European Commission

Lighting the Cities

Accelerating the Deployment of Innovative Lighting in European Cities

June 2013

Digital Agenda for Europe

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FOREWORD

by Neelie Kroes

Commission Vice-President for the Digital Agenda for Europe

The European Union has set itself the ambitious target of increasing energy efficiency by 20% by the year 2020. Lighting accounts for about 50% of the electricity consumption in cities. European cities can therefore play a major role in the reduction of the carbon footprint by large-scale deployment of highly innovative and eco-friendly LED lighting solutions.

Today, LED lighting technology has come of age and is able to deliver benefits to cities and citizens alike. It offers more controllable and higher quality light, enhanced visual performance and improves the ambience and safety of urban environments. Moreover, LED lighting will make our cities 'greener' by saving up to 70% of lighting energy and reducing costs compared to existing lighting infrastructures. Procuring and deploying innovative lighting infrastructures at the municipal level also offers the potential to boost local innovation, growth and jobs.

The larger roll-out of intelligent LED lighting systems in cities will be part of the creation of sustainable smart cities: cities where lighting innovation is interlinked to other smart city networks (communications, renewable energy, building or traffic management systems). This is the ideal way to offer dynamically adaptable optimised lighting services to citizens and businesses.

This report provides guidelines on how best to proceed with the deployment of LED lighting in European cities. It addresses, in particular, cities that are still considering their first LED lighting projects or have limited experience in this field. The guidelines were compiled by a dedicated EU Task Force on Lighting European Cities, with the close involvement of several European cities, energy distribution companies, the lighting industry and financial institutions with experience in LED lighting projects.

This report is part of my Digital Agenda for Europe flagship initiative. It follows up on the Commission Green Paper 'Lighting the Future', which identified European cities as potential lead markets for speeding up the wider deployment of innovative LED lighting solutions.

I welcome this report, and I hope it will turn out to be an incentive for European cities to share Europe-wide their experiences, results and lessons learnt with the deployment of LED lighting.

Neelie Kroes

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1. INTRODUCTION

European municipalities are increasingly looking to improve efficiencies and reduce costs for providing services to their citizens, especially in times of austerity now facing Europe. Public lighting represents a significant share of their total electricity costs, accounting for up to 60% of that budget.

This report is aimed at **decision makers** in **European cities** responsible for **indoor and outdoor lighting infrastructures**.

It is directed towards cities that might be considering their first SSL deployments, and to those that already have some experience and would benefit from more information.

The adoption and deployment of new technologies such as Solid State Lighting (SSL) based on light-emitting diodes (LED) offers significant opportunities for meeting this challenge.

SSL is the most innovative lighting technology emerging on the market. It offers high quality light and visual performance, while providing substantial cost saving opportunities, reducing light pollution in cities and driving innovation in the lighting and construction sectors. When combined with intelligent light management systems, SSL can save up to ***70% of electricity used for lighting***[1] and ***significantly reduce energy and maintenance costs*** compared to current lighting installations.

The European Union has set itself an ambitious target: by 2020, to reduce energy used for general lighting by at least 20%.

This target will be achieved through the massive deployment of Solid State Lighting solutions in Europe.

A number of EU cities have already deployed SSL and experienced its benefits over traditional lighting technologies. They report increased lighting efficiency, energy savings of up to 50-60% and consequent substantial cost savings and reduced maintenance costs. SSL is already mature enough to be justified by a sound business case based upon **total cost of ownership (TCO)**[2]. In addition, it enables creative lighting deployments to enhance cultural aesthetics and promote citizen safety and well-being.

This report is aimed at decision makers in European cities responsible for their indoor and outdoor lighting infrastructures. It presents the findings of a Task Force for Cities[3] that was established by the European Commission with the aim of delivering a roadmap for achieving wider deployment and major rollout of new SSL-based lighting technologies for cities throughout Europe. European cities have the potential to become a major lead market for

1 http://www.photonics21.org/download/Photonics21StrategicResearchAgenda_aktualisierte_Neuauflage.pdf

2 **Total cost of ownership** (TCO) is an accounting concept that calculates the total costs to own, operate and maintain an installation; TCO is also known as full ***life-cycle costing calculation*** (LCC).

3 The Members of this Task Force are provided at the end of this report

- There are more than 90 million traditional streetlights in Europe, with over 75% of the installations being older than 25 years.
- There are massive opportunities for energy savings from the widespread deployment of SSL technology in EU cities.

The report aims to provide clear guidance on how best to roll out SSL, covering the following topics:

- Why to consider SSL technology now
- How to make a business case and secure funding
- How to specify and procure SSL equipment
- How to secure social acceptance of SSL technologies

innovative LED lighting solutions, as identified in the Commission Green Paper 'Lighting the Future'[4] published in December 2011 as part of the **Digital Agenda for Europe** flagship initiative[5] under the Europe 2020 strategy for smart, sustainable and inclusive growth.

This report is directed towards those cities who might be considering their first SSL deployments and to those that already have some experience, but would benefit from more information. It is also anticipated that this report could be of value for informing local, regional and national government organisations, as well as for the wider SSL community.

Recommendations are given on how a city could initiate an SSL deployment, from the preparation of an urban lighting strategy, development of the business case through consideration of immediate cost savings and longer term TCO analysis, and the vital activity of engaging with local businesses and citizens to ensure the best prospects for acceptance and success.

The practical issues of SSL component selection and procurement are provided, with particular emphasis on the practicalities of securing financial support and training the city procurers on the key issues relating to specifying this new lighting technology.

The report also discusses how experiences of SSL deployments can be leveraged to maximize benefits within Europe, through the communication of results and lessons learnt, and through the formation of municipal associations and communities of practice.

In the mid- and longer-term, SSL solutions will be interlinked and dynamically interact with other city infrastructures, such as ICT and sensor networks, energy, facility, mobility and street lighting management systems, as well as renewable energy systems. This will enable cities to provide dynamically adapted optimal lighting conditions at minimum energy consumption and ultimately to contribute to zero-energy buildings and neighbourhoods. The deployment of energy saving SSL, coupled with smart sensors for detecting environmental conditions, presence and light output, could be the first steps in the realisation of such *smart cities*.

4 COM(2011) 889 final of 15 December 2011
5 http://ec.europa.eu/digital-agenda

2. WHY MOVE NOW TO INTELLIGENT, CITIZEN-CENTRIC SSL?

Public lighting accounts for up to 60% of a typical municipality's electricity costs. Street lighting accounts for the biggest share and here SSL solutions offer in general energy savings of up to 60% over mercury vapour lamps, and, in some cases, up to 20% over high-pressure sodium (HPS) lamps.

