

# The digital ceiling:

## LED luminaire-integrated lighting controls

BY VESSI IVANOVA, PHILIPS LIGHTING

The opportunity for lighting designers to create value through lighting has never been greater. We know how to create light; how to make it more efficient; how to control it and now by embedding intelligence in LED light, we are able to create digital light points that are for more than illumination.

We know that switching to LED lighting with controls can deliver significant energy savings compared to conventional lighting, but even more value is possible, beyond illumination, with connected lighting systems based on luminaire-integrated controls.

### DELIVERING VALUE BEYOND ILLUMINATION

At the most basic level, all LED luminaires have some form of integrated control and may also offer a range of additional capabilities, such as the ability to communicate information about their own status and operations. This could include internal operating temperature, energy metering, and lifetime monitoring, which lighting system owners and managers can use to optimise system performance, efficiency, and maintenance.

Other LED luminaires use integrated sensors to collect information on usage and environmental factors in illuminated spaces including occupancy levels and activity patterns, temperature changes, and daylight levels.

If the lighting system is integrated with a lighting management software platform on the back end, system owners and managers can store, visualise, and analyse historical information to enable better facility management.

System architects are currently engaged in a conversation about how much control or intelligence to integrate into luminaires themselves. Some systems thinkers are moving beyond LED luminaires with integrated controls to imagine a 'digital ceiling' – a distributed computing platform that combines a network of intelligent luminaires with external control devices, databases, and software to deliver extraordinary illumination and value beyond illumination.

For owners and managers of illuminated spaces, value beyond illumination includes optimised workflows and energy efficiency based on deep insight. For users of illuminated spaces, value beyond illumination includes the ability to personalise lighting preference.

When the market for digital control reaches an inevitable tipping

### SNAPSHOT OF CONNECTED LIGHTING SYSTEM PROTOCOLS

When considering connected lighting systems for a specific project, it is valuable to have an understanding of the 'pros' and 'cons' of the various lighting system protocols – wireless, Power-over-Ethernet (PoE), DALI, Powerline Carrier (PLC), Load Control 0-10V.

#### Wireless

**Pros:** Retrofit, potentially fewer wires

**Cons:** Can be unreliable for high bandwidth lighting control (for dynamic and colour-changing effects and light shows, for example) and can be subject to interference from other competing wireless signals within a space. A comprehensive Radio Frequency (RF) site survey is a very important part of the planning process.

#### Power-over-Ethernet (PoE)

**Pros:** Easy installation, easy integration

**Cons:** Limited wattage per fixture, no standards for lighting

#### DALI

**Pros:** Established digital lighting standard (IEC 62386)

**Cons:** requires recommissioning on ballast replacement within an existing system, limited data and slow communication speed.

