

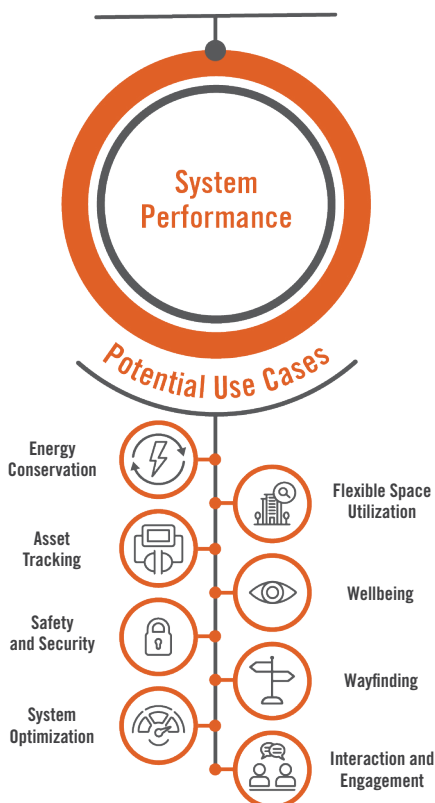
Understanding the Potential of Connected Lighting Systems

CONNECTED LIGHTING SYSTEMS

Connected lighting systems (CLS) provide a platform where control of lighting and other systems combine to provide enhanced benefits in buildings. CLS typically include a “digital canopy” of networked sensors, occupancy detection, Internet connectivity, interfaces with other system controls, indoor positioning, and multiple- and application- specific analytics. This document provides an overview of the system performance benefits and use cases that organizations can realize through the adoption of CLS.

Possible CLS Capabilities

Networked Sensors, Light and Occupancy Detection, Two-way Communication, Indoor Positioning, Power/Component Monitoring, Connectivity



UNLOCKING THE BENEFITS

Connected lighting systems serve many organizations, including commercial and government offices, educational and healthcare institutions, and retail and distribution facilities. The use cases and benefits fall into two broad categories:

- **Real estate performance:** reduce operating costs and improved return on capital
- **Workforce performance:** increase productivity and improve welfare of building occupants

USE CASES

The real estate and workforce benefits of connected lighting systems derive from a wide variety of use cases illustrated below.



Energy Conservation

Information gleaned from an array of lighting mounted sensors enables granular system response, reducing waste in lighting and HVAC systems. Building occupancy analytics enable

predictive system response and help to optimize allocation of energy sources in support of net zero energy strategies.



Asset Tracking

Lighting provides a widespread and powered array of monitoring points that can track valuable assets in buildings. Asset tracking can optimize building operations

by facilitating easy access to critical equipment, increasing equipment utilization, and reduce capital expenditures.



Safety and Security

Sensor-based occupancy information (number of occupants and location) helps first responders organize their activities rapidly and efficiently, enhancing safety and security. The same data can be used to manage occupancy and traffic flow to minimize occupant density and fight contagion. Similar to asset tracking, luminaire-mounted devices can identify and locate visitors throughout the building and provide information to building security systems.



System Optimization

Information, such as internal temperature and run time, reported by lighting, HVAC, and other building systems permits automatic, real-time optimization of performance, reducing energy consumption and extending the useful life of equipment. Real-time reports of equipment and component failure and an integrated dashboard simplifies maintenance operations.



Flexible Space Utilization

Analytics based on real-time space usage enable re-allocation (or modification) of underutilized space types to those in demand, without the time or cost of extensive study or a major renovation. This flexibility supports optimal architecture for workflow organization, and enhanced collaboration. The same analytics can also “right-size” facilities for typical daily populations, rather than for the overall number of employees.



Wellbeing

Employee wellbeing is increasingly recognized as enhancing an organization’s bottom line. An integrated system supports wellness strategies by coordinating the control of heat, light, airflow and other building systems to granular input from environmental and occupancy sensors. Strategies to support healthy circadian rhythms utilize dynamic control of electric light.



Wayfinding

Wayfinding takes advantage of the density of luminaire mounted devices, analytics, and an individual’s own mobile device or visible light communication. Wayfinding supports other use cases, such as traversing unfamiliar facilities, rapid access to conference spaces, flexible desk assignment, and emergency response, that depend on occupants finding their way to specific locations reliably and efficiently.



Interaction and Engagement

By leveraging the density of luminaires, indoor positioning can offer remarkable location accuracy in real time. Together with user-activated devices, this enables targeted communications to users seeking to purchase products or view objects of interest.

For More Information:

- Visit the [Integrated Lighting Campaign](#) website or email integratedlightingcampaign@pnnl.gov for more information on how to get involved with the campaign.
- Visit the [DOE Better Buildings Lighting and Electrical Technology Research Teams](#) page for more information on DOE resources.
- Visit the [DOE Solid-State Lighting](#) website for more information on DOE solid-state lighting research and development activities.