Streetlights as an Asset to Public Safety, Crime Prevention, Sustainability, and Economic Growth

Abstract

This whitepaper explores the benefits and opportunities of implementing LED streetlights with smart lighting controls in urban and suburban environments. By examining the correlation between LED streetlights and improved public safety, reduced crime rates, positive environmental impact, and their potential contribution to economic growth, this paper aims to provide a comprehensive understanding of the advantages of this technology.

Illuminating Urban Futures

The smart cities of the present are safer and more connected, with a smaller environmental footprint than the urban areas of the past. Streetlights have emerged as a key component as cities rapidly grow their investments in technology to further this vision.

It is well known that illuminated streets are less susceptible to crime and fatal accidents than ones without sufficient lighting. Many cities are turning to energy-efficient light-emitting diode (LED) fixtures, which deliver lower operating costs and brighter light than traditional high-pressure sodium (HPS) fixtures.

However, LED lights are too bright straight out of the box, designed to compensate for a gradual loss of lumens in later years. This over lighting contributes to light pollution and an estimated $3 billion (about $9 per person in the US) in annual energy waste according to Dark Skies.

An intelligent Lighting Management System (LMS) is an essential companion to the LED streetlight.

These smart controls replace the existing photocell, plugging directly into the socket

of a streetlight to allow municipalities and utilities to fine-tune brightness, set dimming schedules, improve operational efficiency, and reduce energy costs.

Without an LMS, the newly installed LED streetlight does not operate in accordance with its intended specifications. That is why smart, energy-efficient lighting controls are critical.

Light Up the Night for Safety

Properly lit streets are the foundation of public safety. Lighting can improve visibility leading to a reduction of fatal midblock vehicle crashes by up to 50%. But not all lighting is created equal.

Weather like rain, fog, and snow create glare from lighting that can further impair vision. Smart lighting controls ensure that LEDs are set to the right lighting level for placement, time of day, and prevailing weather and traffic conditions. In the context of a smart city ecosystem, the simple streetlight with added intelligence can deliver a diverse range of capabilities that collectively enhance street safety.

For example, with the addition of an intelligent streetlight platform like UbiHub, streetlights can turn into license plate recognition (LPR) and street analytics sites. Having ample light in conjunction with these technologies improves image quality and accuracy. The real-time insights that result give city planners and law enforcement agencies a comprehensive view of activity from anywhere.

This convergence of technologies transforms streetlights into central nodes in a city's public safety layer, offering city authorities and law enforcement agencies a comprehensive view of activities and incidents in the city.

Shining a Light on Crime

The relationship between proper lighting and crime prevention is undeniable. Criminal activity thrives in the shadows, where actions are less likely to be witnessed or captured on camera. Well-lit areas, conversely, act as a natural deterrent, dissuading criminals from acting in the first place.

A 2016 study in which streetlights were randomly allocated to public housing developments in New York City found that the provision of lighting resulted in a minimum 36% reduction in nighttime outdoor index crime.

Smart lighting with LTE connectivity enables real-time adjustment of lighting. During incidents, cities can use lights equipped with cloud-based controls to remotely illuminate the site of events to help emergency services respond to incidents.

Greener Cities, One LED at a Time

Climate action plans have become critical imperatives for cities around the globe. As mayors pledge support or adopt plans, traditional lighting solutions frequently fall short in both energy efficiency and data insights.

Many are choosing to upgrade to LEDs, which provide more light while using less energy than HPS fixtures. A smart lighting controller is an essential companion to any LED deployment.

Smart lighting controls can reduce energy consumption with power schedules and dimming capabilities. An LED streetlight with smart controls drives energy savings of around 70%. Overhauling an entire network of city streetlights with LEDs with an LMS can eliminate more than 68,000 tons of additional GHGs.

Economic Impacts

The reduced energy consumption combined with real-time alerts on outages creates far lower operating, maintenance, and replacement costs. Rather than rolling trucks to patrol for downed streetlights or waiting for citizens to call them in, cities receive real-time status updates on lights that need attention so they can deploy crews directly to the problem area.

It does not end there. The addition of smart controls also extends the lifecycle of a lighting system by more than 30%.

In a city of a million residents, converting to LED lighting alone could save $109 million in operating costs over a 15-year period. Adding smart controls would contribute an additional $29 million in savings over the same period.

The initial deployment of LEDs and smart controllers is also an opportunity to boost the local economy, creating a new set of roles in installation, operations, and maintenance.

Cities Thrive with LED Streetlights

According to Northeast Group, over 68% of the cities in North America have made the conversion to LED lights, but less than 30% have opted to add lighting controls. Lighting controls can deliver an additional ~20-40% in energy savings by enabling communities to implement remote dimming schedules.

They also give cities real-time alerts that help them predict, prevent, and address issues, thereby radically improving operational efficiency.

