

MARKET RESEARCH NOTE

How Wireless Technology Is Enabling the Adoption of Commercial Connected Lighting

Bluetooth® Market Research Notes provide in-depth analysis of trends and forecasts highlighted in the annual [Bluetooth Market Update](#). This report on commercial connected lighting systems developed by Guidehouse Insights analysts shares perspectives on the future of the industry, explains why wireless controls are gaining traction in the market, and outlines how wireless technologies will address some of the barriers prohibiting wider adoption of connected lighting systems for commercial buildings.



Table of Contents

- Market Overview 3**
- Market Dynamics 4**
 - Market Drivers and Barriers 4
 - Market Size and Projected Growth 5
 - Wireless Technology Opportunity 7
- Market Outlook and Trends 8**
 - Continued Advancements in Hardware 9
 - Software Analytics Supporting Increased Digitalization 9
 - Value-Added Services 9
- Conclusions 10**
- Bluetooth Market Research Community 11**



KRYSTAL MAXWELL

*Senior Research Analyst
Guidehouse Insights*

Guidehouse Insights is a market intelligence team that provides emerging technology research, data, and benchmarking services for today’s rapidly changing and highly regulated industries.

Unless otherwise noted, data is derived from Guidehouse Insights guidehouseinsights.com

Market Overview

Lighting control technologies have become more sophisticated over time. Options have expanded from manual on-off control to offerings that incorporate multi-feature sensors and luminaires embedded with controls as well as lighting systems that interact with other building systems, such as heating, ventilation, and air conditioning (HVAC), security, and fire and life safety. Despite the technology improvements, customers often struggle to understand the benefits of the more advanced offerings, which has stagnated overall market growth. In addition, terminology within the lighting industry is inconsistent, magnifying confusion for potential customers. Connected lighting, networked lighting controls, advanced lighting controls, intelligent lighting, and smart lighting are synonymous with specific brands, but it is unclear to customers if there is any difference between these labels in terms of features or functionalities. This market research note uses the U.S. Department of Energy’s definition of connected lighting:

An LED-based lighting system with sensors and controllers that are networked, which can be either wired or wireless, enabling lighting products within the system to communicate with each other and transmit data.

Commercial connected lighting has the potential to connect billions of lighting devices, creating a data platform that can save energy and money while providing valuable insight for building owners and managers. This level of granular insight is made possible through a dense sensor network made up of increasingly more intelligent sensors, luminaires embedded with sensors, relays, and switches (shown in Table 1).





Connected Lighting Systems			
Sensors	Embedded Luminaires with Sensors	Relays	Switches
			
<ul style="list-style-type: none"> • Occupancy sensors detect the presence or absence of a person through infrared or ultrasonic technology. • Photosensors are based on light-sensitive photocells that produce an electrical current in proportion to the amount of light that strikes it. • Multi-feature sensors include any combination of sensors within one unit. As the market advances these could include temperature, CO₂, or humidity. 	<ul style="list-style-type: none"> • Luminaires with controls embedded directly into them enable granular data and luminaire-level lighting control. 	<ul style="list-style-type: none"> • Relays range in sophistication. • Basic relays transmit on-off signaling from switches. • Advanced relays can guard against current leakage and assist in communication logic between multiple switches and sensors. 	<ul style="list-style-type: none"> • Switches range from a simple switch to turn a light on or off to more advanced switches used for lighting control systems with multiple scenes, dimming, and network capabilities.

Table 1: Connected Lighting System Components (Source: Guidehouse Insights)

While wired lighting control solutions have been used traditionally and continue to grow in popularity, wireless controls have started to gain more traction, especially with the increasing adoption of connected lighting systems. Wireless technologies are uniquely positioned to address some of the barriers prohibiting wider adoption of connected lighting systems. A key benefit of wireless controls is their greater flexibility in the retrofit market, ease of installation, and potential cost savings compared with wired solutions.

Market Dynamics

Although the connected lighting systems market for commercial buildings has not followed adoption as quickly as LED technology, the market is gaining traction. This section looks at the drivers and barriers for connected lighting systems, the wireless opportunity, and market size and projected growth.

