



## Smart Lighting Solutions

Managing Energy Consumption, Enhancing Safety  
and Improving Environment

IN COLLABORATION WITH

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## SMART CITY LIGHTING SOLUTIONS: AN OVERVIEW

Rising utility costs and the need to enhance safety and security is prompting many cities to invest in technology solutions such as smart lighting. Moreover, growing emphasis on environmental sustainability is also encouraging migration to light-emitting diode (LED) lamps, which significantly help reduce electricity consumption. To further help cities tackle their utility consumption, LED lights are being connected to Internet of Things (IoT)-based hardware, software, and applications to optimize lighting usage and management. Smart lighting solutions are a key element of smart city initiatives due to their obvious value proposition and the relative ease of implementation compared to more complex solutions.

Smart or connected lighting solutions include both indoor as well as outdoor lighting. From a smart city perspective, smart lighting solutions span across a range of areas owned, operated, and maintained by local city governments.

EXHIBIT 1: Smart Lighting Deployment Areas for Local Governments



Source: Frost & Sullivan

Lighting deployments encompass a range of indoor and outdoor scenarios and account for a large portion of a city’s energy expenditures, with street lighting representing the bulk of the spending. The diverse deployments also render it difficult for cities to cost-effectively and efficiently manage and maintain the lighting infrastructure. Furthermore, street light ownership and maintenance protocols can be rather complex in that it may involve private utilities as well as city and/or county government agencies. For technology solution providers, this means lengthy purchase cycles and a relatively complex buying process which may involve collaboration with multiple agencies.

## OPERATING CHALLENGES FACED BY CITIES

Within the U.S. market, energy expenses command a significant portion of a city's overall spending. The presence of millions of street lighting structures alone creates significant maintenance and management challenges for city and county governments as well as others involved in the upkeep. A majority of the utility expenditures are funded by taxes and a declining tax base for many large metro areas has further created cost control pressures for local governments.

Apart from the need to reduce energy-related expenses, cities are increasingly focusing on environmental sustainability objectives which often involve reducing the overall carbon footprint. The U.S. Department of Energy (DOE) estimates that street lighting alone consumes energy equivalent to 1.9 million households and their greenhouse gas emissions are equivalent to 2.6 million cars. Adding an automated dimming capability to street lighting alone can significantly reduce electricity waste—specifically when there is no activity around/near the lighting fixture. Furthermore, the DOE estimates that operations and maintenance costs for street lighting to range between \$4 - \$6 billion per annum. It is estimated that outdoor lighting can consume up to 50 percent of a city's total energy expenditures thereby creating a strong case for deployment of smart lighting solutions.

## SMART LIGHTING COMPONENTS AND FUNCTIONS

Connected street lighting may involve a lighting pole equipped with LED or traditional lamps, sophisticated controls for lighting automation and remote management. In addition, other hardware units such as solar photovoltaic (PV) panel, sensor for environmental monitoring, CCTV camera, wireless network, digital signage, electric vehicle (EV) charging and connected to a secured cloud network through low power, high coverage cellular connectivity or fiber networks re part of the solution. Typical outdoor smart lighting implementations fit one or more of the below-listed scenarios:

- LED street lighting with integrated lighting control functionality
- LED street lighting with standalone sensors mounted on top of the lamp, and
- Smart lamp poles equipped with LED lamps and intelligent controls along with other hardware units that caters to one or more use cases for smart city applications.

It is important to understand that both indoor and outdoor lighting fixtures vary greatly in their style and size which renders it difficult to realize huge economies of scale in deployment. Further technical differences in functionality can also prevent cities from employing uniform smart lighting solutions. For instance, an outdoor lighting system may involve both motion and PV panels to regulate on/off/dimming functions. Indoor lighting, on the contrary, may only need to rely on a motion sensor for it to be turned on/off. Moreover, outdoor lamp posts may also need to be integrated with other IoT solutions such as temperature and air quality measurement instruments as well as video surveillance. Smart indoor lighting typically requires integration with a centralized building management system, and hence, may require IoT vendors to work closely with building solutions providers. In addition, the role and importance of having a robust IoT platform cannot be undermined when deploying smart lighting solutions.

## ANTICIPATED BENEFITS AND OUTCOMES

Smart lighting solutions offer several key benefits to city planners and managers, some of which include:

- Connected or networked street lighting infrastructure provides additional 20 to 30 percent energy savings on top of the 50 percent savings achieved by switching to LEDs.
- In addition, smart lighting can also render greater efficiency to maintenance and management of outdoor lighting.
- Smart city solutions can help improve safety and security possibly leading to reduction in crime rate. Integration with other smart city solutions such as video surveillance can further add to the value proposition of such solutions.
- Smart lighting solutions also help cities reduce their overall carbon footprint.
- Numerous large and small cities in the U.S. are deploying/retrofitting their street lighting with LED lamps to reduce their overall energy consumption. Some of the more prominent examples include Seattle, Boston, New York City, Atlanta, and many others.

## ROLE OF NETWORK INFRASTRUCTURE AND CONNECTIVITY

Smart lighting, specifically street lighting, employs a variety of network connectivity mechanisms including wired, wireless, and cellular. Moreover, smart lighting solutions often leverage a cellular/wired combination for more reliable connectivity. Often, the data transported includes much more information than a simple lamp status notification which further increase the importance of having a reliable, always-on network. For instance, the streetlight infrastructure is used to gather and relay information on air quality, weather, video surveillance, and other similar solutions designed to enhance citizen safety while also improving overall quality of life. Essentially, a resilient, reliable, and secure connectivity solution is a must-have for smart lighting solutions.

## THE LAST WORD

Smart lighting solutions include a wide array of technologies that must be integrated with a robust platform for visualization and data analysis. A city must work closely with its infrastructure provider and vendor partners to overcome several hurdles that range from budgetary constraints to technical challenges in implementing such solutions. Much like other IoT solutions, effective collaboration and coordination with other members of the ecosystem is required for development, implementation, and management of such solutions within the smart city framework.

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