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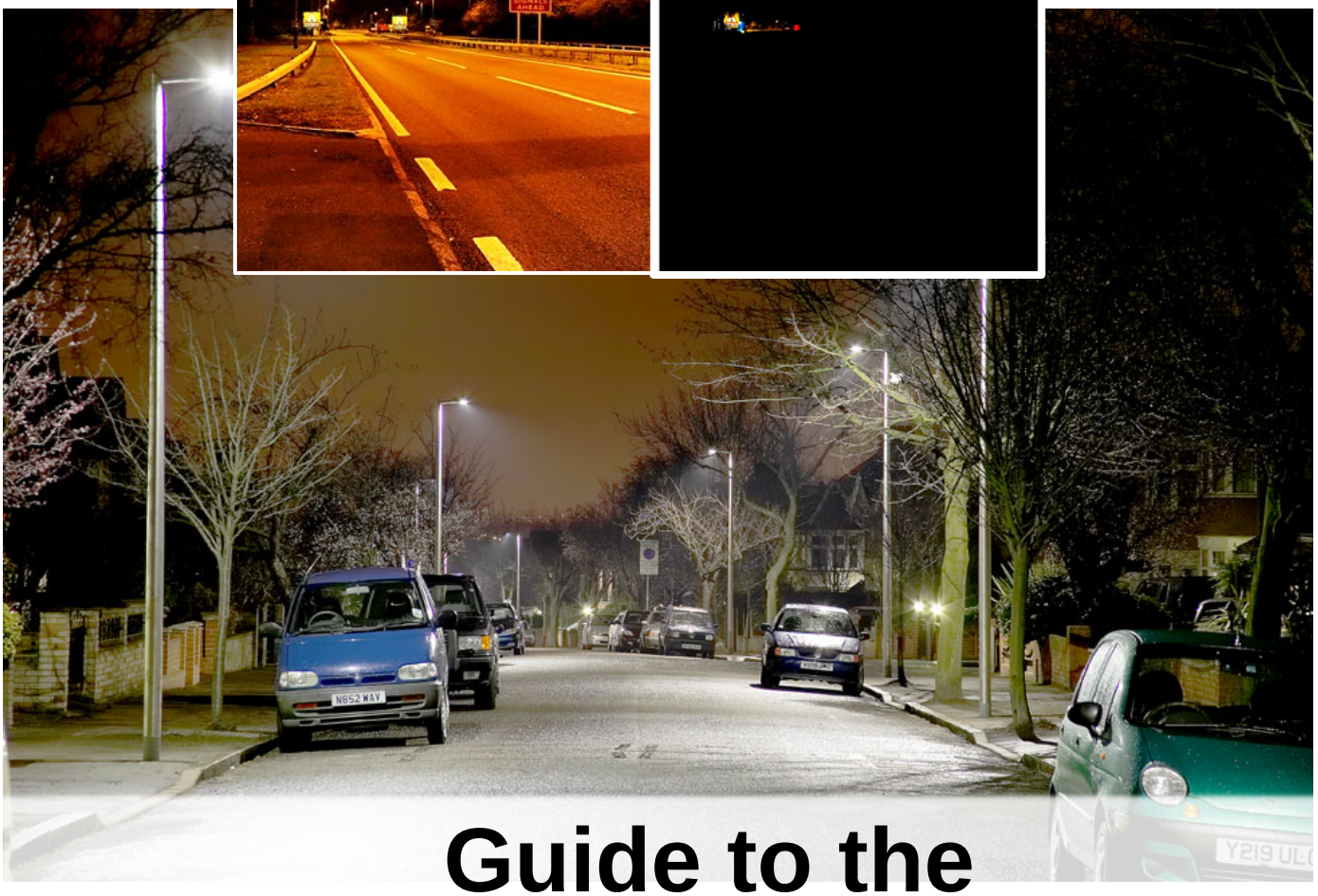
INSTITUTION OF LIGHTING PROFESSIONALS



Guide to the Intelligent Lifetime Management of Public Lighting Life Safety Engineering Systems

March 2013

Contents

1. Introduction

Public Lighting, as a Life Safety Engineering System (LSES) – and in particular Street Lighting - has gathered unprecedented media and public attention in recent years. The reasons for this are the increasing cost of energy, the pressure being put on local authorities to reduce budgets, and legislation in the form of the carbon reduction commitment energy efficiency scheme which encourages energy users to reduce their carbon consumption through the requirement to purchase carbon credits based upon their consumption. All public lighting will fall under the CRCEE from April 2014 when the cost will be £16 per tonne of CO_2 consumed. Local authority asset owners have reacted in different ways to mitigate increases in electricity costs and the carbon reduction commitment obligations.

The Highway Electrical Association has carried out extensive research into the activities of local authorities to reduce their carbon footprint and minimise the electrical energy consumption for street lighting and related highway electrical assets.

Road Lighting thinking and technology has advanced in recent years and there are many methods and means available to provide intelligent management of the lighting asset to optimise the energy consumed and to achieve the right light level on the task at each time period from dusk to dawn. The point being that the task and the many variables that contribute to the selection of the lighting class can vary through the night, so intelligent management of the lighting can allow the light levels to be varied according to the task at different times between dawn and dusk.

In rural areas – there may be an argument for switching off lighting – however this should not be based purely on crime statistics, as the effects of the fear of crime can be pernicious, particularly with an ageing population and can make residents “prisoners in their own homes”. It is important to remember that lighting is primarily for safety and wellbeing, and there are other energy efficient options.

The technology exists now (& has been installed in many parts of the UK) to vary lighting to a defined (using EN 13201 and BS5489) level, subject to pedestrian and traffic flows –whilst still retaining a degree of comfort for residents and the travelling public.
There is now little excuse or cost benefit for imposing the arbitrary switching off of street lighting unless this is something the residents actually desire (having been informed of all the practical alternatives) and the process and decisions reached are based on sound engineering judgement from competent lighting practitioners.
In many areas, including urban areas, there is little appetite for switching off lighting and here there is more scope for profiling the lighting requirements through the night to achieve an intelligently managed solution which responds to the varying needs of the populace at different times of the night in the most energy efficient way.

This guidance document provides information for decision makers, budget holders and lighting practitioners to help them plan their lighting policy for an efficient and sustainable future. It also provides guidance to lighting practitioners on the various options available to them and provides a summary of what different lighting authorities are doing throughout the UK.

2. Executive Summary

The Highway Electrical Association (HEA) has undertaken a comprehensive review of the actions that Local Authorities have taken and are planning to take to reduce the carbon footprint of their lighting and to improve its energy efficiency. The review summarises the state of play across the UK and provides straightforward guidance for an appropriate response in this area, supported by technical information for the relevant lighting engineers.

The Benefits of Public Lighting

The benefits of lighting can be summarised as follows:

- ✓ Reducing night time accidents (typically up to 30%, with the cost of a road traffic fatality being £1,653,687, serious accident being £185,831 – source DfT)
- ✓ Reducing street crime
- ✓ Reducing fear of crime
- ✓ Facilitating social inclusion, including lifelong learning by facilitating the use of the infrastructure and facilities after dark
- ✓ Promoting local businesses and tourism by facilitating traffic and pedestrian movement and encouraging the viewing of buildings and areas of interest at night
- ✓ Promoting sustainable transport (walking, cycling, public transport)
- ✓ Promoting physical fitness (by encouraging walking and cycling)
- ✓ Allowing the effective use of CCTV systems at night
- ✓ Assisting the emergency services to carry out their duties more easily after dark
- ✓ Facilitating the use of the road infrastructure for longer for travel and commercial transport and distribution
- ✓ Maintaining or improving the quality of life and well being

The Approach

When looking to manage energy consumption, the approach should include the following steps (see also the Checklist for Local Authorities / Public Lighting Asset Owners):

1. The local authority / asset owner should establish a lighting policy, reviewed at regular intervals or on changes of relevant legislation or guidance

2. The local authority / asset owner should carry out a detailed risk analysis (including a pedestrian and traffic safety analysis) of lighting provision and particular areas of concern (e.g. hospitals, schools used after dark, areas prone to accidents).

3. The local authority / asset owner should then determine what can be done with the existing lighting – e.g. Do Nothing (leave as is), Change light sources and luminaires, modify switch on and switch off times, Dim, apply variable adaptive lighting switch off in whole or in part for the night.

4. The local authority / asset owner should first inform, and then consult – preferably using positive responses, particularly when considering switching off of lighting - with relevant stakeholders, including residents (Consultation, without prior information setting out the available options in a form likely to be understood by the "lay person", is meaningless and can easily lead to an inappropriate solution).

The Options

Within the documented local authority or other asset owner Lighting Policy, the available options should be listed, with those preferred or chosen and the rationale for this. Available options include:

1. Removing lighting from those signs or bollards where it is not required and this is permitted under the TSRGD
2. Removing or switching off lighting where consultation, after appropriate information has been made available, indicates positively that this is the wish of all affected stakeholders - and confirming this after regular reviews (recommended annual reviews over a three year period).
3. Replacing existing light sources and / or control gear with more efficient light sources / control gear
4. "Trimming" – replacing existing photocells with ones where the light level at which they switch on, taking into account the length of time the light source takes to run up to full designed brightness – and where the level at which they switch off is appropriate
5. Part Night Lighting - where the lighting is switched off part way through the night when the lighting requirement is reduced in terms of traffic flow (pedestrian or vehicular). This would typically be from midnight to 5 or 6am.
6. Dimming – adjusting the level of lighting to suit the usage of the road or area at specific times through the night, either through electronic dimming ballasts or through computerised central management systems
7. Variable lighting / Lighting Profiling / Adaptive Lighting – implementing central management systems enabling compensation to account for light sources being brighter at the start of their life – which depreciates over time, varying the output of light sources to suit the usage based on the required parameters such as traffic volume or pedestrian flow, enabling the appropriate lighting class to be chosen for the traffic flow at that time.

Funding

There are a number of "Invest to save" options and some authorities have reversed earlier decisions to implement part night lighting following coroners reports, resident pressure or simply by getting a better understanding of the benefits of the investment in new technology which most often make that the favoured option with relatively short pay back periods.

There are numerous funding options available to local authorities for invest to save schemes including self-funding through capital and revenue budgets, Prudential Borrowing, Salix funding, PPP and other government and privately funded schemes.

Checklist for Local Authorities / Public Lighting Asset Owners

Item	Comment	Y / N
Do you have a written Public Lighting Policy?	Informed by a competent lighting practitioner and in terms understood by other stakeholders	
Is it current (i.e. has this been reviewed in the last two years or on change of relevant legislation / standards?)	BS5489 has been revised and re-issued in 2013 and therefore lighting policies need to take this into account	
Does the lighting policy set out the lighting classes for each road, footpath or other public place in accordance with EN13201 and BS5489?		
Are the lighting levels set for each road and do they take account of variations in use through the night?		
Are the lighting levels set appropriate for the use at the time designed and in accordance with EN13201 and BS5489		
Has the policy been approved by the local authority Council / public lighting asset owner board?	This is to ensure senior management buy in	
Are you receiving technical public lighting advice from a competent person(s)?		
Does the competent person(s) have evidence of competence and underpinning knowledge through : 1. A C.V.? 2. Relevant certificated qualifications ? 3. Ongoing records of Continuing Professional Development (CPD) to ensure competence is maintained and up to date?		
When considering changes to the policy to manage public lighting (e.g. switch off times and levels), has a documented risk assessment covering all the available options and areas been carried out?		
When considering changes to manage public lighting, have the relevant other costs been taken into account (e.g. ensuring the electrical and structural safety of any columns, other road safety measures such as the use of different road studs, retroreflective signs, signs informing the travelling public that the lighting has been switched off)	The Health and Safety at Work Act, the Electricity at Work Regulations and the Electricity Safety, Quality and Continuity Regulations together with common law duties apply	
When consulting on proposed changes, do the consultees include the residents (especially shift workers), those using facilities in the area, the police and other stakeholders?		
When consulting on proposed changes, have the consultees been informed in advance, including all the available options, in easy to understand language?		
Have the consultees given the local authority a mandate to change based on a positive vote (particularly for switching off)?		
Are the changes, once implemented, being reviewed annually over a total three year period (to align with accident / safety studies which uses the same period) before confirming the change?	The total review period is important, particularly when considering total or partial switch off, or changes in light sources to enable statistically valid figures to be obtained	

3. Background

The Highway Electrical Association has carried out extensive research into the activities of local authorities to reduce their carbon footprint and minimise the electrical energy consumption for street lighting and related highway electrical assets.

Through this research, Information has been obtained from nearly every highway / lighting authority through a combination of telephone interviews and a review of internet based data and media reports. In excess of 80% of all authorities responded, making this research the most comprehensive carried out in this area

The result of the research is this Guidance document entitled "Intelligent Lifetime Management of Public Lighting Life Safety Engineering Systems." This guidance document provides information regarding the trends among local authorities and case studies highlighting best practice.

The options available for lighting our streets are numerous and all of these options are being used to some extent somewhere in the UK.

The trend now is moving towards a fully managed intelligent variable lighting solution which takes advantage of state of the art technology and provides the right light in the right place at the right time.

Part night lighting however does fit with the requirements of some rural authorities, but it should only be considered following a thorough risk assessment, safety review and cost benefit analysis of all the options carried out by a competent practitioner. In addition it requires a strict set of criteria to be met before it is contemplated. The needs and safety of the residents and users should be paramount and they should be fully consulted. The hidden costs of a part night lighting solution should not be dismissed.

Intelligent managed solution

The intelligent managed solution being spearheaded by a number of authorities uses a white light solution, with high efficiency light sources such as LEDs and is controlled by a central management system, (CMS) or pre-set electronic controllers which allow the lighting level to be varied up or down as the usage of the streets varies through the night. This provides benefits including reducing the energy consumption and light pollution whilst maintaining a level of safety for the users.