Case Study:
City of Philadelphia

To reduce energy consumption and operation costs, the City of Philadelphia is deploying Ubicquia's UbiCell smart lighting controller in tandem with an LED streetlight upgrade over the next two years. The project, which will prioritize neighborhoods with high crime rates, is expected to result in a 10% reduction of the municipality's carbon emissions and marks the largest energy conservation initiative the city has ever taken on.

Objectives

- Reduce energy consumption
- Reduce maintenance costs
- Improve asset management and visibility, with real-time alerts
- Reduce environmental impact
- Enhance public safety
- Implement remote dimming schedules

Highlights

- 39 million+ kilowatt-hours saved annually
- 10% reduction in carbon emissions
- Initial $90 million investment
- Anticipated $200 million in saving

The Challenge

Traditional lighting systems require regular inspections and manual replacements, a process that can be time-consuming and expensive. The City of Philadelphia was seeking a smarter lighting solution that could reduce energy consumption and costs while making streets safer.

The Solution

The city decided to deploy LEDs with Ubicquia's UbiCell smart lighting controller. LEDs are more energy efficient, easier to maintain, and cost-ineffective to operate than traditional HID or HPS streetlights. When combined with UbiCell, which is easy to deploy with an LED upgrade, these smart city lights deliver real-time monitoring, scheduling, dimming, and diagnostic capabilities that further streamline operations.

Philadelphia's new lighting management system will automatically alert the city when lights need to be replaced, allowing for more proactive maintenance. Streets Commissioner Carlton Williams emphasized, "We can be more proactive instead of reactive, waiting for someone to say a streetlight is out."

The Result

Officials in Philadelphia hope the new lights will help the city with its Vision Zero goal of eliminating traffic deaths by 2030. Deputy Managing Director for Transportation, Infrastructure, and Sustainability Michael Carroll noted, "The quality of this light is so much superior to the light that existed before. You can see, almost as if it is daytime, people moving around, things happening in the street… That reduces the risks to people walking around, moving around on bikes, getting to the bus, getting to the train."

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Technological Advancements

Smart LED lighting systems deliver a wide range of features and benefits that go beyond traditional lighting solutions. From remote monitoring and adaptive lighting to data collection for urban planning, smart LED lighting is reshaping our cities and illuminating a path toward a more sustainable and interconnected future.

One of the key elements that sets smart LED lighting systems apart is their integration with Internet of Things (IoT) technology. This connectivity allows for many intelligent features that enhance the functionality and efficiency of lighting solutions.

1. Remote Monitoring:

Smart LED lighting systems can be remotely monitored and controlled in real time through a central management platform. This capability enables cities, municipalities, and facility managers to have immediate insights into the performance of their lighting infrastructure. If a light goes out or malfunctions, it can be quickly identified and addressed, reducing downtime and maintenance costs.

2. Adaptive Lighting:

Adaptive lighting is a feature that adjusts the brightness and color temperature of LED lights based on factors such as time of day, weather conditions, and occupancy. This not only ensures that lighting is optimized for visibility and safety but also contributes to energy savings by dimming or brightening lights as needed.

3. Data Collection for Urban Planning:

Smart LED lighting systems are equipped with sensors that gather valuable data about their surroundings. This data can be used for urban planning purposes, including traffic management, pedestrian flow analysis, and environmental monitoring. For instance, data on traffic patterns can help optimize signal timings, reducing congestion and emissions.

Future Prospects

As technology continues to advance, LED streetlights are poised to play an even greater role in the evolution of urban planning. A forward-looking view of the industry reveals several exciting developments that align with the Ubicquia product roadmap.

1. Integration with 5G:

The rollout of 5G networks promises to revolutionize connectivity, and lighting is positioned to play a pivotal role. Smart streetlight poles can serve as an infrastructure backbone for 5G small cell deployments, expanding coverage and connectivity while minimizing visual clutter.

2. Advanced Environmental Sensing:

Smart LED lighting systems will increasingly incorporate advanced sensors for environmental monitoring. This includes air quality sensors to measure pollution levels, noise sensors to monitor urban soundscapes, and even cameras with machine learning algorithms for enhanced security and surveillance.

3. Reducing Stress on the Grid

Cities will prioritize load shedding to prevent overwhelming the grid as EV charging demand surges. Any opportunity to reduce power consumption will be critical to sustaining the grid.

4. Smart City Ecosystem Integration:

Future smart LED lighting systems will become integral components of broader smart city ecosystems. They will seamlessly communicate with other smart infrastructure, such as traffic signals, waste management systems, and public transportation, to create more efficient and sustainable urban environments.

Innovation in the smart LED lighting industry is expected to align with the emerging needs of the smart city, ushering in a brighter and more connected future for urban communities.

Smart LED streetlights are on a trajectory of continuous improvement and integration with the broader smart city ecosystem. These developments will not only enhance the quality of urban lighting but also contribute to more sustainable, connected, and resilient cities.

