

**Report for Defra**

**A review of local authority road lighting initiatives aimed at reducing costs, carbon emissions and light pollution**

Status: Final

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## 1. EXECUTIVE SUMMARY

This review of local authority road lighting initiatives was commissioned by Defra's Statutory Nuisance team in response to one of the recommendations contained in the Royal Commission on Environmental Pollution's (RCEP) report "*Artificial Light in the Environment*". The RCEP report made reference to road lighting trials being undertaken by local authorities in the UK that have been reducing or turning road lights off. This report has been produced following a review of fifteen out of twenty five such initiatives identified in England and Wales.

The overall aim of the review was to examine the local authority road lighting trials and initiatives and draw out the lessons learnt.

Local authorities have implemented these initiatives in response to economic pressures such as rising energy prices and environmental concerns about wasted energy and the effects of carbon emissions and light pollution. Changes have been made to the way they deliver public road lighting services by:

- switching selected road lights off;
- lighting roads for part of the night only;
- dimming the level of lighting during the early hours of the morning;
- reducing the "burning" time of lamps in the evening and early morning; and / or
- using new and evolving technologies such as a central management system (CMS) or light emitting diodes (LED).

These initiatives have the potential to provide a range of benefits including substantial financial savings to local authorities, reduced carbon emissions and reduced light pollution. However, the benefits need to be considered in the context of the important role that road lighting plays in terms of assisting traffic safety and helping to reduce crime. Local authorities have needed to carefully consider the impacts of proposed changes on these issues and adopt appropriate management strategies prior to, during and post implementation. These strategies have included the use of measures such as exemption criteria, risk assessments and active engagement with stakeholders.

From this review, it is evident that there are a range of options and tools available to local authorities as they consider how best to respond to the growing economic and environmental pressures on the way they deliver their public road lighting services.

It is hoped that the information contained within this report may inform local authorities which face similar challenges in the future, in identifying some of the key issues that may affect their particular public road lighting service and assist in the process of implementing changes appropriate to their circumstances.



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## 2. INTRODUCTION

### 2.1. Background

In November 2009, the Royal Commission on Environmental Pollution published its short report “*Artificial Light in the Environment*”<sup>1</sup>. The report set out the Royal Commission’s concerns about the relatively un-researched effects of outdoor artificial light on society and the natural environment. The report made a number of recommendations aimed at addressing these issues through future central and local government policy development, research and practical initiatives.

One of the recommendations contained in the report suggested

*“that local authorities and others responsible for the provision of road lighting should pay careful attention to the outcome of the trials currently under way to examine the impact of reducing or turning off lighting in quieter areas where there is unlikely to be any significant use of the roads by pedestrians or road traffic and that they should consider what lessons they can draw from them to help minimise negative impacts”.*

The Government responded<sup>2</sup> positively to the report and stated that it would encourage the collation and dissemination of such information. Defra commissioned this review pursuant of its role of ensuring future relevant Government policy development suitably considers the impact of outdoor artificial lighting.

From the outset of this review, it was evident that the road lighting trials and initiatives have prompted a range of views from stakeholder groups both in favour and against such action. Implementation of such initiatives has the potential to deliver positive benefits to society and local communities in terms of the reduction in the cost of public road lighting services, reduction in energy use and carbon emissions and reduction of light pollution. However, road lighting and lighting of public amenity areas provide significant benefits to society and local communities in terms of assisting traffic safety and helping to reduce crime. Striking a balance between these two requirements requires careful consideration and management.

This report presents a review of fifteen local authorities responsible for the provision of public road lighting and their experiences of trialling or implementing changes to the way they deliver their road lighting services in response to changing economic, societal and environmental pressures.

The road lighting trials and initiatives being implemented by the fifteen local authorities include:

- switching selected road lights off;
- lighting roads for part of the night only;
- dimming the level of lighting during the early hours of the morning;
- reducing the “burning” time of lamps in the evening and early morning; and
- using new and evolving technologies such as a central management system (CMS) or light emitting diode (LED) lights.

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<sup>1</sup> The Royal Commission on Environmental Pollution, “Artificial Light in the Environment”, November 2009.  
[http://www.rcep.org.uk/reports/sr-2009-light/documents/RCEP\\_artificiallight.pdf](http://www.rcep.org.uk/reports/sr-2009-light/documents/RCEP_artificiallight.pdf)

<sup>2</sup> Government Response to the RCEP Report Artificial Light In the Environment, March 2010  
<http://www.defra.gov.uk/environment/quality/local/nuisance/light/documents/rcep-artificial-light-report.pdf>



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This report examines the drivers that have prompted these changes to public road lighting services, the issues which they have needed to consider and address before, during and post implementation and the approaches they have used to assist in the aim of achieving positive outcomes for both the local authorities and the communities they serve. Whilst it has not been possible to carry out a full cost benefit analysis of the initiatives, the review has identified some of the more common elements which have been considered by the local authorities.

Details of some of the local authority initiatives reviewed have been highlighted within the report to provide practical examples of some of the issues discussed.

It is hoped the information contained within this report may inform local authorities which face similar challenges in the future by sharing the lessons learnt so far.



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## **3. METHODOLOGY**

### **3.1. Introduction**

The review was divided into three distinct parts:

- identification of local authorities;
- desk-top study; and
- local authority discussion group.

### **3.2. Identification of Local Authorities**

Twenty five local authorities across England and Wales were identified from press articles and stakeholder websites such as the British Astronomical Association's Campaign for Dark Skies. Initial discussions were then held with each of the local authorities about their particular trial or initiative. Fifteen local authorities in England were subsequently identified as having undertaken relevant initiatives and able to provide further information about them.

### **3.3. Desk-top Study**

Having received information from the local authorities, a desk-top study was carried out and, as a result, a number of key issues were identified including:

- key drivers for change for each of the local authorities;
- factors considered by each local authority;
- management measures adopted to assist implementation of the respective initiatives; and
- cost and benefits.

### **3.4. Local Authority Discussion Group**

On the 19<sup>th</sup> January 2011 a meeting was held at the Defra offices in London where representatives from thirteen out of the fifteen local authorities who were able to attend discussed their particular initiatives and shared their experiences in further detail.





## 4. TYPES OF INITIATIVES

### 4.1. Introduction

The types of initiatives and trials implemented by the local authorities consist of one, or a combination of:

- switching selected road lights off;
- lighting roads for part of the night only;
- dimming the level of lighting during the early hours of the morning;
- reducing the “burning” time of lamps in the evening and early morning; and
- using new and evolving technologies such as a central management system (CMS) or light emitting diode (LED) lights.

A summary of the local authority initiatives has been provided at the end of this section in **Table 4.1**.

### 4.2. Road Lighting Switch Off

This involves the switching off of road lights at selected locations and the removal in certain circumstances of the lighting columns.

#### **Buckinghamshire County Council**

Buckinghamshire County Council commenced a three year Energy Saving Trial in 2007 which initially involved switching off street lights at 7 sites across the county; this increased to 46 sites in 2008 to a total of 1,627 street lights. Any site that was subject to a speed limit of 30 mph was not considered as part of the trial.

Over the period of the trial, the council has monitored and evaluated information from various sources such as injury collision data from Thames Valley Police, see **section 7.4**, regular meetings were held with the police to discuss any community safety or antisocial behaviour issues and quarterly inspections of the general condition of enhancement measures, see **section 7.7**, implemented have been undertaken. The council also receives regular feedback and correspondence on the trials from members of the general public, see 7.6

Although the trial will not be completed until 2012, interim results are positive and the council reports continuing achievement of the original aims of the trial in reducing energy consumption and associated energy costs and reducing carbon emissions and light pollution, see **Summary Table 8.1**. Again, although the trial is not complete, comparison of collision numbers before and after the trial shows a general reduction overall.

#### **Leicestershire County Council**

Leicestershire County Council is responsible for approximately 67,000 road lights and 12,000 illuminated signs. In April 2010, the council commenced a four year programme of reducing street lighting. The programme involved a range of initiatives including switching off approximately 1,000 lights in a small number of rural locations, part-night lighting, see **section 4.3**, approximately 40,000 lights in residential areas and dimming, see **section 4.4**, approximately 2,000 lights on urban through routes.

For every area chosen for inclusion, see **section 7.2** and **Appendix 1**, in the programme, a risk assessment, see **section 7.3**, was completed and consultation exercise, see **section 7.6**, carried out.

When the initiative is fully implemented, it is projected to save approximately £700,000 per annum and carbon savings of 3,000 tonnes per annum, see **Summary Table 8.1**.



#### Nottinghamshire County Council

In October 2010, Nottinghamshire County Council commenced a four year programme of street lighting energy and cost saving. The project was initiated in response to budgetary pressures but also issues of carbon reduction and light pollution (sky glow), see **section 5**.

Nottinghamshire's lighting stock totals approximately 90,000 road lights and 15,000 illuminated signs which currently costs approximately £7.9m to operate annually. The programme was designed to achieve annual cost savings of approximately £1.25m annually and estimated annual carbon savings of 5,800 tonnes CO<sub>2</sub>, see **Summary Table 8.1**.

The programme involved switching off lights that were deemed unnecessary; part-night lighting, see **section 4.3**, in residential areas; dimming of lights, see **section 4.4**, on main roads during periods of darkness when traffic flows are lower and lower levels of lighting would not affect road safety and more recently trimming on part-night lighting photo electric cell units.

All street lights have been considered but each site is subject to a risk assessment, see **section 7.3**, to determine whether the lights should remain on for reasons of safety or crime prevention. This would be followed by a consultation exercise, see **section 7.6**, to commence prior to confirmation of implementation.

### 4.3. Part-night Lighting

This involves the switching off of road light during certain periods of the night typically by the use of a part-night photo electric control unit (PECU). Road lights may be switched off during the early hours of the morning, for example, between the hours of midnight and 05:00am when traffic has significantly reduced on the road.

#### Wokingham Borough Council

Wokingham Borough Council owns and maintains 16,000 street lights across the borough. In June 2009, the council commenced a trial of switching off of 996 street lights between the hours of midnight and 05:30am.

