



LED Street Lighting

Cutting Costs While Improving Safety and Service

Today's light emitting diode (LED) street lights are designed to offer a completely new and revolutionary service to cities and towns around the world. Street lights are no longer dull, commodity fixtures emitting yellow light. Innovations in lighting technology, systems and controls now mean that street lights are much more energy efficient, offer better quality light and can help local authorities save money, while improving the services they offer their constituencies.

There are many compelling reasons for local governments and municipalities to convert to LED street lighting:



Lighting Quality

LED street lighting offers a significant improvement over the ubiquitous yellow glow of sodium. The white light of LED systems offers better colour rendition and object detection, and enhances safety and comfort. LED street lighting also offers better optical design opportunities which cannot be achieved with conventional sources, resulting in more even illumination and reduced light pollution.



Energy Savings

LED street lighting is more energy efficient than conventional technologies – with designs that save on average between 40 and 80 per cent of energy, depending on the technology being replaced. For example, a 250 W sodium fixture can be replaced with 110 W LED. Adding controls to the network to enable late-night dimming (within safety standards) can capture a further 15 to 30 per cent savings.



Less Maintenance

LED street lighting provides a significantly longer operating life than conventional technologies, so there are fewer lamp changes and less down-time and expense associated with street light outages. Many cities have saved 50 to 75 per cent of their street lighting maintenance budget by switching to LED technology.



Intelligent Networks

Coupling LED street lighting systems with controls and intelligent networks further augments their benefits, supporting municipalities in managing and facilitating other critical municipal services, such as emergency responders, parking, traffic flow and even air quality monitoring.





Municipalities today face many demands on their budgets and time. Moreover, the literature suggests that street lighting can account for as much as 50 per cent of a municipal energy budget. Hundreds of cities around the world have taken the step to upgrade their lighting systems to incorporate new LED technology and controls, and realised the financial benefits and performance improvements of doing so. More detail on the motivation behind this shift, including light quality, energy savings, lower maintenance and intelligent networks, is given below.



Lighting Quality

The improvements in lighting quality that come from shifting to white-light LED sources from older yellow sodium systems go beyond the aesthetic. Studies have shown that safety is also improved. The white light sources double driver peripheral vision, speed up the human eye response time and increase brake reaction time at least 25 per cent. People’s perception is that, at the same lighting levels, white-light systems are brighter and safer than yellow light.

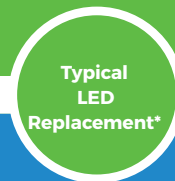
In addition to the human-perception benefits, LED systems offer optical improvements that deliver more even illumination on the road surface or walkway, thereby avoiding dark spots and pools of light. LED street lights are typically composed of dozens of individual LED light point sources, which are optically designed and arranged to provide light coverage much more efficiently and evenly across the illuminated area. They are, in essence, a collection of spot lights, carefully arranged to provide even lighting – something which was very difficult to achieve with conventional technology, which is typically a single light source shining through a large lens. LEDs also offer better optical precision, so there is a significant reduction in ‘light pollution’, including ‘up light’ (wasted light illuminating the night sky) and light encroachment outside of the intended lit area, which can affect wildlife.



Energy Savings

Upgrading to LED street lighting has the potential to generate significant energy savings. Case studies from around the world highlight the energy savings benefits that have been realised by municipal authorities who have shifted from conventional street lighting to LED systems. The literature points to energy savings of anywhere from 40 to 80 per cent, depending on the lighting design and the technology being replaced. Additionally, LED technology lends itself much more readily to dimming. Indeed studies have shown that late in the night, when there is less traffic and eyes have adjusted to the darker conditions, it is possible to safely reduce the levels of illuminance on the street, typically yielding a further 15 to 30 per cent of energy savings.

The table below offers indicative estimates of the energy saving potential of LED street lighting compared to typical conventional technologies. These savings translate directly into smaller energy bills for cities and municipalities.



Conventional Technology	Typical LED Replacement*	Energy Savings
Mercury vapour 200 Watts 450 Watts	LED replacements 65 Watts 135 Watts	67% savings 70% savings
High pressure sodium 100 Watts 250 Watts	LED replacements 55 Watts 108 Watts	45% savings 57% savings
Metal halide 100 Watts 175 Watts	LED replacements 45 Watts 85 Watts	55% savings 51% savings
Incandescent/halogen 200 Watts	LED replacements 25 Watts	88% savings

Note: Actual installation wattages will vary depending on the installation and national/local safety standards. Energy saving figures are indicative averages based on desk research.



Lower Maintenance Costs

Replacing broken street lights is a regular cost that all cities and towns have to pay. Given that street lights operate about 4,000 hours/year (on average 11 hours/night) and that most conventional lamps are rated for about 20,000 hours of service, these are generally replaced on a five year cycle. Changing street lights carries significant associated costs for traffic control, lane and ramp closures, and sometimes forces transport authorities to engage in late night work to avoid congestion and modal conflict. Hence the costs of maintaining a traditional system are very high.

