The Business Case for a Lighting Management System with Intelligent Controls

A SMART CITIES WHITE PAPER

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Introduction

Many cities are interested in upgrading from traditional lights to LEDs because they provide significant energy and cost savings. Some cities, however, elect not to add a lighting management system with intelligent lighting controls to the new LED system. This is a mistake since adding the lighting management system brings every city even more energy and cost savings and can shorten the payback period of the project. In addition, a lighting management system can significantly improve the quality of lighting services, improve public safety, and provide a foundation for additional smart city improvements and citizen benefits.

In this paper, we will identify:

- The problems cities face when attempting to manage an LED-based lighting system without lighting controls.
- The capabilities that a control-based lighting management system provides.
- The benefits of using intelligent lighting controls to control and manage your LED lighting network.

The Challenges of Managing LED Lighting Systems without a Lighting Management System

LED light fixtures offer significantly greater energy efficiency and a long, predictable lifetime (e.g., two to four times the life of a traditional high-pressure sodium streetlight). Based on that information, it's easy to think that if you upgrade your lights to LEDs, you won't have to touch them for 10-15 years. The reality is, however, that even in a city full of newly installed LED streetlights, 10% of the lights may require maintenance on an annual basis. Some common issues that require maintenance of LED lights are:

- **Electrical problems** – power surges, improper wiring, manufacturing defects, bad photocells
- **Environmental damage** – lightning strikes, hurricanes, tornados, floods
- **People-related damage** – vandalism, vehicles running into poles
- **Citizen complaints** about the color and intensity of the LED's light which may require action to block the light that is emitted

Without a lighting management system in place, detecting and addressing these issues can be costly and troublesome. Issues can only be identified through proactive day and night patrols or by citizen complaints. These methods do not identify issues quickly, cause public safety issues due to improperly lighted streets, require the city to incur significant costs, and are frustrating for everyone involved.

Once an issue is identified, the lack of a lighting management system usually means that there is little information available about the equipment that needs to be maintained. Even determining the location of the streetlight requiring repair is often an issue and maintenance crews can spend valuable time "fixing" the wrong streetlight. The result is that 2.6 truck rolls on average are required to inspect, diagnose, and fix a standard streetlight issue,

which increases the cost of the repair and the length of time that residents live with improper and possibly unsafe lighting.

The costs are significant if you are maintaining an LED streetlight network without a lighting management system. See Figure 1 for a sample calculation of the costs a city of 10,000 streetlights may incur.

Cost of Maintaining LED Streetlights without a Lighting Management System with Intelligent Controls	
Number of Streetlights	10,000
% of Streetlights Requiring Repair/Year	10%
Streetlights Requiring Repair/Year	1,000
Cost per Truck Roll	$200

Truck Rolls to Repair Each Streetlight	2.6
Cost to Repair Each Streetlight	$520
Cost to Repair Streetlights per Year	$5,200,000

Additional Costs: Day/Night Patrols and Call Center Costs

Figure 1: Estimated maintenance costs for a city with 10,000 LED streetlights without a lighting management system with intelligent controllers.

How CIMCON's Lighting Management System Works

CIMCON's lighting management system gives you comprehensive information about your lighting network and allows you to:

- Remotely control your streetlights, including control to dim lights to reduce energy consumption or to address citizen complaints
- Immediately detect lighting issues, such as day burners and damaged fixtures, and remotely diagnose issues to avoid unnecessary truck rolls
- Accurately track asset information about the lighting network, including fixture specifications, GPS-defined pole location, to inform repair crews and reduce truck rolls

As shown in Figure 2, CIMCON's Lighting Management System is made up of the following major components:

- **Intelligent Lighting Controllers** – CIMCON's control devices, sometimes called "controllers" or "nodes", are installed at each streetlight to monitor, control and log all the critical parameters of the light connected to it.
- **Mesh Network** – Embedded in each CIMCON lighting controller is a low-power radio that can send and receive information to other nearby lighting controllers. These communication channels are used to send control commands to the streetlights and to collect data on the health and performance of the lighting network.
- **Gateways/Routers** – These devices serve as a "switchboard", providing a communication channel between a group of intelligent lighting controllers and LightingGale, the system's cloud-based, central management software.
- **LightingGale** – CIMCON's cloud-based central management software enables real-time, remote monitoring and management of streetlights. It provides users with the tools to control and operate LED streetlights using the CIMCON controllers, analyze the performance of the lighting system, check the health of the system's controllers and gateways, and more (see Figure 3).

