

Future Energy Savings Proposals

The basis for this next stage is to take forward, using technological improvements, the reduction of levels in:

- Energy Costs
- Maintenance Costs
- Carbon emission
- Light pollution

The approach required is multi-phased, with a proposed outline programme as follows:

Proposal 1 - 2015-16 – Capital investment of £980k** for replacement of © 8-9,000 lights with LED gear trays (saving £190k p.a.**) – in progress

Proposal 2 - 2017/18 - Capital investment of ©£1,000k** for replacement of ©2,350 lights (1,700 life-expired small residential units and 650 larger Highway units) with LED complete assemblies (saving £100k p.a.**) – proposal stage of MTFP

Proposal 3 - 2018/19 – Capital investment of ©£2,000k** for replacement of ©2,200 lights (in conflict areas) with LED complete lantern assemblies for the larger highways units (saving £100k p.a.**) – possible future proposal for MTFP

** - Costs current to August 2015

Proposal 1

Proposal 1 is currently underway and due to be completed by March 2016.

Initial MTFP Proposal 2

The opportunity exists to use this data to guide further investments into low-energy lighting technology for more effective savings as suggested in the MTFP Options meeting for 2017/18. A £1,000,000 investment could be split into two distinct lots (*prices correct to April 2015):

Lot a - There are currently © 1,700 life expired (55 watt low pressure sodium) lanterns in the Borough (1,300 of which are referred to in this exercise, the remaining 400 are already subject to Part-night lighting), these are the oldest and most inefficient units within the asset register for street lighting. As the whole lantern unit is life-expired, replacement of just the light source with an LED gear tray (as per 2015-16 investment) would not be effective. Therefore the entire unit needs to be replaced at a cost of ©£300k* (for 1,700 lantern units – design life 20 years) plus ©£200k for the installation & rewiring of the complete units; making a total of ©£500k*, with a saving of £43k* per annum it gives a pay-back period for this is estimated at 12 years (isolated from other savings in the street lighting budget – see below). This investment will mean that these exhausted assets can be replaced in a coordinated manner rather than having to be replaced in an ad-hoc approach (only replacing them when they fail), that will probably prove less efficient and so more expensive.

Lot b - With the remaining amount Highway (Class A & B roads) lantern units can now be replaced; as Lot A will have completed the replacement of the remaining residential lighting in the Borough. These Highways units will be a mix of low and high pressure sodium units (rated between 90 and 250 watts), priority will be given to conflict areas such as roundabouts, junctions etc. For the remaining amount of money (£500k*) approximately 650 complete Highway lantern units (design life 25 years) can be replaced at a cost of ©£400k* with installation cost of ©£100k*, with a saving of ©£56k* per annum, gives a pay-

back period for this is estimated at 9 years (isolated from other savings in the street lighting budget – see below).

Both Lots a and b (1,700 residential + 650 highway units) equate to an energy saving of ©£100k* (overall payback period estimated at 10 years, isolated from other savings in the street lighting budget – see below)

Assessment of Alternate Replacement Strategies

Looking at future options there is a need for this initial Proposal 2 (2017-18) to be challenged by any viable alternates that are in the market, this requires a comparative exercise to take place. For the purposes of this report the following options have been looked at with comparative costs (per 100 units over 20 years – top table in Appendix E) used for the following options:

- Like for like replacement (conventional units)
- Replacement with CPO (Halide) in place of conventional
- LED replacements for conventional
- Optimal option combining the options that indicate best value

To develop this process, an exercise was carried out on the remaining units in conflict area (after the 2015-16 LED gear-tray replacements), the first table shows Proposal 2 (2017-18) based on the replacement of 650 55W HP Lamps and 1,700 55W LP Lamps, the results are as follows:

- Like-for-Like Replacement - a comparative initial low cost (approx. £334k) with high energy and high maintenance costs (totalling £7,200k over 20 years).
- CPO (Halide) Replacement – comparatively median initial cost (approx. £688k) with relatively high energy and maintenance cost (totalling £3,305k over 20 years).
- LED Replacement - a comparative initial high cost (approx. £810k) with low energy and maintenance costs (totalling £1,940k over 20 years) CPO (Halide) approach - a comparative low cost (approx. £482k) with low energy and maintenance costs (totalling £1,966k over 20 years).

