



WHITEPAPER

The Business Case for Smart Street Lights

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Street lighting is an important community service, but it can consume as much as 40 percent of a city's energy budget. Legacy street lights are failure prone and costly to manage, which add to lighting costs. Consequently, street lighting has emerged as a leading smart city application.

By replacing existing street lights with LED-based lamps, utilities and other street light operators can cut energy and operations costs by 50 percent or more. Networking those LEDs delivers an even faster return on investment (ROI), taking the payback period down to 6 vs. 8 years, as a result of features such as remote management and faster outage response.

In addition to near-term savings, a network-based lighting solution provides an ideal platform for multiple smart city services, including smart parking meters, traffic lights and traffic management systems. Municipal utilities also have the opportunity to leverage smart city infrastructure for smart grid applications such as advanced metering infrastructure (AMI), demand response (DR) and distribution automation (DA). By leveraging Silver Spring's unique communications infrastructure and expertise, cities and utilities can deliver ongoing value and build a lasting competitive advantage for their community.

Understanding the operational details of networked LEDs and comparing those benefits and costs to traditional lighting lays the foundation for building a business case to upgrade street lights. The hard dollar savings in energy and operational costs make the case for replacement, and networked LEDs provide additional community value as well.

The Advantages of Networked LEDs

Legacy high-pressure sodium and mercury street lamps are not energy efficient and typically operate 12 hours a day at full intensity,; so their energy cost is high. These lamps also have a short life span (around 5 years), resulting in unpredictable and expensive operations. Operators must replace roughly 20 percent of these lamps each year.

Currently, operators detect light outages either when a community member calls to report it or when mobile crews detect outages during periodic checks. Consequently, the time to replace a lamp can vary considerably, impacting public safety and an operator's liability.

New energy efficient LED-based street lights have a life span of up to 20 years, enabling lower energy and operations costs. . In order to take full advantage of this new LED technology, these street lights must be networked. Operators benefit from lower energy and operations costs, which can be reduced even further when street lights are connected to a network.

Networking gives operators remote access and advanced functionality, including the ability to dim street lights and control their runtime by scheduling them to switch on/off as conditions (such as shorter/longer days) warrant. This network-based control yields an additional 10 to 20 percent energy savings beyond just LED replacement, along with greater operations and management savings.

For example, since LEDs burn brighter than conventional street lamps, operators can dim them to 50 percent brightness for additional energy savings with minimal compromise in light output. And, by controlling street light runtime remotely, operators also have the option to eliminate photocells for further cost reduction.

In addition, networked street lights provide continuous, accurate status information to operators, enabling them to identify outages immediately. Due to their longer life and automated outage detection, networked LED lamps can eliminate up to 90 percent of truck rolls and reduce repair and maintenance costs through more precise crew dispatch.

Operators who deploy a network to connect street lights are also in a solid position to leverage a common communications and management infrastructure for other smart city applications.

Networked LEDs Make a Better Business Case

Through extensive financial analysis and customer engagements, Silver Spring has gained insight into what makes and breaks the business case for smart street lighting. Using a model of a city with 50,000 lights, an energy cost of \$0.07/kWh, a replacement of all lights over 2 years, and a total lifetime cost of ownership over 20 years, Silver Spring’s analysis shows that deploying networked LEDs has a faster ROI than LEDs alone and yields greater benefits.

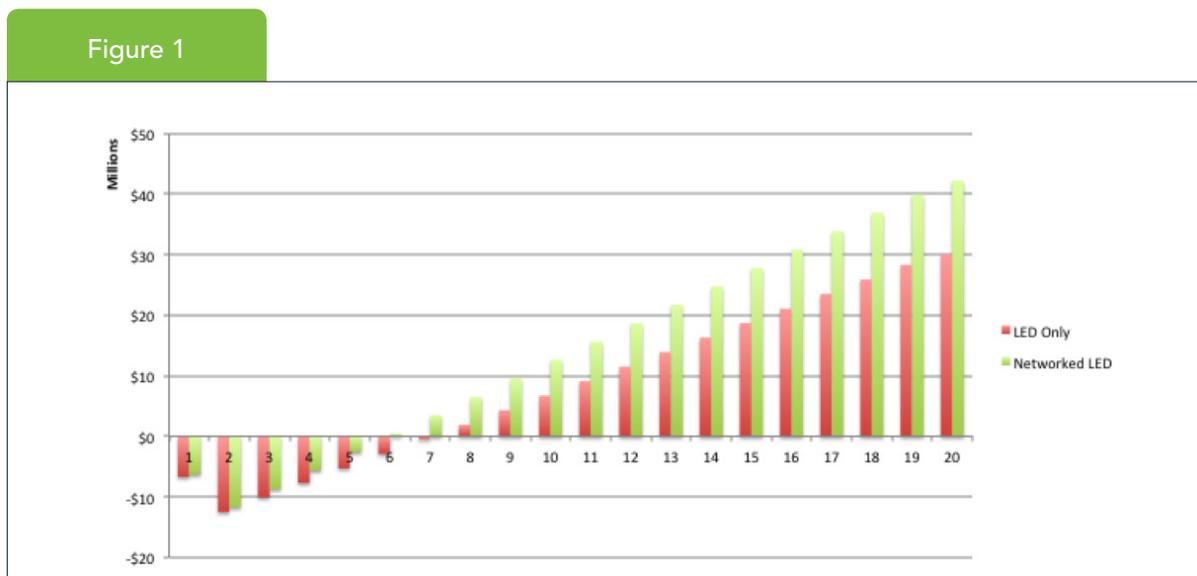
For LED replacement alone, the time to payback is approximately 8 years. Networked LED lamps shorten the payback time to 6 years. Our analysis shows that the network adds approximately 20 percent in costs but delivers at least 30 percent in incremental benefits, which are driven by operational savings as well as increased energy savings from dimming and reduced nightly burn time enabled by the network. The figures break out as follows:

