

**Street-Lighting Policy in North-East England: Current Practice and Future Questions**

*Stakeholders Report*

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**Caveats and Acknowledgements**

This report has not been peer reviewed, although it has been viewed by participants prior to publication.

Many thanks to Harriet Bulkeley and Sandra Bell in their support in designing and carrying out this project. Thanks also to Phillip Thress for his productive comment on the initial report, and to all participants in the research and workshop. Thanks to the Durham Energy Institute and the EPSRC for funding the research. This is not the final research report to funders, but a report provided for participants and stakeholders. Any interpretations of data and any errors remain the author's own.

## Summary

This research project is an attempt to document and explore current practice in governing the choices of street-lighting technologies in the North-East of England. This research project consisted of interviews with local authority (LA) staff,<sup>1</sup> as well as with representatives from the Spennymoor<sup>2</sup> branch of Thorn Lighting. These interviews were followed by a research workshop, discussing some of the findings with participants and academics from Durham University.

## Context

Street-lighting policy has become increasingly complex over the last decade. Rising energy prices and the necessity to change practice in order to respond to climate change have shifted the aim of street-lighting away from an attempt to light the city as brightly as possible, towards a desire to provide the most financially and ecologically efficient lighting available. LAs, nationally, have begun to look into new more efficient luminaires, and new practices such as dimming lights during the quieter periods of the night, or switching off street-lights completely. The North-East LAs range from densely populated urban authorities, through to large rural areas. As such, they face a full range of lighting challenges and provide a good subsection of national policy to explore.

## Findings

The findings of this report can be grouped under five headings:

### **1. Technological Innovation and Uncertainty**

While new LED lighting technologies offer the best energy and financial choices for LAs, infrastructural and institutional obstacles are slowing their introduction in the North-East.

Since the mid-2000s, multiple new technologies and lighting practices intended on reducing energy used by lighting have emerged. This has resulted in uncertainty about which practices and technologies to adopt. While guidelines are available to clarify the technical capacities of lighting technologies, the choice of technology and approach is significantly more complex. This is because LAs may already be in long-term PFI contracts, or may have to factor in the cost of having recently replaced luminaires and units. In addition, local political pressures have limited the use of night-time dimming to non-residential areas, and have stopped all but one of the participating LAs from switching off any lights at night (see finding 5). The general financial pressures currently faced by LAs mean that lighting engineers are under pressure to select the cheapest LEDs, but the proliferation of new manufacturers and technologies has created uncertainty about the reliability of products, particularly at the 'bottom end' of the market. Therefore, while all LAs interviewed have considered installation of LED lighting, under current conditions the period of LED introduction will come over multiple decades.

### **2. Trials**

Due to this uncertainty, LAs have been engaged in multiple product trials. These trials are intended to both test manufacturer claims, so as to make a business case for particular technologies, but also to provide a

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<sup>1</sup> For a list of participants please see page 1 of the full report

<sup>2</sup> A small town in County Durham in the North-East

publicly-oriented showcase for an LA's willingness to innovate in relation to lighting technology. This report identifies three paradigms of trialling: Public Consultation; Stealth Trials; Learning from Others.

### **3. Dominance of finance**

LA participants described energy use and financial constraints as the dominant factors in driving current change. While these are often connected – using less energy will typically also save money – where they conflict, financial restraints currently win-out. At the moment, measures that will result in energy savings but which do not have associated financial benefits are unlikely to be developed. Other key aims of street-lighting (see list p5) are still considered important in everyday practice, but are not currently priorities which drive technological innovation.

### **4. Patterns of Investment**

Investment patterns in street lighting varied. In particular, there is a significant gap between those LAs which are in patterns of one-off investment, and those who are involved in a continual upgrade. While most lighting engineers preferred the idea and flexibility of being able to conduct a rolling upgrade of stock, the political realities of financing means that this is not often possible. LAs are then forced to attempt to predict future trends, in order to get best value out of these one off investments

### **5. Dimming and Switching Off**

All LAs have begun or are looking towards some level of dimming of lights during the night. While the simplest and cheapest way of achieving this is through pre-programmed dimming, this lacks flexibility and is not appropriate in all locations. Centralised Management Systems (CMS) contain the possibility of significantly more intelligent dimming regimes, but require an upfront cost, as well the installation of hardware in luminaires themselves. At least two LAs have future-proofed their stock to ensure that this will be as easy as possible, which is indicative of the potential that lighting engineers see in CMS. Opinions on switching off lights are mixed, but at the moment those LAs which have considered it have generally stopped due to political pressure: only one LA has switched off lights at night, in the context of pedestrianized routes where alternatives exist.