Although the combined approach initially appears to be the best solution, there are some technical/practical implications to the combined approach:

- The 250W HP lamps are located along highway routes, so will require traffic management (with its associated costs) for the changing of lamps, this would need to happen 5 times over a 20 year period for CPO and nil for LED option.
- Energy costs are likely to rise in the near and medium term future, so (over a 20 year period) the higher energy used in CPO units will be at a cost disadvantage to the lower energy LED alternatives.
- The demand for CPO units is declining, so reducing the availability of replacement parts, whilst LED demand is on the rise, so challenging (and subsequently reducing) existing prices – especially with bulk orders. Most LED lanterns supplied are future proofed.
- The LED lantern also includes for CMS (Central Management System – for dimming), where the CPO units do not.
- The LED wattages required to replace 250W HP lamps may be less than assumed (after undertaking the necessary street lighting designs), which would reduce the LED whole life costs.
- If the initial unit cost is put to one side, the 250W HP whole life costs for both LED and CPO are comparable over the 20 year period.

So there is a clear choice with this proposal (2017-18):

- A. To use LED technology for both 250W HP and 55W LP lamps, so mitigating the implications above.

- B. To use CPO technology (with its uncertainties as outlined above) for the 250W HP lamps and the LED option for the 55W LP units.

Option A should mean that the £1M investment will (for the most part) go on replacing the 250W HP and 55W LP stocks (totalling ©2,400 units); with Option B the £1M investment can follow Proposal 2a (Appendix E) – where the combined CPO/ LED approach is outlined in the bottom table (with green headers) with the replacement of the 250W HP, 100W HP, 135W LP, 90W LP and 55W LP stocks (totalling ©3,200 units).

If Option B is chosen the remaining stock in Conflict areas will be ©1,350 150W HP units with a total initial cost of ©£1,070k - see the 'remaining Units in Conflicted Area' column of the CPO/ LED Replacement Table (green headings) under the Proposal 2a heading in Appendix E.

If Option A is chosen then the remaining stock (in Conflict areas) will follow Proposal 3 (2018-19) – in Appendix E, with each option and a best combination option showing the following results:

Like-for-Like Replacement - a comparative initial low cost (approx. £350k) with high energy and median maintenance costs (approx. £3,850k and £300k).

CPO (Halide) Replacement – comparatively low initial cost (approx. £657k) with relatively high energy and maintenance cost (approx. 3,080k and 444k).

LED Replacement - a comparative initial high cost (approx. £1,755k) with low energy and maintenance costs (approx. £1,728k and £0k).

The combination LED/ CPO (Halide) approach - a comparative initial high cost (approx. £1,600k) with low energy and maintenance costs (approx. £1,810k and £66k).

Conclusion

Option A (LED only replacement) represents a higher cost (total unit replacement total 2,400) choice compared to Option B (Combined CPO/ LED) – total replacement total of 3,200 units. This then leads to the £2,000k possible investment for Proposal 3 being spent as follows:

Proposal 3 (Option A) – replacing the remaining 'Conflicted area' stock (approx. 2,200 units).

Proposal 3a (Option B) – replacing the remaining 'Conflicted area' stock (approx. 1,300 units) and investing a further £1,000k in converting © 40% of the remaining lighting stock (see Table 3 below).

Therefore the preferred options are 2a and 3a (Option B) with the proviso that around 1,000 CPO Halide units will probably need replacing with LED alternates post 2023.