Today's LED lighting systems are offering multi-year warranties and come with lifetimes of 100,000 hours - a five-fold improvement over the service life of conventional street lighting technologies, representing 25 years of service at 4,000 hours/year. This has been achieved by creating designs that incorporate features such as surge protection to prevent electrical faults, heat sinks and other thermal design measures to improve heat transfer and prolong LED life. Furthermore, systems that incorporate controls and intelligent networks are able to monitor and report back on their performance and functionality, thus enabling the control unit to know exactly where any failures have occurred.

Case studies have found that the maintenance cost savings from upgrading to LED lamps have typically been between 50 and 75 per cent, which lowers costs and frees up staff to work on other critical municipal priorities. Lower maintenance costs are a critical factor to keep in mind when looking at the payback from adopting an LED street lighting solution.



Controls and Intelligent Networks

Beyond the energy and environmental benefits, an intelligent network of street lights spread out across a city or town also offers communications improvements. Systems which can assist with many of the normal functions of a living city, including parking and traffic flow, are available. They can provide drivers with real-time information about the availability of parking, including where spaces are available and whether parking lots are full, thereby avoiding wasted time and unnecessary journeys searching for a space. Street lighting systems can monitor traffic flow, and offer alternative routing based on weather, construction and changes to traffic signal timing. Intelligent street lights can also monitor air quality and other environmental conditions to improve information flow and enable municipalities to take action to benefit the lives of their citizens.

Intelligent lighting systems can also improve the emergency response to dangerous developments by assisting with traffic control, providing information about the location of an incident and reducing response time. Systems which have audio functions can even detect gun shots and automatically notify police of the time and location of an incident.





From Idea to Reality

Mayors around the world who have already taken the step to LED street lighting are currently benefitting from the energy and performance savings from this upgrade. The value proposition of LED street lighting is compelling from a cost, environment, safety and service perspective. Innovations in lighting technology, systems and controls now mean that street lighting is much more energy efficient, offers better quality light and can help local authorities save money, while improving the services they offer their constituencies. Payback periods vary around the world, but many projects are now coming in with a payback period of less than five years on the investment.

The following are a series of steps and instruments that a municipality could consider in making the shift to LED street lighting:

1. Decide whether LED street lighting is appropriate for your community;
2. Determine the scope (number of lights) and timing of the project;
3. Identify possible sources of finance;
4. Develop a business case that looks at the costs and benefits, with an emphasis on the payback period;

5. Develop, and issue, a procurement specification, taking into account local safety standards;
6. Meet with LED street lighting suppliers to discuss your options;
7. Test the preferred solution in your community and solicit feedback;
8. Issue the final procurement specification and select a supplier;
9. Install the LED street lights;
10. Develop and implement a maintenance programme.

Financing

Financing an LED street lighting retrofit can be a hurdle for many municipalities, even if the planned transition offers very favourable economics. As LED street lighting systems are designed to last for 15 to 20 years, all aspects of initial costs, ongoing expenses, and long-term savings must be taken into account. A growing variety of financing and business model options are available, but the most common are: 1) city-owned and maintained, 2) city-owned and third-party maintained, 3) utility-owned and maintained, and 4) utility-owned and third-party maintained. Linked to the business models, different sources of finance are available including self-financing, utility financing, grants/rebate schemes, and third-party financing. The key point being, if the business case is strong, the financing will follow.



Further information and assistance

Some primary and secondary resources where interested parties can get more detailed information and access to tools on street lighting include¹:

PUBLIC ORGANISATION RESOURCES

ADEME

<http://www.ademe.fr/collectivites-secteur-public/gerer-equipements-services/eclairage-public>

DesignLights Consortium

<http://www.designlights.org/>

DOE Municipal Solid-State Street Lighting Consortium

<http://energy.gov/eere/ssl/doe-municipal-solid-state-street-lighting-consortium>

Les Eco Maires (Guide pratique, *Le Maire et la Gestion de L'énergie*)

http://www.ecomaires.com/wp-content/uploads/2013/04/Le_Guide_pratique_le_Maire_et_la_gestion_de_l_energie2.pdf

LED Lighting Facts

<http://www.lightingfacts.com/>

Super-efficient Equipment and Appliance Deployment (SEAD) Street Lighting Tool

<http://superefficient.org/sltool>

The Climate Group

<http://www.theclimategroup.org/what-we-do/programs/LED-scale-up/>

The World Bank (manual, *India: Energy-Efficient Street Lighting – Implementation and Financing Solutions*)

<https://openknowledge.worldbank.org/handle/10986/22275>

PRIVATE SECTOR RESOURCES

Leotek Group

<http://www.leotek.com/education/documents/Leotek.LED.Streetlight.Guide.V7-101613.pdf>

Osram

http://www.osram.com/osram_com/applications/street--urban/index.jsp

Philips Lighting

http://www.lighting.philips.com/pwc_li/sg_en/lightcommunity/assets/road_lighting/led-road-planners-guide-oct-2013.pdf

1. This is not an exhaustive list, but is a partial listing intended to support local governments. Other resources are available from both the public and private sector.



For more information on LED street lighting, please contact:

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