Other ways of reducing energy usage include trimming which is a means of switching the lights on and off "just in time" at dusk and dawn.

Local Authorities are de-illuminating traffic signs when allowed to by the TSRGD or replacing the lamps with more efficient LEDs. Illuminated Bollards are being converted to solar powered LEDs or replaced with a retro-reflective bollard face.

Local authorities are taking advantage of the flexibility afforded by revised European and British standards.

Invest to Save - Funding options & Pay Back

There are encouraging signs that more Local Authorities are taking advantage of the "Invest to save" options rather than part night switch off and indeed a number of authorities have reversed earlier decisions to light part night following either coroners reports, resident pressure or getting a better understanding of the benefits of the investment in new technology which most often make that the favoured option with relatively short pay back periods.

There are numerous funding options available to local authorities for invest to save schemes including self-funding through capital and revenue budgets, prudential borrowing, Salix funding, PPP and other government funded schemes. There is no "one size fits all" solution and the needs and budgets of each authority is different leading to different ways of

approaching the problem. Detailed cost benefit analyses are being prepared by competent lighting practitioners and innovative solutions are being devised to maximise the returns.
Many of the solutions investigated have attractive payback periods where local authorities are taking advantage of lower energy costs & lower maintenance costs. The savings achievable are to a large extent dependent on the current inventory within an authority, and for how long the Authority has been adopting a low energy approach to street lighting.

Local authorities have tackled the issue in many ways ranging from the adoption of a part night lighting policy as an instant method of reducing energy consumption to an “invest to save” policy whereby there is an investment in new technology which allows for the intelligent life-time management of the street lighting asset.

This guidance document reviews the different options available and the benefits of each. More importantly it provides guidance to the local authority on methods of reducing energy consumption whilst intelligently managing the lighting in a sustainable manner. The overall outcome of this is to achieve a service which is fit for purpose in serving the needs of the users on the highway and residents.

In compiling the guidance, extensive research was undertaken into the policies and activities of local authorities, particularly where the media has reported it.

In addition, most local authorities were interviewed and asked to respond verbally to a questionnaire. The results of this are reported within this document.

This guidance is aimed primarily at informing lighting practitioners and providing them with a step by step approach. There is a separate Executive Summary which is aimed at Highways Managers, Local Government officers, MP’s and others who need to know the facts and an outline of the steps that can be taken to improve the lighting service in a sustainable way.

Highway Electrical Association

The HEA – the Highway Electrical Association – is a members organisation with a long history (60 years in 2012). Formed by the amalgamation of ASLEC – the Association of Signals, Lighting and other highway Electrical Contractors - and HEMSA – the Highway Electrical Manufacturers and Suppliers Association – in 2011, it represents over 80 Members whose contracting activities range from street lighting, traffic signals and signs to highway communications and camera systems and another 40 Members who manufacture, assemble, supply and distribute equipment into the Highway Electrical Sector as well as overseeing and client organisations.

This makes it one of the largest and most influential bodies in the sector. The HEA is an ISO9001 registered organisation and membership of the HEA is open to any organisation operating in the highway electrical market.

The HEA's main objectives and further information are available at: www.highwayelectrical.org.uk. In particular there is a wealth of useful information, the majority, including this report, freely available to the public to download at http://www.highwayelectrical.org.uk/pages_metro/m_downloads_exp.htm

4. Acknowledgements

This guide was initiated by the HEA and prepared by Alistair Scott BSc CEng FILP MIMechE from an initial media study carried out by the HEA and sustainability guidance included within the HEA LIGHTCORE carbon calculator, and with input from the HEA Chief Executive, Gareth Pritchard BTech(Hons) CEng FILP MIET Tech (IOSH). Thanks are due to the HEA and HEA-HEMSA Councils for their input and direction.

Alistair Scott is the Managing Director of UK consultancy, Designs for Lighting Ltd and is a Past President and a Fellow of the Institution of Lighting Practitioners. He is a past chair of the ILP London & South Eastern region and also its Membership & Education committee.
Alistair has spent 25 years in design and managerial positions within the lighting industry, having been Engineering Director with Urbis Lighting prior to heading up DfL in 2005. He chairs the BSI committee EL/001/02 Road Lighting responsible for BS5489-1:2013 and sits on the European CEN Joint Working Group working on the 2013 revision of EN 13201 Road Lighting standards. Designs for Lighting are a HERS registered and ISO9001 accredited consultancy.

The HEA is also grateful for comments supplied by the Institution of Lighting Professionals (ILP), in particular Allan Howard and Keith Henry. The Institution of Lighting Professionals unites the skills of engineering, design and technology in order to deliver quality lighting for the built environment, to the benefit of clients and the public as a whole. In setting and establishing standards for good practice, the Institution seeks to ensure that its members attain and develop the professional knowledge, education and skills to meet necessary competencies, and to benefit their careers. Working on exterior and interior projects, in public spaces, workplace, leisure, retail and residential applications, members of the Institution of Lighting Professionals deliver excellence in light and lighting at all times, and are recognised by both private and public clients for the qualities they bring to lighting projects.

The reduction in the use of public lighting by many UK local authorities has been an issue of deep concern to lighting professionals, the industry, politicians and the public. This report is supported by the Institution of Lighting Professionals (ILP) and targets the specifics of the arguments for and against reduced night time lighting. It looks to the application of good lighting practice supported through the use of competent lighting designers and risk assessments to provide safe streets are night for all users beyond the often poorly informed views appearing in the media.

5. Scope

Designs for Lighting have been commissioned by the HEA to prepare a proposal to undertake research and to subsequently produce a briefing / guidance note on intelligent lifetime management of Public Lighting Life Safety Engineering Systems including switching / control options. The aim is to examine whether the intelligent management of public lighting is a sensible and possibly preferred option for asset owners, rather than adopting a “knee jerk” response to the need to reduce energy and carbon emissions by simply switching street lighting off.

The guidance note will inform highway authorities of the benefits and risks associated with each option for controlling of street lighting assets during the hours of darkness looking at all night lighting, dimming, part-night lighting or switch off.

The scope of tasks include:

I. Research and collate information regarding existing legislation relating to the requirement to light roads and maintain in light

II. Review existing technical codes of practice and guidelines regarding road lighting in relation to dimming, switch off, part night lighting and variable lighting

III. Review existing references to dimming / switch off / part night published by local authorities, lighting press or found online.

IV. Research local authority current practice to ascertain the breadth and depth of the practice on an authority by authority basis identifying where possible:

- Has the local authority "switched off"?
- If not – do they plan to – and if so, what and when (see bullet point below)?
- If so – what have they done – dimmed, part night switch off, complete switch off; what criteria did they use; and when was this implemented?
- Did they consult and if so whom and what response (numbers) did they get in favour / against?
- Do they have statistics before the implementation and after (& if after how long after) on: Effect upon Accidents, Crime, Fear of Crime
- Have they switched any areas back on following incidents or public pressure – if so where and nos. of units

V. Write a Guidance note for local authorities and other public lighting asset owners highlighting and informing best practice along with the benefits and issues relating to public lighting management

6. Legislation, Standards and Guidance

Legislation which relates to highway lighting includes:

Highways Act 1980

The Highways Act 1980 empowers Local Authorities to provide street lighting as detailed in Clause 97 of the document reproduced below:

Lighting of highways.
97.-(1) The Minister and every local highway authority may provide lighting for the purposes of any highway or proposed highway for which they are or will be the highway authority, and may for that purpose-

(a) contract with any persons for the supply of gas, electricity or other means of lighting ; and
(b) construct and maintain such lamps, posts and other works as they consider necessary.

(2) A highway authority may alter or remove any works constructed by them under this section or vested in them under Part iii of the Local Government Act 1966 or section 270 below.
(3) A highway authority shall pay compensation to any person who sustains damage by reason of the execution of works under this section.
(4) Section 45 of the Public Health Act 1961 (attachment of street lamps to buildings) and section 81 of that Act (summary recovery of damages for negligence) apply to a highway authority who are not a council of a kind therein mentioned as they apply to such a council.

The Public Contracts Regulations 2006

The Public Sector Directive 2004/18/EC sets out the EC public procurement requirements and it was implemented into English law by the Public Contracts Regulations 2006 (SI 2006/05) (the 'Regulations'). The law as set out in the Regulations is subject to interpretation through evolving European and national case law. The law is applicable to "contracting authorities" as defined in Regulation 3 of the Regulations.

"A contracting authority by public law is defined (Article 1 of the Directive and Regulation 3) as anybody meeting the following three conditions:

- *Established for the specific purpose of meeting needs in the general interest, not having an industrial or commercial character; and*
- *Having legal personality; and financed for the most part by the State or regional or local authorities or other bodies governed by public law, or subject to management supervision by those bodies, or having an administrative, managerial or supervisory board, more than half of whose members are appointed by the State, regional or local authorities, or other bodies governed by public law.*

The public procurement procedures set out in the Regulations must be followed before awarding certain contracts when its value is above a certain threshold. In particular the contracts should be advertised in the Official Journal of the European Union (OJEU). OJEU is the central database for European public sector tender notices. Thresholds are set every 2 years and the current thresholds are set out below. These can be found on the OJEC website, and grant recipients should check this to ensure that they are working to the correct values.

The relevant clauses are:

(5) Subject to technical requirements which are mandatory in the United Kingdom and to the extent that those requirements are compatible with Community obligations, a contracting authority shall define the technical specifications required for a contract in accordance with paragraph (6) (7), (8) or (9).
(6) A contracting authority may define the technical specifications referred to in paragraph (5)—
(a) by reference to technical specifications in the following order of preference—
(i) British standards transposing European standards;
(ii) European technical approvals;
(iii) common technical specifications;
(iv) international standards; or
(v) other technical reference systems established by the European standardisation bodies; or
(b) in the absence of the technical specifications referred to in sub-paragraph (a), by reference to the following technical specifications—
(i) British standards;
(ii) British technical approvals; or
(iii) British technical specifications relating to the design, calculation and execution of the work or works and use of the products;
and each reference to a technical specification made in accordance with this paragraph shall be accompanied by the words "or equivalent".

Coroners Rules Act 1984 as amended in 2008 - Rule 43

One of the powers available to a coroner is the power to make a Rule 43 report. Rule 43 provides coroners with the power to make reports to a person or organisation where the coroner believes that action should be taken to prevent future deaths.
If the coroner feels that the evidence gives rise to a concern that circumstances creating a risk of other deaths will occur or continue to exist, he/she may make a Rule 43 report which is sent to the organisation which has responsibility for the circumstances. A recipient of a Rule 43 report must send a written response within 56 days.

This rule has been used in recent years to highlight potential issues relating to street lighting or perceived inadequacies in the street lighting.

A notable example of this rule in action was in Milton Keynes where the coroner wrote to Milton Keynes Council in April 2012 regarding a fatality on the unlit section of the grid road. Milton Keynes have since undertaken a full risk assessment and safety review of the lighting provision and are re-instating lighting on many grid road streets where they feel that the risks are greater.

Health and Safety at Work etc. Act

This sets out requirements in terms of the general duty of care. Particular notice should be taken by asset owners of section 3(1) which states "It shall be the duty of every employer to conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that persons not in his employment who may be affected thereby are not thereby exposed to risks to their health or safety." This covers the duty of care between local authorities and other public lighting asset owners, and users of that asset in terms of residents and the travelling public. There are a number of incidences of local authorities being prosecuted under this section.

Corporate Manslaughter and Corporate Homicide Act

The Corporate Manslaughter and Corporate Homicide Act 2007 is a landmark in law. For the first time, companies and organisations can be found guilty of corporate manslaughter as a result of serious management failures resulting in a gross breach of a duty of care. Particular notice should be taken of factors for the jury to consider which puts the question "Are/were there attitudes, policies, systems or accepted practices within the organisation that may have encouraged or tolerated a failure of duty of care?

CRC Energy Efficiency Scheme

The CRC Energy Efficiency Scheme is a mandatory scheme aimed at improving energy efficiency and cutting emissions in large public and private sector organizations. The Carbon Reduction Commitment (now renamed the CRC Energy Efficiency Scheme) is a mandatory carbon emissions trading scheme to cover all organisations using more than 6,000MWh per year of electricity (equivalent to an annual electricity bill of about £500,000).
The scheme requires organisations (including many lighting authorities) to purchase and submit sufficient CRC allowances to meet their annual liabilities for CO2 emissions. Under CRC an unmetered electricity supply measured on a passive or non-half hourly basis is not currently classified as a CRC supply and therefore not reportable for the purposes of CRC qualification or footprint and annual reporting. However this is due to change so that all public lighting will fall under the CRCEE from April 2014 when the cost will be £16 per tonne of CO_2 consumed.

Crime and Disorder Act 1998

Section 17 of the *Crime and Disorder Act 1998* places a duty on local authorities to consider crime and disorder implications when discharging their functions. Amongst other things, it states: "*Without prejudice to any other obligation imposed on it, it shall be the duty of each authority to which this section applies to exercise its various functions with due regard to the likely effect of the exercise of those functions on, and the need to do all that it reasonably can to prevent, crime and disorder in its area*."

Ecodesign for Energy Related Products Directive

The Eco-design of Energy Related Products Directive (2009/125/EC) is a framework that sets requirements for energy related products. It aims to improve the environmental performance of products throughout their life-cycle by integrating environmental aspects at a very early stage in the product design. The Directive was transposed by Statutory Instrument (SI 210 No: 2617) which came into force on 20 November 2010.
Under this Directive, the European Commission, assisted by a committee of Member States, adopt implementing measures relating to individual product types. To date these have been adopted by Member States in the form of EU Regulations and as such are directly applicable in the UK and all other Member States.