The next step is to consider pay-back durations

Annual Savings and Pay-back Periods

Taking the replacement strategies above (2015-16, 2017-18, 2018-19), these are anticipated to translate into the following reductions in yearly maintenance and energy costs:

PROPOSALS	ANNUAL STAND-ALONE SAVINGS FROM EXISTING MAINTENANCE & ENERGY BUDGETS										Savings Totals (£k)
	2016/17		2017/18		2018/19		2019/20		2020/21		
	Mtce ⁴	Energy	Mtce ⁴	Energy	Mtce ⁴	Energy	Mtce ⁴	Energy	Mtce ⁴	Energy	
1 (2015-16 ¹)	£100k	£290k	£100k	£290k	£100k	£290k	£100k	£290k	£100k	£290k	£500/1,450k
1 (2015-16 ²)	£160k	£290k	£160k	£290k	£160k	£290k	£160k	£290k	£160k	£290k	£800/1,450k
1 (2015-16 ³)	£320k	£290k	£320k	£290k	£320k	£290k	£320k	£290k	£320k	£290k	£1,600/1,450k
2 (2017-18 ¹)#	£100k	£290k	£121k	£390k	£121k	£390k	£121k	£390k	£121k	£390k	£584/1,850k
2 (2017-18 ²)#	£160k	£290k	£181k	£390k	£181k	£390k	£181k	£390k	£181k	£390k	£884/1,850k
2 (2017-18 ³)#	£320k	£290k	£341k	£390k	£341k	£390k	£341k	£390k	£341k	£390k	£1,684/1,850k
3 (2018-19 ¹)!	£100k	£290k	£121k	£390k	£142k	£490k	£142k	£490k	£142k	£490k	£647/2,150k
3 (2018-19 ²)!	£160k	£290k	£181k	£390k	£202k	£490k	£202k	£490k	£202k	£490k	£947/2,150k
3 (2018-19 ³)!	£320k	£290k	£341k	£390k	£362k	£490k	£362k	£490k	£362k	£490k	£1,747/2,150k

Table 1: Annual savings from existing maintenance and energy costs for Proposals 1, 2 & 3 (Proposal 2a equates to Proposal 2, Proposal 3a equated to Proposal 3)

Note: all costs are current to August 2015

Key:

- ¹ – Reducing the Routine Maintenance budget only (£100k) with partial Part-night lighting (£60k)
- ² - Reducing the Routine & Non-routine Maintenance budgets (£160k)
- ³ – Combining maintenance savings and part-night lighting saving £320k (£160k plus up to £160k)
- ⁴ – Represents maintenance and/ or part-night lighting saving combinations
- ⁵ – Summation of maintenance and energy savings by March 2021

TABLE NOTE:

- Proposal 2/2a - 2017-18 - ©2,300 – 3,200 LED/ LED & CPO Halide replacement lights taken out of conventional lamp replacement regime of the remaining stock of 18,500 (27,500 minus 9,000 LED gear-trays) – equates to ©12% saving of remaining routine Maintenance budget (£175k) translating to an additional ©£21,000 saving p.a.

! - Proposal 3/3a - 2018-19 - ©1,300 - 2,200 LED replacement lights taken out of conventional lamp replacement regime of the remaining stock of 16,150 (27,500 minus 9,000 LED gear-trays, minus 2,350 LED replacement 2017-18) – equates to ©14% saving of remaining routine Maintenance budget, £154k (£175k minus £21k), translating to an additional ©£21,000 saving p.a.

Pay-Back Summary

These strategies could lead to the following investment recoveries:

Proposal 1 - 2015-16 – Capital investment of approx. £980k[®] for replacement of ©9,000 lights with LED gear trays (saving £290k p.a.[®]) – combined savings will be have recovered the cost in the end of 2017/18 with combined reduced Maintenance Budget & Part-night Lighting or 2018/19 with either the reduced Maintenance Budget or Part-night Lighting.

Proposal 2/ 2a - 2017/18 - Capital investment of approx. £1,000k[®] for replacement of ©2,350 – 3,200 lights with LED complete assemblies or CPO (Halide) / Led combination (saving £100k p.a.[®]) - combined savings will be have recovered the cost by the end of 2019/20 with combined reduced Maintenance Budget & Part-night Lighting or 2020-21 with either the reduced Maintenance Budget or Part-night Lighting.