Factors driving the adoption of Intelligent SSL in cities

- Need to reduce costs for public service provision
- Significant (up to 70%) energy savings and extended luminaire lifetimes
- Better light quality and visibility and less light pollution
- Greater lighting design creativity and functionality
- Improved street safety and security
- Increasing urbanisation will require higher levels of sustainability
- Networked lighting will form an integral part of the future Smart City

The much longer lifetime of SSL also reduces maintenance costs. When combined with energy savings, this means that in many cases municipalities can recover the costs of a basic non-networked LED-based street lighting installation within six to ten years[6]. In addition to energy-savings and low maintenance costs, SSL also offers other benefits in terms of improved customer service resulting from the superior controllability of light colour, intensity (dimming[7]), and direction. In outdoor lighting for example, SSL offers better visibility and reduced light pollution due to high uniformity of coverage, colour quality and tunability. A recent survey[8] showed that for public lighting citizens preferred the white light provided by SSL to the colour of conventional street lighting, and that SSL offered higher visibility and feeling of public safety. A well-lit city is a safer and more comfortable city, and the design creativity offered by SSL contributes to enhancing city environments.

Nowadays, many cities deploy SSL systems with added smart controls for dynamically changing lighting levels in response to specific needs. In addition to the benefits mentioned above, such 'intelligent' lighting systems can save up to 70% of energy[9]. They allow communication between lamps and provide remote access, resulting in a total system that includes dimmable

6 It is predicted that with an uptake of LED technology, the prices will be more or less the same as standard lights in four years' time. Source: «StreetSMART» in Traffic Technology Today, January 2010, http://viewer.zmags.com/publication/6e26c868#/6e26c868/38

7 LED lifespans increase when the drive current is reduced, making them ideal for smart control

8 LIGHTSAVERS programme. «Lighting the clean revolution», http://thecleanrevolution.org/publications/lighting-the-clean-revolution-the-rise-of-leds-and-what-it-means-for-cities

9 E-Street predicts an annual saving of 64% in streetlight energy consumption from introducing intelligent street lighting in Europe, www.e-streetlight.com

luminaires, advanced lighting control and individual monitoring of luminaires. A key factor here is the control system and its interaction with other networks (e.g. communication, sensing or traffic monitoring) for a truly integrated light and energy management approach. Similarly, intelligent SSL can bring potential benefits to road users and road safety (LED lamps can flash or change colour to signal an emergency situation). Also in schools, an SSL system with dynamic colour and intensity adaptation has been shown to significantly improve student performance[10]. Finally, the contribution offered for the lighting aesthetics and its use for enhancing a city's cultural identity should not be underestimated. An example of this is the application of LED illumination to the Brussels City Hall[11].

Consequently, the value to municipalities of switching to SSL goes beyond a mere cost-benefit analysis offsetting higher purchasing costs against the significant savings on energy and longer lifetimes. Although the positive result of such an analysis is fundamental to each decision to invest in SSL, there are other aspects to consider arising from the increased functionality potential and the social benefits offered by intelligent SSL lighting.

Why move to SSL now

- SSL is a mature technology and high-quality luminaires are commercially available
- SSL projects are often economical in a full cost calculation over the lifetime of the lighting installation
- Within a digital lighting system, LEDs are the most efficient light source available, offering long lifetimes (in excess of 50.000 hours) and savings of up to 70% over conventional light sources
- SSL deployment experience exists – many EU cities are gradually adopting intelligent SSL lighting solutions
- SSL deployment provides opportunities for stimulating the local economy through engaging with local businesses
- A favourable European policy context is already in place for facilitating the transition to SSL

Why move to SSL NOW?

The benefits of adopting SSL technology are manifest, but the question remains as to why municipalities should embark on this path now, particularly when service provision budgets are tight and new investments closely scrutinised?

In essence, it is because this is a technology whose time has come – the technology has achieved the necessary degree of maturity to justify serious consideration. High quality luminaires are commercially available and many cities have SSL projects that can be shown to be economical in a **life-cycle costing calculation (LCC)** [2,12]. Experience is steadily increasing through widespread deployment trials across Europe, resulting in

10 See e.g. Barkmann et al (2009), 'Effectiveness of dynamic lighting in Hamburg schools', www.ubp-herten.de/UKE-Ergebnisbericht_Feldstudie.pdf

11 http://www.luciassociation.org/new-sound-and-light-show-in-brussels-belgium.html

12 **Life-cycle costing calculation** (LCC) covers all costs over the lifetime of the installation (investment, operation, maintenance and end-of-life costs).

a solid body of best practice for design, financing, procurement and deployment. Combine this with a growing regulatory drive for energy efficiency (see next section), and a compelling case for deploying SSL emerges.

There are still some barriers hindering the wider deployment of SSL, in particular[13]:

- A limited awareness amongst many municipal lighting departments and luminaire designers of the substantial benefits offered by SSL. The uptake of any new technology needs time and efforts to raise the awareness of users to its benefits compared to conventional solutions.

- The up-front investment costs for SSL are much higher than for conventional lighting, requiring a consideration of total cost of ownership (TCO) to determine the full potential economic benefits.

- A great variability in product quality and in the reliability of information provided by SSL suppliers, and a lack of shared information on performance data of tested SSL products.

Overcoming these barriers is discussed in section 3 of this report.

A favourable European policy context

The current EU policy context is particularly favourable for the deployment of high quality LED lighting in outdoor and indoor installations. The Green Paper 'Lighting the Future'[4] laid down the basis for the widespread deployment of high-quality SSL in Europe. A lighting installation (mainly in the non-residential sector) is one of the main elements to take into account for calculating the energy performance of a building, as required by the EU Directive on Energy Performance of Buildings[14] (EPBD). The recent EU Energy Efficiency Directive[15] requires EU Member States to renew central government buildings in agreement with the minimum energy performance requirements of EPBD, and encourages the application of energy management systems. It also asks authorities to purchase only products, services and buildings with high ratings for energy performance, consistent with the Energy Labelling[16] and Ecodesign[17] Directives, which also strongly support the transition to high quality LED lighting in outdoor and indoor residential installations.

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13 Other barriers related to SSL deployment have extensively been described in the Commission Green Paper 'Lighting the Future'.

14 DIR 2010/31/EU

15 **Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012**

16 Regulation 874/2012/EU of 12 July 2012

17 Regulation 1194/2012 of 12 December 2012. Regarding LEDs, it completes and complements the Regulations 244/2009/EC and 245/2009/EC.