## **Recommendations**

- North-East LAs would benefit from sharing trial data, or exploring joint-trials. At the moment, this is done on an ad hoc and informal basis, but a regional 'trials database' would help share information, and reduce the role of rumour. Though there are clearly some difficulties in this level of inter-authority work, it would represent clear possibilities for both financial efficiencies and sharing of best practice.
- CMS offer significant opportunities for LAs to innovate, to reduce costs and reduce energy use, without compromising other key governance goals. While there are obstacles to their installation, they seem to offer long term energy and financial saving opportunities.
- A form of Green Deal to encourage either LEDs to CMS might encourage financially neutral or non-viable energy saving projects to be taken up by LAs.
- More knowledge is required about how communities and individuals are affected by moves towards dimming regimes. While biological responses to lighting levels are well researched, social aspects such as well-being are currently more poorly understood. Current trials, while obtaining resident feedback, do not seem to offer this knowledge.

## Introduction

“It's so much darker when a light goes out than it would have been if it had never shone.” (John Steinbeck, *The Winter of Our Discontent*)

Roads, city centres and residential areas lit by street-lights are some of the key symbols of the modern world. For years, good (local) governance has been equated with “keeping the lights on”. However, public lighting accounts for around 20% of energy use of local authorities (LA) in England and Wales. With electricity prices more than doubling between 2002 and 2012,<sup>3</sup> and LA income falling, the amount of money spent on street lighting is becoming increasingly subject to scrutiny. At the same time, LAs have become increasingly concerned about carbon use, due to both political will and increasing legal obligations to change practice. Street lighting, as one of the major areas in which local authorities retain the autonomy and ability to make significant cuts to their energy use, is therefore also scrutinised for its carbon efficiency. These factors have combined to create a pressure for innovation and evolution with regards to street lighting technologies and practices.

This pressure for innovation has resulted in a proliferation of lighting technologies being offered to local authorities looking for ways of reducing both energy use and costs. As well as new technologies, new ways of using lighting are also being investigated by local authorities, centred on dimming or switching off lights at key moments. Each technology has potentials to increase efficiency and thus reduce costs and carbon use, but all changes must be balanced against the need for:

- a) Reduction of night time road traffic accidents.
- b) Reduction in the severity of accidents.
- c) Reduction of crime, particularly crime against the person.
- d) Reduction in the fear of crime.
- e) The expansion of the night time economy.
- f) To encourage mobility and engendering a feeling of well-being.

This report discusses findings from interviews with six local authorities in North-East England, as well as representatives of a lighting design company based in the North-East. The research attempted to identify:

- The influences on street-lighting policy
- The current barriers towards innovation
- The current pushes towards innovation

## Method and Participants

This research project has looked at the current practice of a number of local authorities in North-East England. Of the 12 local authorities contacted, 8 replied, with whom 6 interviews were arranged. The participating authorities are:

- Northumbria
- North Tyneside

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<sup>3</sup> Department of Energy and Climate Change, 2012. *Quarterly Energy Prices December 2012*  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/65940/7341-quarterly-energy-prices-december-2012.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65940/7341-quarterly-energy-prices-december-2012.pdf)

- Newcastle
- South Tyneside
- Durham
- Darlington

In addition, an interview was also carried out with Thorn Lighting, in order to obtain a broader perspective on lighting design. While Thorn's work will inform this report, the reflection will mainly be from the interviews with LAs.

Following the research, a workshop was held in which participants and academics could respond to the initial findings of the report. The ideas and comments from this workshop, and other comments received on the report, have been worked into this final document.