In addition to the Ecodesign requirements, Green Public Procurement (GPP) has been introduced. GPP is defined as "a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured." GPP is a voluntary instrument, which means that Member States and public authorities can determine the extent to which they implement it. Public authorities are major consumers in Europe: they spend approximately 2 trillion euros annually, equivalent to some 19% of the EU's gross domestic product. By using their purchasing power to choose goods and services with lower impacts on the environment, they can make an important contribution to sustainable consumption and production and can provide industry with real incentives for developing green technologies and products. Further information can be found at http://ec.europa.eu/enterprise/policies/sustainable-business/documents/eco-design/legislation/implementing-measures/index_en.htm

Traffic Signs Regulations and General Directions (TSRGD)

This document sets out the regulation that sets out the design and conditions of use of official traffic signs that can be lawfully placed on or near roads in England, Scotland and Wales and gives rules on where and when signs should be illuminated. It was last amended in 2011.

In addition, a Traffic Signs Policy Paper, called "Signing the Way" was published by the DfT in October 2011 which sets out a policy framework for ensuring that the traffic sign system in Great Britain meets the future needs of all road users, while building upon the existing and established traffic sign system. It sets out recommendations for improving the information that traffic signs communicate to road users by providing more freedom for decisions about signing at the local level. Finally, Traffic Advisory Leaflet (TAL) 01/13, Reducing Sign Clutter, was published in January 2013 by the DfT.

Standards, technical reports & guidance

BS EN 13201:2003

This standard is the European Standard produced by CEN which is concerned with Road Lighting. It is formed of 4 parts of which the relevant part for the purpose of this guidance is Part 1 or CEN/TR 13201-1:2004.

CEN/TR 13201-1:2004

This part is not normative but was provided as a technical report to be used by countries that either did not have their own local guidance or required supplementary guidance. This document specifies the lighting classes set out in EN 13201-2 and gives guidelines on the

application of these classes. .Section 6.1.3 of this standard provides guidance on varying the lighting class based on varying parameters throughout the night as follows:

6.1.3 Night-time use
Unless otherwise stated, parameters are only relevant during hours of darkness. The value of the parameters can vary at different periods during the night and also in different seasons of the year, thus the recommendations may vary during these periods.
Significant variation of parameter values can apply at different periods of the night, particularly in respect of ambient luminance and traffic flow. The application of the Tables in Annex A can therefore indicate different lighting classes appropriate to these different periods. For this purpose a more detailed analysis of traffic flow than that provided by ADT can be necessary.
NOTE Various methods of reducing lighting level and thereby energy consumption, can be applied in the periods when a class of lower lighting level is indicated.

BS5489-1:2013

This British Standard Code of Practice was published in Dec 2012 with a remit to reflect the growing requirement in the UK to minimise energy consumption whilst providing safe lighting installations. As a British Standard Code of Practice it is required to support the European Standard EN 13201, and is not allowed to contradict it. BS5489-1 has specific clauses regarding energy and sustainability. The requirement for minimising the electrical energy consumption is a consistent theme and there are guidelines on how to achieve this. Some of the important clauses are included below:

4.4.2 Measures to minimize electrical energy use

NOTE 1 Energy efficiency measures will be covered in BS EN 13201-5, which will define the calculation and measurement of energy efficiency coefficients of road lighting installations.
Good lighting can contribute to electrical energy and carbon reduction strategies, and should be at the forefront of any electrical energy and carbon reduction strategy developments. There are various strategies available, each of which should be carefully assessed. These strategies include the following.

Variable lighting.
The road lighting standards classify the required lighting class based on usage; therefore when the use of a road or area reduces, for example, between midnight and 0600hrs, and providing the equipment is suitable, the lighting levels can be reduced through dimming.

Trimming.
Trimming can be applied to switch on and switch off ambient light levels. Modern light sources operated on the optimum electronic control gear do not require as much time to warm up to full output, therefore the lighting can be switched on closer to the time required, thus reducing the operating hours.

Part-night.
Lighting is turned off between certain hours such as midnight to 0600hrs. Longitudinal uniformity should be maintained during the switch off and switch on that occur during the hours of darkness, that is, switching not occurring at dusk and dawn. The control system should switch lights on and off in a contiguous order, as a random approach will temporarily compromise longitudinal uniformity.

Switch off. Lighting is switched off and removed.
If either of the last two options are considered, the highway authority should ensure that road safety is not discernibly compromised. If moving to part-night or switch off then the authority should ensure that the highway signage, white lining and other features are assessed by a qualified highway engineer to ensure that they are compliant for an unlit road. These two options should only be implemented once a full risk analysis and user consultation has been undertaken.

4.4.3 Hours of Operation

Lighting throughout the hours of darkness is particularly important as an aid to crime prevention, policing, and the general safety and comfort of the community. The level of lighting may vary during the night, dependent upon usage and other factors. In some limited situations, a lighting installation may be completely extinguished during certain periods of the night or the year when usage is very low. A risk assessment should be undertaken prior to making a decision for part-night lighting.

4.4.4 Variable lighting levels

Ever-improving technology allows for more flexibility in the variation of lighting level on all classifications of road dependent upon usage at any one time. As the usage is reduced, typically the lighting level can be reduced, unless there are over-riding reasons not to do so (such as a high accident or crime rate). It might even be that it is appropriate to switch off for some periods of the night. Variable lighting is often referred to as dimming, but more appropriately is lighting to the correct lighting class to meet specific road parameters at a particular time. It might be that the highest lighting level an installation can achieve is only used on rare occasions, where traffic density is higher than normal (such as match days near to a football stadium), while the everyday lighting level might in reality be when the installation is operated at a lower lighting class. There are additional environmental benefits of using variable lighting levels, including reduced light intrusion, light pollution, electrical energy consumption and carbon emissions.
If switching light sources off is the method used to vary the lighting level, it should be ensured that the uniformity requirements are still met. When varying the lighting, each lighting level should meet the requirements of a distinct lighting class from BS EN 13201-2:2003

BS 5489 Annex A Selection of lighting classes

An important outcome of the selection process is to ensure that the area is neither overlit nor underlit. This is a difficult balance to achieve and it is therefore advised that the selection process is undertaken by a competent person. It is furthermore advised that a risk assessment is included along with consultation with relevant stakeholders. *A 5 step process has been incorporated into the standard*

Step 1 - The first step is to select the relevant table for the main users.
Step 2 **–** Do a risk assessment on the road from a lighting design perspective noting any elements of the road or users which may lead to a higher or lower lighting requirement.
Step 3 – Adjust the lighting class on the basis of the risk assessment outcome.
Step 4 – Make an adjustment to the target illuminance based on the S/P ratio of the lamp if applicable (only for subsidiary roads).
Step 5 – Repeat the above process steps 1-4 for different periods of the night when the usage and risks may vary sufficiently to allow a different lighting class selection.

Ways to reduce energy consumption

There are 4 changes to the new BS5489-1:2013 which when taken together will often lead to a significant reduction in electrical energy consumed combined with a potential reduction in column numbers.

i. New selection process leads to lower lighting levels
ii. Revised Maintenance Factor table leads to higher MF
iii. S/P ratio replaces 1 class step change for white light
iv. Variable lighting promoted for most road lighting tasks

CIE Publication 115:2010,

Recommendations for the lighting of roads for motor and pedestrian traffic

The CIE publication is an international guidance document which provides influence to standard makers in Europe and the UK and can be adopted in its own right. It introduces the concept of variable lighting (termed adaptive lighting in the document). It states:

"Since it was previously issued in 1995 power consumption and environmental aspects have become more important and at the same time, the improved performance of luminaires and lamps, and

especially the introduction of electronic control gear, has made it possible to introduce adaptive lighting for roads for motorised traffic, conflict areas and areas for pedestrians.
The visual needs of road users under reduced traffic volumes during certain periods of the night and the positive benefits of reduced energy consumption and potential environmental improvements, are some of the considerations which justify the installation of adaptive road lighting. There are a variety of suitable methods which can be used for the intelligent control of a road lighting installation. The control systems range from very simple to sophisticated applications."
Changes in the parameters under consideration when selecting the normal lighting class could allow a variation of the normal lighting level at different times of the night. The most important parameters in this respect are likely to be traffic volume and composition and weather conditions, but ambient luminance can also have an influence.
The use of variable lighting can provide a significant reduction in energy consumption, compared with operating the normal lighting class throughout the night. It can also be used to reduce energy consumption by reducing the lamp light output to the maintained value when the installation is clean and the lamps are new."

Interim Advice Note (IAN) 167/12 Guidance for the Removal of Road Lighting Highways Agency 2012

This IAN provides interim guidance to service providers on actions to be undertaken in order to select, assess, and implement removal of road lighting. The scope relates only to those lighting installations that have reached the end of their operational life.
The document states that the "Highways Agency is committed to reduce the energy consumption and carbon emissions (CO2) of its roadside equipment, *without a discernible shift in safety*. Any decision to remove existing lighting requires careful assessment; this is not currently covered by any other issued guidance or advice. Therefore new guidance is required to assess the actual benefits that an existing scheme is providing against the actual running costs".

The document instructs service providers that they must demonstrate to the service manager that Full Switch-off has been considered in accordance with the assessment guidance within this IAN. This has to be done prior to any major lighting works on the network including installation, maintenance, refurbishment, replacement / renewal.

The IAN provides guidance on a 10 point assessment process:

1. Site Selection
2. Site Verification
3. Safety Benefit Assessment
4. Road Safety Report
5. Lighting Design Report
6. Running costs assessment
7. BCR Benefit Cost Ratio Assessment
8. Decision taking
9. Communications plan
10. Implementation

Whilst the above process is designed for end of life scenarios, the ten point assessment process may be beneficial when considering other options to change the operational profile of the installation

Street Lighting – Invest to Save
Reduction or removal of street lighting – Interim Advice Note LB1

This advice note was written by the Institution of Lighting Engineers (ILE) now the Institution of Lighting Practitioners (ILP) and published in 2006 by the UK Lighting Board in consultation

with the County Surveyors Society (CSS) now known as ADEPT. The advice was an early response to the rising cost of electrical energy and the knowledge that some local authorities were reviewing their policy on the provision, operation and maintenance of street lighting. It was prompted by the well-publicised trial of switching off lighting in some rural traffic routes in Buckinghamshire. It urges Local Authorities to take account of the direct and indirect costs associated with switching off street lighting before making such decisions. The Advice Note is downloadable at www.theilp.org.uk

Save Money and Keep the Lights On

This document also published by the ILP is essentially an update on the Invest to Save document described above. It talks of the benefits of good lighting and the implications of switching off lighting and associated issues.

Police Road Deaths Investigation Manual

This practice advice contains key roles, investigative principles and individual strategies and components to assist an effective and practitioner investigation into a fatal collision. This manual adheres to the principle that all fatal collisions should be investigated as 'unlawful killings' until the contrary is proved. When a collision has occurred and highway involvement is alleged then the highway authority should be able to show that it took reasonable measures to ensure that the safety of the road user was not compromised. The prior knowledge held by the highway authority on a road is also of great significance.

When developing a forensic collision investigation strategy, human, vehicle and environmental factors should be considered. This will determine the relevance or otherwise of these factors to the investigation, and whether they are explored at the scene and/or at a later stage.

Lighting is included as an example of environmental factors as follows:

- Road condition, e.g., condition of the road surface.
- Road geometry, e.g., curvature and grade.
- Roadside protection, e.g., purpose and condition of the central reservation barriers.
- Signage, lighting, automatic traffic signals.
- Weather conditions at the time of the collision.

7. Guidance on Available Options

Steps which Local Authorities can take to minimise energy consumption

This chapter covers the technical options that are available to Local Authorities to assist with reducing electrical energy consumption.

Road lighting has developed over the years from a recipe type solution to a performance / task based solution. This is further developed with a wider choice of light sources and the ability to vary the light according to the task at different periods of the night. In essence this can be summed up as "the right light in the right place at the right time".

Local Authorities have many more options now when considering the lighting policy in particular with reference to minimising energy consumption whilst at the same time maintaining a lighting service which is fit for purpose. There is also a wide spectrum of variants when analysing the inventories of different authorities, with some authorities having had significant investment in recent years, whilst others are struggling with obsolete inefficient equipment.

There are two ways of controlling light sources – switching using photoelectric control units (PECUs) or timeswitches – which may be coupled with dimming ballasts which are capable of dimming the light source to predefined levels, or alternatively central management systems (CMS) which use a more sophisticated control mechanism.

Create / Review street lighting policy

The lighting policy is the first stage in developing an intelligently managed street lighting asset. It is important to ascertain within the policy the essential needs and aspirations of the street lighting service from the public and the elected members within an authority. The first step is to create a written policy – as most local authorities have, through custom and practice, a de facto policy of providing lighting from dusk to dawn on all adopted (& in some cases unadopted) highways.

The street lighting policy provides guidance to the lighting of streets in the Authority and may give limits or restrictions on lamp types, lighting classes etc. It is recommended that the policy be reviewed at regular intervals to ensure that it takes into account changes in lighting design standards or technology. There is a movement towards creating lighting plans which would look at roads on an area or individual basis and assign a lighting class to the road based upon the specific issues associated with that road.
The lighting policy should also be amended to incorporate variable lighting and efficient light sources. The lighting policy should be flexible enough to allow local authorities to easily adopt emerging technologies, rather than be specific on lamp types. This is particularly important in an era when new technologies are being introduced on a fairly frequent basis.