The new EU regulation for Energy Labelling of electrical lamps and luminaires explicitly includes LED lamps and modules. It defines two new energy classes, A+ and A++ (mainly populated by LEDs). The gradual phase-out of inefficient directional lamps is expected by September 2016, when only class B or higher will remain so that the superior energy efficiency of LEDs can be highlighted. The quality of the lamps will be assured by the new Ecodesign regulation for directional lamps and LEDs, which completes and complements the previous regulations for non-directional and professional lamps.

Finally, Green Public Procurement (GPP)[18] criteria exist for indoor and street lighting and for traffic signals. They provide state-of-the-art specifications for lighting products and services with a reduced environmental impact throughout their life cycle that public authorities in EU Member States may wish to consider when procuring such goods.

[18] Green Public Procurement (GPP) is a voluntary scheme at EU level. It is a process whereby public authorities seek to procure goods, services and works, which have a reduced environmental impact throughout their life cycle. See COM(2008) 400.

Examples of European cities pioneering SSL

Representative European experiences of SSL deployments are illustrated by the following case study summaries[19]:

Birmingham (UK)[20]

This is the largest municipal LED deployment in Europe so far, comprising 90,000 street lights. An effective public lighting strategy has been implemented incorporating (i) smart networked controls, allowing dawn and dusk trimming of lighting levels and dynamic lighting output management for lumen depreciation; and (ii) a real-time monitoring system that allows the collection of performance data with subsequent optimisation of lighting control.

It will be possible to vary the light level of individual lighting units according to its recorded needs, and so achieve a significant reduction in energy consumption.

SSL in Birmingham

- 90,000 street lights
- 50% expected energy savings leading to a £2m reduction in annual running costs
- Managed 100,000 hours operation lifetime
- Maintenance savings were a key factor in selecting SSL
- The whole operation is financed through a 25-year Private Finance Initiative contract

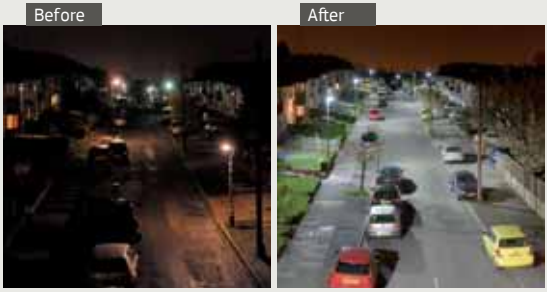

Figure 1: The impact of LED deployment in Birmingham (© City of Birmingham and Indal/WRTL)

[19] More information on some of these as well as on other European LED city pilots are listed on the website of the EU PLUS project http://www.luciassociation.org/Articles-best-practices.html.

[20] http://birminghamnewsroom.com/2012/07/city-is-shining-thanks-to-10000-eco-friendly-leds/

Eindhoven (The Netherlands)[21]

Eindhoven uses special lighting effects for many outdoor and public spaces, including buildings, parks, and art works, thereby earning the accolade of 'City of Light'. Eindhoven has installed sensor-activated lighting systems that dim the light levels in the absence of cyclists or pedestrians, thus reducing costs. The city is closely linked to Philips, whose headquarters are based here, and so hosts many SSL demonstration installations.

SSL installations in Eindhoven

- In sporting areas, providing high light levels without the glare or light spillage associated with conventional lighting
- The Catharina square is lit with an innovative SSL design using 'floating' luminaires with minimal lamp posts, to provide an atmospheric feel and create additional public space for citizens

An innovative deployment of SSL in Eindhoven is the use of colour to provide safety information and to reduce environmental impact. Coloured lights have been installed in the pavements as auxiliary safety indicators to better highlight pedestrian and cyclist crossings in the city, and low intensity green lighting has been deployed on rural cycle paths to improve visibility and minimise impact on the local fauna.

Figure 2: Bridge Lighting in Eindhoven[22] *(© City of Eindhoven)*

21 http://www.luciassociation.org/eindhoven-the-netherlands.html

22 Courtesy PLUS project and LUCI Association (http://www.luciassociation.org/plus)

Hódmezővásárhely (Hungary)

In 2010 and 2011 more than 6,000 new LED street lighting luminaires were installed in the city of Hódmezővásárhely. The energy savings achieved are 35% and the new lighting solution is nearly maintenance free. Through the new SSL solution the lighting levels and the overall visual comfort and feeling of safety have been significantly increased.

Figure 3: Kaszap Road, replacement of HPS by LED (© City of Hódmezővásárhely, Tungsram-Schréder)

Mechelen (Belgium)

The city of Mechelen has over 10,000 street lights installed with a total electricity consumption of more than 4.4 million kWh per year. In the city centre, traditional street lighting has been replaced in stages between April and June 2012 by 577 innovative high-quality LED lighting units spread over 90 streets. LED lighting has brought great improvements in safety, the environment and the general ambience. The new lighting units result in expected energy savings of 37% and have much longer lifetimes (approximately 60,000 hours). The installed system is future-proof and can easily be upgraded to keep pace with the rapid evolution of LED technology, which will permit additional energy savings. The project was implemented by the Flemish regional electricity distribution network operator Eandis.

Figure 4: Mechelen's street lighting (©Philips Lighting)

Lyon (France)[23]

Lyon is a major cultural city that has embraced SSL lighting for illuminating its historical urban environment. Lyon provides a good illustration of how SSL can meet varying illumination requirements, with lighting designs selected to match the different areas of the city and their respective functionalities. This innovative approach makes use of the great flexibility of LEDs to provide distinct lighting identities across the city. In addition, Lyon has adapted the design of lighting at pedestrian crossings, bus stops, etc. to aid people with visual and physical disabilities.

SSL in Lyon

- In the refurbished Guillotière Bridge, achieving 50% energy savings
- In Place Bellecours, saving 130,000 kWh per year
- In the Passerelle St Vincent pedestrian bridge, together with proximity sensors to dim light levels to 10% when unused
- Host to the annual Lyon Festival of Lights, using LED in light installations designed by light artists – LED fixtures use a tenth of the energy and last 20 times longer

Figure 5: Lyon city centre[24] *(© City of Lyon, M. Djaoui)*

[23] http://www.luciassociation.org/lyon.html

[24] Courtesy PLUS project (http://www.luciassociation.org/plus) and LUCI Association

Tilburg (The Netherlands)

Since 2008 the city of Tilburg is investing in SSL street lighting. Today, 15 % of the 44,000 light points are equipped with LED luminaires. In one renewal project, low-pressure sodium lamps were replaced by new light points with LED luminaires. In combination with a dimming of lighting levels to 60% at night time, a reduction in power consumption of more than 65% was achieved. Overall, Tilburg has realised energy savings of 13% since 2008 and expects to realise 20% savings by 2015.