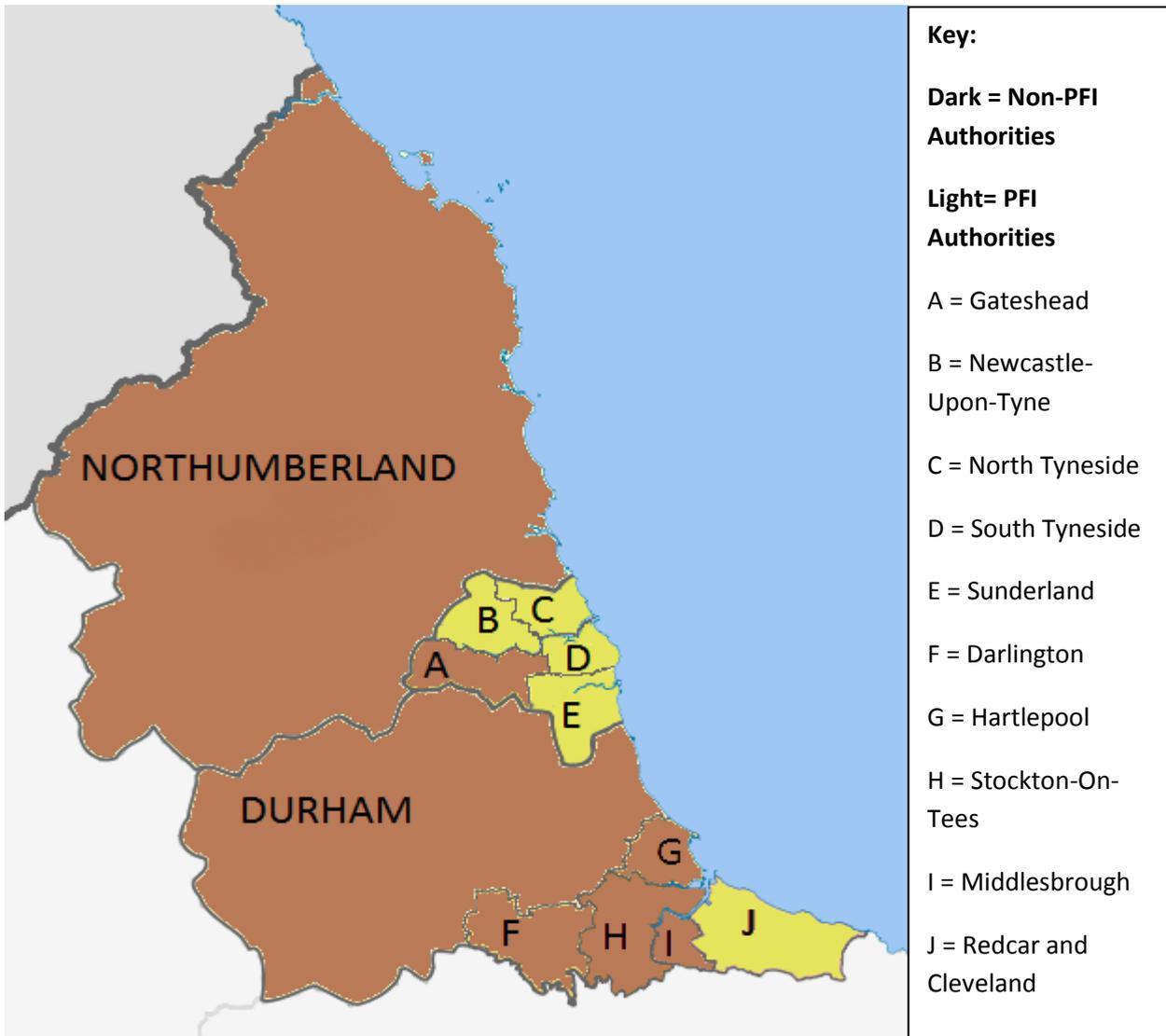
It should be noted that the data in this report is qualitative. While it provides a representation of current practice in North-East England, a larger research project would be required to ensure that findings are representative of national practice as a whole.

Figure 1 shows a map of the local authorities in the North-East, divided into those with PFI deals, and those without. As this map shows, my participants have come from a range of situations. In particular, there are three 'PFI' councils and three non-PFI; with four urban councils, one large urban/rural mixed council, and one mainly rural council.

### **Findings**

The principal findings are discussed in the report summary. The following report is divided into a more detailed exploration of the five key areas, with data, findings and recommendations presented together.

