the implementation of LED lights in Sept 2015. The steady increase post May 2016 is likely to be related to a change in recording practices used by the Gwent Police.

Caution should be used when analysing these crime figures as they are influenced by a huge range of factors and the effectiveness and impact of street lighting is open to much debate (refer to background paper: London School of Hygiene & Tropical Medicine in partnership with University College London - published in the Journal of Epidemiology and Community Health - July 2015).

It also needs to be noted that a significant amount of the reported crime figures is committed in the hours of daylight, or within buildings or dwellings that would not be influenced by the presence or type of nearby street lighting.

5. WELL-BEING OF FUTURE GENERATIONS

5.1 This report contributes to the Well-being Goals as set out in Links to Strategy above (3.5). It is consistent with the five ways of working as defined within the sustainable development principle in the Act in that it supports:

- Long term asset management solutions, as the LED conversions are both more durable and have a longer life-span than the current conventional (sodium) lighting units. This allows for more effective and predictable resource/ financial commitment for replacement and maintenance of these units.

- A prevention strategy based on having less reliance on the maintenance of the lighting units; the street lighting budget can then be re-focussed on the other structural elements of the lighting column, including the electric cables and focussing on making Caerphilly a safer and more environmentally friendly authority, with the reduction in energy expenditure meaning that energy saving initiatives, such as restricted hours lighting, are no longer an issue for urban areas. The application of LED lighting along interurban routes could also allow a return to whole night operation with no increase in the energy usage. The lower energy usage will mean reduced CO_2 levels needed for energy generation, so increasing the environmental benefits at the local and national levels.
- Effective lighting leading to collaboration with internal departments for town centre initiatives / schemes and the inclusion of other public bodies, such as the Police, in making urban areas less prone to crime and vehicular/ pedestrian accidents.
- The involvement of the public in instigating further LED conversion schemes with effective feedback mechanisms to receive comments both positive and negative and so improve the service provision.

6. EQUALITIES IMPLICATIONS

6.1 Dimming or switching off of street lights could have a significantly greater negative impact on people with certain types of visual impairment compared with the majority of the population. It will also significantly affect older people for both reasons of eyesight, and potentially a number of groups such as older people, the LGBT community, lone women etc. in terms of feelings of vulnerability and an increased fear of crime.

6.2 The clearer, more focused street lighting provided by LED units should assist poorly sighted individuals, as well as helping define the less able bodied to be identified in poor lighting conditions, on or around the highway.

7. FINANCIAL IMPLICATIONS

7.1 There are no direct financial impacts from the assessments that have been carried out in this report. The only potential impact will be on the possible future investments for LED conversions and any measures (existing and additional) required for this to take place.

8. PERSONNEL IMPLICATIONS

8.1 These proposals will not have any direct impact on CCBC personnel.

9. CONSULTATIONS

9.1 All comments received have been taken into consideration for inclusion into this report.

10. RECOMMENDATIONS

10.1 Scrutiny to review the impact of the investment to change from the existing conventional (sodium) luminaries to LED (light emitting diode) street lighting that has taken place in urban residential areas within Caerphilly County Borough Council (CCBC) and comment on the current methods of measuring and monitoring the energy savings for future phases of LED street lighting conversion.

10.2 Scrutiny Committee to consider and comment on the data and information within this report and note the current approach taken for both light pollution and maintenance aspects when implementing the LED conversions.

10.3 Scrutiny Committee to consider and comment on the data and processing of public responses within this report and note the current processes used when implementing LED street lighting conversion.

10.4 Scrutiny to review the accident and crime figures and note that the current figures show no significant change with the introduction of urban LED street lighting and that further data will be required to more accurately assess any possible effects of LED street lighting.

11. REASONS FOR RECOMMENDATIONS

11.1 The views of the committee will be considered as part of any future phases of LED conversions.

12. STATUTORY POWER

12.1 Highway Act 1980.

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Gemma Thomas - Road Safety Officer
Trish Reardon, HR Manager

Background Papers:
Highways Act 1980
London School of Hygiene & Tropical Medicine in partnership with University College London (published in the Journal of Epidemiology and Community Health - July 2015)