SSL in Tilburg

- A clear strategy is in place to invest in LED street lighting
- About 1,750 LED luminaires are installed every year
- Since 2008, 13% energy savings have been achieved
- Since mid-2012 smart controls are now implemented in every LED lighting project
- Received the **EU Green Light Award** in 2011

Figure 6: New LED lighting in Tilburg (© Philips Lighting)

Albertslund and the wider Copenhagen Region (Denmark)

The municipality of Albertslund, located in the wider Copenhagen area, has adopted a new lighting plan which is solely based on LED technology. The plan includes the development and testing of different street lighting designs and Wi-Fi based smart control systems. In recent years, the town has contributed to the invention of several outdoor lamps, in close cooperation with designers and manufacturers; noteworthy is the award winning "A-lamp". Today, the first stage of a "Scandinavian Lighting and Photonics Science Park" is under development in Albertslund, with the 'Danish Outdoor Lighting Lab' (DOLL) as the driving force. Copenhagen, the European Green Capital 2014, will invest € 40 million to replace 21,000 street and traffic lights with SSL by 2015.

Figure 7: Albertslund street lighting (© City of Albertslund)

Other examples of Cities pioneering SSL

Many other European cities are currently deploying intelligent SSL lighting or are experiencing its use in pilot implementations[25, 26]. Examples include Amsterdam, Budapest, Dresden, Ghent, Gothenburg, Leipzig, Nice, Norden, Stockholm, Stuttgart, Tallinn, etc.

Some EU Governments are facilitating the change to SSL by supporting urban pilot and demonstration projects[27]. The European Commission is supporting several pilot actions through its Framework programme for Competitiveness and Innovation (CIP). These involve LED lighting for indoor and outdoor lighting in cities[28] (LED4ART[29], ILLUMINATE[30], LITES[31]).

Beyond Europe, several other countries are also investigating the benefits of SSL through state supported R&D initiatives and pilot projects which contribute to a better understanding of the practicalities of municipal SSL deployments. The LightSavers programme[8] collated case study information from a consortium of 12 major cities across four continents, through field-testing of 27 LED products in a series of 15 trials.

25 http://iet.jrc.ec.europa.eu/energyefficiency/publication/led-projects-and-economic-test-cases-europe
26 PLUS website: www.luciassociation.org/plus
27 E.g., http://www.photonikforschung.de/forschungsfelder/led-leitmarktinitiative/kommunen-in-neuem-licht
28 http://www.cip4led.eu
29 http://www.led4art.eu
30 http://www.illuminateproject.eu
31 http://www.lites-project.eu

3. PREPARING THE TRANSITION TO SSL

Committing to Change – Adopting an urban lighting strategy

Key steps for planning SSL deployments

- Develop the economic case to justify the investment, including return on investment and life cycle costing analysis
- Identify and engage with the key stakeholders, including citizens
- Establish or subscribe to a database of SSL test results

The SSL deployment strategy should be part of an overall urban lighting strategy and be based on a clear understanding of the lighting requirements and of any shortcomings associated with the existing lighting infrastructure. A detailed technical plan and its associated business case(s) must be developed, with a clear appreciation of what the new SSL deployment should provide both in the short and the longer term.

The European ESOLi project[32] has produced an illustrative Best Practice catalogue[33] based on SSL deployments across Europe that summarises experiences across a range of municipal lighting requirements, and offers guidance to new users. A broader perspective of adopting SSL is provided by en.lighten[34], an international organisation sponsored by the UN: a detailed toolkit was produced, "Achieving the Global Transition to Energy Efficient Lighting"[35], which provides guidance for countries considering making the transition to SSL.

Assessing the Status Quo – Planning & building the business case

Develop the economic case

Assessing the full economic value of an SSL project and then securing the necessary capital investment requires the application of standard analysis techniques. These tools have been widely used in the energy efficiency industry, and can be readily applied to SSL. They are based on the TCO[2] and LCC[12] concepts and provide a more realistic assessment of the long-term economic value to the owner of the SSL system. An example of the LCC approach to green public procurement (GPP) of indoor and outdoor lighting is detailed in the Swedish Environmental Management Council's Procurement Criteria for Lighting Products[36], which also has links to a lighting calculation tool.

32 http://www.esoli.org
33 http://www.esoli.org/images/stories/Download/ESOLi_Best_practice_catalogue_EN_120426.pdf
34 http://www.enlighten-initiative.org
35 http://www.enlighten-initiative.org/portal/CountrySupport/Toolkit/tabid/79082/Default.aspx
36 http://www.msr.se/en/green_procurement/criteria/Office/Lighting-products and http://www.msr.se/en/green_procurement/criteria/Street-and-property/Outdoor-lighting

LCC must be complemented by the impact on maintenance costs, the possible relocation of luminaires and the training of personnel. A similar approach has been conducted by the German Energy Agency *Dena*, providing online-tools to plan, organise, finance and implement the change to SSL both for outdoor and indoor applications[37].

This analysis should also include consideration of the financial impact of changes in maintenance schedules, possible relocation or replacement of luminaires (for optimising lighting conditions), and any staff training required, so addressing the full picture. A practical example of this is the Birmingham City deployment mentioned earlier[20].

An appreciation of the range of SSL lighting equipment and its performance capabilities can be obtained either by consulting supplier information, or, even better, by consulting databases based on test results assembled by municipalities. For example, the Belgian energy distributor EANDIS, which coordinates the transition to SSL street lighting for many Flemish municipalities, has together with other Belgian grid operators accumulated test results on a wide range of components, and this database is accessible online[38]. The cities of Budapest[39] (Hungary) and Tallinn[40] (Estonia) have also gathered data in LED technology pilot projects. Other Best Practice cases are listed in the PLUS Showcase database[19].

The Swedish Environmental Management Council has established Procurement Criteria for Lighting Products based on LCC[12].

Engaging with stakeholders, actively involving citizens and promoting local innovation

For any planned deployment of SSL in municipalities, engagement with stakeholders and citizens is essential for securing social acceptance of SSL from local residents and for providing new business opportunities at the local level. Such engagement should be a key factor at all stages of the process, right from the initial planning stage through to post-deployment system evaluation.

Local economic development policies would profit from a better understanding by cities of

Stakeholders to engage with in SSL deployment

- Local citizens, shopkeepers
- Municipal departments
- (Lighting) Industry and local research organisations
- Energy companies
- Trade associations

37 http://www.lotse-strassenbeleuchtung.de and http://www.lotse-innenbeleuchtung.de
38 http://www.synergrid.be/index.cfm?PageID=17536
39 http://www.luciassociation.org/the-liberty-bridge-budapest-hungary.html
40 http://www.luciassociation.org/led-test-street-project-tallinn.html

the existing contribution companies can make in the lighting sector and their related growth potential. Cities could then better support the local lighting sector to innovate and generate more jobs. There are also many benefits for cities of cooperating more closely, particularly with their Universities and the higher education sector to establish local courses and expertise in lighting design and engineering.