Market Drivers and Barriers

Several drivers and barriers are influencing the growth of the connected lighting market:

Drivers:

- **Proliferation of LEDs:** LEDs are naturally more controllable than legacy lighting technologies and have provided the foundation for increased adoption of lighting controls and connected lighting systems.
- **Energy savings:** Many control strategies—from occupancy sensing to daylighting—provide energy savings on top of the savings realized by an LED upgrade alone.
- **Growth of Internet of Things (IoT) and number of connected devices available:** Customers are demanding greater insight into buildings. A connected lighting system provides the infrastructure needed for increased granular data and integration with other building automation systems, such as HVAC, security and access, and fire and life safety.

Barriers:

- **Cost:** The cost barrier is two-fold: additional cost and the lack of understanding around the benefits of the cost premium required for connected lighting systems.
- **Lack of standardization:** Many wireless communication technologies are proprietary, creating a lack of standardization across vendors, which can inhibit the growth of networks that enable connectivity and interoperability.
- **Staffing challenges:** Gaps between modeled performance during the design phase and documented performance during operations can often be attributed to the human element. Professionals need to be trained in these new advanced systems to manage and maintain them.

Market Size and Projected Growth

LEDs provide the foundation for increased adoption of lighting controls and connected lighting systems for commercial buildings. Guidehouse Insights estimates the global revenue for commercial connected lighting systems will grow from roughly \$4.4 billion in 2020 to \$19.1 billion in 2029 at a compound annual growth rate (CAGR) of 17.9% (Figure 1). Growth over the forecast period is expected across all global regions, verticals, offering types, and technologies. As the intelligent building market advances and customers demand digital solutions, data-driven insights, and more customization and controllability, lighting provides a high-impact pathway to deliver these through cost savings, an improved occupant experience, and personalization. Key players within the commercial connected lighting ecosystem have worked to educate building owners and managers, lighting designers, electrical engineers, and other decision makers on the value proposition of commercial connected lighting and available solutions. Showing this value proposition has helped increase interest in connected lighting for commercial buildings.

Market segmentation by offering type shows similar revenue growth rates between the three segments over the next 10 years. Services are expected to grow slightly faster than hardware or software at a CAGR of 19.4%, compared with 16.0% and 18.6%, respectively. Advancement