20-year analysis of networked LEDs

Costs: \$572 per light
 Benefits: \$778 per light
 Benefit/cost ratio: 1.36
 Payback: 6 Years

	Costs (Year 1)	Costs (Year 2)	Benefits (Years 3 -20)
LED	\$9M	\$9M	\$3.1M
Networked LED	\$9.2M	\$9.5M	\$4.0M

Figure 1 illustrates the financial advantages of networking street lights with the return on investment occurring two years earlier than the LED only approach.



The ROI advantages from networked LEDs

Business Case Benefits

The benefits of deploying networked LED-based street lamps fall into two categories: energy savings and operational savings.

Energy savings:

Typically, the largest benefit of networking LED street lights is lower energy costs, which result from the following features:

- » **Low wattage:** LEDs provide significant energy savings by delivering the same or enhanced quality light at lower wattages than legacy bulbs.
- » **Dimming:** Due to their high light output, LED lamps can be dimmed as much as 50 percent when first installed with minimal compromise in light output. In addition, operators can schedule lamps to dim as circumstances allow, such as at low traffic times, in unpopulated areas the middle of night, etc. The city of Brittany, France, for example, dims its street lights by 60 percent between 11 p.m. and 5 a.m. to save energy.
- » **Reduced burn time:** With on/off scheduling capabilities, operators can easily modify street light operation to coincide with changing sunrise/sunset times, reducing lamp burn time.

As a result of these features, networked LEDs can reduce energy use for street lighting by 60 to 74 percent. For example, Los Angeles and Oslo, Norway, which have launched smart street light projects, have seen energy savings of 63 and 62 percent, respectively.

Operational savings:

The operational savings from networked LEDs will vary depending on the costs the street light operator currently incurs to maintain their lights. We use conservative estimates when calculating operational savings, which are based on the following features of networked LEDs:

- » **Long lifetimes:** LED lamps last 3 to 4 times longer than legacy lamps, so require replacement less often, which reduces hardware and installation costs.
- » **Remote monitoring and management:** Street light management software gives operators visibility into street light operations (for example, how much energy a lamp is using) as well as control over dimming and on/off schedules, reducing the need to run lamps for long periods, deploy photocells, etc.
- » **Automatic outage detection:** Management software provides instant outage notification, dramatically reducing the number of calls (and related costs) to the call center and cutting downtime up to 90 percent. With accurate outage information, operators can eliminate truck rolls due to false alarms, pinpoint non-working lamps and quickly dispatch crews to specific lights.
- » **Proactive maintenance:** Silver Spring's street light management software also provides predictive information, alerting operators to lamps approaching end-of-life, so replacements can be scheduled proactively. Utilities that periodically conduct manual surveys of their lights can eliminate this cost entirely for even greater ROI.

Figure 2 illustrates the combined energy and operational benefits of deploying networked LED-based street lights. For our “generic” 50,000-light municipality, upgrading to networked LEDs yields nearly \$40 million in benefits over 20 years, or \$778 per light.