Specifically, engagement can be foreseen in the following manner:

Any business case for SSL should include analysis of societal benefits

- Improved security for citizens
- Cultural or aesthetic enhancements
- Improvements in workplace – learning – healthcare environments
- Changed citizen perceptions of their living environment
- Attracting more tourists for the city and visitors for local commerce

- **Planning phase:** Early engagement with all stakeholders through local consultations at the definition phase of the overall lighting concept. This will help mitigate natural conservatism that might otherwise result in unwarranted concerns about 'new technology'[41]. Early involvement of local industry and local research actors will help contribute to best planning and to technological innovation. This may also require general information and educational measures to provide a better understanding of SSL, and so improve awareness and ensure a wider appreciation of the benefits of SSL. There may also be valuable opportunities for engaging with local lighting companies to promote new business possibilities that could accompany a planned SSL deployment.

- **Deployment phase**: Supplying stakeholders with clear information on the planned timescales and actual achieved progress should ensure positive engagement and is likely to increase the community acceptance of any disruption or delays encountered during deployment.

- **Evaluation phase**: Seeking feedback from the stakeholders on the deployment results as well as the overall process itself. This includes disseminating information on the effectiveness of the new SSL system in terms of lighting quality, energy efficiency and impact on society or local business.

Measures through which such a dialogue with stakeholders could be initiated and sustained by the municipality include forum meetings, representation in planning committees, articles in the local press and on community web sites, and awareness surveys.

41 In previous SSL case studies this has not been a major issue.

Basic steps for preparing a citizen-centric lighting strategy

- ***Assessment:*** What is the extent and capabilities of the existing lighting system, and are there major shortcomings?
- ***Vision:*** Where do you want to go with your lighting system? Are there specific targets, both quantifiable and less tangible ones?
- ***Zoning:*** Do the lighting requirements vary within the different zones of the planned deployment?
- ***Changes:*** What specifically needs to be implemented to move from your current system to the desired lighting vision?
- ***Planning:*** Develop a five- or ten-year deployment strategic planning that will allow these changes to be implemented. Consider additional environmental issues, such as recycling of old luminaires.
- ***Stakeholder Engagement:*** How can you engage with the key stakeholders, in particular the citizens?

4. MAKING THE TRANSITION TO SSL

Scoping the market for good-quality SSL products

Major steps for transitioning to an SSL system

- Selecting the SSL system and supplier
- Securing the finance to cover initial investments
- Procuring and installing the SSL system
- Establishing revised maintenance procedures
- Monitoring the transition and periodically updating or revising the strategy as necessary
- Establishing or subscribing to a database of test results
- Joining an existing support network, e.g. the EUROCITIES network of major European cities, the Lighting Urban Community International Association (LUCI), etc.

A wide range of commercial SSL products is now available and their number is increasing steadily. The selection of luminaires and other associated equipment requires a detailed evaluation of the specific lighting needs of the proposed deployment. The rapid pace of change in SSL technology and product offers makes it increasingly challenging to scope the market, and obtaining independent advice on equipment that meets minimum performance standards would be desirable.

Manufacturers in the EU are not required to have their products approved by independent testing labs. However, the EU Eco-Design regulations covering LED lighting products[42] provide methods to set performance expectations. National authorities in EU Member States are responsible for market surveillance and for checking compliance with EU regulations.

Some websites have been launched as initiatives from lighting professionals, the lighting sector, or testing labs that provide product information on a broad range of LED lighting products, such as the *LED Lamp & LED Fixture Locators*[43] or *whichledlight.com*[44].

Securing financing

Although costs are starting to come down, a major challenge for the uptake of SSL in cities today is still the relatively high level of up-front investment costs, in comparison to conventional technologies, even if on paper the SSL project could pay this back over the lifetime of the investment through the achieved energy savings and reduced maintenance costs. If municipal deployment of SSL is to be accelerated, alternative models of financing should be considered.

42 Commission Delegated Regulation (EU) No 874/2012 ; Commission Regulation (EU) No 1194/2012
43 http://www.ledfixturelocator.com and http://www.ledlamplocator.com
44 http://www.whichledlight.com

Public Funding

The majority of public funding sources available for lighting projects are managed at the national level (although some come from the EU and other foreign donors), and funding conditions differ in each EU Member State. In general, the funds are not specifically for SSL, but are usually provided in association with environmental and energy saving issues.

At the EU level, two schemes are noteworthy. The European Energy Efficiency Fund[45] (EEEF) is a public-private partnership that provides fast and flexible market-based financing for commercially viable public sector related energy efficiency and renewable energy investments, particularly in urban settings. Projects include energy saving measures in buildings and modernisation of local public infrastructure, including energy-efficient public outdoor lighting. The target beneficiaries of the Fund are municipal, local and regional authorities, as well as entities acting on their behalf, such as local energy utilities and energy service companies. The EEEF offers both debt and equity instruments, and investments should typically be in the range of €5 million to €25 million.

Another source of funding is the European Local Energy Assistance (ELENA) programme[46] jointly initiated by the European Commission and the European Investment Bank (EIB). Run by the EIB and funded through the Intelligent Energy Europe programme[47], ELENA targets local and regional authorities. It covers up to 90% of technical assistance (TA) costs needed to prepare, implement and finance energy efficiency or renewable energy projects, and should mobilise an investment of at least 20 times the TA costs. Information on the funding sources available in a range of European countries has been collected by the ESOLi project [32].

Finance Models

Public-private partnership models for supporting energy services may be a viable option for saving energy and maintenance costs, whilst at the same time guaranteeing high quality lighting systems. Usually, this means financing and operating procedures for providing specific energy services to the owners of the lighting systems, but may also include cost effective delivery of electricity to the system owner. There are also energy service models that include provisions for utilisation of renewable energy, replacement of existing components and systems, energy metering and billing, LCC assessment[12], and interfaces with other customer services.

45 http://www.eeef.eu
46 http://www.eib.org/products/elena/index
47 http://ec.europa.eu/energy/intelligent

The main distinguishing feature of most energy services is that the energy service company (ESCO)[48] bears the risk of the lighting and installation management with regard to energy. With this responsibility comes the opportunity to make a profit, if the intended efficiency improvement is actually achieved.

Energy Service Models

Given the rapid SSL technology evolution, energy saving contracts should include specific provisions to ensure that installed LED sources are regularly replaced by better performing and more energy efficient new ones.