The trial was initiated as part of the council's attempts to reduce energy consumption, carbon emission and costs

The street lights selected for the trial were identified by reference to a range of specific exemption criteria, see **section 7.2** and **Appendix 1**. Taking these criteria into account and, together with safety audits, the council estimated approximately 9,600 street lights could be part-night lit depending on the success of the trial.

It is estimated that the reduction in operating hours of the 996 street lights will save approximately £18,000 per annum energy costs and reduce carbon emissions by about 130 tonnes per annum.

#### Gloucestershire County Council

In February 2009, Gloucestershire County Council commenced a part-night lighting project to switch off approximately 7,000 out of 58,000 street lights between the hours of midnight and 05:30am as part of an initiative to save more than £90,000 (at 2010/11 energy rates) and reduce carbon dioxide emissions by 626 tonnes per annum.

The council used exemption criteria, see **section 7.2** and **Appendix 1**, to determine which lights were suitable for part-night lighting. Each scheme was bespoke to its particular area and was undertaken in consultation, see **section 7.6**, with the parish or town council, local community and Gloucestershire Police.

#### Essex Country Council

In 2007, Essex County Council implemented a pilot scheme of part-night lighting in two districts within the County. All street lights located in the two pilot areas were included unless covered by one or more exemptions, see **section 7.2** and **Appendix 1**. The schemes were implemented following consultation exercises in the two districts, see **section 7.6**, with the police, district councils and local communities. They were then subjected to a detailed risk assessment, see **section 7.3**.

The annual energy consumption of the 120,000 street lighting in the County amounts to approximately 44 million kilowatt hours of electricity which equates to 19,000 tonnes of carbon emissions. The costs of implementing the two part-night schemes was estimated at £140,000 with annual savings of £54,000 and 312 tonnes of carbon dioxide per annum. It was also estimated that extending the scheme across the whole county could realise annual energy savings of between £600,000 and £2m.



#### **Borough of Poole**

More than 18,000 road lights in the Borough of Poole produce approximately 5,000 tonnes of carbon dioxide a year, at an annual cost to the council of around £800,000. The council has set a target to reduce its carbon emissions by 25 per cent by 2013. In December 2009, the council commenced an energy saving trial of part-night lighting in selected areas throughout the borough. The trial comprised 117 lighting columns in residential streets and 30 columns on a main traffic route. These road lights were switched off between the hours of midnight and 06:00am by the use of part-night photo electric control units (PECU).

Estimated annual cost savings and carbon savings from the trials ranged from approximately £15 and 105kgs CO<sub>2</sub> per 70W lamp on a residential street to £28 and 200kgs CO<sub>2</sub> per 150W lamp on a main traffic route.

#### **Leicestershire County Council**

Leicestershire County Council is aiming to convert approximately 40,000 road lights to part-night lighting. Since the commencement of the initiative in April 21,600 road lights have already been risk assessed and 15,000 have been identified as being capable of conversion to part-night lighting. Standard PECUs are being replaced by part-night PECUs. Every replacement part-night PECU also has alternative settings from the conventional 70/35 lux to 55/28 lux, see section 4.5, to reduce the burning time of the lamps in the evening and early morning.

### **4.4. Variable Lighting (Dimming)**

British Standard BS5489-1 2003<sup>3</sup> provides for the ability to vary the lighting provision of a road where demand varies during the course of the night. Dimming technology allows road lights to be dimmed during periods of lower traffic usage, again, typically, around 01:00am - 05:00am.

#### **Leicester City Council**

Leicester City operates a total of 34,000 road lights. In response to rising energy costs and the future requirement to purchase carbon allowances under the CRC scheme, a range of initiatives are being implemented by the council.

These initiatives include the dimming of 2000 road lights fitted with 250W lamps; replacing 756 lamps (250W) with 140W white light lamps; future introduction of a city wide central management system (CMS) and the switching off of selected bollards and replacing them with retro-reflective bollards.

Each of the sites selected for dimming was subject to a risk assessment and dimming levels were set appropriate for the given traffic levels. The estimated savings of the dimming initiative alone are £70,000 and 387 tonnes of carbon per annum, see Summary **Table 8.1**,

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<sup>3</sup> British Standard BS5489, Code of Practice for the design of road lighting - Part 1: Lighting of road and public amenity areas.



#### **Gloucestershire County Council**

In April 2009 and March 2010, the council implemented its street light dimming scheme where high wattage lamps (100-400W) on main roads were dimmed by approximately 35% between the hours of 10:00pm and 05:30am).

It is estimated the scheme will save approximately £172,800 and 806 tonnes of carbon dioxide per annum.

#### **Leeds City Council**

Leeds City Council, under their Private Initiative (PFI), are currently in the process of replacing approximately 80,000 old streetlights throughout Leeds. At the beginning of the initiative, street lighting accounted for approximately 6% or 5,300 tonnes of the total council's Carbon Footprint and the council is working to reduce these levels. The PFI has given the council the opportunity to take advantage of new lantern technologies and introduce white light sources in both rural and urban areas.

In late 2009, Leeds commenced a trial to dim the street lighting on a traffic route in the city initially reducing the light output by about 20% after 9pm and then a further reduction to 50% between midnight and 5am after which the street lights returned to full output. After the trial was completed, the council carried out a survey of residents to determine their perception of the trial.

- 80% of residents had not noticed the reduction in light output;
- 89% of residents thought the dimmed street lighting would have no effect on road traffic accidents;
- 77% of residents thought the dimmed street lighting would have no effect on crime; and
- 79% either had not noticed or felt that the dimmed lights would make no difference to their perception of safety.

## **4.5. Trimming**

Trimming refers to the turning on of road lights later in the evening and switching them off earlier in the morning commonly by the use of PECUs with alternative settings to the conventional ones used for low pressure sodium (SOX) lamps.

Most street lights fitted with PECUs have been set to switch on at 70 lux as the natural lighting levels fall at dusk and off at 35 lux as the lighting levels increase at dawn. These settings allowed time for lamps such as SOX to reach their maximum output. However, modern lamps operated on electronic control gear can reach their full and required lumen output a lot quicker and therefore PECU settings can be reduced to settings such as 55 lux on and 28 lux off.

#### **Oxfordshire County Council**

In April 2007, Oxfordshire County Council commenced the implementation of a council-wide Carbon Management Programme aimed at achieving an 18% reduction in carbon dioxide emissions from 2005/06 levels by 2012 through the implementation of range of initiatives across council activities, including the reduction in energy consumption from street lighting.

The street lighting initiatives include replacement of light sources with more efficient lamps, part-night operation of selected rural roads and parish footway lighting and trimming of new street lighting installations.

Estimated costs savings from the trimming initiatives alone is estimated at £3,500 in year 1 of the programme, rising to approximately £20,000 in year 5, with estimated carbon savings of 275 tonnes cumulative over 5 years.



#### **Dudley Metropolitan Borough Council**

In 2009, Dudley MBC carried out a project on a residential housing development within the Borough to demonstrate the energy saving capabilities of a range of lighting technologies.

The project included the use of a central management system, replacement of high pressure sodium lamps with white light lamps or LEDs allowing a reduction in the lighting class, see **section 6.5.1**, and the trialling of both the dimming and trimming of selected lamps.

The project also included a survey of residents on the estate before and after the trials seeking their views on the various changes implemented.

The results of the project, see **section 6.5.1**, demonstrated the potential benefits in terms of energy cost savings and savings from the reduction in future carbon allowances needed to be purchased under the CRC. The residents' survey also found favourable reactions from the trial.

## **4.6. New Technologies**

In recent years, a number of new technologies have developed to the point where they are now being seriously considered by local authorities. These new technologies include central management systems (CMS) and light emitting diodes (LED).

A CMS has the potential to provide significant improvements to the management of public road lighting providing additional functionality to lighting control such as the ability to remotely switch lights on/off (part-night lighting or trimming) or vary the levels (dimming) according to requirements. A CMS also has the ability to provide remote metering capability and fault detection.

New technologies being used by local authorities also include the use of light emitting diodes (LED). LED technology has advanced rapidly in recent years to the point where they are now being seriously considered as a viable alternative to the conventional lamps.

#### **Cornwall County Council**

As part of a three year Invest to Save<sup>4</sup> programme which commenced in April 2009, street lights across Cornwall are being replaced and new lamps are being installed. The project which was initiated by Cornwall County Council to cover its stock of 48,000 lighting units, has now been expanded to include 3,000 additional units previously owned by the district councils.

The new central management system will enable the council to reduce energy costs and the council's carbon footprint by allowing new lamps to be dimmed to different levels of light or switched off completely during times of lower traffic use such as midnight to 05:30am. The new lamps operate via electronic control ballasts, see **section 6.5.1**, which operate with little or no circuit losses unlike the existing magnetic type which wastes electricity. The new electronic control ballast also has intelligence to monitor the lamp performance and its operating characteristics, letting the control system and administration team know if it has developed a fault.

The council has consulted and sought feedback from key stakeholders such as the police, parish and town councils, local communities and environmental groups.

The project is also contributing to research to evaluate the impact of public lighting on carbon reduction, crime, community safety, quality of life, the environment and policing, known as the Cornwall Project.<sup>5</sup>

<sup>4</sup> Street Lighting – Invest to Save, Institution of Lighting Professionals, 2006

<http://www.theilp.org.uk/uploads/File/Technical/Street%20Lighting%20-%20Invest%20to%20Save.pdf>

<sup>5</sup> The Cornwall Project <http://www.cornwall.gov.uk/default.aspx?page=23842>



### Leeds City Council

In July 2009, a trail of LED street lights was installed on the Tavistock Estate in Leeds. The scheme involved the installation of 8 LED lanterns on one street and 8 conventional lanterns on an adjacent street. The energy consumption per lantern was 52watt. However, whilst the conventional lantern needs to be maintained every 3 years the LED lantern does not require maintenance for 12 years. This was counterbalanced (at the time) with the purchase price of an LED lantern being around 3 times more than the conventional lantern.