#### Powerline Carrier (PLC)

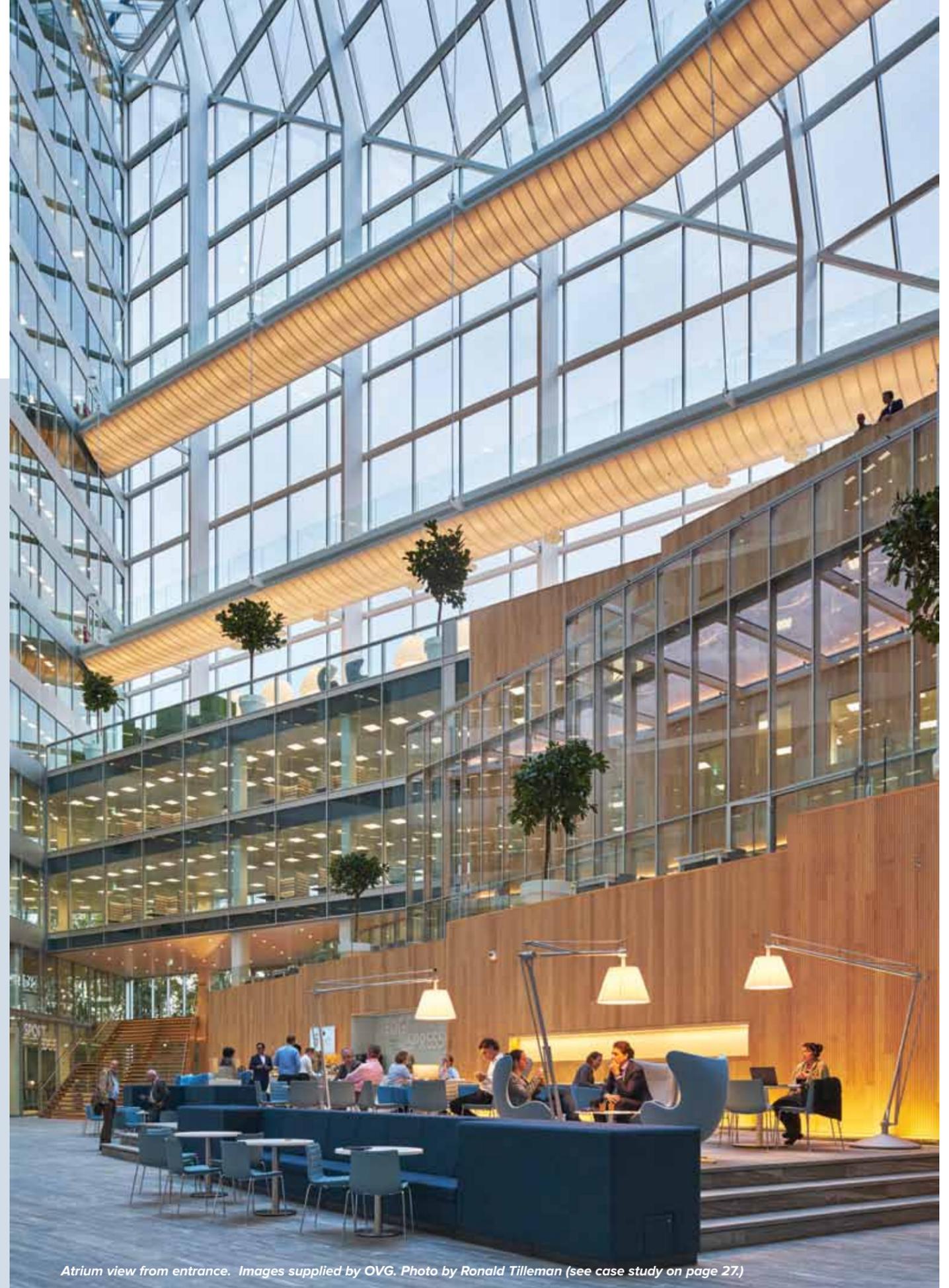
**Pros:** Uses existing infrastructure

**Cons:** Interference and lacks security

#### Load control, 0-10V

**Pros:** Standard

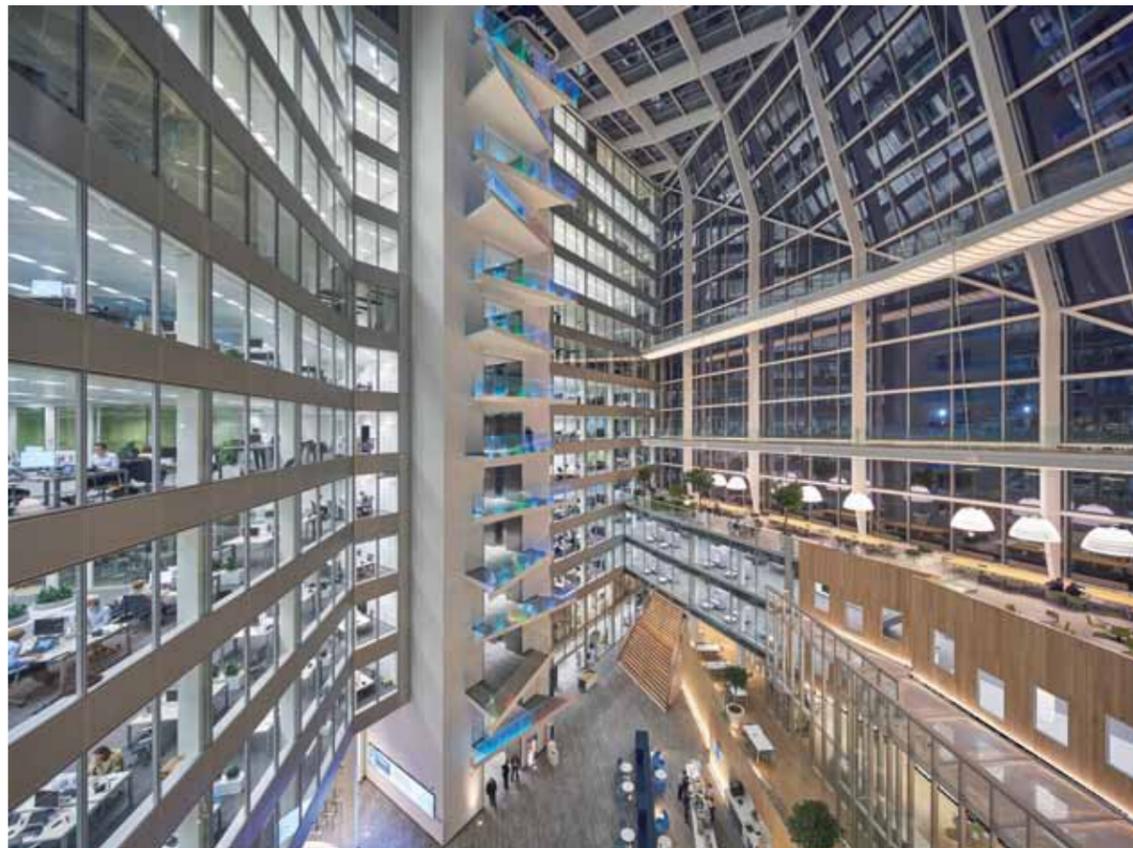
**Cons:** No data, no intelligence



Atrium view from entrance. Images supplied by OVG. Photo by Ronald Tilleman (see case study on page 27.)