Figure 1: North-East Local Authorities



## Detailed Findings

### Uncertainty and technological innovation

*“There’s an awful lot of companies out there making claims as to what their equipment can and can’t do”* (Participant 2)

*“there’s a new LED lantern every week”* (Participant 4)

There has been a proliferation of new lighting technologies over the last decade, with a number of LAs expressing concern at uncertainties about the variety of technologies and variety of companies appearing on the market.

The major development in lighting technology has been the emergence of LED lighting. At the moment, LEDs are used only sporadically in the region, and all LAs are currently still installing either SON (High Pressure Sodium) or Phillips CosmoPolis lanterns. Equally, all North-East LAs have at least trialled LEDs, with three looking to moving towards using these as standard. Of the remainder, two require new residential developments to use LED lighting, and the remaining LA requires that all developments consider LEDs.

LEDs require less energy than other technologies to create the same levels of illumination. They also burn out much more slowly than existing technologies, and require less energy to switch on and off. As such, they are the best type of lighting to use alongside Centralised Management Systems (CMS). However, there remain limits to their immediate uptake. Cost is a major issue: LEDs which guarantee the same quality as SON and Cosmopolis luminaires remain more expensive, although prices have fallen and continue to fall. Retrofits are also problematic as the differing lighting outputs from LEDs may require that existing columns are moved. In locations where these columns are modern, have been recently replaced or are currently at a high standard, the extra cost and energy of this could undermine the financial and environmental advantage of installing LEDs. Some LAs with long-term PFI deals would also have to negotiate contract alterations over LEDs. Finally, at the cheaper end of the market, a number of new manufacturers with untested LEDs may not offer guarantees for the lifetime of the LED. Despite these obstacles, LEDs seem to likely to continue to develop as the main lighting technology in the region due to their lower energy use. However, institutional, financial and infrastructural restraints mean that their integration is likely to be gradual (over a period of 20-30 years) under current conditions.

The innovation in LED technology has been accompanied by a number of new manufacturers emerging. As one participant stated, *“we’re absolutely bedazzled by the choice”* (Participant 4). This seemed to be a common theme among all LAs, with participants describing being approached with offers of new products at least a couple of times a month. Such variety has generated scepticism at the claims being made by organisations. This scepticism seems to be quite healthy: one participant recounted over-hearing a story of an organisation that had purchased a large number of LED luminaires cheaply, only for around 25% of them to fail. It is imperative that claims about lighting are tested, particularly from new manufacturers. However, this also runs the risk of inaction: as one participant said, *“you can’t sit on the fence forever and say ‘oh I’ll wait till generation 3 or 4 comes out’, you’ve got to do something”* (Participant 6). As such, LAs are having to develop new techniques for exploring which new lighting technologies to introduce: small-scale trials, as covered in the next section, are currently the most common approach.

## Trials

*“We’ve got several trials going on at the moment. I think there are 13 different LED types in x, there are another couple of types in x village, so that’s been going on about 18 months” (Participant 7)*

One of the main ways of responding to the uncertainty surrounding future technologies is to attempt trials or tests of lighting technologies and practices. In tackling climate change, small scale experiments by local authorities are often seen as one of the most effective ways of testing new technologies<sup>4</sup>. At their most basic level, trials help verify manufacturer claims, and illustrate to LA officials and/or the public what new lighting styles will look like. In the north-east local authorities, three major trial types were identified:

### 1. Public consultation

The most common form of trial is to install one or more technologies in a test street or area. This allows for a comparison of manufacturer claims, as well as helping judgements based around aesthetics, and the practicality of installing different luminaires. It also offers the opportunity to obtain public feedback on new lighting.

Methods of evaluation can vary, but they typically include questionnaires to gather feedback from the users of the spaces being tested by the trial, and measuring of the lighting levels in-situ. Many of these trials are also used to demonstrate the innovative and forward thinking role being taken on by an LA with regards to energy use. For example, one LA fitted multiple bordering streets with different types of lighting technology, and then walked residents and others stakeholders around the area. While testing lighting levels and gathering feedback from residents is clearly important in these trials, their use as ways of showcasing a LA’s innovation with regards to energy can be equally important.