Approximately 12 weeks after the installation of the new lights, residents were surveyed and their views were favourable both in terms of the aesthetic appearance and the effectiveness of the LED lighting as an alternative to the conventional lighting.

### Gloucestershire County Council

Over the last 18 months, two trial LED street lighting systems have been installed in Gloucestershire. The first involved the one-for-one replacement of 65 residential 35W low pressure sodium lanterns with LED lanterns operating at 36 circuit watts. Typically these lanterns would have been replaced with high pressure sodium lanterns operating at 96 circuit watts.

The second of these schemes involved the one-for-one replacement of 104 main traffic route 150W high pressure sodium lanterns with LED lanterns operating at 121 circuit watts. The energy savings derived from these two schemes is between 35% to 40% and maintenance regimes for the converted units has extended from an annual visit to one every six years. Those LED trials also include a central management system that will allow flexible management of the asset by allowing remote switching on/off, dimming and fault detection.

### Hampshire County Council

Hampshire County Council's Street Lighting Private Finance Initiative (PFI) commenced in April 2010 and will see the replacement or updating of 150,000 street lights, illuminated signs and bollards in Hampshire with the latest energy efficient equipment during the course of the project offering significant reductions in energy consumption and CO<sub>2</sub> emissions.

Energy consumption has been cut by 2.5m kilowatts per hour (Kw/h) saving the council £181,000 since the PFI began in April 2010. This has been achieved through the introduction of more energy efficient equipment and the roll out of a remote monitoring system which enables better light control and dimming, see **section 4.4**. To date over 6,000 lights have had this new technology fitted.

The first LED lanterns were installed in Hedge End, Hampshire as a trial. These new lanterns, use cutting edge technology to reduce energy consumption by over 50% (in comparison with traditional equipment). Investigations as to how this technology can be used to provide additional cost savings are underway.

The 25-year project offers benefits such as reducing carbon emissions up to 15%, reduced light pollution and targeted lighting in areas of high crime.



**Table 4.1 Summary Table of Local Authority Initiatives**

Local Authority	Type of Initiative					
	Switch off	Part-night	Dimming	Trimming	LED	CMS
Buckinghamshire	✓ 3 year trial (2009-12)					
Cornwall		✓	✓			✓
Dorset		✓				
Dudley			✓ (trial)	✓ (trial)	✓ (trial)	✓ (trial)
Essex		✓				(proposed)
Gloucestershire		✓	✓		✓ (trial)	✓ (trial)
Hackney					✓	✓ (trial) and (proposed)
Hampshire			✓	✓		(proposed)
Leeds		(considering)	✓ (trial)	✓	✓ (trial)	
Leicester City	✓ (proposed on selected bollards)		✓			(proposed)
Leicestershire	✓	✓	✓	✓		
Nottinghamshire	✓	✓	✓			
Oxfordshire		✓		✓	✓	
Poole		✓				
Wokingham		✓ (trial)	✓ (trial)			✓ (trial)





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## 5. DRIVERS FOR CHANGE

### 5.1. Introduction

Local authorities reported that the most significant driver for exploring new ways of delivering public road lighting services was the increasing running costs. Energy prices have increased significantly over the past decade and further rises are anticipated in the future. More recent pressures on local authority budgets due to current economic conditions have only reinforced the need for change.

Increased awareness of the adverse impacts of climate change and the need to reduce carbon emissions were also significant drivers for change. Focus on carbon reduction has gained significant momentum recently, for both economic and environmental reasons, with the implementation of the Carbon Reduction Commitment Energy Efficiency Scheme (CRC), where allowances are purchased by the local authority equivalent to their annual carbon emissions.

Awareness about the effects of wasted energy and light pollution on the environment has led to growing demands for action to tackle obtrusive outdoor lighting. Obtrusive lighting refers to a range of negative effects such as the inability to properly see and observe the night sky, the nuisance impacts on individuals and local communities and the largely un-researched effects of artificial light on the natural environment.

### 5.2. Financing Public Road Lighting Services

With road lighting accounting for a notable proportion of the local authorities' annual budget and with electricity prices rising considerably over the past decade, these have been significant drivers for local authorities to implement cost saving initiatives. More recent pressures due to the current economic climate have reinforced the need to ensure public road lighting services are delivering value for money.

#### **Nottinghamshire County Council**

There are around 90,000 street lights and 15,000 illuminated signs in the County. The electricity bill for street lighting increased dramatically from £1.05m in 2004/05 to an estimated £5.05m in 2010/11.

As detailed in **Table 5.1**, nationally, public road lighting continues to be a significant consumer of electricity and therefore a significant contributor to carbon emissions.





**Table 5.1 Total Consumption Electricity used by Public Administrations<sup>6</sup>**

	Total Annual Consumption (GWh)		
	2007	2008	2009
<b>Total Public Administration</b>	20,087	20,055	19,073
• Public Lighting*	2,223	2,179	2,166
• Other Public Sector <sup>7</sup>	17,864	17,876	16,907
<b>Public Lighting Percentage Consumption of Total</b>	11%	11%	11%

\* Sales for public lighting purposes are increasingly covered by wider contracts that cannot distinguish the public lighting element.

**Table 5.2** shows the increases in electricity prices which has led to substantial increases to the local authority's public road lighting bills.

**Table 5.2 Prices of Electricity purchased by non-domestic consumers<sup>8</sup>**

	Price (Pence per kWh)					
	2004	2005	2006	2007	2008	2009
<b>Average Excluding Climate Change Levy</b>	3.87	4.87	6.37	6.85	7.93	9.06
<b>Average Including Climate Change Levy</b>	4.16	5.15	6.69	7.10	8.20	9.35

## 5.3. Carbon Reduction

### 5.3.1. Carbon Reduction Commitment Energy Efficiency Scheme (CRC)

The Carbon Reduction Commitment Energy Efficiency Scheme (CRC) is a mandatory carbon emissions reporting and pricing scheme covering both public and private organisations using more than 6,000MWh per year of electricity (equivalent to an annual electricity bill of about £500,000) and at least one half hourly meter (HHM) settled on the half hourly market. It came into force in April 2010 and aims to reduce UK carbon emissions. The primary focus is to reduce emissions in non-energy intensive sectors in the UK.

Whether unmetered supply such as road lighting falls under the requirements of the CRC depends on the category of supply. Unmetered supply is split into three categories depending on the method used to calculate electricity consumption for billing purposes, see **Table 5.3**.

<sup>6</sup> <http://www.decc.gov.uk/assets/decc/Statistics/publications/dukes/311-dukes-2010-ch5.pdf>

<sup>7</sup> "Other Public Sector" refers to electricity use in public administration buildings, town halls, central government offices, schools, libraries etc

<sup>8</sup> <http://www.decc.gov.uk/assets/decc/statistics/source/prices/qep341.xls>



These categories are known as:

- dynamic;
- passive; and
- non-half hourly (NHH),

With different local authorities using different categories of supply, the direct relevance of the CRC will vary depending on qualification to the scheme or not. However, it is likely to be a material consideration for the future of energy management of public road lighting services.

**Table 5.3 Categories of Unmetered Supply**

<p><b>Dynamic Supply</b></p> <p>CRC includes unmetered supply such as road lighting as a dynamic supply (including pseudo half hourly metering) and therefore reportable for the purposes of CRC qualification, footprint and annual reporting</p> <p>Dynamic supply<sup>9</sup> “is characterised by the existence of :</p> <ul style="list-style-type: none"><li>• a set of equipment fixed to land that performs a common function (for example, street lighting),</li><li>• one element of the set of equipment is metered (for example a lamp post); and</li><li>• the existing meter point is used as a benchmark to determine the overall supply to the entire set of equipment in a given period.”</li></ul> <p>Pseudo Half-Hourly Metering<sup>10</sup> “is a technique for calculating half hourly electricity supplies where the supply is unmetered”. It is defined as a dynamic supply where it meets the above characteristics.</p> <p>A dynamic supply apportions the un-metered consumption across half hourly periods by reference to the operation of an array of representative PECUs in or by making use of switching times reported by a central management system (CMS)</p> <p><b>Passive &amp; Non-Half Hourly</b></p> <p>An unmetered supply measured on a passive or non-half hourly basis is not reportable for the purposes of CRC qualification or footprint and annual reporting. A passive supply apportions the un-metered consumption using an inventory based estimate of annual burning hours to the daily time of sunrise and sunset.</p>
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## 5.4. Other Environmental Concerns

Light pollution (or obtrusive light) is the general term which refers to the multifarious negative effects which may be caused by artificial lighting. Over the past couple of decades, concerns about the effects of light pollution on local communities have led to growing demands for action to tackle obtrusive outdoor lighting such as:

- sky glow – “A combination of reflected and refracted light from the atmosphere. A major effect of sky glow at night is to reduce contrast in the sky. This is the most pervasive form of light pollution and can affect areas many miles from the original light source.”<sup>11</sup> ; and
- light trespass and the nuisance impacts this may have on individuals and local communities.

<sup>9</sup> Carbon Reduction Commitment Energy Efficiency Scheme, User Guide

[http://www.decc.gov.uk/en/content/cms/what\\_we\\_do/lc\\_uk/crc/user\\_guidance/user\\_guidance.aspx](http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/crc/user_guidance/user_guidance.aspx)

<sup>10</sup> Ibid

<sup>11</sup> Artificial Light in the Environment, RCEP, 2009

[http://www.rcep.org.uk/reports/sr-2009-light/documents/RCEP\\_artificiallight.pdf](http://www.rcep.org.uk/reports/sr-2009-light/documents/RCEP_artificiallight.pdf)



### Essex County Council

In 2005, the county council revised its Street Lighting policy to reflect growing environmental concerns. Measures included the introduction of white light (SON) lighting with downward reflectors in all new schemes and for replacement lighting (as opposed to the old undirected yellow light (SOX) lighting) and a more rigorous approach to evaluating whether street lights are required at all in new developments.

The House of Commons (HoC) Science and Technology Committee produced a report on Light Pollution and Astronomy<sup>12</sup> in October 2003. The Report made recommendations on how light pollution could be controlled without reducing the levels of light needed for safe illumination of urban and rural environments.