Commercial Connected Lighting Systems Revenue by Offering Type

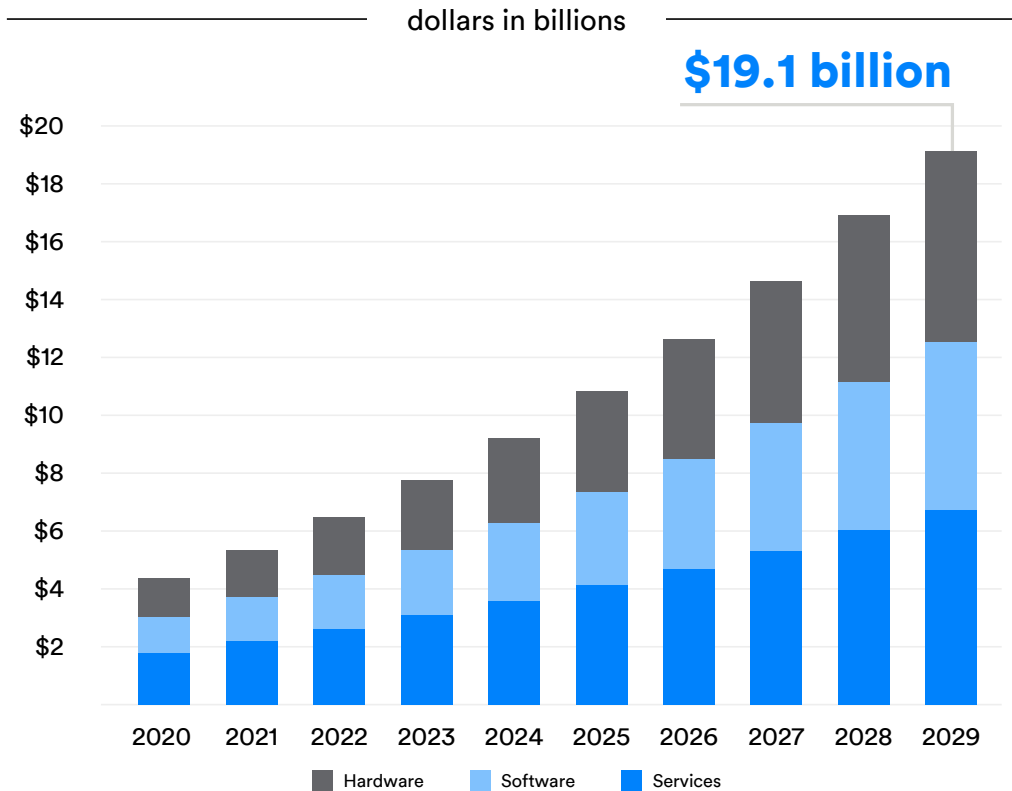


Figure 1: Commercial Connected Lighting Systems Revenue by Offering Type, World Markets: 2020-2029. Units in \$ billions (Source: Guidehouse Insights).

Commercial Connected Lighting Systems Hardware Unit Shipment Share

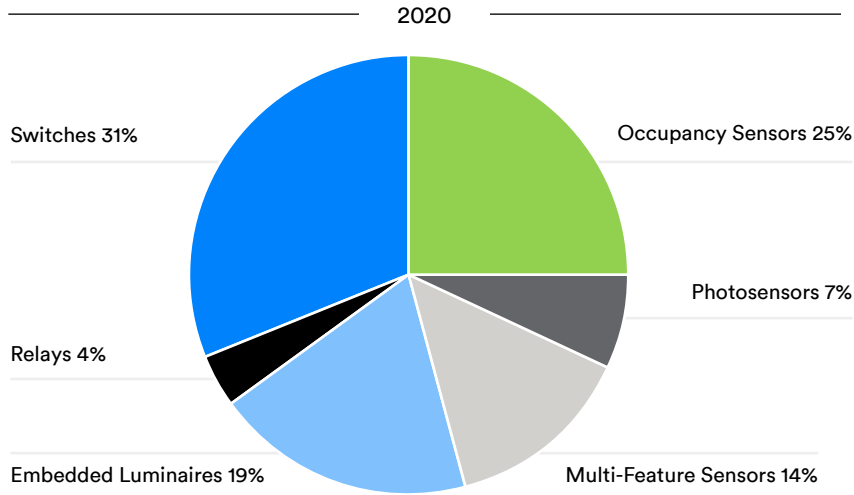


Figure 2: Commercial Connected Lighting Systems Hardware Unit Shipment Share by Equipment Type, World Markets: 2020 (Source: Guidehouse Insights)

of the intelligent buildings market has led to greater insights into the built environment through hardware, software, and services focused on energy efficiency, building automation, space utilization, and occupant comfort. Because of the increase in commercial building data, gathered through sophisticated building systems such as a connected lighting

system, the industry is shifting from hardware-focused to software and services-focused. New opportunities are created in this shifting landscape where the influx of data has ensured actionable insight. Lighting is uniquely positioned within the broader intelligent buildings market to provide a granular data stream given the ubiquitous nature of a lighting system.

Occupancy sensors, switches, and embedded luminaires are expected to constitute the majority of hardware unit shipments at the beginning of the annual forecast in 2020 (as shown in Figure 2), with an estimated 21.5 million unit shipments for these three product types combined.

Multi-feature sensor unit shipments are expected to grow at a higher CAGR than other product types. As Figure 3 shows, multi-feature sensors are anticipated to grow from 4.2 million unit shipments to 27.8 million unit shipments at a CAGR of 23.3% between 2020 and 2029. As a result, multi-feature sensors are expected to constitute the largest share of commercial connected lighting hardware shipments by 2029. As systems become more sophisticated, the benefits of multi-feature sensors over a single function sensor are stimulating the growth of the multi-feature unit shipments. While the cost for a multi-feature sensor is more than an individual sensor, a combined sensor costs less than two individual sensors. Occupancy sensors and embedded luminaires are tied for the next quickest growth, both with a CAGR of 16.6%. The desire for more granular data and control, increased energy savings, utilization of the luminaire power source, and integration and control with other building systems are driving embedded luminaire deployments.