### 2. Stealth Trials

These trials are similar to the above, but are intended to overcome the perceived public aversion to change. Described by one LA as “stealth trials”, they involve implementing new technologies in an area without informing residents in advance. Again, lighting levels can be tested, but a time gap is left before gathering feedback: *“if you just do it and wait for the reaction you might get a more genuine feedback”* (Participant 3). For these forms of trial, the evaluation tends to be judged by whether people notice the change or not. Three LAs mentioned carrying out these forms of experiment.

While less well publicised than other trials, these tests can still play an important political role, by presenting new lighting technologies to key stakeholders: *“there’s also some streets at x near where a cabinet member lives where we’ve tried the different types of bulbs so that he could have a look at them”* (Participant 3); *“we dropped down to a 3518 photocell and they did the street where the street lighting engineer lived at the time and just put them in and obviously didn’t say anything and he didn’t realise”* (Participant 5). Here, then, stealth trials can have greater political impact than a traditional consultation-based trial, by proving that lighting levels and aesthetics can be maintained with a new technology.

### 3. Learning from others

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<sup>4</sup> Corfee-Merlot, J., Kamal-Chaoui, L., Donovan, M.G., Cochran, I., Robert, A., P.J., T., 2009. Cities, Climate Change and Multilevel Governance, OECD Environmental Working Papers. OECD.

Some LAs took the opportunity to learn from the experiments of others. *“People are saying to us ‘Do you want some of ours?’ ‘No’ I’m thinking ‘What’s the point? I can just go up to x and have a look at 12 streets there”* (Participant 4). Here, the repetition of trials might be avoided across multiple LAs, with the ability to learn across different local contexts being taken.

The advantage of experimentation is that it combats the proliferation of technologies and new practices, by allowing these to be tested ‘in the field’. ‘Stealth trials’ overcome some of the limits to traditional consultation, although it is recommended that they are always followed-up with a survey of residents to check that un-reported complaints are not occurring. They also lack the same level of political impact as public consultation based trials, which may make them less appealing to LA executives. Clearly, lighting standards must always be maintained during any trial.

Across all LAs, two major concerns with trialling can be identified. First, in many cases the process of evaluating and building upon a trial can be unclear. In other words, how is a trial deemed successful, and do successful trials result in genuine change? Two LAs spoke of the wide variety of lighting types now in place in trial areas across their territory. This may create future maintenance costs, bringing into question the cost-benefit of some trials. While trials can and do inform business cases, the process of how this data is fed into businesses cases was unclear. Second, there is a concern that trials might fail to capture the variety of lighting needs. Interestingly, the LAs which were more likely to take approach 3 were also those who were more likely to express the importance of tailoring lighting solutions to a particular place. It is important that small scale trials are not extrapolated out into communities and locations where lighting requirements are different, due to differences in social grouping, the built environment, ecology or topography.

Due to the proliferation of both technology and trials, there may be more scope for LAs to collaborate in sharing trial data. Potentially, a regional trials database could be useful so that LAs could cross-check products and plans, in order to avoid unnecessary repetition of trials. This might also ensure that trials are better shaped for type of land-use. It is presumed that, for example, a suburban housing development in Durham is more similar to a suburban housing development in Northumberland or Darlington, than it is to a village or city centre in Durham. Sharing trials would help use resource more effectively, and would improve knowledge sharing.

## Drivers for change

*“Energy is behind sort of every sort of decision we make” (Participant 5)*

Current practice and decision making are dominated by demands to save both energy and money. Across the country, around 20% of LA energy bills are spent on lighting, while energy prices have more than doubled since 2002.<sup>5</sup> In the context of budgets driven by austerity pressures, this area of high spending is bound to receive attraction. In addition to this, LAs now also have both an obligation and a desire to reduce their carbon footprint. Again, as a significant portion of energy bills, street-lighting forms one of the largest controllable areas of carbon use that LAs now have.

However, while energy is important – and often described by participants as the most important factor – it is in fact financial savings which ultimately drive decision making. As one participant said, *“it’s basically a payback, how much energy reduction compared to the cost of the units? They [LEDs] are still quite expensive at the moment”* (Participant 2). For example, one of the identified limits to CMS is that while the close control over street-lighting might use less energy – and thus might reduce the LA’s carbon footprint - these savings may not bring financial benefits. This was supported by comments that energy savings would only be a significant feature if they were achieved in ways that can be measured. Street lighting energy use is currently unmetered, based instead on assumed consumption. Without meters “you couldn’t even measure [energy savings], you know, there’s no real energy saving because you can’t measure when it’s actually working on or off” (Participant 3). Participants recognised the political and reputational value of appearing to be leading the drive towards energy saving, but in practice it seems that the underlying financial pressures are the dominant feature.

