The Future of Light

Connected Lighting

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We are always
connected

The internet has changed everything

The shift from analog to digital has completely changed our world over the last 30 years. We walk around with smartphones in our pockets containing more computing power than that which helped Neil Armstrong set foot on the moon in 1969. Technology is a personal tool and we want and need to be connected with people and organizations, wherever they are globally.

Workspace trends

- Workplace innovation in offices is driving more effective use of spaces — from more than one desk per full-time employee to less than one desk per full-time employee (average 0.5–0.7)

- People-centric "smart" buildings with flexible, activity-based workspaces are becoming the norm

- Measurement of workspace utilization rates is often a manual process, and optimization may not take place

- Measuring workspace utilization with occupancy sensors is a more progressive method, but costs can be high for installation and maintenance

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Connected Lighting – communication and data through lighting

Connected lighting systems offer a digital ceiling infrastructure that provides both high-quality, reliable illumination and a smart, high-bandwidth communications platform that delivers and extraordinary value beyond illumination.

Information collected through a connected lighting system's high-bandwidth network affords deeper insight into building usage and greater control over the distribution and consumption of resources. Building owners and managers can realize enhanced value and savings from optimizing lighting and other building verticals, such as HVAC.

PoE
Power over Ethernet

87.5% less mains connections

CAT5 **cable** is data and power cable
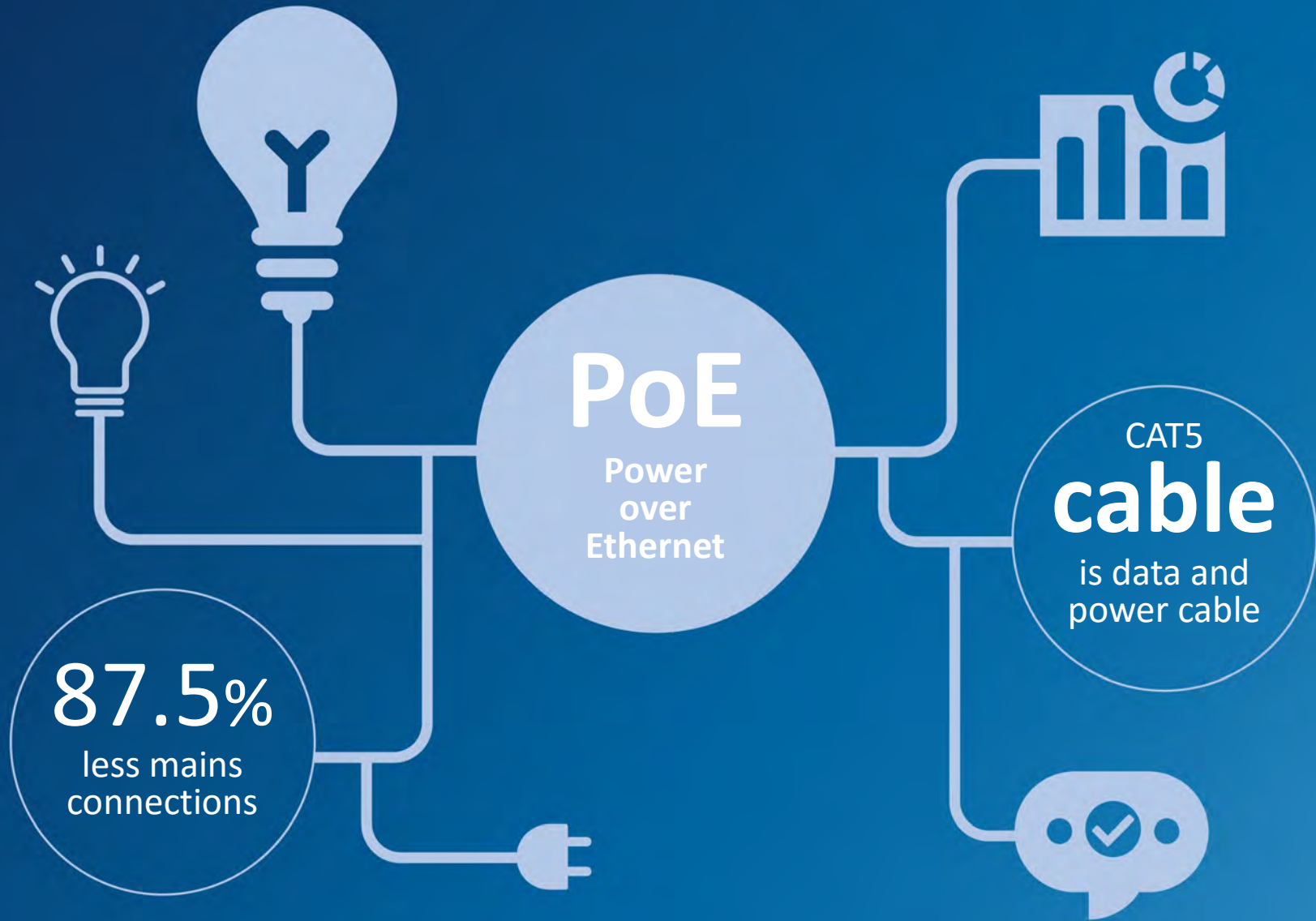
Visible Light Communication