One of the recommendations stated: “Light trespass and glare affects astronomers, but it can also affect us all. We are persuaded by the evidence that light trespass is measurable and controllable. We recommend that obtrusive light should be made a statutory nuisance.”

As a consequence of the recommendations contained within the HoC report and, in recognition of the serious impacts on the quality of life of individuals and local communities, “*artificial light emitted from premises which is prejudicial to health or a nuisance*” was brought within the statutory nuisance regime in England and Wales in April 2006, through the Clean Neighbourhoods and Environment Act 2005<sup>13</sup>.

More recently the Royal Commission on Environmental Pollution in their report “*Artificial Light in the Environment*” looked more widely at the effects of light pollution and the relatively un-researched effects of artificial light on the natural environment.

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<sup>12</sup> Light Pollution and Astronomy

<http://www.parliament.the-stationery-office.co.uk/pa/cm200203/cmselect/cmsctech/747/747.pdf>

<sup>13</sup> Public road lighting is not likely to qualify as artificial light statutory nuisance as it unlikely to be located on *premises*.



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## 6. KEY ISSUES

### 6.1. Introduction

Outlined below are key issues considered by the local authorities before, during and post implementation of these initiatives. The range of factors considered cover a range of Social, Technical, Environmental Economic and Legal factors. There was recognition of the careful balance required between the desire for reducing costs, improving energy efficiency and achieving positive environmental outcomes and the important social role that modern public road lighting contributes to maintaining road safety and aiding crime prevention. It is difficult to consider any of the factors in isolation.

### 6.2. Road Safety and Crime

The current British Standard BS5489-1:2003 states that the roles of street lighting as:

*“Road lighting encompasses the lighting of all types of highways and public thoroughfares, assisting traffic safety and ease of passage for all users. It also has a wider social role, helping to reduce crime and the fear of crime and can contribute to the commercial and social use at night of town centres and tourist locations. Road lighting should reveal all the features of the road and traffic that are important to the different types of road user, including pedestrians and police.”*

The local authorities recognised the important role road lighting plays in assisting road safety for all users of the highways including drivers, cyclists, police and pedestrians alike. This was by far the primary consideration for all the local authorities reviewed when assessing their proposals for trialling or implementing the new initiatives.

The British Standard also states:

*“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. Nevertheless, in some limited situations a lighting installation may be completely extinguished during certain periods of the night when usage is very low. Where crime prevention is an important consideration, however, lighting should not be extinguished.”*

Again, the local authorities recognised that road lighting had a role to play in aiding crime prevention. In particular white light has played a useful role in high crime areas. Where street crime is a major problem and CCTV has been installed to aid prosecutions by the police, the use of white light sources with a Colour Rendering Index of  $R_a > 80$  can be advantageous because of the improved differentiation of colours and the subsequent better identification of objects and people.

### 6.3. Location

The type of area / location was a material consideration for some local authorities, not only in terms of road safety and crime prevention as detailed above but also in terms of Environmental Zones. The Institution of Lighting Professionals (ILP) in the publication “Guidance Notes for the Reduction of Light Pollution” makes recommendations on the use of Environmental Zones. Environmental Zones are areas where specific activities take place or are planned and where specific requirements for the restriction of obtrusive light are recommended. Zones are indicated by the zone rating (E1...E4)<sup>14</sup>. The ILP guidance

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<sup>14</sup> CIE ,150 2003, Guide to Limitation of Obtrusive Lighting



recommends that Local Planning Authorities specify the following environmental zones for exterior lighting control within their Development Frameworks.

**Table 6.1 – Environmental Lighting Zones**

Zone	Surrounding	Lighting Environment	Examples
E1	Natural	Intrinsically Dark	National Parks or Protected Sites
E2	Rural	Low District Brightness	Industrial or residential rural areas
E3	Suburban	Medium District Brightness	Industrial or Residential Suburbs
E4	Urban	High District Brightness	Town Centre or Commercial Areas

Where an area to be lit lies on the boundary of two zones, the obtrusive light limitation values used should be those applicable to the most rigorous zone.

British Standard BS5489 makes explicit reference to Environmental Zones to aid the decision making process for local authorities in street lighting design.

**Hampshire County Council**

Hampshire County Council have published a Street Lighting Policy and one of the principles contained within the policy regarding the provision and maintenance of street lighting refers to :

“The avoidance of detrimental environmental impact in terms of the visual appearance of lighting, both day and night, adjacent to and on the highway and the overall impact on the environment in terms of energy conservation and light pollution.”

The policy also makes reference to the CIE/ILP Environmental Zones:

- Zone E1 – The general presumption is that street lighting should not be provided in Zone E1 areas unless the county council or the local lighting authority can demonstrate an overriding road safety issue which cannot be overcome by other means.
- Zone E2 – The general presumption is that street lighting should not be provided in Zone E2 areas unless the county council or the local lighting authority deem it to be in the best interest of the local community from either a road safety or personal security point of view.
- Zone E3 – As a general rule roads shall be lit to the levels originally provided at the time of adoption. For the sake of clarity, replacement columns shall be installed on a 1:4:1 basis with the new columns being positioned at the rear of the footway and on property party lines wherever possible.
- Zone 4 – Generally all zone 4 areas will be lit to the BS relevant at that time.

## 6.4. Economic Factors

The scale and scope of the local authority initiatives have been significantly influenced by economic considerations such as:

- replacing lamps in bulk or burn to extinction;
- replacing PECUs and / or control gear on failure or in bulk;
- implementing a county-wide CMS or implement smaller local trials; or
- considering potential future needs (e.g. introduction of a CMS) or addressing more immediate ones.



All require careful consideration of the capital expenditure and the ability to finance the initiatives; the payback period and future savings.

#### 6.4.1. Capital Costs, Payback Period and Future Savings

Investments such as the purchase of modern lamps and luminaires, part-night photo electric cell units or timers; electronic control gears or dimming technology may amount to a capital investment in the order of thousands or hundreds of thousands of pounds. It was reported that the investment in LEDs as opposed to high pressure sodium (SON) or ceramic metal halide (CMH) lamps significantly raised the purchase cost of lamps and luminaires by up to three times; however, this may change as LEDs become economically more attractive. Implementation of a CMS across the whole of a local authority's geographical area would require significant capital investment in the order of millions of pounds.

Proposed street light switch offs and lighting column removals also entailed capital outlays for enhancement measures as outlined in **section 7.7** in the order of tens or hundreds of thousands of pounds.

The local authorities considered the initial capital funding of investments as one of the biggest challenges despite the potential longer term benefits.

Payback periods typically ranged from between 2-8 years depending on the type of initiative and the scale and rate of implementation. Future monetary and carbon savings from each of the local authority initiatives have been summarised in **section 8**.

#### 6.4.2. Methods of Financing Initiatives

Obtaining the funding to support initiatives requires the availability of capital within existing local authority budgets and/or from alternative sources. Below, are examples of the external sources of funding adopted by some of the local authorities to support, primarily, the capital funding of their initiatives.

**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 professional Prudential Code, endorsed by the Chartered Institute of Public Finance and Accountancy. An example includes Cornwall County Council.

**The Private Finance Initiative (PFI)** secures private funding for public bodies in return for part privatisation. PFI allows a public sector body to work with the private sector to provide services on a long-term basis, typically 25-30 years. The private sector takes on the responsibility for providing a public service against an agreed specification prepared by the public sector and carries the responsibility and risks for the work. The public sector typically pays for the project through a series of performance related payments. Examples include Leeds City Council and Hampshire County Council.

**Salix Finance** is an independent social enterprise, a not for profit company limited by guarantee that provides grants and loans to public sector bodies. It provides funding for proven technologies which are cost effective in saving CO<sub>2</sub> and will enable any further energy saving technologies to work at their best. Examples include Gloucestershire County Council and Leicester City Council

**Regional Improvements and Efficiency Partnerships (RIEP) Funding.** RIEPs are partnerships of local authorities including fire and rescue authorities and other public bodies



that work together at regional and sub-regional levels to support efficiency, performance improvement and innovation, including meeting national and regional improvement needs. An example includes Leicester City Council

### 6.4.3. Passive or Dynamic Supply

Given the requirements of the CRC, as detailed in **section 5.3.1**, more detailed consideration was also given by local authorities to the type of unmetered supply chosen for their public road lighting.

Under a passive or non-half hourly supply, there is no need to purchase carbon allowances; however, this means it is arguably more difficult to manage energy use efficiently and lacks any reporting capabilities.

Under a dynamic supply, if the local authority qualifies for the CRC, there is a requirement to purchase carbon allowances. However, accurate burning hours from a PECU array are available, financial benefits from part-night, trimming and dimming are better realised and better information on energy usage is also available.

Further advice on the management and purchase of electricity supply can be found in the UK Lighting Board's guidance document "Street Lighting Energy - The Lighting Practitioners Guide to Electricity Supply" which explains *"the various roles and responsibilities in the electricity supply industry, together with information intended to assist local decisions on the most appropriate energy procurement and management options."*

### 6.4.4. CRC Carbon Allowances

Local authorities participating in the CRC will have to monitor their carbon emissions and purchase allowances for each tonne of CO<sub>2</sub> they emit. The more CO<sub>2</sub> the local authority emits, the more allowances it has to purchase. So there is a direct financial incentive to reduce their carbon emissions.

## 6.5. Environmental and Technical Factors

As previously highlighted, growing awareness and concern about the effects of light pollution has meant that the local authorities have given consideration to the negative environmental impacts of road lighting and how best these may be reduced through their initiatives.

### 6.5.1. Energy Efficiency and Reduction of Carbon Emissions

Irrespective of whether the local authorities participate in the CRC, the improvements in energy efficiency and reduction of carbon emissions were arguably a prerequisite to any of the initiatives.

Modern lamps such as high pressure sodium (SON) or ceramic metal halide (CMH) lamps and LEDs have significantly better luminous efficacy than, for example, high pressure mercury lamps.