Selection of Lighting Classes

A key to minimising energy consumption is to ensure that the optimum lighting classes is selected for the task taking into account the particular issues and risks associated with the street at different periods of the night.
BS5489-1:2013 has recently been published and this provides a fresh approach to the selection of lighting class. In the majority of cases the new selection will lead to appropriate lighting classes being selected which in turn leads to lower lighting levels being recommended. In this way there is greater flexibility to ensure that roads are not over-lit. The 5 step approach is discussed in BS5489 Chapter 7.
When designing lighting profiles which vary during the night dependent on usage, it is important that all designed lighting levels – whether dimmed or not – comply with a defined lighting class appropriate to the situation at that time, using EN 13201 and BS5489.

Mesopic vision and scotopic/photopic (S/P) ratio.

Recent research has concluded that at lower lighting levels and for tasks associated with pedestrian visual requirements, light sources with a higher S/P ratio give improved visual performance for a given luminance. Guidance on how to benefit from this is provided in the ILP PLG03 guide and in BS5489-1:2013. This will lead to potential savings either by increases in maximum column spacing or a reduction in installed power.

Review Luminaire Maintenance Factors

Recent research undertaken by the industry has led to a re-think on the long-established values for luminaire Maintenance Factor. The research undertaken on behalf of the County Surveyors Society (now ADEPT) and other industry sponsors measured the degradation of light output from luminaires in the field and this has led to a more scientific predictor of luminaire maintenance factors based upon environmental zone and mounting height. The maintenance factors table is in BS5489-1:2013 Annex B. The research concluded that generally higher maintenance factors could be adopted compared to previous standards.

This will lead to potential savings either by increases in maximum column spacing or a reduction in installed power.

Energy efficiency.
The energy efficiency of road lighting is not only a matter of light source efficacy in terms of lumens per watt (lm/W). The efficiency of the complete lighting installation should also be taken into account, including the effectiveness of the light source, control gear and luminaire optic combination in providing the selected class of lighting on the road, with the desired degree of colour rendering. The competence of the designer is also important in optimising the lighting design. Energy efficiency of energy related products such as light sources are covered by European directives (see Legislation)

Review existing lighting equipment
Existing lighting equipment should be reviewed in order to establish whether it is cost effective within the overall policy to carry out various changes to equipment in order to benefit from changes to lighting switch on levels and efficient light sources and control gear. Items which could be considered within this include:

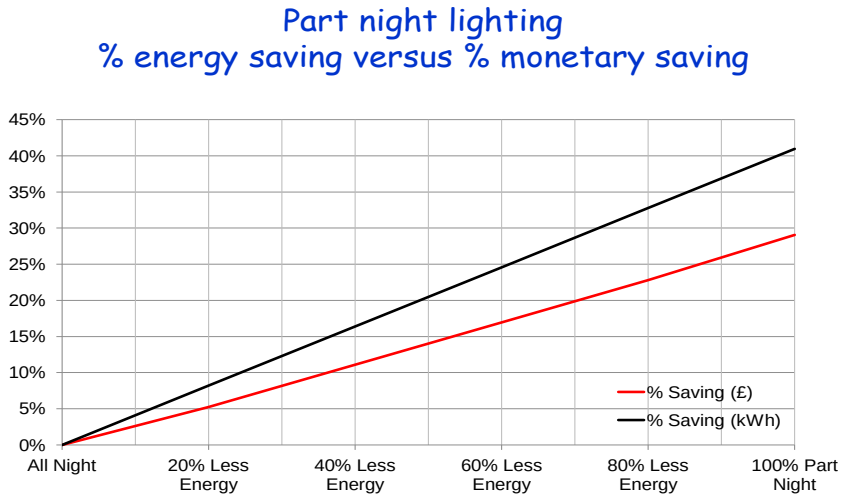
1. Reviewing illuminated signs to confirm that illumination is required and appropriate in accordance with the TSRGD
2. Reviewing bollards to establish whether these should be removed, retained or replaced with retroflective self righting bollards(RSRB) or solar powered RSRB's containing transilluminated signs
3. Reviewing light sources (e.g. luminaires, illuminated traffic signs, illuminated bollards) to ensure that appropriate and efficient light sources are in place taking into account the Energy Related Products Directive and considering the retrofitting of new light sources
4. Reviewing control gear to ensure that inefficient control gear is replaced (e.g. replacing wire wound ballasts with electronic control gear)
5. Reviewing switching to confirm whether switch on and switch off lux levels are appropriate for the run up times of the light sources (trimming)

Lighting Profiling – Adaptive Lighting

Potential Impact of lighting profiling on energy bills

Power Data Associates have created a technical note to provide information upon the potential impact of part night lighting upon energy bills.

The technical note looked at the annual kWh consumption for three different scenarios ranging from all night lighting to 100% part night lighting from midnight to 5am. The report concludes that the forecast energy kWh savings would not be pro-rata to the reduced cost of energy. This is based upon the variation of energy tariffs at different times of the night.
Part of the energy cost comes from the Distribution Use of System (DUoS) charges which allow distribution businesses to recover their costs from operating their networks. The tariffs vary according to the energy demand and are in three price bands red/amber/green. The costs and times for each price band vary from region to region. The DUoS charges make up part of the overall energy cost and have the effect of increasing the kWh figure when incorporating dimming or switching part night as the user is using proportionally higher amounts of energy at the expensive rate. A very approximate rule of thumb would suggest that the energy savings will be 10% higher than the monetary savings for a typical part night scenario.



PowerDataAssociates

Potential Impact of lighting profile changes on maintenance activities

The potential impact of changes to the management of public lighting on maintenance activities should be carefully considered and factored into the decision making process. Merely switching off lighting does not absolve the asset owner for ensuring the electrical and structural safety of the assets through regular periodic inspection and testing. Where Central management systems are being considered, this would negate the need for night scouting which would bring a positive cost benefit to the decision making process. Other possible changes – such as changing lighting profiles or adopting newer technology in terms of light sources and control gear / drivers may also have some impact on maintenance activities, such as extending the period between maintenance visits to lighting units – and possible extended life of light sources. It should be noted that whilst the use of LED's may extend the life of the light source, that due to the more complex failure mechanism associated with LED's, the only reliable way to determine end of life is by taking lighting measurements on site at more than a single point per luminaire.

Variable Lighting

Variable lighting (sometimes called Profiling Lighting or Adaptive Lighting) is an option to increase or decrease the lighting level at different times based upon different requirements.

The lighting standards recommend that lighting be varied dependent upon the usage such as traffic volume or pedestrian flow, and that the appropriate lighting class be chosen for the traffic flow at that time. Thus the variation in lighting level should be in steps of 1 class with the uniformity requirement always to meet the most onerous condition.

From various research and anecdotal sources, the public do not tend to notice reductions in lighting level on a street until that reduction is significant - such as 50% or greater. Hampshire trialled a regime of a reduction of light output to 25% in residential areas from midnight to 5am, but amended that to 50% following consultation and negative public feedback.

The light level is adjusted using a dimmable electronic ballast which is either pre-set to specific levels or operates on a 0-10V, Dali or other protocol. The signal is controlled either via the PECU or using a CMS system.

Central management systems (CMS)

CMS offer significant levels of control and flexibility, providing two-way communication between a remote server and each light point of an installation. The control of individual light points provides significant functionality, including individually programmable switching and

the facility to vary the light source output using established digital protocols, the ability to remotely override programmed switching or dimming events on special occasions, remote monitoring of the status and fault reporting of light points (thereby removing the need for patrols), gathering of data for maintenance planning, monitoring electrical energy usage, and linking to GIS systems. Communication may be by mains-borne signals or wireless. A particular advantage of some Central Management Systems is the ability to reduce lighting levels at the start of life of the light source – when it's output is at its highest - and then to gradually increase the output of the light source to compensate for the source's reduction in light output over time (compensation for the depreciation of light output). Local authorities are using CMS systems to control switching, dimming, fault detection, reduce night scouting requirements, metering.

Part night lighting

This is when the lighting is switched off part way through the night when the requirement is reduced in terms of traffic flow (pedestrian or vehicular). This would typically be from midnight to 5 or 6am. Part-night PECUs can be used to switch off or reduce the light source output of the luminaires during the night, e.g. at 0100hrs when activity reduces, or can be used to dim the light source to pre-defined factory set levels when used with dimming ballasts

If part night lighting is to be considered, then it is essential that the authority undertakes full consultation and performs a risk assessment for each area being considered. It is also essential that full cognisance is taken of the costs of part night lighting. It should only be considered if a cost benefit analysis shows this to be a best option compared with invest to save initiatives which often show good pay-backs.

Not all areas even within rural areas will be suitable for part night lighting. There will always be exception criteria. Some authorities have lit walking routes which enable pedestrians to get most of the way home. It is important that the criteria chosen is relevant to the location and the result of consultation with residents, parish councils etc.

Exception Criteria for Part Night Lighting

As part of the risk assessment and safety review most authorities operate to a set of criteria whereby lighting will be kept on in critical areas. The list would typically include the following:

1. Major lit inter urban dual carriageway traffic routes
2. Conflict areas, e.g. roundabouts (consideration to be given to mini roundabouts within residential estates)
3. Sites where street lights installed for accident remedial measures
4. Town centre, shopping and residential type development where there is one or more of the following features:
    a. CCTV sites
    b. High proportion of high security premises e.g. banks, jewellers etc.
    c. High crime risk
    d. High concentration of people at night such as – transportation interchanges, pubs, nightclub areas, etc.
5. Main approaches to areas defined in 4 above where there is a mix of development between residential and commercial / industrial i.e. not exclusively residential
6. Sites where the Police can demonstrate that there is likely to be an increase in crime if the lights are switched off
7. Remote alleys linking residential streets
8. Where there is a statutory requirement.
9. Junctions
10. Safe walk home routes
11. To highlight steps or other hazards

A number of rural authorities which operate some part night lighting on their network are looking to re-instate an all night lighting regime with more efficient equipment with which they can carry the lighting level at different times of the night and can often make energy savings over and above those they achieved with a part night lighting solution.

Lighting switch off

A few local authorities have identified stretches of road particularly outside of built up areas where they have assessed that the street lighting is not required and can be switched off permanently or even removed.

Some of the reasons could be:

- De-trunked traffic route outside of built up area with no pedestrian traffic
- Roads which previously had housing which has been demolished
- Rural motorways with few junctions and good night time accident statistics

The Highways Agency has identified a number of locations on its motorway network and has produced an interim guidance note IAN167/12 for the "Removal of Road Lighting" which is detailed in chapter 6. This document puts safety as the key criteria to be met prior to any decision being made. The safety assessment should be carried out by road safety practitioners in consultation with other relevant practitioners and should ensure that there is no "discernible shift in safety" caused by the actions. In particular, the switching off of, for example, alternate lights, or one in three rather than complete roads is deprecated, as it causes confusion amongst road users and other stakeholders as well as causing issues with lighting levels and uniformity.

Trials in both Milton Keynes and Buckinghamshire have led to a reversal in the switch off at a number of sites following increased accidents and a review of safety.

Follow Up and Review

In accordance with good engineering principles, changes to policy should be followed up and reviewed after implementation to ensure the aims are being met and that any lessons learned can inform future decisions. It is recommended that annual reviews are carried out over a three year period following implementation, in order that statistically valid data can be gathered, particularly in respect of accident and incident data.

8. Funding Options

There are numerous options available to local authorities if they have identified a need and have approval for further investment to save energy. One of the key drivers for some of the investment models is achieving a pay-back within a relatively short period of time of typically less than 10 years. Some options require a shorter pay-back period as part of the conditions of the funding. Some options are detailed below:

Prudential borrowing

The Local Government Act 2003 introduced new freedoms and flexibilities for local authorities. One of the new powers allowed local authorities to borrow to invest in capital works and assets so long as the cost of that borrowing was affordable and in line with principles set out in a practitioner Prudential Code, endorsed by the Chartered Institute of Public Finance and Accountancy. Prudential Borrowing is the set of rules governing local authority borrowing in the UK. Under prudential borrowing, the amount of debt and other liabilities most local authorities can incur is no longer capped by an upper limit. Instead

borrowing must conform to the Prudential Code which (among other things) requires that borrowing be affordable and prudential. Local authorities have been making use of prudential borrowing for a number of years now, with great variation existing between authorities in the amounts invested and the purpose to which it has been put.

Case Study – The Cornwall Project.

Cornwall CC initiated an Invest to Save project following a review of its policy. They looked at three potential options and consulted with the public on each. These options were:
Option 1 – Dusk to Dawn lighting
Option 2 – Part Night Lighting (Off between 12.30am and 5.30am
Option 3 – Hybrid: Dimming on main roads; Part Night Lighting on residential Roads and Dawn to Dusk lighting in urban areas

An Option Appraisal Report was presented to committee offering variations on the three options above plus further options of Do nothing, decommissioning of some assets, or micro-generating technologies..
The options were evaluated against a number of objectives:

- Energy & carbon management
- Flexible management of stock
- Crime and disorder
- Sustainability
- Casualty reduction
- Highway Asset Management Plan

The top scoring option was to change all lights to New Technology and operate Variable lighting on the entire network. New Technology includes high efficiency luminaires with white light source controlled by electronic gear and managed and monitored by a CMS.
The estimated saving on consumption would be between 35 and 50%.
The council decided on a 3 year lantern replacement programme taking advantage of the existing columns which had been replaced in the 1990's
The funding was through Prudential Borrowing over 25 years with an estimated saving of £54m and reduction of energy of up to 60%. The following benefits were communicated to the residents.

- Communities will be able to influence how and when their streets will be lit.
- Improved lighting for vision and providing better images on CCTV footage, which will help with crime and disorder.
- Over 25 years there will be up to an estimated £54m saving on the cost of running the 47,000 street lights across Cornwall.
- Carbon footprint reduction by up to 50%, which is the UK's target for carbon emissions by 2050. .
- Reduction in light pollution and sky glow will benefit all including star gazers.