- Our connected lighting system communicates data through the light itself

- More accurate positioning than other indoor positioning methods through a 'highly granular' lighting grid

- Office workers control lighting and comfort levels via a smartphone app
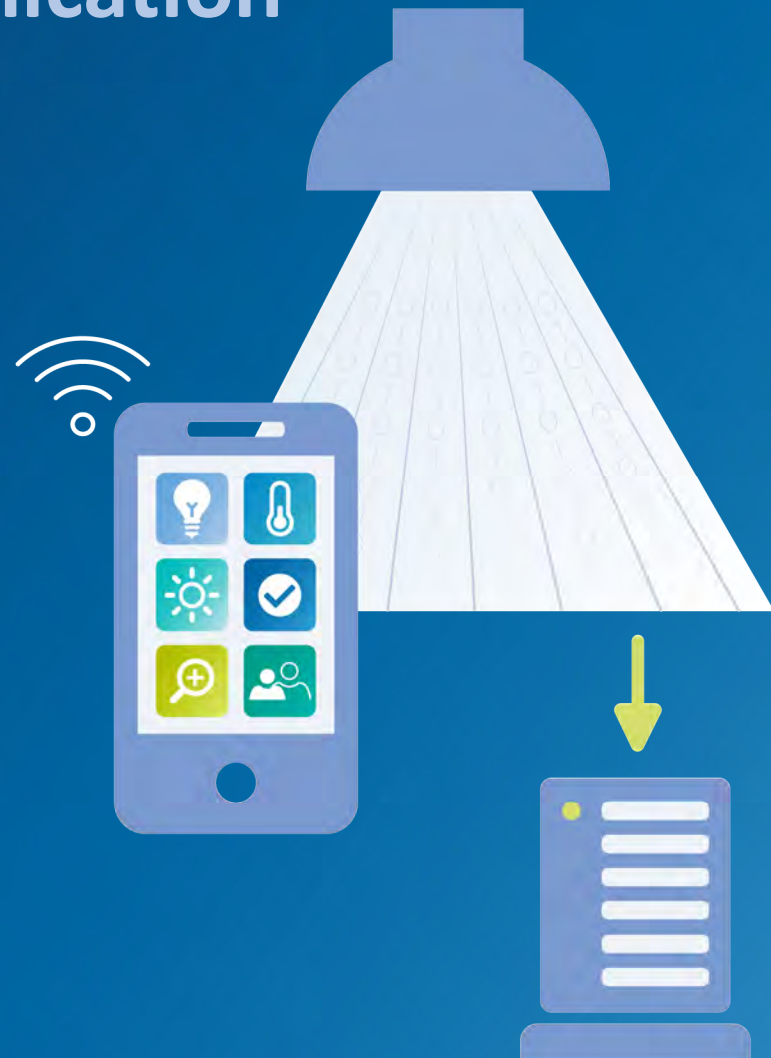
Connected Lighting
Value Categories

Efficiency

Saving energy on the lighting system, but also saving energy on systems integrated to make use of the sensors and data

Future-proof

Maintain, sustain, enhance, and integrate — not just today, but as technology evolves

Optimization

Use data-driven insights to optimize resource delivery and streamline building management workflows

Performance

Satisfy regulatory requirements, and optimize lighting for task, performance, and convenience

Efficiency

- Up to 80% energy saving for lighting through the connected lighting system compared to traditional lighting

  - Energy savings through LED, occupancy, daylight harvesting, personal control, scheduling, system optimization through

- Energy reporting through software, with measured per fixture information, reporting and comparisons at: room/area/floor/building level supporting sub-metering of lighting as a vertical to support certifications like BREEAM, without any electricity meters

- Energy savings on other verticals can be made – a result for example of zero occupancy in the space

- Proactive alerts indicate anomalies in the lighting system and building as they happen

  - Failures of lamps/ballasts/gateways trigger an alert via email or UI or via API to another system