There are three basic models for the provision of the energy service:

- **Lighting Contracting** – a pure service model, where the lighting system ownership remains with the public authority. It is the simplest and the most widely used model.
- **Light Supply Contracting** – a complete transfer of the system to a private company. The contractor takes over the full responsibility for the lighting system, including the planning and construction of the lighting system, its financing and operation, the invoicing of the finished end product, and the purchase of electricity. This latter feature might be attractive if the contractor is a utility with access to advantageous electricity prices. However, it could be less attractive to a municipality, as they would be bound to the contractor over the full contract period.
- **Energy Performance Contracting (EPC)**[49] – a combination of elements from the above two models. The ESCO is responsible for the implementation of the energy saving measures and the operation and maintenance of the lighting system. The payment to the ESCO is based on the actual energy savings. EPC has a high potential for financing modern and energy efficient street lighting solutions, especially in municipalities with limited budget for investments and staff with limited knowledge of street lighting.

For the lighting customer, who also owns the lighting system, the energy service project can be funded by three alternative financing models (or a combination of them):
- Self-financing – the customer provides the financing from own funds
- Debt financing – the customer takes a loan from a financial institution
- Energy service provider financing (third party financing) – the funding comes from the energy service provider (e.g. an ESCO).

[48] **Energy Service Company (ESCO)** delivers energy services in a user's facility or premises. ESCOs accept some degree of financial risk for doing so. The payment for the services delivered is based (either wholly or in part) on the achievement of these improvements and any other agreed performance criteria.

[49] **Energy Performance Contracting (EPC)** is a contractual arrangement between the beneficiary and the provider (normally an ESCO) of an energy efficiency improvement measure, where investments towards achieving that measure are paid for in accordance with a contractually agreed level of energy efficiency improvement.

Procuring SSL

Most municipal authorities find the procurement process for SSL quite challenging. SSL is a new technology with characteristics that can be very different from the more familiar traditional lighting systems. From the procurement point of view it is often unclear what specifications should be requested. From the supply point of view, there is great variability in product quality and in the reliability of information provided. Although the number of high quality products is rising steadily, there are still poorly performing products on the market, which can result in poor user experience undermining the overall reputation of SSL technology.

Following the experience gained in extensive studies at several European SSL test sites, minimum performance requirements must be defined and applied, to ensure higher acceptance and improvement of SSL luminaires. These SSL-specific performance requirements should be expressed in line with existing LED lighting standards or pre-standards from European (CEN, CENELEC) or international (IEC, CIE) standards organisations.

Procurement specifications should be well thought through so that they could lead to the selection of high quality lighting solutions based on a comparative assessment of the performance of the offered SSL solutions.

In 2011 the IEC published two pre-standards on performance requirements for LED modules and LED luminaires, together with the test methods and conditions to show compliance[50]. These criteria, together with the specification of minimum performance requirements for the project at hand, can be used as a basis for the SSL tender specification. The procurer should require that the SSL performance related product specifications be measured according to the appropriate IEC specifications. The procurer could also opt to require independent third party verification of performance claims as part of the tender.

Several organisations, including European and national lighting sector associations and grid operators in charge of public lighting, have developed selection tools and guides to assist new buyers of SSL systems[51]. A national funded German project involving the lighting industry, research organisations and an accredited test lab[52] is developing standardised quality criteria for establishing a performance quality label for LED lamps[53].

50 IEC/PAS 62717 and IEC/PAS 62722

51 https://www.theilp.org.uk/documents/led-product-specifications/led-spec-2012v2.pdf, http://www.celma.org/archives/temp/CELMA_TF_Apples_Pears(KR)009_CELMA_Guide_quality_criteria_LED_luminaires_performance_Sept2011_FINAL.pdf, http://www.esoli.org/images/stories/Download/ESOLi_Best_practice_catalogue_Appendix_EN_120426.pdf http://www.lotse-strassenbeleuchtung.de, http://www.synergrid.be/download.cfm?fileId=C4_11_3_Specifications_for_lighting_equipment_with_LED_technology_v032012.pdf

52 VDE Prüf- und Zertifizierungsinstitut gGmbH

53 http://www.aif.de/fileadmin/user_upload/aif/service/mediathek_PDF/Projektflyer_2012/Projektflyer_LED_Web.pdf

The European Commission has recently published a set of environmental criteria for Green Public Procurement of indoor and street lighting[54].

Public procurement regulation in the European Union allows the inclusion of selection, award and exclusion criteria in a public tender. These can be used to prevent procurement decisions being based on pricing alone, and so open the way for procuring more innovative lighting installations offered by SSL technology. Procurers should be able to award points for those aspects that are most important to their specific requirements. Additionally, EU Member States and public authorities can implement, on a voluntary base, the Green Public Procurement (GPP) scheme[54] for procuring goods, services and works with a reduced environmental impact throughout their life cycle.

Training the procurers and the other municipal staff

Having skilled staff within the lighting sectors of municipalities will be essential for changing the patterns of investment and utilisation of SSL.

Many architects and technical consultants lack specific knowledge and experience of SSL and its advanced lighting concepts and design possibilities. Therefore, they often advise their clients that tenders should be based on simple functionality alone, leaving the contractors or suppliers to do the detailed design and technical specifications for the system. Frequently this results in the contractor selection being based on cost alone, without taking due account of other relevant aspects, such as upgradability[55], life cycle costing[12], quality, environmental performance or benefits for society.

There is currently a lack of solid evidence-based knowledge within European municipalities of how the planning of lighting should be implemented, and of well-trained staff specialised in the procurement of SSL lighting systems. The ESOLi project[32] has prepared an illustrative example of a suitable programme for SSL procurement training[56].

54 http://ec.europa.eu/environment/gpp/pdf/criteria/street_lighting.pdf
http://ec.europa.eu/environment/gpp/pdf/criteria/indoor_lighting.pdf

55 To keep pace with the rapid evolution of LED technology it might be desirable to require upgradability of e.g. luminaires so that LED modules can be replaced periodically by more performing next-generation modules

56 http://www.esoli.org/images/stories/Download/Training_Summary_of_required_skills_111019_EN.pdf

SSL technology deployment

Specialist service providers would normally undertake the technology implementation process, so the primary role of the municipality during the deployment would be monitoring of progress and verification of the quality and completeness of the contracted services provided. Verification would cover quantity and location of luminaires, optical performance, and energy efficiency. Certain performance metrics, such as lifetime and self-adjustment, will only be verifiable after a sustained period of operation. Suitable warranty provisions with the SSL contractor would be needed to cover this aspect.