Alongside this project there is a lighting and crime study being undertaken by Dr Kate Painter. The main aim of this research programme will be to evaluate the impact of the street lighting programme on communities across Cornwall.

The Cornwall project is seen as a pathfinder Invest to Save project.

PPP

A public-private partnership ("PPP") arrangement differs from conventional public procurement in several respects. In a PPP arrangement the public and private sectors collaborate to deliver public infrastructure projects – such as roads, railways, airports – which typically share the following features:

- a long-term contract between a local authority and a private sector company based on the procurement of services, not assets;
- the transfer of certain project risks to the private sector, notably with regard to designing, building, operating and/or financing the project;
- a focus on the specification of project outputs rather than project inputs, taking account of the whole life cycle implications for the project;
- the application of private financing to underpin the risks transferred to the private sector; and
- payments to the private sector which reflect the services delivered. The PPP Company may be paid by the Authority.

The rationale for using a PPP arrangement instead of conventional public procurement rests on the proposition that optimal risk sharing with the private partner delivers better "value for money" for the public sector and ultimately the end user.

PPP arrangements are more complex than conventional public procurement. They require detailed project preparation and planning, proper management of the procurement phase to incentivise competition among bidders. They also require careful contract design to set service standards, allocate risks and reach an acceptable balance between commercial risks and returns. These features require skills in the public sector which are not typically called for in conventional procurement.

Assessment of the PPP option

In order to consider the PPP procurement option, the Authority and its advisers need to answer a set of key questions:

- Is the project affordable? How will the Authority pay for the project?
- What are the key sources of risk in the proposed project? What is the optimal risk allocation and risk management strategy?
- What are the financing sources for the proposed project? Will the project be "bankable" (i.e. capable of raising debt finance)? Will it attract investors? Will it comply with the requisites for EU or national public funding?
- Even if the project is affordable and bankable, does the project represent value for money?
- Has the issue of the "balance sheet treatment" of the project (i.e. the classification of the project as a public sector investment for the purposes of national debt and deficit under the "excessive deficit procedure" of the Maastricht Treaty) been considered?

PF2 (formerly PFI)

The private finance initiative (PFI) is a procurement method which uses private sector capacity and public resources in order to deliver street lighting infrastructure and services according to an Output Specification defined by the local authority. It is a type of Public Private Partnership (PPP), with the main defining characteristic being the use of project finance (using private sector debt and equity, underwritten by the public) in order to deliver the public services. Beyond developing the infrastructure and providing finance, private sector companies operate the public facilities.

A local authority signs a contract with a private sector consortium, technically known as a Special Purpose Vehicle (SPV). This consortium is formed for the specific purpose of providing the PFI. It is owned by a number of private sector investors, usually including a construction company, a service provider, and a bank. The consortium's funding will be used for the construction phase of the Core Investment Period and to undertake maintenance and capital replacement during the life of the contract. Street Lighting PFI contracts are for 25 years and the consortium is paid for the work on a "no service no fee" performance basis.

There are many Street Lighting PFIs in existence and the list follows:

Project	
Brent - Street Lighting	Derby City Council - Street Lighting & ITS
Islington - Street Lighting	Leeds Street Lighting
Manchester City - Street Lighting	London Borough of Barnet - Street Lighting
Newcastle & North Tyneside - Street Lighting	London Borough of Enfield - Street Lighting
Staffordshire - Street Lighting	South Coast Councils - Street Lighting & ITS.
Stoke - Street Lighting	Nottingham City
Sunderland - Street Lighting	Croydon & Lewisham
Wakefield - Street Lighting	Knowsley
Walsall - Street Lighting	Oldham & Rochdale
London Borough of Ealing - Street Lighting	Cambridgeshire
South Tyneside Borough Council – Street Lighting	Northamptonshire
Redcar and Cleveland Borough Council – Street Lighting	Portsmouth Highways
Lambeth - Street Lighting	Sheffield Highways
Dorset Street Lighting, ITS and Bollards	Hounslow Highways
Norfolk County Council - Street Lighting	Isle of Wight Highways
Surrey CC	

PF2 will;

- Strengthen significantly the partnership between the public and private sector by Government looking to act as a minority public equity co-investor in PF2 projects;
- Ensure that procurement is much faster and cheaper;
- Improve the flexibility of services;
- Transform the approach taken to transparency;
- Improve the value for money of risk allocation in the contract;
- Widen sources of debt and equity finance;
- Deliver value for money by developing and consulting on guidance which will replace the existing Value for Money Assessment Guidance

Salix Finance

Salix Finance Ltd. was established in 2004 as an independent, publicly funded company dedicated to providing the public sector with interest free capital finance funding for energy efficiency projects. Salix Finance loans are provided for energy efficient projects that pay for themselves within five years (in England, longer in Wales) through lower energy bills and /or reduced maintenance. Repayments are made from the money saved on energy bills and, once the loans are repaid, the organisation continues to benefit from the low carbon equipment and the saving it delivers.

Salix funding for England is provided directly by the Department of Energy and Climate Change (DECC). Salix Finance is responsible for reporting all relevant CO_2 and financial savings to DECC. With DECC's support projects to the value of £186m have been completed to date, through interest free loans and recycling funds. These projects will deliver savings to the Public Sector of £54m and 320,000 tonnes of CO_2 annually and £756m and 4m tonnes of CO_2 over their lifetime.

The Welsh Assembly Government funds Salix Finance via Carbon Trust Wales and the three organizations have worked in partnership since 2005. To date annual savings of £2.5m and 14,961 are being achieved annually from interest free loans and Recycling Funds from the current investment of £11m.

Case Study – Bristol City Council

Salix funding has been successfully used by Bristol City Council to fund replacement street lighting. They delivered a £1.1m street lighting project to upgrade over 10,000 street lights on main roads across the borough. Bristol City used a £550,000 loan from Salix plus match funding from their existing Salix Recycling fund to upgrade the lighting to an energy efficient white light. The annual savings on energy costs are projected to be £503,000 providing a project payback of 2.2 years. In addition there is a projected annual saving of 2,380 tonnes of CO_2 providing lifetime savings of over £7.5m and 35,724 tonnes of Co_2.
The case study is downloadable at www.salixfinance.co.uk/case-studies

Case Study – Torfaen County Borough Council

Torfaen County Borough Council had a strong program of street lighting refurbishment they wanted to continue with. They used a Salix 100% interest free capital finance loan of £543,820 to further their program of street lighting upgrades and controls, saving them over £80,000 on their annual energy costs. In addition to these savings, they estimate a further £46,000 of annual maintenance savings. The funding paid for 1,900 luminaires and energy efficient 2230 ballasts.
The payback for this project is 6.8 years with annual savings of £80,299 and 416 tonnes of CO_2 and lifetime savings of greater than £1.1m and 5,809 tonnes of CO_2. In addition there will be an estimated further annual maintenance cost saving of £46,000.
The case study is downloadable at www.salixfinance.co.uk/case-studies

Case Study – London Borough of Bromley

In 2007 LB Bromley began working with the Carbon Trust on its Local Authority Carbon Management Programme. With an aspirational target of reducing the Council's carbon emissions by 25% over five years, Members agreed in 2008 to invest £250k of capital to be match-funded by Salix in order to help meet this goal. The Salix Finance model was thought appropriate for the following reasons:

- It was match-funded
- The Council's original £250k investment would be available should no further projects become viable (and when existing internal loans had been repaid)
- The ring-fenced, revolving nature of the fund meant that the original capital would go much further than one-off spending on individual projects
- The strict compliance and monitoring criteria would give all concerned confidence that projects would be proven technologies with robustly quantified savings.

LB Bromley also decided to take advantage of the Salix Energy Efficiency Loan Scheme (SEELS) in order to finance the extension of a street lighting SON Replacement and Dimming Project. This loan of £425,200 was too large for their regular invest-to-save Salix Fund but since they had already identified a strong business case, technology and contractors, so the extension made good sense.

The projects involved include:

- Street-signage: conversion from 24hr to dusk-to-dawn switching
- Central Island Columns: conversion from 24hr to dusk to- dawn lighting
- Street Lighting : Fit Electronic gear to SOX lanterns
- Crossing Bollards : Conversion from 24 hr to dusk to dawn lighting
- Street Lighting: SON Replacement & Dimming

The council have focused predominantly on Street Lighting and associated lit-Highways works for the following reasons:

- Street Lighting is projected to be a growing part of their carbon footprint; in other words, without taking action, energy consumption from this sector would not worsen, not even levelling off.
- Savings from street lighting are straightforward to quantify and the savings are easily realised.

Research Funding

St Helens MBC

BLISS project – Better Lighting in Sustainable Streets

BLISS is a European lighting project which is underlined by a need to reduce energy consumption through the use of new technology. St Helens Council is the lead on the project with partners in the Netherlands, Belgium and Germany. Impacts on crime, accidents and community spirit are being closely monitored. BLISS is exploring ways to reduce street lighting energy consumption. The key aim is to create new low-energy lighting solutions that offer greater comfort, safer environments and improve everyday urban life. BLISS is a match funded NWE INTERREG IVB project which was established in 2009 to achieve a reduction in street lighting energy consumption. This is achieved by utilising various equipment and techniques, such as LED technology and variable lighting levels. These changes should reduce energy costs and improve lighting standards without compromising crime statistics and road traffic accidents, which can be negatively affected by lighting changes. In 2009 St Helens installed a small number of trial schemes on residential sites, demonstrating the initial energy savings that could be achieved. The trial was installed on roads containing 165 houses, compromising mainly social housing, and demonstrated energy savings of 30%. Crucially surveys among residents revealed high levels of satisfaction with the lighting changes.

In 2009 trial installations were carried out on 3 residential estates with an estimated annual energy saving of 40%**.**

In 2010 around 20 different schemes were installed with an estimated annual energy saving of 33%.

In 2011 around 30 schemes have been chosen with an estimated annual energy saving of 36%.

9. Summary of Previous Surveys of Local Authority Activity

In November 2010, BBC Newsnight polled 75 councils in England and Wales, asking whether they were considering moving to permanent or partial night switch off of street lights or implementing the dimming of lights. The result was that 42% of councils in England and Wales are considering some switch off measures.

This was reported in HEN 88.

In September 2011, DEFRA published some research entitled “A review of local authority road lighting initiatives aimed at reducing costs, carbon emissions and light pollution”. This review looked at the activities of 15 local authorities and concluded that there were a range of initiatives that local authorities could adopt to reduce their carbon footprint and increase the energy efficiency of the street lighting assets.

Some of the key findings from the survey respondents include:

- 29% of authorities have trimmed the amount of time lighting is on for
- Photoelectric cells generally switch on at 35 lux and off at 18 lux
- 37% of authorities have profilked (dimmed) their lighting
- 19% of authorities have undertaken part night lighting

- 7% of authorities have removed lighting
- Authorities views of public reaction to lighting scheme changes is generally neutral

During 2012, APSE carried out a state of the market survey on street lighting. 45 local authorities in the UK responded and they identified that reducing the amount of energy used remains one of the most important issues for those managing street lighting services. Targets to reduce carbon emissions are also on the minds of managers. Trimming, dimming and switch off have been the implemented by a number of councils and some councils are investing in central management systems enabling much more specific management of the network. The general trend amongst respondees is that trials are being widely undertaken and are at various stages of testing alongside investment in replacement and new lamps and CMS.

The APSE survey found that addressing the fear of crime is one argument made for the provision of a street lighting service, alongside the need to provide light for drivers, and this is likely to remain. Publicity over the number of police officers on the beat and the growing number of elderly people as a proportion of the population mean that pressure for an effective street lighting service will remain. The provision of street lighting services remain one of the most basic council services providing light for vehicular and pedestrian traffic, helping to reduce the fear of crime and the incidence of actual crime as well as providing aesthetic quality to many public places. The soaring cost of electricity, cuts to local government budgets and developments in lighting equipment and systems have all had an impact upon the way this service has been delivered in recent years. The approach taken will clearly be dependent upon access to funds and the levels of historic investment in the stock.

10. Responses

Each Local Authority in the UK has been contacted and asked to respond to the questions contained within the questionnaire which is set out in Appendix 2. The preferred method of response was by telephone interview, but some Local Authority representatives requested an e-mail with an electronic copy of the questionnaire. The overall response rate has been excellent with replies obtained from 83% of local authorities in Great Britain. This figure includes those authorities whose registered phone number in the Highway Electrical Yearbook is out of date and those which do not appear to have a practicing lighting engineer. This makes this one of the most comprehensive surveys undertaken in this area.

The response rate from different types of authority was as follows:

Authority Type	**No. Authorities**	**No. Responses**	**% Response**
County Councils	30	25	83%
Metropolitan BC's	36	29	81%
London Boroughs	33	28	85%
Unitary & Other Councils	52	45	87%
Scottish Councils	33	26	79%
Welsh Councils	22	17	77%
Total	**205**	**170**	**83%**

The DfT, on behalf of the Highways Agency, responded to a Freedom of Information request in November 2012 – and their response is set out in Appendix 3

11. Results, statistics & charts

There is a clear divide between what county councils are doing compared to unitary and other councils and also compared with the Metropolitan and London Boroughs where there is no part night lighting. Only a third of county councils are not trying part night lighting compared to around 50% of unitaries and 100% of urban authorities.

Q1 The Carbon Reduction Commitment Energy Efficiency scheme places an obligation on Local Authorities to improve energy efficiency. Street Lighting is one area affected by the scheme. How is your Authority tackling the issue?