Proposal 3/ 3a - 2018/19 – Capital investment of approx. £2,000k[@] for replacement of ©2,200 – 2,800 lights (in conflict areas & remaining stock) with LED or CPO (Halide) / LED combination complete assemblies for the larger highways units (saving £100k p.a.[@]) - combined savings will be have recovered by the end of 2020/21 with combined reduced Maintenance Budget & Part-night Lighting or 2022-23 with just reduced Maintenance Budget or Part-night Lighting.

[@] - Costs current to August 2015

Below is a simplified bar chart showing the relative durations of the pay-back period for each of the three Proposals; Payback Combined is the combination savings of Maintenance and Part-night Lighting, Payback Separate is the savings from just the Maintenance or the Part-night Lighting.

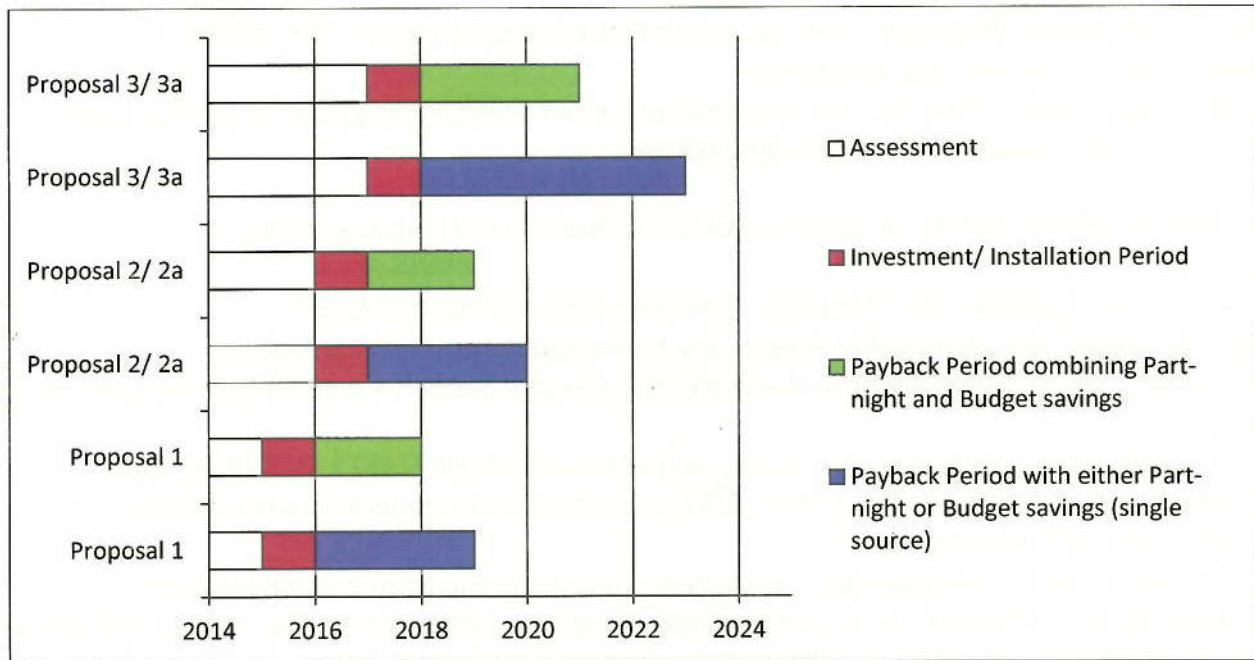


Table 2: Simplified bar-chart to demonstrate the relative durations of Pay-back periods for Proposals 1, 2, 2a, 3 & 3a (3 follows on from Proposal 2 , 3a follows on from Proposal 2a)

As can be seen, the maintenance and energy savings made from the preceding schemes can be used to support the application for Capital Funding required by the succeeding schemes.

By April 2019 the remaining lighting stock (which have not had a low-energy replacement) should number around 8,000, which will form part of the next stage of lower energy replacement scheme (See Table 3 below). This will be the proviso that all newly adopted street lighting assets (new developments etc.) are to a contemporary low energy/ LED standard or equivalent.