Successful deployment strategies could consider:

- ***Prioritisation***: Make initial installations where they will have most immediate benefit. Do not install new lighting where it is not needed, but implement SSL as an integral part of all new infrastructure projects. Choose some high visibility 'demonstration' projects to showcase the benefits of SSL to the community.

- ***Offsetting benefits***: Choose the lighting design that most effectively solves the specific lighting task, balancing function, aesthetics, energy efficiency and economy. For a relatively small investment, good lighting can have a significant impact on the well-being of citizens and enhance their cultural perceptions.

- ***Well-tailored solutions to user-needs***: Adapt the local lighting pattern to match the needs of local businesses and citizen's leisure activities.

- Use improved lighting to ***encourage greater citizen use*** of non-motorised transport through providing attractive, well-lit walkways and cycle paths.

- ***Environmental Impact***: Replace & recycle mercury-based lamps to reduce the environmental impact of hazardous materials, and use luminaire designs that minimise upward emissions to reduce light pollution.

Further suggestions for optimising deployment of SSL are presented in the PLUS Mainstream Guide[57].

[57] http://www.luciassociation.org/images/stories/PDF/plus%20mainstream%20guide.pdf

Operations and maintenance

The very long lifetimes offered by SSL systems – in excess of 50,000 hours – present new challenges for municipalities in terms of maintenance. Overall there are very significant cost savings in maintenance operations, as with SSL lighting fixtures there will be no more need for the frequent lamp replacement that would otherwise be required by the limited lifetime of conventional lamps. This could be somewhat offset by the more frequent cleaning of lamps which may be needed, particularly for locations such as busy roads where there is a high level of pollution. The capability of intelligent SSL lighting to self-test and implement in-life self-adjustment will have a significant impact on maintenance requirements, as will networked lighting that allows automatic notification of luminaire faults.

A further maintenance issue to consider is unification of the luminaire stock or LED-modules to minimise the number of variants held as inventory for replacements. If such standardisation can be adopted during the planning stage, considerable savings in operational costs will be possible.

Assessing impact and measuring performance

Monitoring the operation of a new SSL installation is important for generating data on overall lighting performance and user acceptance. This data can be used to assess the overall success against the initial plans, and to monitor on-going operational performance. Monitoring will also provide benchmark data, against which subsequent performance improvements can be measured.

A very limited number of private European companies have established larger scale testing and demonstration facilities, enabling the testing of lighting designs in an urban environment. The Philips Outdoor Lighting Application Centre (OLAC)[58] in Lyon is such a facility. The OSRAM subsidiary SITECO operates an outdoor lighting test centre in Traunreut, where LED street lighting luminaires can be experienced under real conditions[59]. The LED showcase of the German energy supplier RWE in Kaarst near Düsseldorf is yet another example[60]. It can be anticipated that independent facilities offering impartial testing of SSL components in real-world configurations will be established over the coming years in response to wider deployment of this technology. Ideally, these would offer virtual testing facilities, allowing municipalities to demonstrate technology to decision makers, politicians and citizens groups.

58 http://www.newscenter.philips.com/main/standard/about/news/press/article-15312.wpd
59 http://www.siteco.com/en/light/lighting-test-area.html
60 http://www.kaarst.de/C12578AF003D5B97/files/rwe_infoflyer_led_park_driesch.pdf/$file/rwe_infoflyer_led_park_driesch.pdf

5. LEVERAGING EXPERIENCE

Communicating results achieved and lessons learnt

The sharing of good practice and applicable knowledge amongst decision makers and practitioners is an important way of influencing decisions concerning lighting. Clearly it will only be possible to improve European and national decision making underlying SSL deployment strategies, if well-proven successful examples of lighting solutions can be demonstrated, based on solid documentation and analysis of all relevant aspects (investment, maintenance, energy costs, life-cycle calculations, etc.). This will help overcome the fact that municipalities in many countries are under pressure to choose short-term, economically viable solutions over longer-term, more sustainable and environmentally friendly lighting solutions. It also further serves to emphasise the potential benefits of EU mandated actions, supporting joint, cross-border activities, in parallel with efficient measures for the dissemination of results and best practices.

Varying levels of reporting can be considered, depending on local practice, but could range from annual reports provided to politicians, monthly reports for lighting departments, real-time monitoring reports for maintenance engineers, to readily accessible on-line newsletters for citizens.

Dissemination of knowledge and good practice activities should be targeted towards:

- Lighting planners & staff in municipal technical and environmental departments
- Local citizens
- National and regional level decision makers
- Lighting professionals, advisory engineers, lighting designers and architects
- Other organisations, NGO's and the lighting industry

A wide range of new dissemination routes could be employed at the European and national level, including:

- Registration and collection of best practice municipal lighting projects
- Publishing on the Internet
- Published yearbooks of recent case studies
- Presentation at relevant trade fairs (Light & Building[61], LumiVille[62]) and conferences (EU coordinated, European NGO's)
- Introduction of new European prizes[63] to reward exemplary municipal LED lighting projects (prizes could reward e.g. the 'Municipal LED Lighting Project of the Year' or the 'LED Lighting City of the Year')
- Joining existing networks of cities which offer opportunities for disseminating and showcasing best practices

61 http://light-building.messefrankfurt.com/frankfurt/en/besucher/messeprofil.html
62 http://www.capurba.com/lumiville/en
63 Could be inspired by existing award schemes such as the LUX Awards (http://www.luxawards.co.uk/)

The dissemination task should be organised as a collaborative action between a European coordinating organisation and regional/national based networks or cluster organisations.

Sharing knowledge through associations and communities of practice

More broadly, there are opportunities for mutual support between municipalities through the formation of communities of practice and shared resources. Several of these have already been established, for example EUROCITIES[64], the network of more than 130 major European cities sharing knowledge and information on a wide range of policy areas including energy efficiency measures, or LUCI[65], the international association of cities with focus on urban lighting created by the City of Lyon in 2002, and which now brings together 65 municipalities worldwide. European projects such as ESOLi (Energy Saving Outdoor Lighting)[32] or PLUS (Public Lighting Strategies for Sustainable Spaces) also offer such opportunities. Within the PLUS project for example, LUCI has assembled a useful urban lighting database of best practice, accessed via the PLUS website[26].

To promote such dissemination actions, the EU offers funding for collaborative projects within its multi-annual framework programme for research and innovation[66].