Old electromagnetic control gears are typically made up of a ballast, capacitor and ignition switch and have conventionally been used for discharge lamps such as SON and CMH. Electronic control gear is now widely available and arguably a superior alternative to the old electromagnetic control gear in terms of efficiency and functionality, replacing all the aforementioned parts.





Conventional 70/35 lux PECUs installed on old low pressure sodium (SOX) road lights, allowed the time needed, up to 15 minutes, for the lamps to reach their required lumen output. Modern lamps such as SON and CMH, combined with electronic control gear, do not need such a long period to reach their required lumen output. PECUs with, for example, a setting of 55/28 lux, 35/16 lux or 20/6lux, reduce the burning hours of lamps between 5-12 minutes each evening and morning compared to 70/35lux cells. Over a year and, if installed on a significant number of road lights, this can provide a significant saving in the number of burning hours and therefore in reduced carbon emissions and future replacement costs.

#### **Dudley Metropolitan Borough Council (Bluebell Road Trial)**

The 2009 trial carried out by the council on a residential housing development, demonstrated the energy saving capabilities of a range of lighting technologies, as detailed below:

Measured electricity consumption over a 30 day period of 15 road lights, 60w CPO

Measured first burning full night; 70 lux on/35 off then the profile was changed as follows:

- 5 units made dimming only – 70% between 0100-0500
- 5 units made trimming only – 20 lux on/8 off
- 5 units made dim and trim

The results were as follows:

- On 70 lux/off 35 – 30 day average consumption 19,843w per unit
- Trimmed only – 18,978w (reduction of approx. 4%)
- Dimmed only – 17,172w (reduction of approx. 14%)
- Trimmed and dimmed – 16,571w (reduction of approx. 17%)

Given an average unit cost for electricity:

- Savings were estimated of between 86p and £3.26 per year per 60w road light

or, if extended to the entire inventory:

- Between £56,000 and £210,000 per year in energy cost alone
- Carbon credit purchase savings between £4,350 and £16,300

(based on an inventory of total load 15.34Gw)

British Standard BS5489:2003 recommends the use of lamps with a Colour Rendering Index (Ra) of greater than 20 for urban and residential roads. A lamp with a colour rendering index of 100 provides perfect rendering properties. Low pressure sodium (SOX) lamps do not have any colour rendering properties and are therefore not recommended for use in road lighting. The British Standard also allows for a drop in the lighting class in residential roads where white light, with a colour rendering (Ra) greater than 60, is installed. A lower lighting class therefore provides for a lower energy use.

The British Standard also provides for the ability to vary the lighting levels of a road where demand varies during the course of the night. Dimming technology fitted to luminaires allows street lights to be dimmed during periods of lower traffic usage, thereby saving energy.

CMS remote monitoring capability of fault detection can provide considerable savings by removing the need for regular night inspections (scouting). CMS energy monitoring may also help inform future lighting strategies and financial planning





## 6.5.2. Reduction in Light Pollution

A number of the considerations detailed above, also have a positive impact on reducing light pollution:

- dimming of lights during periods of lower traffic usage will avoid over-lighting of roads and amenity areas; and
- modern lamps allow better control of light and improved optics and luminaires direct light to shine where it should rather than potentially give rise to waste and obtrusive lighting such as sky glow or light trespass to neighbouring properties. The light from low pressure sodium (SOX) lamps is difficult to control and synonymous with the typical orange sky glow from urban areas.

### Leeds City Council

New luminaires and lamps being installed in Leeds under their Private Initiative (PFI) will allow the council to relight Leeds with approximately 8,000 to 10,000 less lights than at present.

## 6.6. Miscellaneous Technical Considerations

In addition to the above, there are a number of other miscellaneous technical issues which were considered by the local authorities.

### 6.6.1. Compatibility and Age of Lamp

If the decision has been made to maintain old low pressure sodium (SOX) lamps, then the options for change may be limited. SOX lamps are compatible with part-night lighting and trimming but not able to be dimmed. Some *older* types of lamps such as high pressure mercury lamps are not compatible with modern electronic control gear. Likewise, some modern lamps work on electronic control gear only.

### 6.6.2. Scope of Dimming

For some local authorities, the option of dimming was limited to road lamps with a wattage of 250 Watts or more in order to gain an acceptable return on investment.

## 6.7. Legal Issues

During the course of considering and implementing their initiatives, the local authorities identified a range of powers, duties and requirements that they needed to be mindful of. Detailed below are some of the applicable legislation.

### 6.7.1. Highways Act 1980

Under the *Highways Act 1980* or, in some instances the *Public Health Act 1985* or the *Parish Councils Act 1957*, local authorities (Highway Authorities) in England are empowered to provide road lighting; however, they do not have a legal duty to do so.



The UK Lighting Board's Well-lit Highways<sup>15</sup> states:

*“Highway Authorities have a duty of care to the road user. Any loss to an individual as a consequence of the inappropriate use of these powers may result in action being taken to recover the loss. Such action could be taken on several grounds:*

- *negligent exercise of power (including failure to use that power). There is no blanket immunity.*
- *action for misfeasance of public office.*
- *breach of the common law duty of care (if it can be established).*

*NOTE: This duty of care does not imply any duty on the Highway Authority to keep the public lighting lit. However, an authority responsible for the maintenance of public lighting should be able to demonstrate that they have systems in place to maintain the public lighting equipment in a safe condition, including the detection of dangerous equipment”*

### **6.7.2. Traffic Signs Regulations and General Directions (TSRGD) 2002**

The *Traffic Signs Regulations and General Directions (TSRGD) 2002* prescribe the designs and conditions of use for traffic signs to be lawfully placed on or near roads in England, Scotland and Wales. Among other matters, the Regulations stipulate requirements for the illumination of the road markings, traffic signs, etc.

### **6.7.3. Electricity at Work Regulations 1989 & BS 7671**

Section 4 (2) of the *Electricity at Work Regulations 1989 (EAW Regulations)* states that:

*“As may be necessary to prevent danger, all systems shall be maintained so as to prevent, so far as is reasonably practicable, such danger”.*

British Standard, BS 7671, *Requirements for Electrical Installations*, relates principally to the design, selection, erection, inspection and testing of electrical installations.

These provisions were deemed to apply where columns still retained their service cable irrespective of whether the road lights were switched off.

### **6.7.4. 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. 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.”*

### **6.7.5. Road Traffic Regulation Act 1984**

A restricted road is a road defined under section 82 of the *Road Traffic Regulation Act 1984* which states:

*“there is provided on it a system of street lighting furnished by means of lamps placed not more than 200 yards apart”.*

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<sup>15</sup> Well-lit Highways, Code of Practice for Highway Lighting Management November 2004, UK Lighting Board  
[http://www.ukroadsliaisongroup.org/lighting/well\\_lit.htm](http://www.ukroadsliaisongroup.org/lighting/well_lit.htm)



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Where the speed limit on a restricted road is 30 mph, there seemed to be no consensus between local authorities, which had each sought their own legal advice on the issue, as to whether the speed limit remained enforceable in the absence of a traffic regulation order when the road lights were switched off.



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## 7. MANAGEMENT MEASURES

### 7.1. Introduction

As identified earlier in this report, implementation of the local authority initiatives has the potential to deliver positive benefits to society and local communities. However, consideration must be given to the potential impacts on traffic safety and crime therefore implementation must be carefully managed.

The local authorities recognised that initiatives such as switching lights off and part-night lighting had the potential to meet resistance from stakeholders with concerns about potential negative impacts on road safety or crime prevention. It was therefore considered essential to engage extensively with relevant stakeholders to enable a better understanding of the proposed schemes to avoid misunderstanding and provide the opportunity to influence the proposals.

Other valuable management tools considered for the initiatives included exemptions and risk assessments, supported by relevant statistical data and site inspections.

Employing these tools iteratively ensured the initiatives, once implemented, were regularly kept under review.

### 7.2. Exemptions

As an initial step in selecting candidate roads for their particular initiatives, a number of the local authorities established a list of exemptions which would effectively rule out locations on the grounds predominantly of road safety or personal safety and security.

Typical exemptions include:

- conflict areas such as roundabouts and junctions;
- high crime areas; and
- roads with high levels of night time accident rates.

A range of examples of exemptions from local authorities which have implemented part-night lighting or switched lights off have been reproduced in **Appendix 1**.

### 7.3. Risk Assessment

When implementing switch off and part-night lighting initiatives in particular, the local authorities found risk assessment a useful tool for identifying, managing and mitigating any identified risks.

The results of the risk assessment would be used to inform initial consultation and communication exercises.

Risks typically assessed by the local authorities included the potential negative impacts on:

- road safety such as increased pedestrian casualties and road traffic accidents;
- criminal activity and personal safety and security; and
- communities' perceived fear of crime.



#### Wokingham Borough Council

The safety audit process of determining part-night lighting involved the following :

- using project partner (council members, police, etc.) selected criteria for safety, each street light was evaluated against the criteria to determine whether part-night operation was appropriate
- crime, road traffic accident data and other incidents were investigated during the trial and, if part-night lighting caused a negative impact, the light reverted to normal operation. Part-night lighting did not show an impact on the crime and road traffic figures during the trial, in fact, both figures fell in that period although this cannot be attributed to part-night lighting alone.

#### Essex County Council Risk Assessment

Essex County Council allocated risks into the following broad categories:

- road and personal safety (including increased crime);
- public perception (including increased fear of crime)
- litigation and liability; and
- technical.

For each risk identified a rationale was provided for the assessments made of probability and impact and mitigation needed to minimise the risk.

## 7.4. Data Collection

To better inform the risk assessment process, a range of statistical information was collected by the local authorities. This included information such as:

- traffic and pedestrian casualties over a period of 3-5 years prior to the initiative;
- crime statistics following discussion and advice from the police; and
- site inspections, see **section 7.5**.

## 7.5. Site Inspections

Site inspections have been carried out by some local authorities (sometimes supported by video recording equipment) to identify site specific issues that need to be addressed prior to implementation, including:

- condition and suitability of existing signage in the areas;
- road surface conditions and road markings; and
- foliage near to the roads/areas

Once the initiatives had been implemented, some local authorities have continued site inspections or adapted existing routine highway inspections to include inspections of, for example, recently installed enhancement measures, see **section 7.7**.