Business Case Costs

Evaluated over 20 years, the largest cost to upgrade legacy street lights to smart street lights is the expense of purchasing and maintaining networked LEDs. The costs factored into our model include:

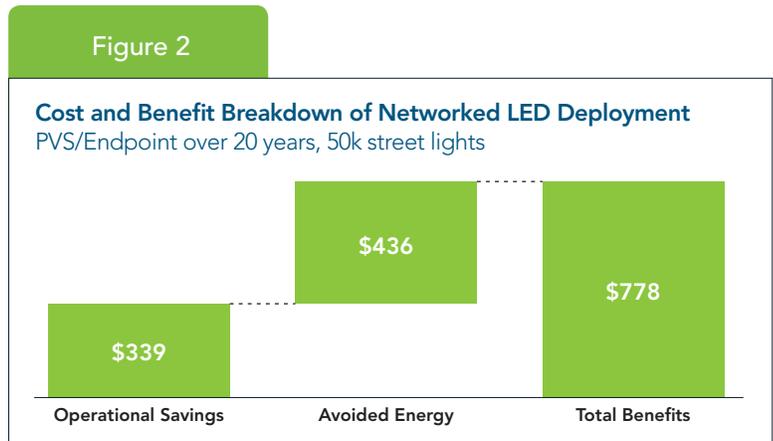
- » **Hardware:** network-integrated LED hardware and its installation, both the initial expense and replacement costs over time.
- » **Software:** street light control software and network management software.
- » **Deployment services:** services provided by a vendor or third party to assist with the planning and deployment of hardware and/or software.
- » **Operations:** network operations and management as well as street light operation and management.

Over 20 years, a typical operator will spend approximately \$572 per light to deploy, operate and maintain their networked LEDs, as illustrated in Figure 3.

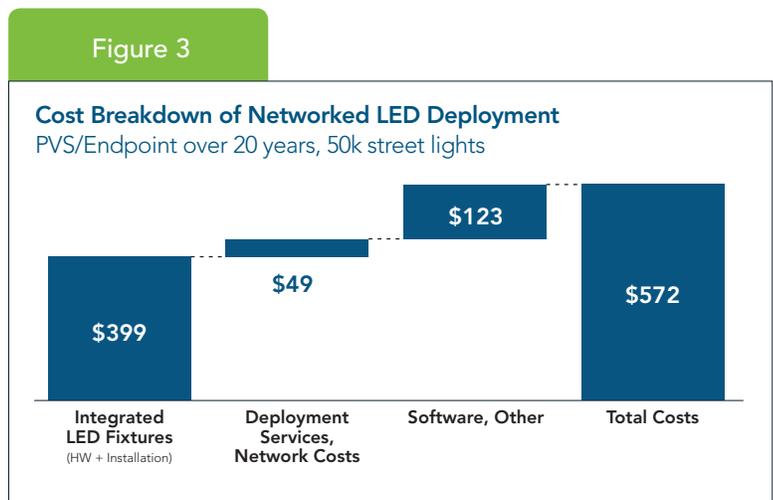
A Positive Community Impact – Additional Benefits

Beyond reducing operator costs and boosting energy efficiency, smart street lights help city leaders bring additional value to their community. These benefits include:

- » Reduced crime from improved lighting;
- » Safer roadways due to increased visibility of hazards;
- » Measurable environmental impact from reduced power consumption;
- » Decreased liability due to public safety incident mitigation; and
- » Improved community view of city services as a result of proactive repairs.



Total benefits of networked LEDs



Costs of networked LEDs

Foundation for Additional Smart City Applications

Smart street lights using networked LEDs offer a compelling smart city application that saves operators money and allows community leaders to establish a platform for smart city services. With little incremental cost, the network for street lights can also serve other smart city and smart grid applications, such as traffic light controls, smart parking, traffic management, EV charging stations, DR, DA, and AMI, making it easy to expand smart city initiatives.

Silver Spring can Help Build your Business Case

A long-term perspective and detailed planning are key to a compelling smart city business case. Selecting a smart infrastructure platform that can support multiple applications across a common network can make a business case more successful by driving down costs, speeding implementation, and yielding a rich set of combined benefits.

Silver Spring Networks can help a utility prepare, and even present, its business case to regulators. We have worked with utilities globally to articulate their smart city visions and strategy, identify relevant benefits and costs, and build a successful business case. Let us know how we can help you do the same.

About Silver Spring Networks

Silver Spring Networks is a leading networking platform and solutions provider for smart energy networks. Silver Spring's pioneering IPv6 networking platform, with 17 million Silver Spring enabled devices delivered, is connecting utilities to homes and business throughout the world with the goal of achieving greater energy efficiency for the planet. Silver Spring's innovative solutions enable utilities to gain operational efficiencies, improve grid reliability, and empower consumers to monitor and manage energy consumption. Silver Spring Networks' customers include major utilities around the globe such as Baltimore Gas & Electric, CitiPower & Powercor, Commonwealth Edison, CPS Energy, Florida Power & Light, Jemena Electricity Networks Limited, Pacific Gas & Electric, Pepco Holdings, Progress Energy, and Singapore Power, among others.

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