The response to this question was immensely varied between authorities and typical responses and actions are found in the following list:

- Variable lighting (dimming) through the night by profiling the requirements
- Trimming of operating hours by adjusting switch on and switch of times
- Retrofit electronic gear in place of wire wound gear
- Reduce lighting levels by re-appraising the requirements in line with BS5489-1
- White light replacement for HPS or LPS lighting with reduced light levels
- Retrofit CFL lamp and electronic gear tray into LPS luminaire
- De-illuminate some bollards and use retro-reflective bollard
- Convert lit signs and bollards to LED light source
- De-illuminate some lit signs in line with TSRGD

Trimming

Many authorities have amended the switch on and switch off levels in response to the quicker start-up and run-up times of modern light sources. The most common lux levels that authorities are using are switch-on at 35 lux and switch-off at 18 lux.

Of UK authorities that provided information on trimming, 67% are trimming and 33% are not. Only 50% of Welsh and Scottish authorities are trimming as shown in the chart below.

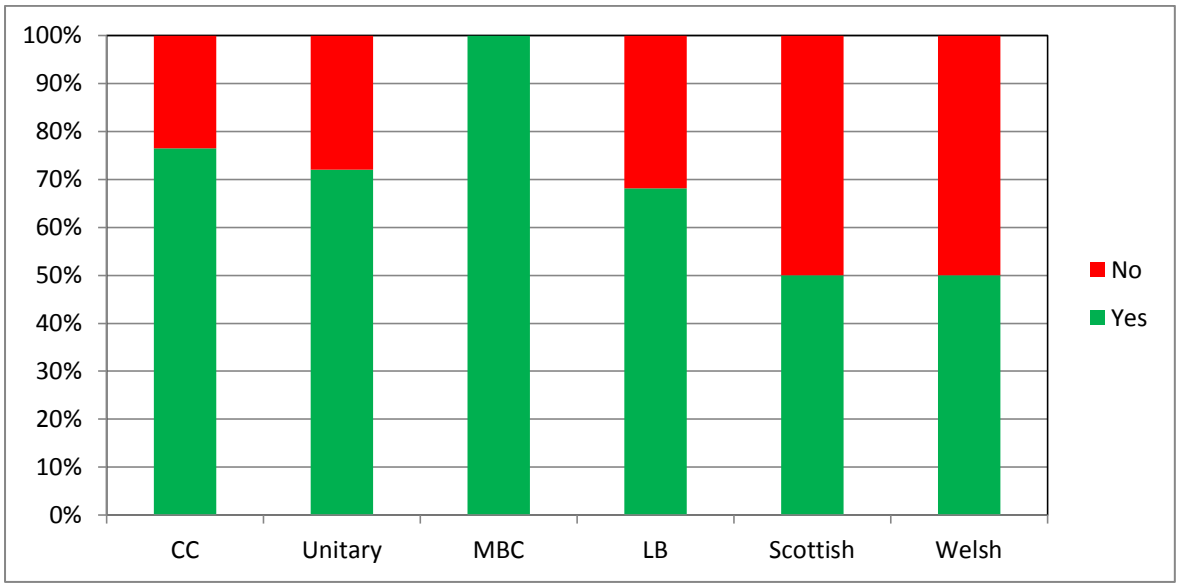


Figure 1 Prevalence of authorities "Trimming" switch on and switch off levels

All authorities were aware of the need to reduce energy consumption, but the extent to which they were able to be effective in this regard was entirely down to the funding made available to them. Some authorities such as Cornwall CC and Leicester City had extensive Invest to

Save initiatives, whilst other authorities were having to make do with little capital or revenue funding.

Q2 Have you any locations where you have permanent switch off or removal of lighting?
a. If yes, what criteria do you use for determining which units?
b. How many?

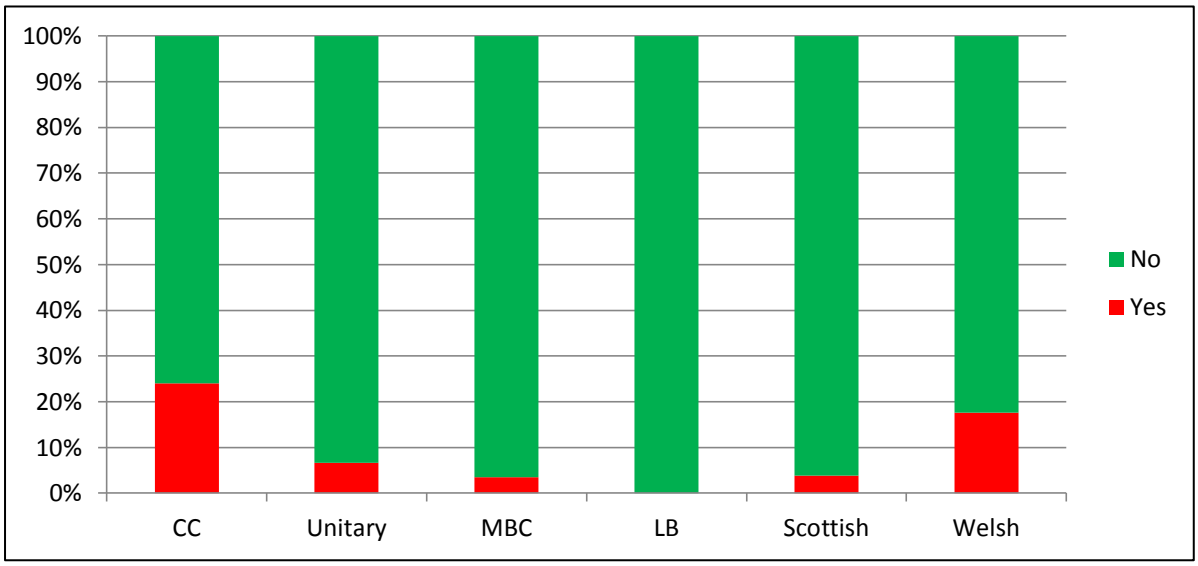


Figure 2 Switch off all night or removal of lighting % of authorities by authority type

24% of English county council authorities and 18% of Welsh authorities have removed or permanently switched off some lighting. In general this is on a very small scale, however there have been some authorities where larger trials have taken place. These include Northamptonshire, Milton Keynes, Buckinghamshire, Powys and Torfaen.
7% of unitary authorities have permanently switched off some lighting. As expected no London Boroughs have any all night switch off. In total in the UK approximately 8% of authorities have permanently switched off any lighting with approximately 3% doing so on a significant scale.
In summary this equates to 8% of the 170 authorities who responded. About half of the switch off schemes are of significant quantities.

Q3 Have you tried Part night Switch Off of lighting?
a. If yes, what criteria do you use for determining which units?
b. How many?

Part night lighting is a widespread practice amongst county councils in England and to a lesser extent in unitary authorities. It should be remembered that a number of authorities have been part night lighting since the 1970's. Examples of this practice are West Sussex CC and Kent CC.
The criteria that local authorities use relate to the times for part night lighting and the locations. The typical operating hours for Part Night Lighting are from midnight to 5am or 6am although with many part night photocells there is no compensation for daylight saving, so that during BST the switching will be an hour later. There is a Scottish authority that is looking to extend the Part Night lighting to switch off from 11pm instead of midnight.

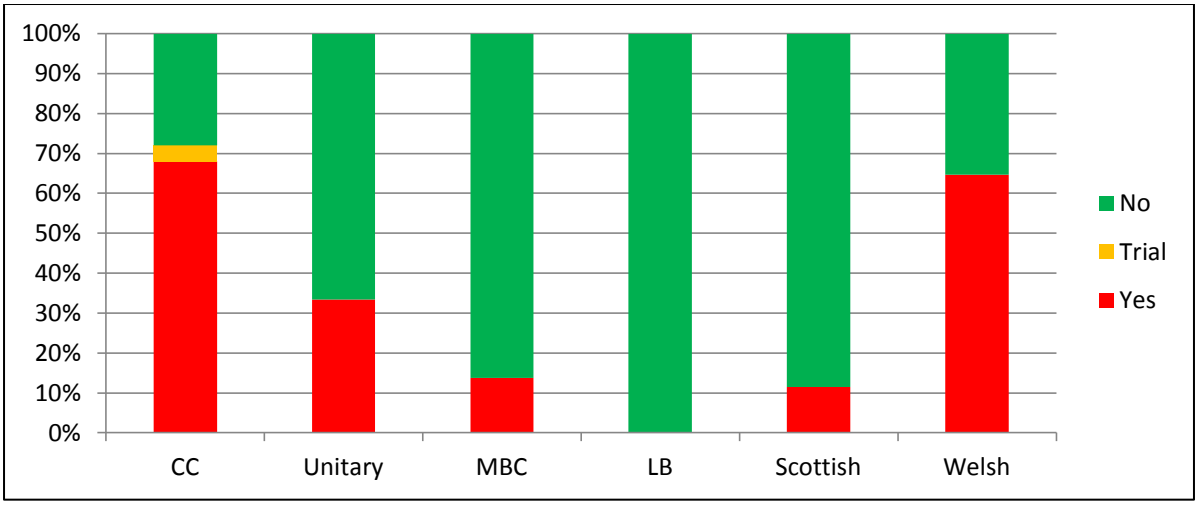


Figure 3 Part Night Lighting uptake % by authority type

In terms of the criteria for which locations are chosen, it appears that some authorities have decided to part night 1 in 2 or 1 in 3 columns, whilst others do a full safety and risk assessment of each site prior to initiating the scheme.
Many local authorities operate a list of exception criteria as part of this process and an example is given in Chapter 7. The exception criteria list for a number of authorities is available from the street lighting section on their web-site. Indeed a number of authorities as part of their communication strategy produce a list of FAQ's relating to Part Night Lighting to provide the background to the strategy.

72% of county councils have introduced part night lighting to some degree
48% of county councils have significant (>1000 columns) part night lighting installations
Of the authorities that are part night lighting, 53% of them have large schemes in excess of 1000 columns whilst the remainder have either trials or a much smaller targeted approach.

65% of Welsh authorities have introduced part night lighting; 41% of Welsh Authorities have part night lighting installations in excess of 1000 columns.

In contrast only 11% of Scottish authorities reported introducing part night lighting, with only 4% having large schemes (>1000 columns)

In English Unitary and other councils about 1 in 3 authorities were using part night lighting with half of those authorities reporting large schemes (>1000 columns)

Only 1 Metropolitan Borough Council (equating to about 3% of MBC authorities interviewed) reported a large part night lighting scheme, and there were no reported part night lighting schemes in London Boroughs.

UK wide 30% of all authorities are part night lighting to some degree. 15% of all authorities have significant part night lighting installations (>1000 columns).

Q4 Have you tried Variable Lighting Levels?
a. If yes; what criteria do you use & timescales?
b. How many?

Variable Lighting is now commonplace within street lighting equipment as a result of changes in British Standards and improvements in control gear technology with the transition

from wire wound gear to electronic gear to control lamps. The main barrier to widespread uptake is the capital cost of introducing schemes, although this barrier is being eroded as volumes increase. Many authorities are ensuring that all new installations are “dimming enabled” so that they have the flexibility in the future to introduce variable lighting.

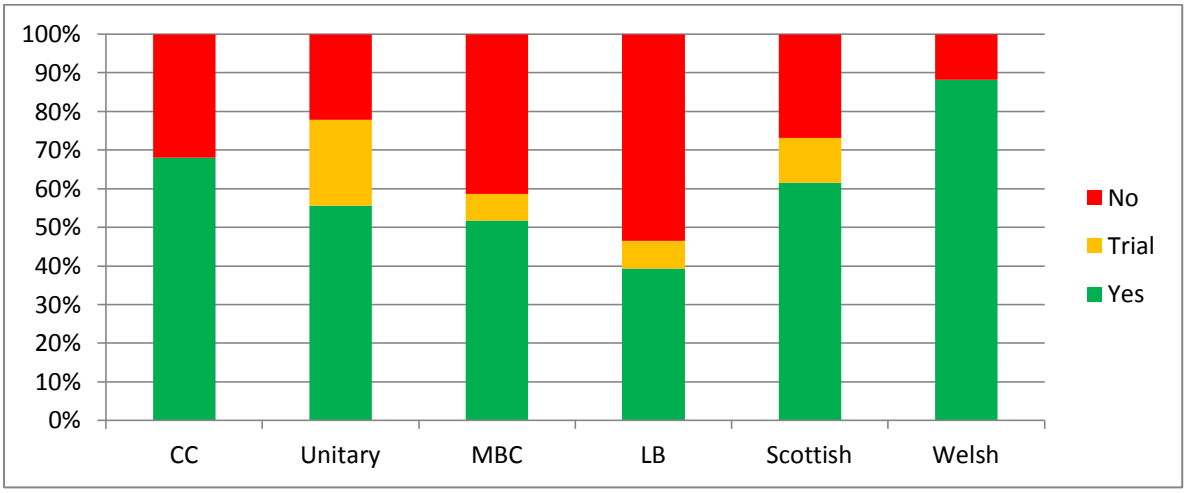


Figure 4 Variable lighting % uptake by authority type

In terms of authorities that are currently using variable lighting technology the results are as follows:

69% of all UK lighting authorities are using variable lighting as part of their energy reduction strategy. The area with the highest take up is Wales with 88% of councils using variable lighting, whilst less than 50% of London Boroughs are doing so perhaps reflecting more of a 24 hour economy in London.

In England, Unitary and other councils lead the way with 78% of authorities, followed by 68% of county councils and 59% of Metropolitan Borough Councils. In London only 46% of councils are adopting variable lighting.

This is clearly a fast moving trend and with the recent publication of BS5489-1:2013, it is anticipated that this trend will accelerate.

Typical variable lighting regimes are as follows:

Midnight to 6am
Vary lighting to 75%, 70%, 60% or 50% of full level

Q5 Have you tried CMS?
a. If Yes, how do you use it?

Central Management Systems have been marketed for many years and similar to many new technologies have had a mixed press as they have had to deal with a number of teething problems and technical difficulties before becoming accepted within the UK market.