Commercial Connected Lighting Systems Hardware Unit Shipments by Equipment Type

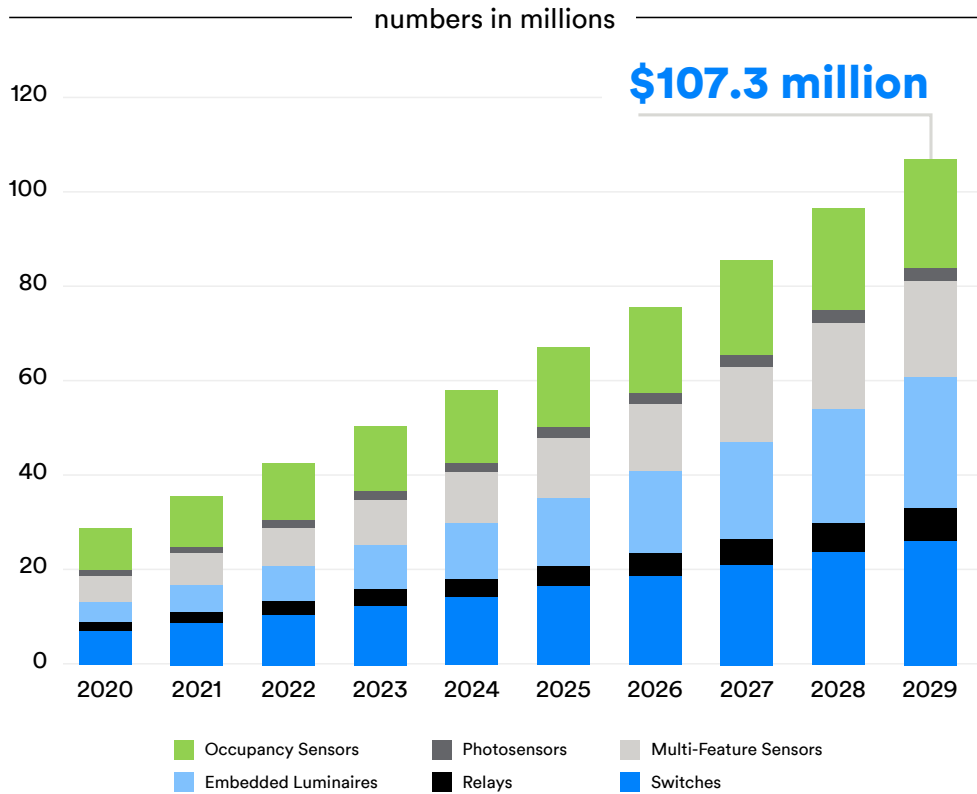


Figure 3: Commercial Connected Lighting Systems Hardware Unit Shipments by Equipment Type, World Markets: 2020-2029. Units in \$ millions (Source: Guidehouse Insights).

Wireless Technology Opportunity

Guidehouse Insights recognizes wireless technologies are creating new opportunities for commercial connected lighting. While the installed base consists of predominately wired solutions, benefits to wireless alternatives are garnering greater customer attention. Growth in unit shipments of wireless technologies within the commercial connected lighting market is expected over the next 10 years, spurred by drivers for the market overall and the unique benefits of wireless solutions.

As commercial connected lighting deployments increase, the benefits of wireless technologies are expected to drive the segment's growth within the broader market. Wireless options can be installed at a lower cost, with less disruption, and in less time — all benefits valuable for retrofit projects. Guidehouse Insights expects retrofits to continue to lead the commercial connected lighting market for the next five years as building owners look to reduce costs, optimize efficiency, and leverage the IoT backbone of these solutions for greater insight into their facility operations. Space utilization and wayfinding

Wireless options can be installed at a lower cost, with less disruption, and in less time — all benefits valuable for retrofit projects.

are specific applications Guidehouse Insights expects to enhance market adoption; preferences of building owners and managers tend to align with solutions that are more cost competitive.

Multi-feature sensors, occupancy sensors, and embedded luminaires are expected to contribute to strong growth within the commercial connected lighting market. The ability to wirelessly communicate with a mobile device enables greater personal control through an app or dashboard, rather than a traditional lighting switch, and provides data and communication for IoT applications, which are central to the opportunity for wireless.

Wireless technologies are positioned to address some of the barriers prohibiting wider adoption of connected lighting, such as decreased cost, and potentially address interoperability issues. Despite this progress, the wireless connected lighting market is fragmented with multiple protocols gathering momentum, including Bluetooth® technology.