### Buckinghamshire County Council

At all trial sites, a number of factors were considered, including:

- collision history – including an examination of collision types, number occurring during darkness / daylight, contributory factors and how collision numbers at the potential sites compared with numbers at other lit and unlit sites;
- community safety issues – highlighting those areas or premises that may generate pedestrian or vehicle activity particularly during darkness, including specific liaison with the police;
- accessibility issues – highlighting where facilities for public transport, pedestrians or cyclists have been provided or are being promoted;
- review of existing signing, road markings, road studs and other physical features such as visibility, alignment and any overgrown foliage etc.; and
- any other planned works or schemes.

## 7.6. Consultation and Communication

Appropriate consultation and communication with relevant stakeholders were found to be one of the key tools used to manage the changes effectively. Consultation was deemed particularly important for the potentially more contentious proposals of switching lights off and part-night lighting but also where dimming or even changes in lamps and luminaires had been proposed.

Relevant stakeholders consulted included:

- parish and district councils;
- local residents;
- local businesses;
- staff and contractors
- emergency services (police, ambulance and fire and rescue);
- neighbouring local authorities; and
- other stakeholders such as environmental groups.

A range of consultation and communication techniques was employed to ensure all stakeholders were suitably engaged. Methods included:

- resident / stakeholder **meetings**. Meetings were used to provide initial information about the proposals and seek views. Regular follow-up meetings with, for example, the emergency services were used to keep the proposals under review.
- **letters / newsletters** to stakeholders. Advisory letters to stakeholders were used to inform and request opinions. Subsequent to implementation, questionnaires have been used.
- **press releases** through local (and national) media.
- **local authority website**. Dedicated web pages on the councils' websites were a popular form of communication. Web pages have included information such as location of the initiatives, FAQs and electronic feedback forms.



- **staff and contractors.** Given that many of the council employees have day to day contact with the public, it was considered important to ensure that staff and contractors were aware of the initiative and reasons for them; and
- **signage** at the location of the trial / initiatives either on columns or at the entrance/ exit to the areas.

### Gloucestershire County Council

Gloucestershire County Council decided that implementation of part-night lighting (PNL) would only take place where the local (parish or town) council had agreed to participate in the project, and the county council would consult with both the police and local councils to ensure that conversion proposals both addressed and met the individual needs of each local council.

Each local council was written to explaining why the county council wished to convert some of the side road lighting and inviting them to participate in the initiative.

For each local council that wished to participate, an outline proposal was prepared on a large scale map based on the county council's exemption criteria, see **section 7.1.1** and **Appendix 1**, developed for the identification of street lights that should remain operational all night. The plan was then presented to the local council again, explaining why the county council wanted to undertake PNL.

Each plan actually showed the maximum amount of street lights that could be converted to PNL. The plan was left with them for their amendments to be made based on their local knowledge and expertise, also outlining their local needs and concerns.

The saving for each individual Parish in money, energy and CO<sub>2</sub> was also explained. Each PNL costs the council £15.38 to convert (including contractors fee). Savings were reinvested into the street lighting service enabling new initiatives to be trialled e.g. LEDs

The county council considered it very important to consult the local council, communities and the police as there was no "one-size-fits-all" plan; each community and also areas within each community had many different and varied needs. Consultation identified these needs and each proposal reflected that. Communities appreciated being consulted and, importantly, that their comments were taken into account

The council's media team was used to help promote PNL and invite local residents to attend all open meetings via newspapers, radio and local television.

This was then followed up by a second Draft Plan and local councils were then encouraged to involve their local communities; this was either achieved by holding an open meeting chaired by the county council, or via newsletters (from the Parish), informing residents of the plan which was available for viewing at their local parish council's offices.

From this, a final draft plan was then produced and sent to the police for their comments/ amendments. The county council has, to date, only been asked to defer PNL in 1 area due to persistent anti-social behaviour. This has now been resolved and PNL has been rolled out.

Work was ordered and completed, as much as possible within the cyclical maintenance programme. To date, a very small number of requests has been received to turn lights back to all night lighting outside individual homes (this was mainly from the elderly) and, as they seemed justified, the council had no problem in restoring these lights to all night lighting.

Parish or town councils that had not previously responded are now showing an interest. As the scheme has rolled out over 2 years, they appear to be reassured that energy and cost savings have been made without compromising the security of people or property.

Gloucestershire County Council's street lighting team considered that the multi-way dialogue with stakeholders had proved very useful and encouraged ownership of a successful outcome and they would not revise their approach. Strong communication skills within the small team of three who set up and completed all the consultations were considered to have helped drive the success of the project.

## 7.7. Enhancement Measures

Following the outcome of the risk assessments where identified risks were able to be mitigated further, some local authorities have made use of enhancement measures. The main purpose of such measures was to aid the identification of features on the road ahead for motorists rather than pedestrians, in the absence of road lighting. These enhancement measures include:



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- retro-reflective and solar powered retro-reflective bollards;
  - electro-luminescent road signs;
  - new or refreshed road markings;
  - new solar road studs;
  - reducing speed limits; and
  - cutting back or removal of foliage.





## 8. COSTS AND BENEFITS

Prior to the implementation of the initiatives and, in some cases, supported by data from the outcome of trials, the local authorities have carried out cost benefit analyses. The results have provided valuable information for evaluating options and helped inform some of the matters considered by the local authorities identified in **Section 6**.

The County Surveyors Society (CSS)<sup>16</sup> document *Invest to Save – Sustainable Street Lighting*<sup>17</sup> makes a number of recommendations to local authorities on the approach they may wish to adopt for their cost benefit analysis for their scheme or range of options

Recommendations include:

*“It is suggested that local authorities concentrate on evaluating the costs that they are incurring and not those that society as a whole incur”*

*“A cost benefit analysis should be undertaken for all the proposed lighting options and where applicable for the existing lighting scheme”*

*“It is also recommended that in order to fully assess the impact of future operating and energy costs then an estimate of future price increases due to inflation are included.”*

**Summary Table 8.1** details the fifteen local authority road lighting initiatives reviewed for this report. The table contains a brief description of the trials and initiatives and the breakdown of some of the headline monetary costs and monetary / carbon savings which have been identified by the local authorities. It does not detail wider social and environmental factors considered earlier in this report.

HM Treasury Green Book<sup>18</sup> provides the general framework of appraisal and evaluation used in central government. It sets out the *five case model*<sup>19</sup> as the central approach to evaluating spending proposals and covers the strategic case, the economic case, the financial case, the commercial case and the project management case. The costs highlighted in **Table 8.1** are only a subset of the impacts and would fall under the financial case. For the broader strategic case it is recommended that all the impacts of the choices are reflected.

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<sup>16</sup> Now the “Association of Directors of Environment, Economy, Planning and Transport” (ADEPT)

<sup>17</sup> CSS Street Lighting Project SL2/2007 [http://www.theilp.org.uk/uploads/File/Technical/SL2\\_secure.pdf](http://www.theilp.org.uk/uploads/File/Technical/SL2_secure.pdf)

<sup>18</sup> [http://www.hm-treasury.gov.uk/d/green\\_book\\_complete.pdf](http://www.hm-treasury.gov.uk/d/green_book_complete.pdf)

<sup>19</sup> The five cases guidance [www.hm-treasury.gov.uk/data\\_greenbook\\_business.htm](http://www.hm-treasury.gov.uk/data_greenbook_business.htm)



**Table 8.1 Summary of Estimated Costs and Benefits of the Road Lighting Trials and Initiatives**

Local Authority	Initiative / Trial	Estimated Financial Costs & Savings			Estimated Payback Period	Carbon Footprint	
		Capital Costs (£)	Annual Operating Costs (£)	Estimated Annual Cost Savings		Annual Carbon Footprint	Estimated Carbon Savings
<b>Buckinghamshire</b>	1,627 lights out of 28,000 switched off in rural or semi-rural locations Road safety enhancement measures implemented		£600,000 on enhancement measures	£78,364/annum (2010/11)			578 tonnes CO2 (2010/11)
<b>Cornwall</b>	Central management system controlling over 51,000 road lights Part-night lighting in residential areas between 12:30-05:30am Dimming on main roads			£54million over 25 years on a current 25yr operational cost £148m		Current road lighting footprint 11,519,810 kgCO2	50% Carbon Reduction
<b>Dorset</b>	Part- night lighting between 01:00am and 05:30am in urban and rural residential areas (Up to 20,000 road lights)			Up to £150,000 / annum			
<b>Dudley</b>	Trials on a number of estates using LEDs and other white light sources , dimming and trimming of road lights using new PECUs and CMS			Potential Savings (if trials extended to all road lights) between £56,000-£120,00 in energy costs £4,350-£16,300 in carbon credit purchases.			