As can also be seen in Table 3 the lower energy replacement units (CPO Halide, LED etc.), will need to be replaced around 2025 due to their respective design life spans. Since these total approximately 20,000, there will need to be provision made for capital investment to replace these in a tight programme window (2-3 years).

Conclusion

To give a clearer summary to this report a high-level table has been included in Appendix F, which gives the Proposal options as:

In Table 1 – Proposals and savings for LED replacements:

- LED Gear-tray Replacements (Proposal 1) which is currently being installed
- Part-night Lighting for Non-conflict Areas – the proposal detailed in Appendix B
- Reduction in Maintenance Budget – the proposal outlined in Section 4.3 of the Scrutiny Lighting Report
- 2017-18 Investment (Proposal 2) – to exchange 650 x 250W(HP) and 1,700 x 55W(LP) conventional lamps with LED alternatives
- 2018-19 Investments (Proposal 3) – to exchange the remaining lighting stock in Conflict Areas (junctions, traffic calming etc.) to LED alternatives

In Table 2 - Proposals and savings for combined CPO (Halide) and LED replacements:

- LED Gear-tray Replacements (Proposal 1) which is currently being installed
- Part-night Lighting for Non-conflict Areas – the proposal detailed in in Appendix B
- Reduction in Maintenance Budget – the proposal outlined in Section 4.5 of the Scrutiny Lighting Report
- 2017-18 Investment (Proposal 2a) – to exchange 650 x 250W(HP), 300 x 150W(HP), 250 x 100W(HP), 150 x 135W(LP) and 1,700 x 55W(LP) conventional lamps with a combination of CPO (Halide) and LED alternatives
- 2018-19 Investments (Proposal 3a) – to exchange the remaining lighting stock (after the implementation of Proposal 2a) in Conflict Areas (junctions, traffic calming etc.) to LED alternative; with the remaining sum being invested in the remaining eligible stock (reference Table 3 below)

The tables have assumed that these proposals/ measures have been introduced at their earliest dates and the projected annual savings (correct to August 2015) are calculated to March 2021, where the sum of all the options are predicted to have broken even.

So what's left to do? Below is a table of the status and numbers of units (as from spring 2019), with proposed investment and further priority stock in conflict areas:

Lighting Regimes	Numbers ¹	2017-18 Proposal 2/ 2a ²	2018-19 Proposal 3/ 3a	Remaining stock requiring Low Energy Replacement	Remaining stock requiring Low Energy Replacement
Lights currently being Part Night Lit	5,000	400 ³		4,700	
Lights that have replacement lower energy lights (CPO (Halide) etc.)	4,000				4,000 (to be replaced ©2025)
Lights being replaced by LED Gear Trays	9,000				9,000 (to be replaced ©2025)
Eligible stock for Part Night Lighting	7,500	1,950 (1,300+650) ⁴	2,194 (2,844-650) ⁵	3,356*	
Energy Efficient Lanterns installed during Routine Maintenance	2,000				2,000 (to be replaced 2025)
Total Stock	27,500				23,506

Table 3: Lighting unit numbers in lighting regime categories with the remaining stock to be converted to LED technology

* - this is a priority energy reduction area as these units burn through the night have a replacement cost of approx. £2,500k (as of August 2015) – reduced to £1,500k, if Proposals 2a & 3a are approved

Key:

¹ – numbers as from Spring 2016

² – MTFP Option suggested for 2017/18 with capital investment of £1,000,000

³ – 55W Low-pressure sodium life expired units already under part-night lighting regime

⁴ – total equals 1,400 55W Low-pressure sodium life expired units plus 650 Low & High Pressure Sodium units in conflict areas

⁵ - total of remaining Low & High Pressure Sodium units in conflict areas (not subject to part night lighting)

If Proposals 2a and 3a are agreed to the latter investment will be able to convert up to 40% of the remaining conventional lighting stock (1,000 to 1,500 units).