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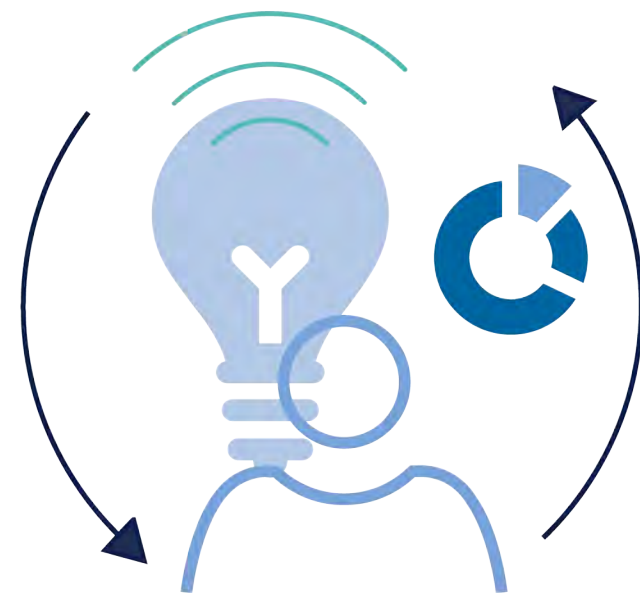
Future proof

- Sensor slots in luminaires provide an easy upgrade path, the Connected Lighting System can grow over time by adding new data sources

- Wall Switches (UIs) can be costly to install and maintain and are no longer needed. Personal Control via an app is possible

- Hardware is typically owned and managed by the building owner and requires limited local configuration to address the differing needs of tenants. Competitively priced basic lighting system applicable to all tenants

- Additional features are delivered by software, firmware updates, integration with other systems, and additional sensors

- Since every luminaire has an IPv6 address, reconfigurations of the lighting system are completely software-based, avoiding the need for rewiring the physical network

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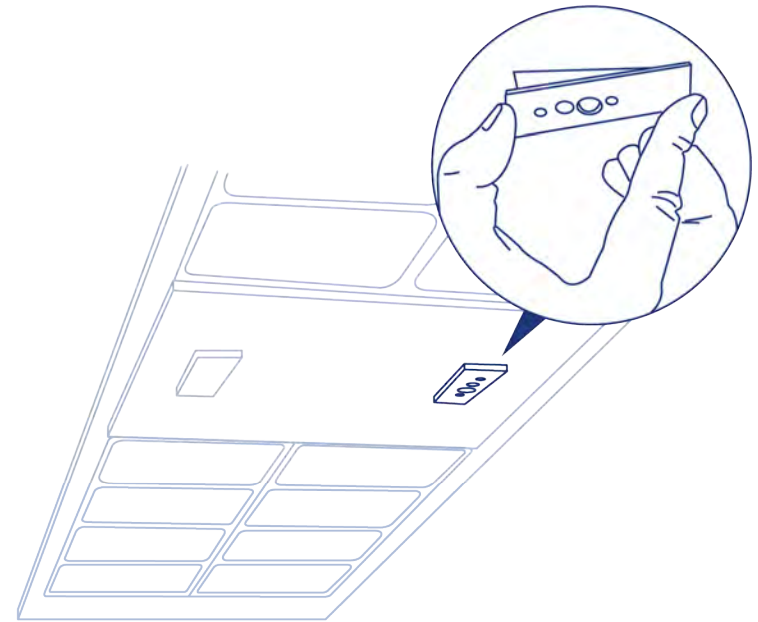
Optimization
beyond illumination

- Facility utilization

- Connected lighting leverages the lighting infrastructure and the data it collects to realize savings beyond the lighting vertical, including:

  - Targeted HVAC

  - Optimized cleaning schedules

  - Location-based services to increase productivity through way finding, personalization, enhanced scheduling, and so on*

  - Connection to the AV system for increased comfort

*2016 Feature

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Performance

- Dynamic control of lighting and temperature with unique
smartphone-based method –
putting employees back in control
of their working environment

- Third-party devices / systems can be integrated
with our system becoming part of a "smart building" app

- App offers lighting control as well
as a means of delivering in-context information
and services to employees

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Optimization & Efficiency
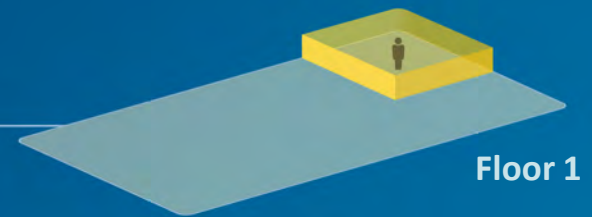## Building optimization example

