



White Paper

Lighting retrofits, with no wires attached

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Abstract

Many people think that updating the lighting in a commercial building means replacing older lamps and ballasts with energy-efficient, dimmable ones. And they're right—efficient bulbs do save money—but even greater savings and benefits are available by adding a wireless lighting control solution to the mix.

Today's lighting control solutions manage and simplify cost- and energy-saving strategies such as scheduling, daylight harvesting, occupancy control, and demand response to provide maximum benefits and returns from lighting retrofits.

Recent advances in wireless technologies have further improved lighting control in a way that especially benefits retrofit situations. Removing the wires from lighting control adds functionality and flexibility, while reducing installation and on-going management costs.

The need for retrofits

With lighting responsible for up to 40% of the total power cost of commercial buildings, retrofits provide the potential for huge cost and energy savings.

More than 75% of the estimated five million commercial, industrial and institutional buildings in the US were built at least 20 years ago. Because of their age, many were grandfathered in when stricter energy-use requirements were introduced in the last decade. Updating the lighting in these buildings to include scheduling, daylight harvesting and occupancy controls is an affordable and intelligent way to deliver energy efficiency and improved system performance, and to help bring these buildings into the 21st century.

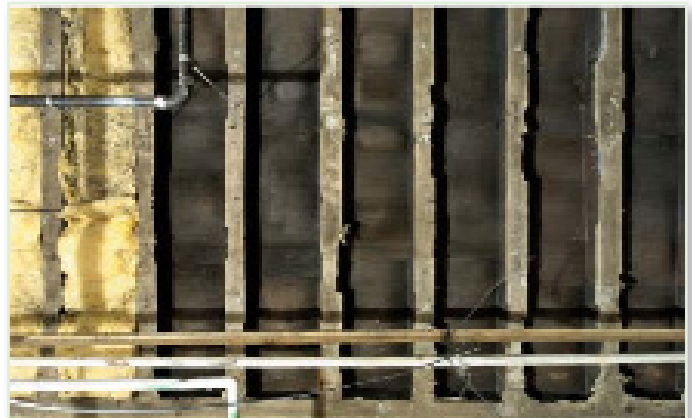
Lighting upgrades are extremely cost-effective, generally providing a time to ROI of two to five years (with savings in both operations and maintenance costs). This is sweetened further by the incentives many governments and utilities offer to promote green building and retrofits.

What is lighting control?

In short, lighting control manages and automates the delivery of the correct amount of light, where you want it, when you want it. Lights can automatically turn on, off or dim at set times or under set conditions, and users can have control over their own lighting levels to provide optimal working conditions.

A lighting control solution automates and simplifies cost- and energy-saving strategies such as

- **Scheduling:** Turn on, off, and dim lights at specified times during the day—for example, automatically turn lights on at the start of business hours, and off after workers leave at night.
- **Occupancy sensors:** Detect when a room is occupied, to automatically turn lights on when someone enters and off (or dim) shortly after they leave.
- **Daylighting:** Use photosensors to detect levels of natural lighting, and automatically dim lights when sunlight is streaming in through windows. This reduces energy use and provides consistent lighting levels.



- **Demand response:** Utility companies frequently offer their customers incentives to encourage them to reduce energy consumption, especially at times of peak usage or when retail energy prices are high. Lighting control solutions can automatically respond to these events and reduce energy consumed by lighting to pre-set levels.

Why wireless for retrofits?

A wired lighting control solution is just that: wired. All lights, sensors and switches are hard-wired to a central controller (or to a gateway that facilitates communication between the lighting network and lighting control software).

Because of the labor and related costs of the wiring, and the complexity of covering a large area with sensors and other control devices, these systems are typically very expensive to implement. Beyond the equipment costs, simply installing wiring to connect a traditional wired lighting control system can cost as much as \$0.50 per square foot. This has historically kept many from talking advantage of full lighting control retrofits, and often limited the scope of lighting controls to individual self-contained systems (for example, one per room or floor).

Wireless communication removes the need to physically connect lights, sensors and switches to each other, reducing lighting control costs and improving capabilities. This is especially important for retrofits, where access to wires within walls and plenums, and introduction of new wires, can be difficult, expensive, and in some cases even impossible.

Wireless communications can start within a single room, allowing sensors, lights, and switches to communicate with each other without the need for wires. Wireless controls can then extend the system to support applications such as scheduling, daylighting, and demand response that typically span multiple rooms, whole floors, or whole buildings.

Floors can be partitioned and offices can be reconfigured using only the control software— without the cost and disruption of rewiring. Eliminating the need for communications wires also provides more flexibility in terms of where sensors and switches can be placed, and can make it more affordable to include additional sensors. Adding photosensors can provide you with more granular information about illumination and lighting usage levels, which enables you to provide more accurate control.