Flexible working space The Edge. Images supplied by OVG. Photo by Ronald Tilleman.



Atrium The Edge by night. Images supplied by OVG. Photo by Ronald Tilleman.

See case study on opposite page.

point, the lighting industry will be affected from end to end, with the lighting industry expected to look more like the electronics and IT industries, than the industry we know today.

With advanced capabilities, at Philips we see digital control and systems integration that used to be strictly about providing excellent, energy-efficient illumination are now focusing more on how to use the lighting infrastructure to deliver measurable business value to customers.

#### LUMINAIRE-INTEGRATED CONTROL AND LIGHTING DESIGN

Systems thinking is the second great disruption that the lighting design community has had to absorb in the last ten years, after the introduction of LED lighting itself.

Intelligent and connected lighting systems do not spell the end of lighting design, but the beginning of an expanded and more central role for lighting designers. With the ability to embed LED light sources in the environment and make them responsive to changing conditions and the preferences and habits of individuals - lighting designers can have a profound effect on the health, comfort, safety, and effectiveness of people, and on sustainability, energy efficiency, and resiliency.

In addition to delivering optimised illumination, designers with a good understanding of connected lighting themes and systems will be able to participate in substantive dialogue with customers about how to use connected lighting as an approach to realising measurable value beyond illumination. In business settings, these values include optimised facility management, HVAC (heating, ventilating, and air conditioning) cost reduction, and enhanced employee performance and satisfaction.

#### APPLICATIONS FOR LED LUMINAIRES WITH INTEGRATED CONTROLS

One of the great advantages, and also one of the challenges of intelligent and connected lighting systems is their flexibility for a broad range of applications. Systems can be any size, from a few lights in a single enclosed office, to a network of tens of thousands of individually controllable light points distributed across several geographical areas. Systems can incorporate a wide range of capabilities, including basic illumination, comfort, and energy savings to specifically targeted, personalised illumination integrated with a variety of personalised services and in-context information.

There are no one-size-fits-all systems. Specifying and designing effective and successful intelligent and connected lighting systems starts with gathering customer and business needs, then tailoring a solution that delivers the specific illumination and other desired capabilities. This approach implies a greater collaboration between traditional lighting design/specification practices and other practices, such as IT systems planning and deployment, systems integration, electrical design and installation, environmental design, and architectural design.

At the very least, lighting designers and specifiers who want to succeed in the new world of integrated systems need to educate themselves on the advanced capabilities of connected lighting systems, and on the role that lighting infrastructures can play in the new digital ecology. ■

## POWER-OVER-ETHERNET CASE STUDY – ‘THE EDGE’, AMSTERDAM

The connected lighting system installed at ‘The Edge’, a cutting-edge office building developed by OVG Real Estate for Deloitte in Amsterdam, is the first of its kind. The building, designed by PLP Architects has achieved Building Research Establishment Environmental Assessment Methodology (BREEAM) Outstanding certification. The certification recognises that best practice has been used to ensure that the building is designed, constructed and operated to high sustainability standards.

As part of its BREEAM accreditation, the building, which includes 40,000sqm of office space, employs a Philips LED connected lighting system, powered using Power-over-Ethernet (PoE) technology.

In addition to the energy savings achieved using LED luminaires instead of conventional luminaires, PoE-enabled luminaires also deliver significant cost savings on lighting installation. As these fixtures receive both power and data over a single Ethernet (Cat 5) connection, labour intensive wiring and expensive materials are eliminated, reducing installation costs by up to 50 per cent.

By transmitting data and power via the one cable, The Edge lighting system also becomes an information pathway. Each fixture is connected to the building’s IT system and recognised as a digital light point able to send and receive information. Since lighting is present everywhere in the building, the system can capture and feed back data about the entire space. Having an integrated view of a building’s occupancy patterns and energy usage provides for more informed decision making with unprecedented levels of energy and operational efficiency.

With a single system showing real time and historical views of building utilisation, Facility managers at the Edge can even see when a room or floor is not used and adjust the temperature, lighting, and cleaning roster accordingly. For office workers at The Edge, the lighting system enables control of the lighting using their mobile device.

The LED luminaires, outfitted with wireless communications devices, also form a dense indoor positioning grid, like an indoor GPS, that support a range of location-based services, such as personalised lighting control via a smart device, wayfinding, or to provide office workers with useful information such as the nearest empty meeting room.