During my research, it seemed that there was a danger that other important areas of policy may become lost and overlooked. Crime and fear of crime were identified, for example, as having been major influences in policy in the early 2000s, but as now being less important. While the connection between crime levels and street-lighting is not a straight forward one, targeted interventions do seem to generally work. In particular, engineers were confident that crime levels had been ‘built into’ calculations: “All I do is just report the crime statistics we get and put it against a particular area... We would look at crime and that would be built into the policy still. However, I don’t think it’s as critical as it used to be but the police tend to blame the light being out on an incident which is easy isn’t it?” (Participant 7). This sense that crime is ‘built into’ models came up a few times – suggesting that an active watch is not being kept on this area. Similarly, broader questions of safety at night were in people’s minds, but again were presumed to be covered if the British Lighting Standards were being met.

While energy and financial concerns are clearly important, it’s also key to remember that priorities have changed before, and will change again. Where possible, LAs should continually reflect on all influences on their current practice. While the standards have their strengths, it is important that they don’t become “something that you follow slavishly because a standard is a sort of average set of rules” (Participant 6). Here, there is a danger of standards working as a ‘black-box’, that is, as covering and hiding set of important features which should be open to more in-depth consideration. While lighting engineers are free to not

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<sup>5</sup> Department of Energy and Climate Change, 2012. *Quarterly Energy Prices December 2012*  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/65940/7341-quarterly-energy-prices-december-2012.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65940/7341-quarterly-energy-prices-december-2012.pdf)

follow the British Standards, in practice most felt that the time taken to conduct the risk assessments and other research required to justify lower lighting levels would not be available to them.

Energy charging practices could also be improved in order to encourage more and faster take up of CMS. This may require the development of new Elexon codes that would acknowledge the energy savings of dimming, or the installation of meters and/or energy use monitoring equipment, in order to identify the amount of energy being saved.

### Rhythms of Investment

*“PFI is not something really that I’m sort of keen on to be honest, I don’t know why you would want to replace all your stock in one go... in the first 5 years when in... well however long columns last, 25 years, 40 years whatever you’ve got to replace them all again” (Participant 5)*

*“PFI was the best way for us to replace our old stock – we had to replace about 80%, while the remaining 20% was what deemed to be compliant” (Participant 1)*

There are two clear rhythms of investment into street-lighting. The first can be characterised as a ‘rolling upgrade’, while the second can be described as ‘intense investment’. While in part this is a division between the ‘PFI’ and ‘non-PFI’ routes, there are also other investment paths that LAs have followed (for example, prudential borrowing).

The ‘intense investment’ approach refers to a rhythm of investment based upon short-term periods of intense stock-upgrade, followed by longer-term periods of maintenance and monitoring. This approach is often, but not always, associated with PFI deals: although PFIs are intended to be risk transference tools, rather than just ways of obtaining up-front cash investments, they nonetheless push LAs into this pattern. Often, such a pattern may be unavoidable, as the only way to secure the necessary finance to upgrade lighting stock. Where LA executives are less keen on maintaining a consistently high budget, they may be more willing to fund one-off investments. Furthermore, there are a number of possible advantages to this approach. First, it can correct for any previous period of under-investment. Second, it may be the best way to harness externally available investment or grants, which may only be available for a limited time. Third, it can concentrate the costs of labour and equipment, as well as any disruption to services, into a small time-frame, using these resources more efficiently. Fourth, it will result in a more uniform stock across the LA territory, potentially reducing maintenance costs.

However, there are two major disadvantages to the ‘intense investment’ approach, which the ‘rolling upgrade’ approach seeks to correct. A ‘rolling upgrade’ refers to an approach in which the lowest quality stock is replaced every year, with the latest and most efficient stock being put in its place. This can help avoid the technological redundancy that intense investment can create. Rather than tying an LA to a technology chosen at one moment in time, which will slowly become obsolete, the LA is able to constantly move with improvements. Furthermore, the ‘rolling upgrade’ approach tends to allow for more autonomy, as LAs are not tied to the stipulations of external funders or the details of a PFI contract. Rather, the LA can allow their lighting stock to slowly improve over time, prioritising the issues which are relevant to them.