Overcoming Challenges

Changes in growing urban areas are often met with resistance from their community. But Smart-everything is the future of our cities, big or small. Now is the time to not only embrace innovation but also leverage it to mitigate the downsides of technologies.

Introducing energy-efficient LEDs can bring unwanted brightness into residential buildings, disrupting sleep and causing other health problems. Smart controllers allow LEDs to be dimmed to appropriate levels based on their surroundings, preserving the benefits of LEDs while eliminating the drawbacks.

The single most common barrier to smart lighting controls is cost. Luckily, there are dozens of federal and state funding and loan opportunities available on a rolling basis that can support cities as they invest in smart technologies like lighting controls. Smart lighting also delivers a return on investment in as little as two years. Cities that work with Ubicquia frequently see their initial investment pay for itself quickly.

Technology implementations can be complex and often present labor challenges, but Ubicquia's solutions are cloud-based with minimal physical components, making them easy and cost-effective to deploy. Installations do not require specialty labor, so going live with your next smart technology from Ubicquia is simple. With a twist and lock, Ubicquia solutions begin delivering real-time data and analytics in minutes.

Further, deploying smart lighting controls at the same time as LEDs limits truck rolls.

As with any technology that leverages sensors or cameras, privacy and security can be a concern. Ubicquia's suite of streetlight and grid solutions offer the ability to limit recognition and what data is collected so that you can protect the privacy of citizens.

The benefits of smart lighting far outweigh what it takes to overcome obstacles and mitigate downsides. Further, smart lighting has become a fundamental component of smart city planning.

Implementation Recommendations

LED lights have become the standard for smart cities across the country and it has become clear that smart controllers are an essential companion to light fixtures, ensuring proper brightness levels and optimizing energy use. Organizations like Dark Skies are paving the way for communities to protect what matters to them with the right combinations of energy-efficient lights that are also provisioned to maintain night sky visibility. Smart controls are an essential piece of this endeavor and have been deployed in dark sky cities like Pepperell, Massachusetts and Rumford, Maine.

The following steps outline the process for procuring a smart lighting solution and implementing it for success.

1. Cost-Benefit Analysis:

Begin by conducting a cost-benefit analysis to assess potential savings from LED installation, the addition of smart controls, and their combined deployment.

2. Energy Cost Savings:

Calculate how annual operating costs will change with LEDs, explore the efficiency boost from a Lighting Management System (LMS), and determine the payback period for the entire smart lighting investment.

3. Financing and Partnerships:

Investigate financing options, grant opportunities, Energy Service Company (ESCO) partnerships, and public-private collaborations, especially in areas with Community Improvement Districts (CIDs).

4. Climate Alignment:

Align smart lighting projects with each city's climate action plan, emphasizing the significance of dimming schedules and accurate energy consumption monitoring for urban infrastructure's climate impact.

5. Equity and Deployment:

Consider equitable distribution, prioritizing historically underserved areas for LED deployment, and recognizing the potential for greater impact in these neighborhoods.

6. Implementation Planning:

Develop an implementation plan aimed at reducing installation and labor costs, maximizing savings, and accelerating data access.

7. Project Timeline:

Establish a clear timeline for LED streetlight installation and define project milestones. Identify opportunities for shared labor costs with complementary projects.

8. Community Engagement:

Engage with the community before installation, addressing concerns about LED light color temperature, and emphasizing the city's commitment to sustainability, responsible energy use, and equity considerations.

9. Public Education:

Educate the public about the benefits of LED streetlights, including energy savings and improved safety. Establish a communication channel for LED adjustment requests and reiterate the city's sustainability commitment.

Adopting a continuous education plan can increase utilization and boost public opinion.

10. Monitoring and Evaluation:

A comprehensive plan for monitoring energy savings and maintenance costs to ensure that the LED streetlight project delivers the expected benefits. Be prepared to make physical and programming adjustments based on performance data, recognizing that smart city success relies on dynamic and responsive infrastructure.

LEDs are not a complete solution without a Lighting Management System (LMS). Cities that purchase LEDs without an LMS leave savings on the table, forgo critical benefits to energy efficiency, put citizens and the environment at risk for problems associated with excessive lighting, and miss the valuable data that an LMS delivers.

Looking Ahead

In today's urban landscape, streetlights emerge as more than mere illuminators; they are pivotal in addressing climate change, grid stress, budgetary limitations, and public safety challenges.

Technologies like UbiCell and UbiHub have been instrumental in this transformation, morphing traditional streetlights into intelligent nodes of a connected city. These powerful streetlight platforms integrate lighting with data-driven insights, offering a cost effective, simple, and impactful approach to urban development. Ubicquia's solutions position streetlights as central elements in the narrative of next generation urban connectivity.

Looking to the future, the role of intelligent streetlighting is set to expand further, playing a key part in the blueprint of smart cities. As we venture into an era of increased urbanization and technological advancement, these smart lighting solutions will continue to illuminate the path towards smarter, safer, more connected urban environments.