Wireless solutions are also ideal for large companies or government departments that have installations covering multiple floors or buildings. In a wireless network using the “mesh” architecture, each device is both a receiver and transmitter of information. This makes mesh networks self-healing, scalable and reliable, and mesh building control systems are able to support more devices than a traditional wired network. Large enterprises can therefore run a lighting control solution as a single unified system, providing centralized control of lighting, as well as a system-wide view of operations, current power usage, detailed energy savings data, and more.

You can find out more about mesh networks in Daintree’s white paper: [What’s so good about mesh networks?](#)

Open standards and interoperability

Selecting a wireless lighting control solution that uses open standards-based wireless networking technology (such as ZigBee® and IEEE 802.15.4TM) provides many benefits over proprietary network protocols including

- lower cost of components
- greater choice due to the ability to “mix and match” components from different vendors
- interoperability with other building automation systems and components

Benefits of wireless retrofits

Wiring and installation costs are often cited as major barriers to deploying advanced controls in existing buildings. Wireless controls help to overcome this by enabling lights to be connected with reliable, secure controls that lower electricity costs, while enhancing the long-term value and viability of buildings.

Cost and energy saving strategies

The following table represents the types of cost savings that lighting control can deliver by reducing or eliminating over-lighting:

	Savings
Scheduling: Dim and turn off lights when rooms are unoccupied.	up to 40%
Photosensors: Adjust electric light levels to take natural light into account.	up to 15%
Occupancy sensors: Adjust lights based on occupancy detection.	up to 50%
Personal control: Individuals set light levels to suit personal preferences.	up to 15%
Demand response: Reduce lighting levels to take advantage of demand response incentives from utilities.	up to 10%
Overall control: Set system-wide lighting levels to avoid over-lighting.	up to 20%
Combined savings	up to 70%

Other cost savings

- **Tax incentives:** Many governments are offering tax incentives to help pay for the purchase and installation of “green” lighting control retrofits.
- **Utility credits:** Some utility companies offer credits for lighting control solutions that support demand side load-shedding and reduced energy use.
- **HVAC:** Lights that are dimmed or turned off typically emit less heat, which can help to reduce air conditioning costs.

Additional benefits

- **Simplified commissioning:** Configuring each device so that it behaves in the way you want and belongs to the correct lighting zones can be complicated at the best of times. Many wireless lighting control solutions help to simplify commissioning by automating much of the process over the air, and providing easy-to-use tools for any manual configuration required.
- **Flexible reconfiguration:** Each device (e.g. luminaire, switch, sensor) within a wireless control system can have a unique address. The lighting system uses these addresses to control individual luminaires, groups (zones) of luminaires, entire floors and entire buildings. Individual lights can belong to multiple zones to provide greater levels of flexibility. That means that once the wireless lighting system is installed, control zones and lighting behavior can be changed by simply reconfiguring the lighting control software.

- **Energy usage data:** Lighting sensors and a centrally managed lighting system can provide a wealth of information about energy usage by time and location, allowing building owners and staff to better manage their energy use.
- **Enhanced maintenance:** The two-way communications provided by mesh networking allows the control system to automatically discover the state of each light (e.g. on or off) and report when luminaires are malfunctioning or lamps need replacing.
- **Attracting and retaining tenants:** Green credentials can help to make buildings more attractive to tenants, and can result in higher retention rates due to enhanced user satisfaction, health, comfort and productivity.
- **Increased productivity:** The ASHRAE GreenGuide cites many examples where better quality lighting, especially an increase in natural daylight, can significantly increase employee production rate and quality, and decrease absenteeism.
- **Compliance to codes:** Many building codes, such as ASHRAE and California's Title 24, advocate energy- and cost-saving measures including automatic shutoff of building lighting (scheduling and/or occupancy control) and daylight harvesting.

Summary

Energy efficient, dimmable lamps and ballasts, together with a lighting control solution, provide cost savings for existing buildings and enable compliance with new building codes and guidelines. They also make it easier to control, manage and maintain commercial lighting, and to incorporate energy- and cost-saving measures such as scheduling, daylighting, and occupancy control.

Wireless mesh networking takes lighting control to the next level for retrofits, drastically reducing the total cost of ownership while providing even greater cost reductions, increased flexibility and functionality, and greater comfort for the occupants.

Updating the lighting in older commercial buildings makes sound economic and environmental sense. With big savings available in energy usage and costs, an ROI of two to five years, and generous incentives being offered by governments and utilities, there has never been a better time to add intelligent wireless control to your lighting.

About Daintree Networks

Daintree Networks is a clean technology company using wireless innovation to improve energy management within commercial buildings. Daintree provides technology for powerful, standards-based wireless lighting control solutions that deliver substantial lighting energy efficiency improvements in a more cost-effective way than ever before.

Since its founding in 2003, Daintree Networks has been a pioneer in wireless mesh networking, with nearly 400 customers using its industry-standard design verification and operational support tool. The company has brought this extensive experience to bear in developing the industry's first truly interoperable platform for wireless lighting controls. For more information, visit www.daintree.net.



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