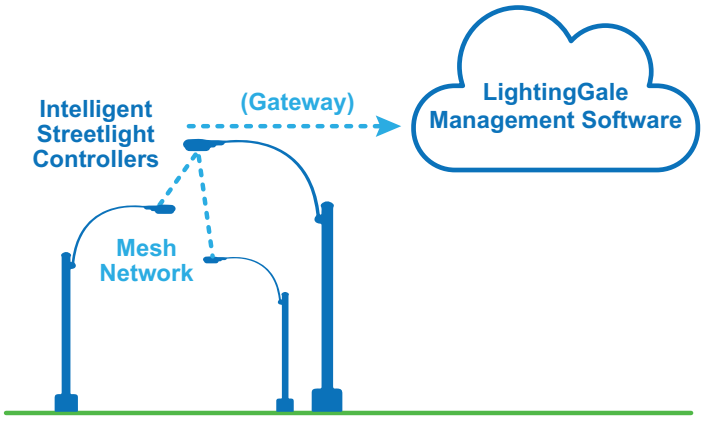

Figure 2: The components of CIMCON's intelligent lighting management system.

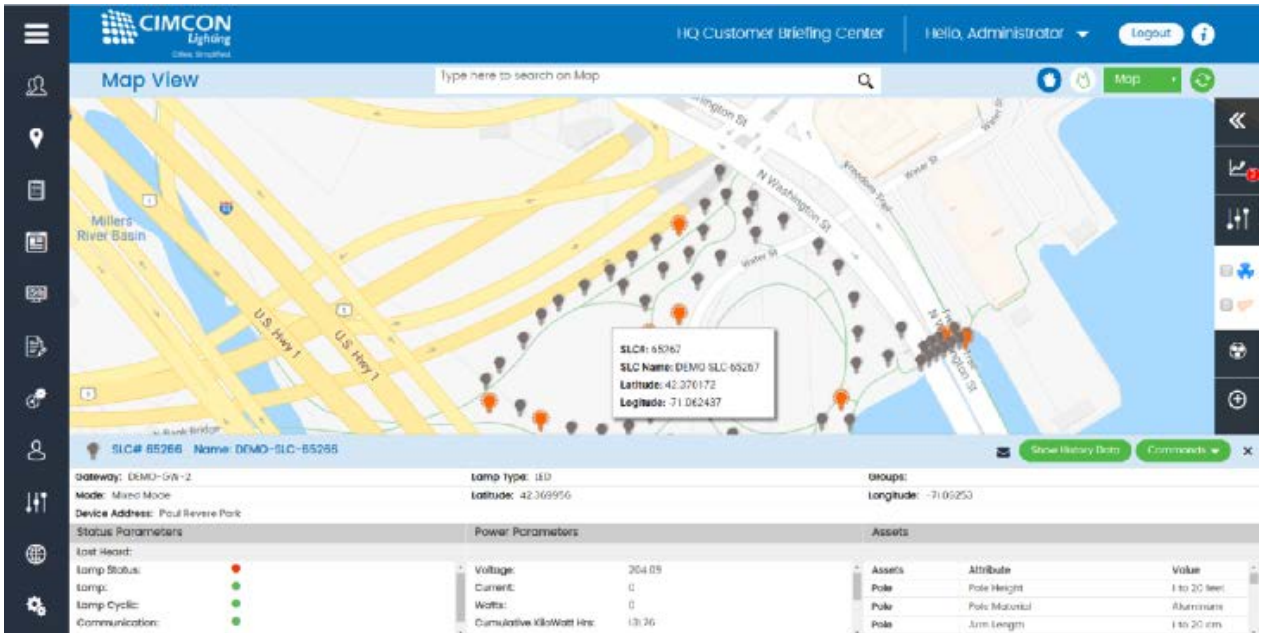

Figure 3: The cloud-based LightingGale software is used to control the streetlights.

In addition to these components, CIMCON's lighting product line includes motion sensors; mobile phone applications (i.e. blue light, first responder, and park safety) that allow for control of the lights to improve public safety; and APIs that allow software developers to use the lighting data in other applications.

Benefits of CIMCON's Lighting Management System

CIMCON's lighting management system enhances LED-based streetlight networks by giving cities or their utility partners remote control over the streetlights. This capability translates into the following significant benefits for citizens, cities and utilities.