64 www.eurocities.eu
65 www.luciassociation.org
66 E.g., the Intelligent Energy Europe programme, aimed at supporting EU energy efficiency policies, http://ec.europa.eu/energy/intelligent

6. MOVING SSL FURTHER AHEAD: SMART CITIES

Adoption of SSL will result in 'greener' buildings and public areas that use substantially less electricity, providing the means for achieving compliance with the 2010 EU Directive for 'near energy-zero buildings'[67] and the 2012 EU Directive for the promotion of energy efficiency[15]. However, energy savings are only the first step, and intelligent lighting through SSL combined with sensors and digital processors as well as with solar photovoltaics will provide an essential enabling technology for ***Smart Cities***. The **EU Smart Cities Initiative** will support this development by pooling resources from the ICT, energy and transport areas, and focusing on the implementation of lighthouse demonstration projects. A Smart Cities roadmap is currently being developed and the Initiative will be partly financed under the new research and innovation framework programme for 2014-2020, **Horizon 2020**[68].

A number of key developments will influence the future deployment of SSL in cities:

Intelligent Lighting Systems: Digital control already allows individual lighting devices to be controlled and offers direct communication between lighting devices and their local environment. This provides possibilities for improved control methods and granularity of lighting controls, such as user interfaces for manual and automatic adjustments in response to daylight availability, occupancy, or time of the day.

Smart cities and communities European innovation partnership

- A new partnership between the European Commission, industry and European cities to boost the development of smart technologies in cities by pooling resources from the energy, transport and ICT areas.
- The scheme will focus on implementing lighthouse demonstration projects
- It will become fully operational under "Horizon 2020"

Adaptive Lighting: SSL can deliver instantly addressable, customised and adaptable light based on the needs or desired mood of the occupants. Dynamic lighting could be used to achieve better educational outcomes, more productive workers and improved health, safety and quality of life.

Health & Well-Being: The quality and type of lighting can impact human health and comfort. Good ambient lighting can relax, soothe or excite. Lighting that could adapt automatically to meet the individual needs will offer great benefit, particularly the elderly and the infirm, but also to students and workers.

Integrated Lighting and Solar Systems & Networked Lighting: The increased intelligence in lighting systems will allow integration with other city systems, such as energy,

67 Directive 2010/31/EU of 19 May 2010 on the energy performance of buildings

68 http://ec.europa.eu/research/horizon2020/index_en.cfm

facility or mobility systems, to optimise power smoothing, generation, delivery and monitoring. Smart lighting also provides a data network, allowing for the flow of information between the different city networks, for example communicating maintenance needs. The lighting network could readily be used to supplement local citizen data networks, providing the infrastructure for city-wide wireless communications.

Integrated Lighting and Solar Photovoltaic systems: Increasingly, lighting systems and solar photovoltaic systems will be integrated into smart building envelopes (e.g. as "Smart Windows") to provide dynamically adapted optimal lighting conditions at minimum energy consumption and ultimately to contribute to zero-energy buildings and neighbourhoods.

Wireless Sensor Fusion: Sensor fusion, combining many different sensor types and distributed intelligence within the lighting system, will open many new applications. Sensors could determine the optimum lighting by monitoring occupancy, temperature, energy management, daylight availability, or the presence of RFID tags.

Though some of these developments will take several years to deployment, others are much shorter term with key features already being investigated through current pilot schemes[69].

[69] http://www.eumayors.eu/IMG/pdf/Covenant_of_Mayors_Case_Study_Albertslund-2.pdf

7. RECOMMENDATIONS FOR MOVING AHEAD

Several issues remain to be resolved to further assist municipalities in undertaking widespread deployment of SSL. To address these, a number of recommendations are made:

i. **Create European Buyers Consortia or User Federations and support the development of specifications and testing facilities:** Establish European Buyers Consortia to share technical information and experiences related to specific SSL projects, building a repository of valuable field experience and product data, and thereby accelerating the uptake of innovative and good quality SSL. Such consortia could coordinate component testing through the establishment of a chain of European testing facilities, and facilitate collective buying, thereby ensuring unified specifications with consequent volume discounts.

ii. **European Level Finance Initiatives:** Innovative finance strategies for large-scale SSL deployments should be developed to overcome installation cost barriers. Schemes should involve the European Commission, national governments, financial investment organisations (national and European banks), and lighting suppliers, providing financial models suitable for different deployment projects, such as the Public Procurement of Innovative Solutions[70] initiative, aimed at increasing the market uptake of innovative products and services.

iii. **European Level Procurement Mandates:** Leveraging community and national procurement powers through mandating changes to public procurement processes will help ensure that SSL technology is actively encouraged for indoor building and street lighting projects.

iv. **Training the procurers:** Providing specific training to public procurers on how to implement SSL-favourable procurement lighting processes will help accelerate the transition to SSL lighting.

v. **Educating citizens:** Significant attention should be paid to citizen education, as this will be critical for SSL acceptance. This is best performed in partnership with industrial stakeholders, energy efficiency sponsors, and state and local governments. SSL awareness demonstrations linked with local R&D and suppliers would provide an effective means of achieving this. There is also a strong need to educate the potential buyers on SSL technology, addressing procurement, specifications, verification, and likely energy efficiency and maintenance cost savings.

vi. **Gateway Demonstrations for moving to Smart Cities:** Major technology demonstration actions are needed to showcase intelligent, interconnected SSL lighting solutions implemented in cooperation with municipalities. Such 'Lighthouse' projects should explicitly

[70] http://ec.europa.eu/enterprise/policies/innovation/policy/public-procurement/index_en.htm

demonstrate the potential commercial benefits that an EU city will have in moving towards *a smart city approach*[71].

vii. **Smart Specialisation and promotion of innovative SSL lighting solutions:** Include large demonstration and procurement actions of innovative SSL lighting solutions as part of the regional specialisation strategies (new cohesion policy), thereby ensuring that the great potential for innovating future SSL can be realised while promoting the local & regional business innovation potential[72].

viii. **The adoption of SSL lighting standards and open lighting architectures:** The adoption of minimum performance standards for SSL can stimulate the uptake of good quality products. The additional move to open lighting architectures will support the deployment of intelligent SSL lighting systems.

Real benefits will materialise only if all the actors identified in the report are actively involved in taking up and implementing the approaches and recommendations proposed in this report.

The European Commission will continue to work in close cooperation with the EU cities and the Member States for further promoting the implementation of these recommendations. In doing so, it will use every framework available (Standardisation, Horizon 2020[68], the new Cohesion funds[72], etc.) to facilitate the deployment of Solid State Lighting in European Cities, so they can realise the huge economic and social benefits inherent with this technology.

71 http://ec.europa.eu/energy/technology/initiatives/smart_cities_en.htm
72 http://s3platform.jrc.ec.europa.eu; http://ec.europa.eu/regional_policy/what/future/proposals_2014_2020_en.cfm

ANNEX – EU Task Force on Solid State Lighting for Cities

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