Released by the Bluetooth Special Interest Group (SIG) in July 2017, the Bluetooth® mesh specifications added a mesh networking topology to the traditional point-to-point star-based network topology, expanding the range, data capacity, and security capabilities of previous iterations of Bluetooth technology. These traits make Bluetooth mesh more suited for building automation, sensor networks, and asset tracking solutions. The number of vendors using Bluetooth technology for IoT lighting solutions has grown quickly since its release. Guidehouse Insights expects this trend to continue.

While wireless technologies have improved to address market pain points, work continues to advance these solutions. The Bluetooth SIG's technology roadmap includes improvements to Bluetooth mesh to increase network optimization, models, and services for solution providers. Enhancements include directed forwarding and remote and certificate-based provisioning to enable scalable use cases.

Market Outlook and Trends

The changing building landscape, moving from hardware-only to a combination with software and services as a platform for building solutions, is possible through the influx of data and analytics. Traditional building management systems cannot provide the real-time sophistication and granular level of control of a connected lighting system within a commercial building. Lighting has morphed beyond illumination to provide additional benefits. As the functionalities of a lighting system continue to advance, the overall lighting platform needs to provide control, connectivity, and analytics. The ubiquitous role of lighting solidifies a lighting system's necessity within the buildings of the future.

Continued Advancements in Hardware

While the connected lighting market for commercial buildings shifts from a hardware-centric industry to one focusing on software and services, the advancements in hardware remain critical to the success of this industry.

The enabling hardware, including occupancy sensors, multi-feature sensors, relays, and other hardware devices, provide energy savings and allow for data to be collected and turned into actionable insights through software and service applications. The dense sensor network of a commercial connected lighting system provides the infrastructure needed for broader intelligent building deployments and value-added services.

Software Analytics Supporting Increased Digitalization

Connected lighting systems for commercial buildings have become smarter and can provide analytics previously relied on by the building management system.

In this new paradigm, lighting lays the groundwork for the intelligent building architect — the lighting points with sensors and connectivity provide data collection nodes throughout the building. The digital nature of the system supports the commercial building market's shift to greater digitization. This shift shows the industry's interest in using the density of lighting systems as the backbone for sensing and control more broadly.

Value-Added Services

For those looking to digitize a building, investing in a commercial connected lighting system can provide the foundation for successful intelligent building solutions, such as space utilization or wayfinding applications.

The lighting system's sensor network provides the infrastructure for IoT use cases that bring value beyond illumination. Value-added services, such as space utilization, indoor positioning, asset tracking, and improved occupant health and well-being, rely on the granular data collection and communication ability provided within the lighting infrastructure through occupancy or multi-feature sensors. These new use cases are creating opportunities for market players to provide long-term customer engagement and create new revenue streams.

The shifting retail landscape has led market players to look for new opportunities and revenue streams. Value-added services help address these needs, both for vendors and customers.

Examples include:

- Greater insights around shopping habits of customers in brick-and-mortar stores
- Coupons and reviews for shoppers
- Easy access via mobile apps
- Retailers providing a shopping experience akin to online shopping and a more seamless experience across all shopping avenues

Education and commercial office buildings might focus on space utilization and improved occupant comfort (e.g., helping a college or university attract students or an office attract employees); these needs can be met by value-added services.

Conclusions

As lighting controls have become more sophisticated, adoption of commercial connected lighting systems has grown as well. Although adoption has been slow due to cost, lack of understanding of the benefits, and staffing challenges, there are drivers helping to push adoption forward. Wireless technologies, in particular, are positioned to address some of the barriers prohibiting wider adoption of connected lighting systems for commercial buildings. These systems have shifted from a solution solely to control lighting within a commercial building to a platform that provides control, connectivity, analytics, and integration with other building systems. The pervasive nature of lighting allows these systems to become the foundation for an intelligent building, providing granular data not readily available through other offerings.

Wireless technologies are positioned to address some of the barriers prohibiting wider adoption of connected lighting systems for commercial buildings.

Bluetooth Market Research Community

Join the Bluetooth Market Research Community to receive early access to market data highlighting the latest Bluetooth technology trends and forecasts. You'll also have the chance to weigh in on what data is collected and shared to ensure you receive the research that's most valuable to you and your business.

Subscribe at

bluetooth.com/marketresearch