Local Authority	Initiative / Trial	Estimated Financial Costs & Savings			Estimated Payback Period	Carbon Footprint	
		Capital Costs (£)	Annual Operating Costs (£)	Estimated Annual Cost Savings		Annual Carbon Footprint	Estimated Carbon Savings
<b>Essex</b>	Part-night lighting trial of two Districts in the County between 12:00-05:00am	Direct Cost of £140,000 (£1.8m over two years if introduced over the whole county)	(The annual energy consumption of the 120,000 street lighting in the County is approximately 44 million kilowatt hours of electricity)	£54,000 per annum (Extending the scheme across the whole county could realise annual energy savings of between £600,000 and £2m.		19,000 tonnes of carbon emissions.	312 tonnes CO2
<b>Gloucestershire</b>	As of March 2010 6,632 road lights adopted for part-night lighting in market towns and rural areas. Between midnight and 05:30am. Dimming of 9,540 high wattage lamps between 10:00pm and 05:30am was completed by March 2010.			<u>Part-Night Energy Savings</u> £90,600 per annum  <u>Dimming</u> £172,800 per annum  2010/11 energy rates			<u>Part-Night</u> 626 tonnes CO2  <u>Dimming</u> 806 Tonnes CO2
<b>Hackney</b>	LED trial of 91 road lights at 7 location in the Borough		£1,405	£2,132		10 tonnes	14 tonnes
<b>Hampshire</b>	Commenced 25 year PFI contract which will include replacement of over half of the 150,000 road and replacement of all lanterns and control equipment		25 year £225m scheme				



Local Authority	Initiative / Trial	Estimated Financial Costs & Savings			Estimated Payback Period	Carbon Footprint	
		Capital Costs (£)	Annual Operating Costs (£)	Estimated Annual Cost Savings		Annual Carbon Footprint	Estimated Carbon Savings
	Proposed dimming of lights by 25% and reduced burning hours. Introduction of CMS proposed.						
<b>Leeds</b>	PFI Contract to replace approximately 80,000 road lights Trial of LED Lanterns on and estate Installation of new white light lamps and electronic control gear Trimming of switching levels to 55/28lux					5300 tonnes	Reduction in Carbon footprint of 200 tonnes by 2011
<b>Leicester City</b>	34,000 road lights Dimming of 2000, 250w road lights between 11:00pm & dawn (1000 installed + 1000 more to be installed in 2011)  Replacing 756 off 250W lanterns with 140W white light ones (90% complete)  Proposed introduction of city wide CMS and white light lamps (figures are for energy saving from fitting lower wattage)	<u>Dimming</u> technology and installation £177,000  <u>Replacement</u> £160,000  <u>Council wide CMS</u> £9m	<u>Dimming</u> £232,268  <u>Replacement</u> £91,763  <u>CMS</u> £1,623,000	<u>Dimming</u> £70,960/ annum  <u>Replacement</u> £41,277/annum  <u>CMS</u> £1m / annum	<u>Dimming</u> 5 years  <u>Replacement</u> No payback as RIEP funding is free  <u>CMS</u> 9 - 10 yrs	<u>Dimming</u> 1268 tonnes  <u>Replacement</u> 496 tonnes  <u>CMS</u> 11,050 tonnes	<u>Dimming</u> 387 tonnes  <u>Replacement</u> 223 tonnes  <u>CMS</u> 6630 tonnes



Local Authority	Initiative / Trial	Estimated Financial Costs & Savings			Estimated Payback Period	Carbon Footprint	
		Capital Costs (£)	Annual Operating Costs (£)	Estimated Annual Cost Savings		Annual Carbon Footprint	Estimated Carbon Savings
	white light lanterns but do not include for dimming & trimming) Proposed switch off of bollards and replaced with retro reflective bollards	<u>Bollards</u> £120,000	<u>Bollards</u> £60,500	<u>Bollards</u> £60,500/annum  based on current energy tariff of 9.9p/KWh	<u>Bollards</u> 1.5 yrs	<u>Bollards</u> 330 tonnes	<u>Bollards</u> 330 tonnes
<b>Leicestershire</b>	67,000 road lights & 12,000 illuminated signs Estimate 40,000 Part-night Lighting between midnight to 05:30am GMT in residential areas Estimate 2000 Dimmed 250W lights by approximately 50% on urban through routes when traffic flows are lower Estimate 1,000 Switch off light in some rural areas.	Project Cost £1.7m	Current energy Bill circa £2.75m	£700,000 / annum		16,790 tonnes of carbon / annum	3,000 tonnes of carbon / annum
<b>Nottinghamshire</b>	Dimming of 250W-400W lights on main roads between 10:00pm and 07:00am Switching off of lights in rural areas Part-night lighting: off	<u>Dimming</u> £976,390  <u>Switch Off</u> £202,482	Total £7,906,000	<u>Dimming</u> £321,119  <u>Switch Off</u> £39,414	<u>Dimming</u> 250W: 3.1yrs 400W: 2.0yrs"  <u>Switch Off</u> 2.2yrs (from removal of	22,181 tonnes CO2	5,800 tonnes CO2



Local Authority	Initiative / Trial	Estimated Financial Costs & Savings			Estimated Payback Period	Carbon Footprint	
		Capital Costs (£)	Annual Operating Costs (£)	Estimated Annual Cost Savings		Annual Carbon Footprint	Estimated Carbon Savings
	<p>from 12:00 - 05:30am in rural and residential areas.</p> <p>Total for all street lighting energy saving measures</p> <p>* Note: columns will be removed 3 yrs after switch-off. Payback period calculated from removal since disconnection and removal represent the major cost for this option.</p>	<p><u>Part-Night</u> £2,041,128</p> <p><u>Total</u> £3,220,000</p>		<p><u>Part-Night</u> £894,228</p> <p><u>Total</u> £1,254,761</p>	<p>column*)</p> <p><u>Part-night</u> 0.9 to 3.2 yrs depending on lamp watts</p>		
<b>Oxfordshire</b>	<p>Part of a council carbon management programme to reduce energy use on property and street lighting,</p> <p>Lamp Changes – Replace SOX with SON, Zebra Crossing convert Tungsten to LED</p> <p>Part-night Lighting on Parish Footways</p> <p>Trimming and New Electronic Control gear</p> <p>Part-night Lighting on rural main roads on approaches to roundabouts and</p>	<p><u>Lamp Changes</u> Capital - £79,000</p> <p><u>Part-night Footways</u> Capital 14,000 per annum</p> <p><u>Trimming</u> Cost neutral to existing approach</p> <p><u>Part-night main roads</u></p>		<p><u>Lamp Changes</u> Gross £6,300 1st year rising to £16,500 in year 5</p> <p><u>Part-night Footways</u> Gross £4,300 to £14,500 in 3<sup>rd</sup> year</p> <p><u>Trimming</u> £3,500 rising to £20,000</p> <p><u>Part-night main</u></p>	<p><u>Lamp Changes</u> 13 years</p> <p><u>Part-night Footways</u> 3.3 years</p> <p><u>Trimming</u> Not relevant</p> <p><u>Part-night Main</u></p>		<p><u>Lamp Changes</u> Carbon saving of 330 tonnes during implementation phase</p> <p><u>Part-night Footways</u> 130 tonnes of Carbon</p> <p><u>Trimming</u> 275 tonnes of Carbon over 5 years</p> <p><u>Part-night Main roads</u> 277 tonnes of</p>



Local Authority	Initiative / Trial	Estimated Financial Costs & Savings			Estimated Payback Period	Carbon Footprint	
		Capital Costs (£)	Annual Operating Costs (£)	Estimated Annual Cost Savings		Annual Carbon Footprint	Estimated Carbon Savings
	junctions	£19,900 over two years		<u>roads</u> £6,450 rising to £12,400 in year 5	<u>Roads</u> 2.7 years		Carbon over 5 years
<b>Poole</b>	Part-night lighting trial between 12:00am - 06:00am Includes 117 lighting (70W lamp) columns in residential areas 30 (150W lamp) columns on a main traffic route 6 Trial Areas approx. 0.8% stock.	<u>Per 70W lamp</u> Installation £45.00  <u>Per 150W lamp</u> Installation £50.00	<u>Per 70W lamp</u> Installation £45.00  <u>Per 150W lamp</u> Installation £50.00	<u>Per 70W lamp</u> £15.03 / annum  <u>Per 150W lamp</u> £28.72 / annum	<u>Per 70W lamp</u> 3 Years  <u>Per 150W lamp</u> 2 years	<u>Per 70W lamp</u> 198kg/CO2  <u>Per 150W lamp</u> 378kg/CO2	<u>Per 70W lamp</u> 105kg/CO2  <u>Per 150W lamp</u> 200kg/CO2
<b>Wokingham</b>	June 2009 1,000 (out of 16,000) street lights being switched off part of the night. Part-night lighting 12:00-05:00am. Could potentially include 9,600 in the future. Involves swapping the current street lighting photo electric control unit with another which has been timed to switch off at the appropriate time. A concurrent trial was run for part-night lighting and dimming using remote monitoring, which use radio signals	To convert 996 street lights cost £70,00  Photo electric control unit - £40,000 including 887 street lights converted  Remote Monitoring - £30,000 including the installation of a central computer	Maintenance – £443,000  Energy - £604,000  Internal Service Recharge - £184,000	For the 996 columns switched off.  £15,000 /annum in energy costs  £1600/annum in carbon taxation (from 2012)	4.2 years estimated feedback	3,375 tonnes pre part-night lighting  3,245 tonnes post part-night lighting	For the 996 columns switched off.  Carbon Savings 130 tonnes /annum



Local Authority	Initiative / Trial	Estimated Financial Costs & Savings			Estimated Payback Period	Carbon Footprint	
		Capital Costs (£)	Annual Operating Costs (£)	Estimated Annual Cost Savings		Annual Carbon Footprint	Estimated Carbon Savings
	to control the output of the street light and feedback the street lighting performance	system to control the street lights, a base station to transmit radio signals, and 107 street lights converted with remote monitoring controls					





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## 9. CONCLUSION

Growing pressures on local authority budgets, particularly from rising energy prices in addition to growing concerns about wasted energy, the effects of carbon emissions and light pollution, have prompted changes to the way that some local authorities are delivering public road lighting services.

Fifteen local authority change initiatives were identified and reviewed as part of this project including switching road lights off for all or part of the night, dimming of road lights during the early hours of the morning, reduction in the burning time of lamps and the use of new technologies.

These initiatives have the potential to deliver substantial financial savings for local authorities and help reduce carbon emissions and light pollution. However, public road lighting serves important roles in assisting traffic safety and aiding crime prevention. Therefore, changes in the way public road lighting services are delivered require careful consideration and management.

The local authorities have considered a range of societal, environmental, technical and legal issues during the implementation of their change programmes and a range of management measures have been adopted to address key concerns.

From this review, it is evident that there are a range of options and tools available to local authorities as they consider how best to respond to economic and environmental pressures on the way they delivery their public road lighting services in the future.