Better Lighting Services for Residents and Cities

CIMCON's lighting management system improves the lighting service level in cities through:

- **Fewer Complaint Calls** – Allows for proactive repairs of lighting failures, reducing calls for lighting repairs and lessening the support structure needed to respond to those calls.
- **Faster Response to Lighting Issues** – The ability to remotely diagnose issues and more accurate information about the lighting assets needing repair can eliminate day burners and reduce the time that lights are out of service.
- **Remote Dimming of LEDs to Meet Citizen Needs** – Avoid the need to change out bulbs, add shades, or move lights to address citizen complaints about light color and intensity.

- **More Accurate Bills for Utility Customers** – Control capabilities and up to date asset information, including GPS location, helps utilities better serve cities and bill accurately.
- **Safer Events** – Adaptative dimming for special events, such as concerts, helps cities enhance the security and experience for attendees.
- **More Effective Emergency Responders** – Remote control of lights can be used to provide emergency responders with improved lighting.
- **Reduced Litigation Risks** – Ability to increase brightness of the LED as the bulb intensity fades over time allows cities to provide adequate illumination as the luminaire reaches the end of its useful life.

20-70% Lower Maintenance Costs

CIMCON's lighting management system reduces the maintenance and repair costs associated with the streetlight network by 20-70% through:

- **Eliminated Truck Rolls for Repairs and Health-Check Patrols** – Remote monitoring and detailed information about the state of the lighting assets allows cities and utilities to detect, diagnose and solve problems without having to send out a crew.
- **Fewer Truck Rolls Per Repair** – Accurate asset information allows you to put the right equipment on the right truck and send it to the right location. This reduces the need for multiple truck rolls, including trips to repair the wrong light, and enables "one trip" repairs for both unplanned and required maintenance. Cities have reported eliminating up to 67% of their truck rolls.
- **Fewer Citizen Complaints** – Cities can eliminate 80% or more of lighting-related citizen complaints with proactive detection and repair of streetlight issues.

20-30% Lower Energy Consumption and Costs

CIMCON's lighting management system allows cities to reduce energy usage by 20-30% by:

- Quickly identifying and eliminating "day-burners"
- Tuning full-on power level
- Dimming during early morning hours
- Billing based on real usage by using the metering capability on the controllers

Increasingly utilities are also offering cities a lower LED Dimming tariff that can lower their energy costs. These cost savings can reduce their energy costs by an additional 10% or more over the LED tariffs.

Improved Asset Tracking and Management

CIMCON's lighting management system provides a convenient and efficient way to record and access information about your lighting system assets, including fixtures, poles, bulbs, sensors, controllers, and gateways, which leads to the following benefits:

- **Reduced Maintenance and Repair Costs** – Detailed and accurate information about location, fixtures, electrical properties, historical performance, poles, and bulbs enables remote diagnosis and reduces truck rolls.
- **Reduced SKU Inventory** – Accurate information, such as burn hours on deployed assets, allows you to better manage inventory and plan for end of life.

- **Convenient Access to Warranty Information** – Easier tracking of key information needed for warranty issues, such as burn hours, serial numbers, manufacturer and installation date, allows you to better manage product warranties.

Lower Capital Expenditures

CIMCON's lighting management system helps reduce capital costs associated with LED lighting networks through:

- **Extended LED Life** – Controls allow you to dim LED lights, which reduces the effective burn hours of the LED. An LED light dimmed to 70% illumination for 5 hours per day reduces the effective burn hours of the LED by 13%, which extends the life of a 10-year bulb to 11-12 years.
- **Avoided Extra Lighting Costs** – The ability to dim the lights allows you to address citizen complaints about color and intensity without having to add shades or change bulbs to a lower/higher temperature.

Better Management Reporting/Analytics

CIMCON's lighting management system includes a comprehensive reporting system that allows cities to easily track and report on the performance of the lighting network, including:

- **Baseline Power Measurement of Existing Lights** – Allows you to easily report energy savings to town administrators.
- **Automated Energy Reports** – Convenient reports that can show post-acceptance performance on a daily, weekly, and/or monthly basis.

Improved Public Safety

The CIMCON's lighting management system improves public safety in the following ways:

- **Sufficient Lighting** – Faster, proactive response to lighting issues results in less time with insufficient lighting, which deters crime and improves safety for drivers, pedestrians and bikers.
- **Better Lighting in High Risk Areas** – CIMCON's lighting management system gives you the opportunity to tune the lighting intensity in high risk areas to help reduce crime.
- **Personal and Integrated Lighting Solutions** – CIMCON's lighting management system offers several specialty mobile applications, such as the Blue Light, First Responder, and Park Safety applications, which adjust the lighting to improve safety for citizens and first responders.