Rolling upgrades allow for faster uptake of newer technologies such as LEDs. However, while many lighting engineers might prefer to have the ability to continuously upgrade their stock, in practice participants were clear that this wasn’t always going to be possible. Therefore, where intense investment is unavoidable as an approach, LAs need to try and ensure that they can include as much ‘future proofing’ as possible. One LA which is currently engaged in an ‘intense investment’ approach is doing this, seeking to use its money to buy a CMS that it can then run itself, without external involvement. This seems to offer better long-term value to the LA.

### Innovating Practices: Dimming and Switching Off

*“We’ve had fixed dimming in for 15 years so... it was tried and nobody noticed a difference on x up to x, that dims at midnight and nobody’s ever commented on it.” (Participant 7)*

Dimming is now recommended as “enabling considerable energy savings and most often representing a financially justified investment”<sup>6</sup>. As streets become less busy during the night, so the requirements for lighting them drop to lower levels.

A variety of different dimming practices were identified:

#### 1. Pre-programmed dimming

This probably the most common form of dimming in place at the moment. Here, lanterns along certain routes are pre-programmed to dim during certain time periods. Three of the LAs interviewed are currently doing this. In some locations, this dimming facility has been used to provide *extra* lighting: one LA is using this in crime hotspots, so that early evening lighting levels are higher than in surrounding residential areas, before dimming to a standard level. Pre-programmed dimming is the easiest form of dimming to manage – there are no extra costs once installed – but it clearly has limited flexibility.

#### 2. CMS controlled dimming

As discussed previously, CMS dimming offers the greatest flexibility and the most possibilities for LAs. Individual luminaires could be controlled using CMS, allowing for lighting levels to be responsive to the specific needs of a community. Control means that lighting could be set at the lowest safe level, and then raised in the event either any specific needs/incidents or planned events. For this reason, some LAs clearly view this approach as one that will drive their future practice: *“at this moment in time the dimming regimes that are available through the charging system, are quite limited... whereas as an example we could say well at 8 o’clock or 9 o’clock in the evening the traffic flow reduces so we can dim to a level... then after 10 or after midnight it drops down again so you can look to dim again... The other thing is, is that what it does allow that as an example if you think that, you know, like football stadiums... if you’ve got a mid-week game on or a match night and they are coming out at quarter to 10, 10 o’clock in the evening you wouldn’t want it dimmed down, you... can literally programme these things in to do things of that nature so I think that’s an area that can show development”* (Participant 2). CMS promises, at least in theory, the possibility of controlling to the level of individual columns, so that dimming can be done in a way which is appropriate for a particular site.

There are, of course, possible limits to this approach. As noted on page 7, changes to charging regimes would be required if the energy saved using this approach is to be measured and transferred into financial savings. The installation costs of CMS are relatively high, so access to upfront funding and a robust business case are required. While externally managed CMS is available, these come with on-going licensing costs, and may reduce the flexibility on offer to the LA.

#### 3. Switching-Off

*“The idea of turning them off at midnight was not very well received. Dimming was maybe a little bit more amenable to people”* (Participant 2). Switching off street-lights at night has proved to be one of the more

<sup>6</sup> Kostic, M., Djokic, L., 2009. Recommendations for energy efficient and visually acceptable street lighting. Energy 34 (10), 1565-1572.

controversial contemporary political issues regarding street-lighting. None of the LAs in the North-East are currently engaged in significant programmes of switching off lights. In residential areas, it is seen as potentially dangerous, with possibilities for litigation and political unpopularity. Currently, two LAs interviewed have started switching off some lights at night: these have been in locations with alternative, and often safer, pedestrianized routes. Three other LAs are currently looking to investigate changing policy or instigating trials, with a view to switching more lights off. In particular, three locations are viewed as being ideal for switching off: rural traffic routes; business parks; pedestrian routes with alternative paths. In the final workshop, all participants agreed that they were likely to consider switching off in the near future, and expected most LAs to be switching off some lights, either permanently or during the darker periods of night, in the near future.