They have within the past few years become the standard within new PFI projects and other large scale investment projects.

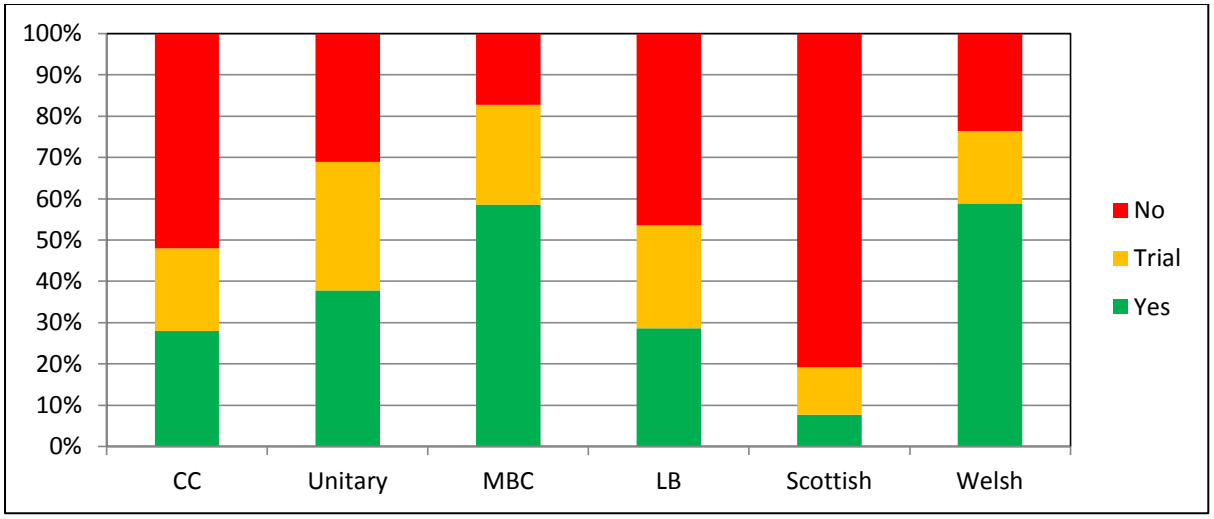


Figure 5 CMS % uptake by authority type

One comment that was repeated was that there would be a greater readiness to invest in a CMS system if there was an open protocol whereby the user could choose from a variety of manufacturers with the same protocol. (Note there is a limited ability to do this).
This view was more prevalent in Scotland which showed the lowest uptake by local councils with only 8% using CMS with a further 11% trialling CMS. In contrast 76% of Welsh councils were using CMS.
48% of county councils were using CMS which may in part be due to the large area of some rural authorities which might make the CMS infrastructure more costly and logistically more complex. 69% of Unitary councils and 54% of London Boroughs are using CMS.

The highest uptake of CMS was in Metropolitan boroughs of which 83% are either trialling (24%) or fully using (59%) CMS.

CMS is used for a variety of purposes as follows:

- Monitoring
- Switching & Dimming
- Metering
- Fault Monitoring
- Reporting KPIs

Q6 Have you amended your lighting policy to create more efficient designs. eg by changing light source or luminaire specifications?

The majority of lighting authorities have amended their lighting policy to take into account the new strategies that they are pursuing as part of their “Invest to Save” initiatives or carbon management plans.

Amended Lighting Policy

Yes	61%
No	39%

At least 6% of lighting authorities do not have a formal lighting policy.

One of the key aspects of a successful lighting carbon reduction strategy is having a robust lighting policy against which all strategies are undertaken. Lighting authorities should seek to create a policy to protect themselves.

a. Are you designing to a Lighting Class?

The majority of Local Authorities are designing to BS5489-1 and BS EN 13201 lighting classes for new installations, but this is not always adhered to when retrofitting new lamp source types or when using variable lighting levels on existing installations.

The results indicate that 91% of authorities are designing to BS5489 whilst 9% are not. Many authorities are designing to a BS class on new schemes, but resorting to 1 for 1 replacement where the columns are not being replaced. In these cases they often try to get as close to a BS5489-1 class as possible.

Q7 Do you have any future plans to incorporate any / more of the above
a. Expand

The vast majority of councils either have ongoing invest to save strategies or definite plans to expand the strategy. 87% of councils were in this position, with 10% suggesting maybe (but dependent on getting funding) whilst only 3% were saying that they had no plans to extend an invest to save policy.

Q8 What savings are you making?
a. Energy

Of the 170 councils who responded, 51% either did not know the % energy savings or felt that the question was not applicable to their authority at that time as they had not started the energy saving strategy.
Of the councils who responded positively to this question, 28% of authorities reported energy savings in excess of 30% and an additional 19% (47% in total) reported energy savings greater than 20%. At the other extreme, 15% reported 0% energy savings or even an increase in energy consumption.

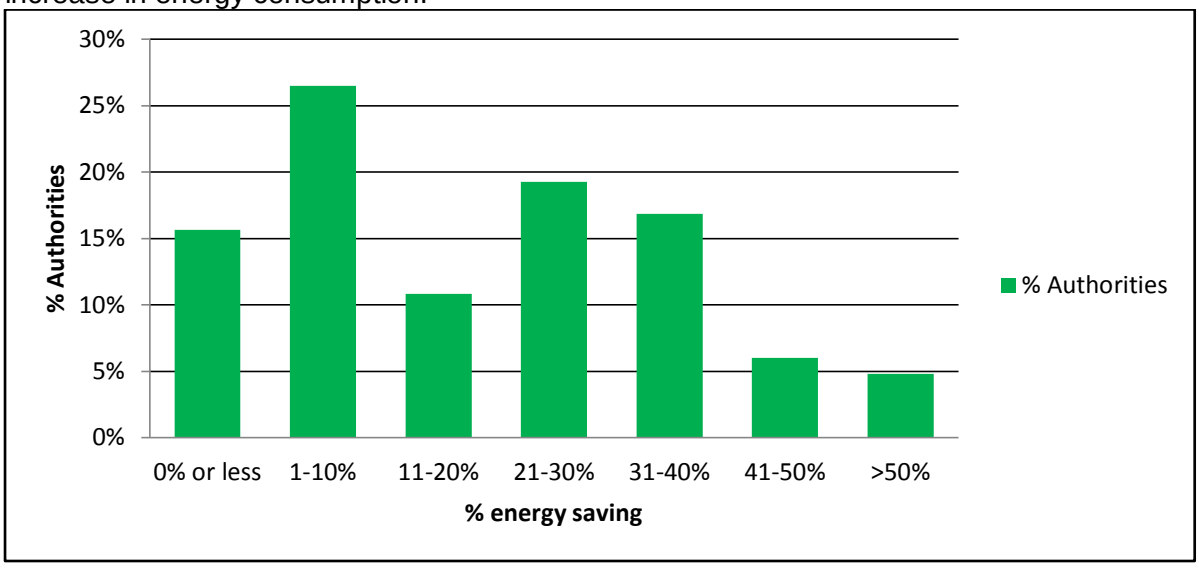


Figure 6 % of authorities reporting energy savings shown as a % of total energy

There are a number of potential reasons cited for this increase:

- A recent investment through say PFI has led to an improvement in lighting levels and quality, but also an increase in energy consumed. (Note. more recent PFIs have

generally been awarded on the basis of an overall reduction in energy consumption being a condition.)

- Little capital funding for energy saving investment coupled with an increasing inventory due to new development.
- Increasing energy due to more accurate recording of inventory and consumption
- UMSUG codes reflecting energy usage more accurately

Many of the respondents mentioned the difficulty of accurate predictions due to the above points creating a fluid baseline.

b. Budgetary

Of the 44 councils that were able to put an approximate or exact value on the budgetary savings from their revised policy they are split into ranges as shown on the attached chart.

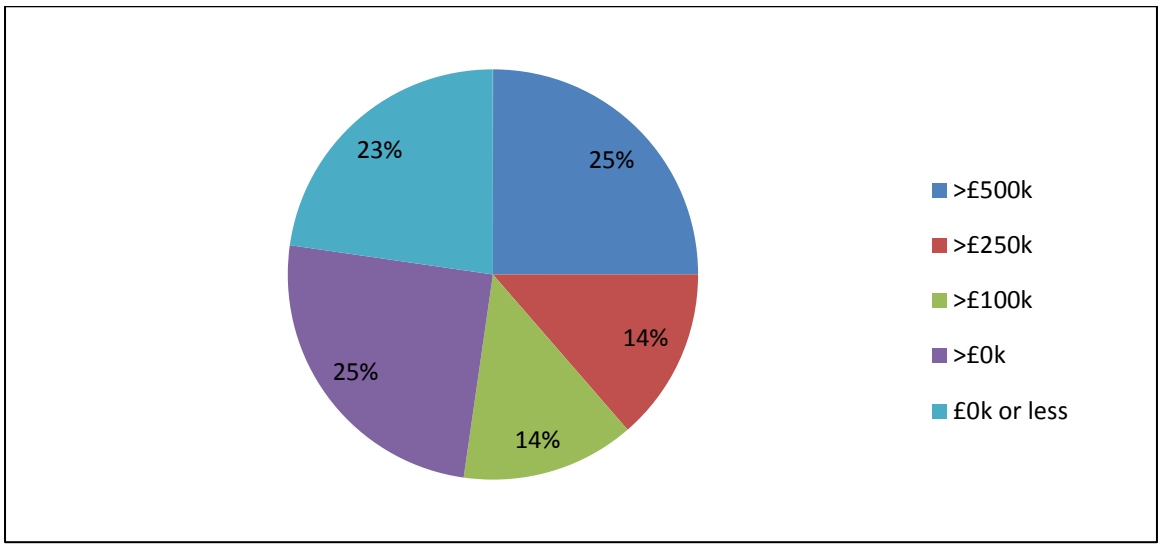


Figure 7 - % of authorities reporting budgetary savings in given ranges

Q9 What other benefits arise from this policy?

Some of the responses to this question were that there were no additional benefits or that the question was not applicable. A future survey could switch the question to “which of the following benefits of an invest to save policy are applicable to your council?” to achieve a greater number of responses. However this approach maybe provides a more reliable response as the respondent has to think about the benefits rather than tick boxes.
There were 55 positive respondents providing input to 77 responses which are listed on the table below. The greatest perceived benefit was ”Reduced Maintenance” and the related benefit of “Improved Reliability”

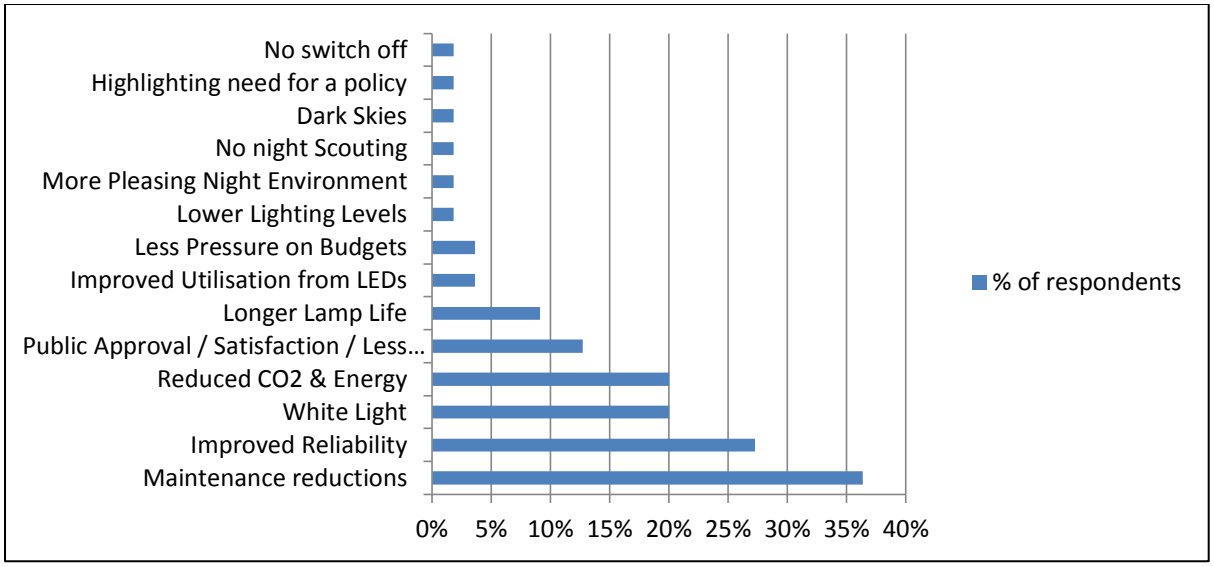


Figure 8 55 respondents provided 77 positive responses to the question of additional benefits from their energy reduction policy

Q10 How do you communicate to the residents?

Communication varies from nothing to a widespread consultation. Generally if the communication is good and comprehensive it will lead to fewer complaints when the schemes are initiated. The most used methods of communications are:

- Letter Drop
- Questionnaire
- Web-site
- Parish / Town / Community Councils
- Roadshows
- Posters
- Open Meetings
- Press Releases
- Forums

Q11 What consultation process did you use?

The main consultation processes adopted by lighting practitioners within councils was to consult with the following stakeholders:

- Police
- Road Safety Officers
- Elected Members
- Parish / Town / Community Councils
- Highways Engineers
- Carbon Management Board

Q12 What issues have arisen & do you have any statistics to back up policy change?

a. Any change in crime stats?

There was no evidence of any authority claiming that they had an increase in crime rates following a reduction in the lighting. On the contrary many authorities claimed that crime had reduced following a part night light installation policy. There is no evidence to suggest that the lighting was directly attributable to the reduction.

b. Any change in accident stats?

There is no evidence to suggest that there is an increase in accidents, however there are well documented cases in 2 authorities where it has been suggested that the lack of street lighting was a contributing factor.

c. Any resident complaints?