A Future-Ready Foundation for Additional Smart City Improvements

Once deployed for lighting control, CIMCON's lighting management system can be leveraged as a foundation on which you can deploy additional smart city solutions. The system's mesh communication network, electrical ports and other features enable cities to deploy CIMCON's NearSky smart city platform and to deploy sensors, cameras, and other devices throughout the city.

The Risks of Not Implementing a Lighting Management System

While it is true that there are clear benefits to deploying a lighting management system along with LED streetlights, it is also true that a city is exposed to significant risks if one is not implemented during an LED upgrade. These include:

- **Falling Behind in the Smart City Age** – Cities are actively deploying smart city technologies to improve their fiscal health, deliver better services for less money, and spur economic activity. By not implementing a lighting management system, an LED streetlight upgrade is a solitary program with no trickle-down benefits. A city would miss the chance of building the communications network that is provided by CIMCON's system, which can be leveraged for smart city data, sensors, and camera deployments. In the short term, this leads to inefficient processes, ineffective services, and higher costs. Longer term this is likely to hurt a city's ability to attract businesses, residents, and investment.

- **Less Fiscal Flexibility** - Cities that do not implement a lighting management system with intelligent lighting controls do not benefit from the large cost savings they bring, resulting in a less favorable budget position. Controls improve fiscal sustainability giving more flexibility to improve other operations and invest in smart city technologies that provide further benefits.

Expected ROI from a Lighting Management System

Figure 4 shows an example of the financial benefit that a city with 10,000 lights can receive by investing in a lighting management system with intelligent lighting controls. This calculation reflects a situation when the lighting management system is deployed at the same time as the streetlights are upgraded to LEDs, which avoids extra truck rolls to install the intelligent controllers at the light poles.

The Financial Benefit of a Lighting Management System with Intelligent Controls	
Number of Streetlights	10,000
% of Streetlights Requiring Repair/Year	10%
Streetlights Requiring Repair/Year	1,000
Cost per Truck Roll	$200

Costs without Lighting Controls		Costs with Lighting Controls	
Truck Rolls to Repair Each Streetlight	2.6	Truck Rolls to Repair Each Streetlight	1.3
Cost to Repair Each Streetlight	520	Cost to Repair Each Streetlight	260
Cost to Repair Streetlights Per Year	$5,200,000	Cost to Repair Streetlights Per Year	$2,600,000

Additional Costs: Day/Night Patrols and Call Center Costs

Total Annual Savings from a Lighting Management System = $2,600,000

Estimated Cost of the Lighting Management System (without rebates) = $10,000,000

Payback (Years) = 3.85

Figure 4: The financial benefit and payback of a lighting management system with intelligent controllers for a city with 10,000 LED streetlights.

Case Studies

Providence, Rhode Island & Ayer, Massachusetts

The benefits of LED streetlights with lighting management systems have been proven in many cities, including:

Providence, Rhode Island

- 73% energy savings from LED conversion and dimming
- Avoided 383 truck rolls per year
- Strong positive feedback from law enforcement
- Addressed resident complaints over LED brightness by dimming lights remotely and without rolling a truck

Ayer, Massachusetts

- Reduced energy usage by 70%, including 50% off-peak dimming
- Service calls costing $1,000 per day were largely eliminated

Source: "The Benefits of LED Smart Street Lighting - A Performance Benchmark of US Cities", Northeast Group, LLC and CityLab Insights, 2019

Conclusion and Next Steps

A lighting management system offers significant benefits to cities and their utility partners, including hard dollar savings from LED dimming tariffs and maintenance cost reductions, as well as softer benefits such as improved lighting for citizens and first responders. In addition, investing in the CIMCON system which provides a flexible infrastructure for future smart city investments avoids the risks of being left behind in the smart city age where cities are deploying smart city technologies to improve fiscal flexibility and be more competitive in attracting businesses and residents.

One major consideration a city should take into account when planning their purchase of a lighting management system is the timing. A city can gain the benefits of a lighting management system and not incur additional installation costs if they install lighting controls at the same time that they install the LED lights. When implemented in this way, the investment in a lighting management system will not only pay for itself over time, but will also improve the ROI of the LED investment with such clear benefits, it seems hard to imagine a city or utility choosing to miss this opportunity to improve their infrastructure, processes, and services.

For more information or a lighting consultation on how CIMCON can improve the performance of your lighting network, please contact CIMCON lighting sales at +1 (978) 320-4002 or sales@cimconlilghting.com.

CIMCON
Cities. Simplified.

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