$1
per sf
per year

Saved on **cleaning**

By analyzing occupancy data, only spaces that have been in use get cleaned, saving resources and costs[1]

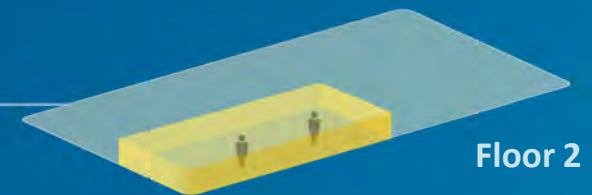[1]Source: Study HTC34 Philips Eindhoven based on xE/m2 cleaning cost

Floor 1

$1.2
per sf
per year

Saved on **heating**

Reduce consumption through occupancy detection. Lighting, heating, and cooling automatically switch on / off depending on occupancy.[2]

[2]Source: Study HTC34 Philips Eindhoven based on 9.5E/m2 HVAC cost

Floor 2

$42
per sf
per year

Saved on **space optimization**

Close off areas to save energy during non-peak periods, based on analysis of usage data. For example, "close floor 12 on Fridays."[3]

[3]Source: Data DTZ (Project mgt & building consultancy) Percentage range of savings: 11-67%; assumed rent price 375E/sf
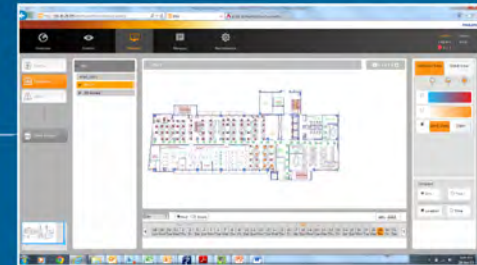
Floor 3

Optimization & Efficiency
Building optimization example

$1
per sf
per year

Saved on cleaning

Using lighting management software dashboard or reports, facility manager
can set time between cleanings based
on occupancy patterns, and can indicate where not to clean if spaces have not been used since the last cleaning

$1.2
per sf
per year

Saved on heating

By linking occupancy data collected from
the lighting system to BACNet, the HVAC system can adjust heating or cooling of spaces in real time depending on presence
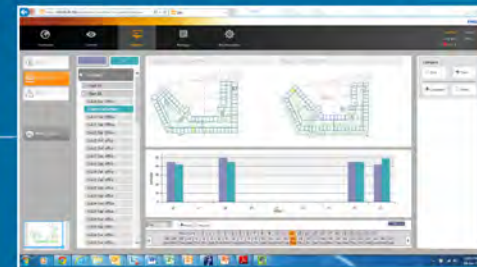of employees

$42
per sf
per year

Saved on space optimization

Granular historical data on the usage of floors and spaces can tell facility managers when to close floors/areas that are not in use. Long-term usage data can assist with WPI and organization/optimization of floors