The evidence suggests that where there is good consultation and sound reasoning behind lighting decisions, then the public are more likely to accept them without too much complaint. However there is also no doubt that many local authorities have received record numbers of complaints regarding part night lighting. In particular Powys had an estimated 5000 complaints when they initially started their switch off policy. At the time of writing Hertfordshire CC have an on-line petition calling for the Part Night lighting to be stopped and there are over 5000 signatures. There was an earlier petition in favour of the part night lighting which obtained 65 signatures. In Northamptonshire there were a large number approximately 4500 appeals against the switch off which were assessed and dealt with by the authority resulting in 1000 appeals being withheld and lighting re-instated for those specific locations.

Q13 A number of Authorities have reversed the decision to Switch Off. Is this something that you have done or would envisage doing?

Of those authorities that have undertaken permanent all night switch off of the street lighting, 47% would consider re-instating the lighting at a later date, or have already re-instated some lighting.

Of those authorities with a part night lighting policy, there are 24% who have either reversed or are in the process of reversing some or all of the locations. The consideration of the reinstatement of all night lighting in some locations follows pressure from residents, councillors, police, or changes in the risks.

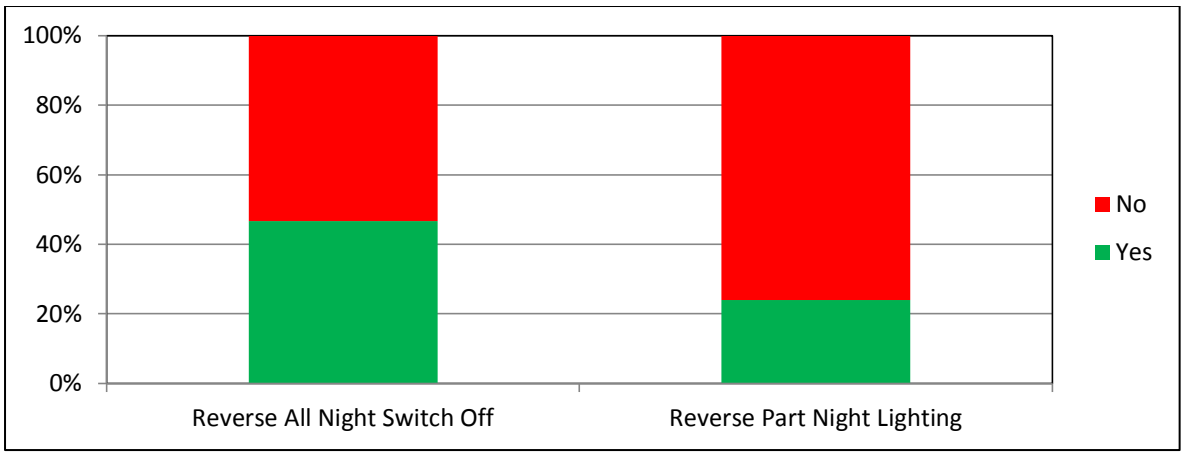


Figure 9 Authorities that have or would consider reversing decisions on switch off

One of the drivers for reversing such decisions is if capital investment increases such that the authority can replace the part night lighting with a variable lighting installation which consumes the same or less energy.

Conclusion

The research highlights the benefits that can accrue to local authorities and other asset owners by following an Invest To Save approach to the management of public lighting assets and using technical advice from competent persons to identify the options and inform the decision making process.

Asset owners considering changes to their management of public lighting should follow the main points as set out in the Executive Summary and Checklist for Local Authorities / Asset Owners set out at the front of this guidance document. In this way there will be a clear auditable trail that reasonable steps have been taken to manage the public lighting asset in an informed, responsible and sustainable way and less likelihood of disenfranchising the residents and other stakeholders.

Appendix 1 – Other Sources of Reference

Lighting and Accident Reduction

RoSPA

Driving outside of daylight hours is more dangerous – only a quarter of all travel by car drivers is between the hours of 7pm and 8am, yet this period accounts for 40% of fatal and serious injuries to the same group. Pedestrians and vulnerable road users suffer from decreased visibility in the dark too. For these reason, ways of reducing the risk to all road users during the hours of darkness must be found.

A study for the Department for Transport found that road safety was perceived as a key benefit for street lighting improvement. In the study, 73% of respondents agreed that 'better street lighting would improve the safety of children', and 63.8% agreed that 'improved street lighting would lead to fewer accidents on the roads'. As well as the public perception that better lighting improves safety, research that compares the quality of road lighting to accident reduction, found that it improves safety.

The most comprehensive study of street lighting to date was carried out by the Cochrane Collaboration which performed a systematic review of the literature and found 17 studies on the introduction of street lighting. The author's conclusion from analysing the studies was "street lighting can prevent road traffic crashes, injuries and fatalities. However, further well designed studies are needed to determine the effectiveness of street lighting in middle and low-income countries."
The presence of lighting not only reduces the risk of traffic accidents, but also their severity. Surveys have shown that the public are in favour of street lighting as a way of improving road safety and that, if anything, it needs to be improved in some areas.

There are economic and environmental reasons why some organisations may wish to reduce the amount of lighting. However there are safety reasons why lighting needs to be available. In some locations, a reduction in lighting quality may not increase the risk of an accident. However, there is the danger that an unconsidered removal or reduction in quality could actually increase accidents and their severity.

Therefore, when considering removal or dimming of lights, location based traffic and accident evidence should be assessed. Accident rates should be monitored to ensure that sacrificing the quality of lighting does not unduly increase the risk. Increases in risk may ultimately lead to lives being lost.

References:

1. Night-time accidents, a scoping study; Report to the AA Trust; H. Ward et al, UCL

2. The value of improved street lighting in rural areas; Ken Willis et al, Centre for Research in Environmental Appraisal & Management, University of Newcastle upon Tyne, October 2003

3. Beyer FR, Ker K. Street lighting for preventing road traffic injuries. Cochrane Database of Systematic Reviews 2009, Issue 1. Art. No.: CD004728. DOI: 10.1002/14651858.CD004728.pub2

4. The relationship between the level of public lighting and traffic safety; a supplementary literature study, D.A.Schreuder. R-88-10. Leidschendam, SWOV, 1988

5. Research on the interrelation between illuminance at intersections and the reduction in traffic accidents; H Oya et al; The Lighting Journal, Vol 68 pp 14-21

6. Street lighting and road safety on motorways; A.A. Vis D-94-18, SWOV 1994

7. Road traffic accidents: the impact of lighting; I Murrey et al, The Lighting Journal, Vol 63 pp 42-46

8. Road traffic casualties: understanding the night-time death toll; S Planis et al, Injury Prevention Vol 12 Issue 2 pp125-128

9. Risk compensation - the case of road lighting; T Assum et al, Accident Analysis and Prevention, Vol 31, pp 545-553

Further information is available at
http://www.rospa.com/roadsafety/adviceandinformation/highway/street-lighting.aspx

The Highways Agency also produce information in their TA49/07 document and the DfT at http://www.dft.gov.uk/webtag/documents/expert/pdf/unit3_4_1-accidents-05-12.pdf

Lighting and Crime

A number of research projects have been carried out – in particular for the Home Office. Some of these are referenced below:

1. David P. Farrington and Brandon C. Welsh 2002 - Home Office Research Study 251 - Effects of improved street lighting on crime: a systematic review - http://webarchive.nationalarchives.gov.uk/20110218135832/rds.homeoffice.gov.uk/rds/pdfs2/hors251.pdf
2. PAINTER, K. A. and FARRINGTON, D. P. (2001b), 'The Financial Benefits of Improved Street Lighting, Based on Crime Reduction'. Lighting Research and Technology, 33, pp 3-12.
3. Painter, K. A. & Farrington, D. P. (2001b) The Financial Benefits of Improved Lighting, based on Crime Reduction, International Journal of Lighting Research and Technology
4. Painter, K. A. & Tilley, N. (1999) Surveillance of Public Space: CCTV, Street Lighting and Crime Prevention, Mansey, N.W.: Criminal Justice Press
5. PAINTER, K. A. (1996), 'Street Lighting, Crime and Fear of Crime: A Summary of Research', in T. H. Bennett, ed., Preventing Crime and Disorder: Targeting Strategies and Responsibilities, (pp. 313-351). Cambridge: Institute of Criminology, University of Cambridge.
6. PAINTER, K. A. and FARRINGTON, D. P. (1997), 'The Crime Reducing Effect of Improved Street Lighting: The Dudley Project', in R. V. Clarke, ed., Situational Crime Prevention: Successful Case Studies, 2nd edn. (pp. 209-226). Guilderland, N. Y.: Harrow and Heston.
7. PAINTER, K. A. and FARRINGTON, D. P. (1999a), 'Improved Street Lighting: Crime Reducing Effects and Cost-Benefit Analyses', Security Journal, 12 (4): pp. 17-32.
8. PAINTER, K. A. and FARRINGTON, D. P. (1999b), 'Street Lighting and Crime: Diffusion of Benefits in the Stoke on Trent Project', in K. A. Painter and N. Tilley, eds., Surveillance of Public Space: CCTV, Street Lighting and Crime Prevention (pp. 77-123). Monsey, N. Y.: Criminal Justice Press, in press.
9. PEASE, K. (1999), 'Street Lighting and Crime: A Literature Review', in K. A. Painter and N. Tilley, eds., Surveillance: Lighting, CCTV and Crime Prevention. Monsey, N. Y.: Criminal Justice Press, in press.
10. WELSH, B. C. and FARRINGTON, D. P. (2000), 'Monetary Costs and Benefits of Crime Prevention Programmes', in M. Tonry, ed., Crime and Justice, vol. 27. Chicago: University of Chicago Press, in press.

Appendix 2 – Local Authority Questionnaire

Q1 The Carbon Reduction Commitment Energy Efficiency scheme places an obligation on Local Authorities to improve energy efficiency. Street Lighting is one area affected by the scheme. How is your Authority tackling the issue?

Q2 Have you any locations where you have permanent switch off or removal of lighting?
a. If yes, what criteria do you use for determining which units?
b. How many?

Q3 Have you tried Part night Switch Off of lighting?
a. If yes, what criteria do you use for determining which units?
b. How many?

Q4 Have you tried Variable Lighting Levels?
a. If yes; what criteria do you use & timescales?
b. How many?

Q5 Have you tried CMS?
a. If Yes, how do you use it?

Q6 Have you amended your lighting policy to create more efficient designs. e.g. by changing light source or luminaire?
a. Expand
b. Are you designing to a Lighting Class?

Q7 Do you have any future plans to incorporate any / more of the above
a. Expand

Q8 What savings do you make?
a. Energy
b. Budgetary

Q9 What other benefits arise from this policy?

Q10 How do you communicate to the residents?

Q11 What consultation process did you use?

Q12 What issues have arisen & do you have any statistics to back up policy change?
a. Any change in crime stats?
b. Any change in accident stats?
c. Any resident complaints?

Q13 A number of Authorities have reversed the decision to Switch Off. Is this something that you have done or would envisage doing?

Appendix 3 – DfT / Highways Agency Response to FoI request Nov 2012

The following is a response from the DfT to a Freedom of Information request in November 2012

Supporting the Government's wider agenda on reducing carbon emissions, motorway lighting was first switched off between the hours of midnight and 5am in 2009, in the Highways Agency's South West region, before being extended to other parts of our network. In considering the locations to switch off lighting, the Agency takes an evidence-based approach which includes considering the latest research into the safety benefits of motorway lighting and undertaking safety assessments of locations. "

Midnight switch off sites
(Lighting switched off between midnight and 5am.)

- M4 between junctions 21 and 22, near Bristol (March 2009; 2.9 miles)
- M5 between Junctions 29 and 30, near Exeter (April 2009; 1.4 miles)
- M27 between junctions 7 and 8, near Southampton (April 2009; 2.4 miles)
- M2 between Junctions 3 and 4, near Chatham (May 2009; 5.3 miles)
- M4 between Junctions 7 and 9, near Maidenhead (June 2009; 2.7 miles)
- M4 between junctions 11 and 12, near Reading (June 2009; 3.0 miles)
- M6 between Junction 27 and 29 in Lancashire (July 2010; 9.5 miles)
- M6 between junctions 26 to 27 in Lancashire (February 2011; 1.2 miles)
- M5 between junctions 2 and 4, to the west of Birmingham (February 2011; 8.0 miles)
- M1 between junction 16 and Watford Gap services (February 2011; 6.0 miles)
- M6 between junctions 21a and 23, near Newton-le-Willows (March 2011; 2.5 miles)
- M5 between junctions 4a and 6, near Worcester (March 2011; 10.0 miles)
- M6 between junctions 31 and 31a in Preston (March 2011; 2.0 miles)
- M54 from junction with M6 to junction 2 near Wolverhampton (March 2011; 5.0 miles)

Lighting was permanently switched off in the following sites

- M58 between junctions 4 &6, near Skelmersdale in Lancashire (March 2011; 3.8 miles)
- M65 between junctions 7 and 10, west of Burnley (March 2011; 5.5 miles)
- M66 between junctions 1 and 4, near Bury (March 2011; 6.6 miles)
- M1 between junctions 10 Luton and junction 13 Milton Keynes (August 2011; 15.0 miles)
- M4 between junctions 20 and 22, near Almondsbury (March 2012; 5.3 miles)
- M48 junction 1 at Aust (March 2012)
- M1 between junction 13 and its Northamptonshire border (September 2012; 13.0 miles)
- M6 between junctions 15 and 16, near Stoke-on-Trent (September 2012; 9.9 miles)

In total midnight switch off is in place on nearly 62 miles of our motorway network, with permanent switch off in place on more than 59 miles of our network.

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