## 10. ACKNOWLEDGEMENTS

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Ian Moore	Leeds City Council
Rob Adamek	Leicester City
Peter Hosking & Kingsley Cook	Leicestershire County Council
Clive Wood & Ronald Miller	Nottinghamshire County Council
David Cookson & Anthony Palman-Brown	Oxfordshire County Council
Steve Johnson	Poole Borough Council
Alison Dray	Wokingham Borough Council



## **Appendix 1**

# **Examples of Exemptions**



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## List of Exemptions

### Buckinghamshire

- Areas where the speed limit is 30 mph
- Areas where there are large numbers of pedestrians or other vulnerable road users

### Essex

- Major lit inter-urban dual carriageway traffic routes.
- Conflict sites (e.g. roundabouts) lit by columns greater than 6 metres high.
- Streets where street lighting is installed for accident remedial measures.
- Town centre development where there is one or more of the following features (a) CCTV sites; (b) high proportion of high security premises; (c) high crime risk; and (d) high concentration of people at night, such as transport interchanges, nightclubs, etc.
- Main approaches to areas defined in (4) above, where there is a risk of development between residential and commercial/industrial (i.e. not exclusively residential).
- Sites where the police demonstrate that there will be an increase in crime if the lights are switched off.
- Remote footpaths and alleys linking residential streets.
- Where there is a statutory requirement.
- Where the configuration of street lighting columns is considered excessive, consideration is to be given to removing one in two lights with the remaining lights left on in full night operation.

### Gloucestershire

- Main traffic routes (dimming of streetlights has been introduced if appropriate).
- Locations with above average road traffic night time injury accident record.
- Areas with above average record of crime.
- Areas provided with CCTV local authority/police surveillance equipment
- Areas with sheltered housing and other residences accommodating vulnerable people.
- Areas with 24hr operational emergency services sites including hospitals.
- Pedestrian crossings and subways.
- Where there are potential hazards on the Highway (roundabouts, central carriageway islands, build-outs, speed-humps, etc.
- Where the existing street lighting installation is considered unsatisfactory by virtue of excessive distance between individual streetlights.

### Leicestershire

- Most main traffic routes (although some lights may be dimmed or switched off)



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- Locations with a significant night-time road traffic accident record
  - Areas with above average record of crime
  - Areas provided with CCTV local authority / police surveillance equipment
  - Areas with sheltered housing and other residences accommodating vulnerable people.
  - Areas with 24hr operational emergency services sites including hospitals.
  - Formal pedestrian crossings, subways, and enclosed footpaths and alleyways where one end links to a street that is lit all night
  - Where there are potential hazards on the highway (roundabouts, central carriageway islands, chicanes, speed-humps, etc.)

### **Borough of Poole**

- Main traffic routes / junctions
- Locations with above average road traffic night-time injury accident record
- Areas with above average record of crime
- Areas provided with CCTV local authority / police surveillance equipment
- Areas with sheltered housing and other residences with vulnerable people
- Areas with 24hr operational emergency services sites including hospitals
- Pedestrian crossings, subways, interconnecting footpaths and alleyways
- Where there are potential hazards (e.g. build-outs, speed-humps, etc.)

### **Wokingham Borough Council**

- Lights at major junctions/ roundabouts.
- In town centres where there is CCTV, high security businesses such as banks, and/or many people at night, for example near nightclubs and train stations, outside community facilities such as the British Legion or leisure centres.
- Areas where street lights are needed to reduce road accidents.
- Areas where there could be an increase in crime through reduced lighting, such as pubs and specific residential areas.
- Remote alleys linking residential streets.
- Near traffic islands, pedestrian crossings, footbridges, subways or where the council has a specific duty of care.
- In public car parks; at bus stops.
- At level crossings, speed humps, traffic lights; where there is sheltered housing for the elderly.



## **Appendix 2**

# **Sources of Information and Further Reading**



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## Sources of Information and Further Reading

### Industry Guidance

Guidance Notes for the Reduction of Obtrusive Light, Institution of Lighting Professionals, 2005

<http://www.theilp.org.uk/uploads/File/Technical/RLP%202005.pdf>

Street Lighting Energy, The lighting practitioners guider to Energy Supply. UK Lighting Board, December 2010

<http://www.ukroadsliaisongroup.org/lighting/energy.htm>

Street Lighting – Invest to Save, Institution of Lighting Professionals, 2006

<http://www.theilp.org.uk/uploads/File/Technical/Street%20Lighting%20-%20Invest%20to%20Save.pdf>

Invest to Save – Sustainable Street Lighting, CSS Street Lighting Project SL2/2007

[http://www.theilp.org.uk/uploads/File/Technical/SL2\\_secure.pdf](http://www.theilp.org.uk/uploads/File/Technical/SL2_secure.pdf)

Well-lit Highways, Code of Practice for Highway Lighting Maintenance, UK Lighting Board, November 2004

[http://www.ukroadsliaisongroup.org/lighting/well\\_lit.htm](http://www.ukroadsliaisongroup.org/lighting/well_lit.htm)

CIE 150: 2003 Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations

Farrington, D. and Welsh, B. (2008): Effects of improved street lighting on crime. Campbell Systematic Reviews: The Campbell Collaboration

[www.campbellcollaboration.org/lib/download/223/](http://www.campbellcollaboration.org/lib/download/223/)

Secured By Design

<http://www.Securedbydesign.com>

Lighting Against Crime A Guide for Crime Reduction Professionals -

[www.securedbydesign.com/pdfs/110107\\_LightingAgainstCrime.pdf](http://www.securedbydesign.com/pdfs/110107_LightingAgainstCrime.pdf)

### Government Reports

Department for the Environment, Food and Rural Affairs (Various reports \_RCEP, House of Commons Select Committee)

<http://www.defra.gov.uk/environment/quality/noise/artificial-light-pollution/>

Atkins, S. Husain, S and Storey, A (1991) The influence of street lighting on crime and fear of crime. Crime Prevention Unit Paper Number 28. London: Home Office.

<http://www.homeoffice.gov.uk/rds/prgpdfs/fcpu28.pdf>

Ramsay, M. and Newton, R (1991). The Effect of better street lighting on crime and fear : a review. Crime Prevention Unit Paper Number 29. London: Home Office

<http://www.e-doca.eu/content/docs/fcpu29.pdf>

Farrington, D. and Welsh, C. (2002) Effects of improved street lighting on crime: a systematic review. Home Office Research Study 251. London: Home Office. (addendum added 14.10 03)

<http://library.npia.police.uk/docs/hors/hors251.pdf>



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Government advice on the planning system and crime prevention including general guidance on the importance of surveillance (overlooking) is set out in the ODPM/Home Office guide: Safer Places the Planning System and Crime Prevention (in particular pp 28-29).

<http://www.communities.gov.uk/publications/planningandbuilding/saferplaces>

### **British Standards**

British Standard BS5489-1:2003+A2:2008, Code of Practice for the design of road lighting – Part1, Lighting of roads and public amenity areas. British Standards Institution

British Standard BS13201-1: 2004, Selection of Lighting Class, BSI

British Standard BS13201-2: 2003, Performance Requirements, BSI

British Standard BS13201-3: 2003, Calculation of Performance, BSI

### **Useful Websites**

Department for Energy and Climate Change (DECC), Carbon Reduction Commitment and Energy Efficiency Scheme (CRC) User Guide

[http://www.decc.gov.uk/en/content/cms/emissions/crc\\_efficiency/user\\_guidance/user\\_guidance.aspx](http://www.decc.gov.uk/en/content/cms/emissions/crc_efficiency/user_guidance/user_guidance.aspx)

The Institution of Lighting Professionals

<http://www.theilp.org.uk/>

London Technical Adviser Group – Lighting Group (LoLEG)

<http://loleg.co.uk/>

Campaign for Dark Skies

<http://www.britastro.org/dark-skies/>

International Dark-sky Association

<http://www.darksky.org>

### **Local Authority Websites**

Buckinghamshire County Council

[http://www.buckscc.gov.uk/bcc/transport/streetlights\\_energy.page](http://www.buckscc.gov.uk/bcc/transport/streetlights_energy.page)

Cornwall County Council

<http://www.cornwall.gov.uk/default.aspx?page=23650>

Dorset County Council

<http://www.dorsetforyou.com/streetlighting>

Dudley Metropolitan Borough Council

<http://www.dudley.gov.uk/transport-and-streets/street-care-and-maintenance/street-lighting/?locale=en>

Essex County Council

(Safer and Stronger Communities Policy and Scrutiny Committee meetings – 18 September 2009, 16 October 2009, 16 July 2010,)





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[http://cmis.essexcc.gov.uk/essexcmis5/Committees/tabid/94/ctl/ViewCMIS\\_CommitteeDetails/mid/483/id/39/Default.aspx](http://cmis.essexcc.gov.uk/essexcmis5/Committees/tabid/94/ctl/ViewCMIS_CommitteeDetails/mid/483/id/39/Default.aspx)

Gloucestershire County Council

<http://www.gloucestershire.gov.uk/index.cfm?articleid=22037>

London Borough of Hackney

<http://www.hackney.gov.uk/es-streetscene-lighting-564.htm>

Hampshire County Council

<http://www3.hants.gov.uk/roads/service564>

Leeds City Council

<http://www.lightsoninleeds.co.uk/Public/Default.aspx>

Leicester City

<http://www.leicester.gov.uk/your-council-services/transport-traffic/highways/street-lighting/>

Leicestershire County Council

[http://www.leics.gov.uk/index/highways/road\\_pathway\\_maintenance/street\\_lighting.htm](http://www.leics.gov.uk/index/highways/road_pathway_maintenance/street_lighting.htm)

Nottinghamshire County Council

[http://www.nottinghamshire.gov.uk/home/traffic\\_and\\_travel/roads/highwayshelpline/streetlighting.htm](http://www.nottinghamshire.gov.uk/home/traffic_and_travel/roads/highwayshelpline/streetlighting.htm)

Oxfordshire County Council (Search – Local Authority Carbon Management Plan)

<http://www.oxfordshire.gov.uk/wps/portal/publicsite>

Poole Borough Council

<http://www.poole.gov.uk/>

Wokingham Borough Council

<http://www.wokingham.gov.uk/transport/streetcare/streetlights/streetlighttrial/>



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