Floor 1

Floor 2

Floor 3

Optimization & Efficiency
Space optimization calculation explained

$42
per sf
per year

$42 per sf **per year figure is based on these factors:**
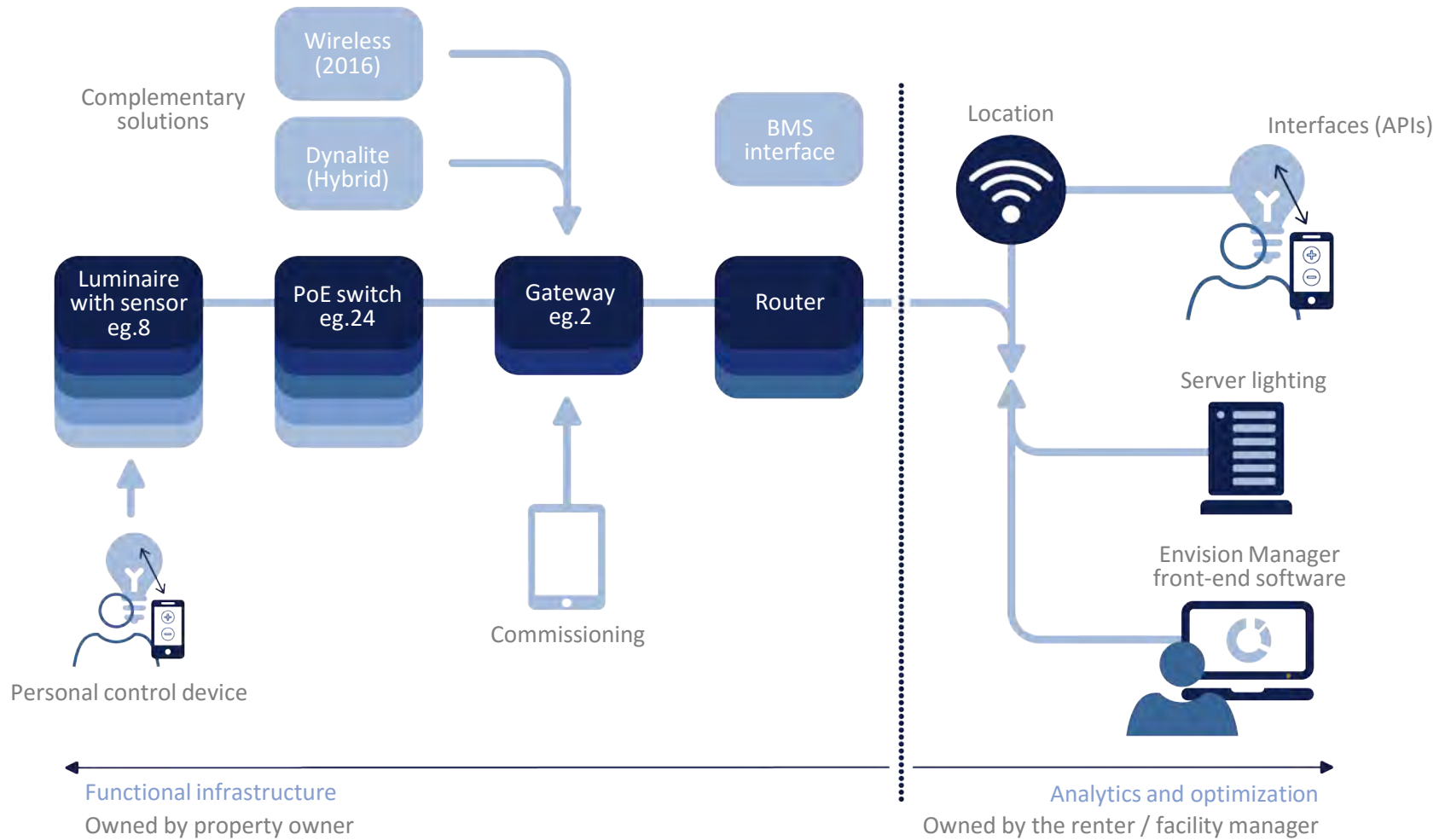
- Energy usage reduction for all building utilities, plus reduced floor space needs

- Our model is based on a standard office space using 3 different lighting solutions

- The combined cost savings equate to 11%

- The average cost per sf per year of office floor space in NYC is $375 sf per year

- 11% savings on this figure equate to overall cost savings of $42 sf per year

Performance

- Using visible light communications, the luminaires can be scanned to identify an employee's location
in the building, affording instant control of the lighting, heating,
and other services in that location

- Default lux level in an office can be lower (300 lux, for example) and raised to 500 lux by employees on demand, helping to realize up to 43% annual energy savings while still complying with regulatory norms

- Third-party devices / systems can use employee positioning information for further integration (AV, Lync, Microsoft, HVAC control, room booking) using an API to provide x,y,z co-ordinates accurate to nearest meter (2H 2015)

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How it all connects

Wireless (2016)

Dynalite (Hybrid)

Complementary solutions

BMS interface

Luminaire with sensor eg.8

PoE switch eg.24

Gateway eg.2

Router

Commissioning

Personal control device

Location

Interfaces (APIs)

Server lighting

Envision Manager front-end software

Functional infrastructure
Owned by property owner

Analytics and optimization
Owned by the renter / facility manager

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Eco System
Easy to grow

The ability to **easily** interface with other systems delivers additional value and is key to system success. Connected lighting systems can interface with many other building verticals:

HVAC

AV systems

Control panels

Room booking

BMS systems

Energy management systems

The capability to integrate can be at API level where SOAP/REST based interfaces can provide information on a real time basis about Energy, Occupancy, Alarms, Temperature. Hardware building level integrations to standards like BACNet are also readily available

Summary
Solutions to stakeholders

Building Developers
Owners of the space

- System is flexible
- Future proof and upgradable
- Higher asset value
- Capex investment kept low
- Safer and easier to install
- Sustainable
- Future – ready for more sensors and more features

Tenants & Employees
Users of the space

- Employee comfort and control is increased, whether for closed offices, boardrooms or even open plan

- Insight and control is highly granular and easily connected with other systems to ensure optimization takes place

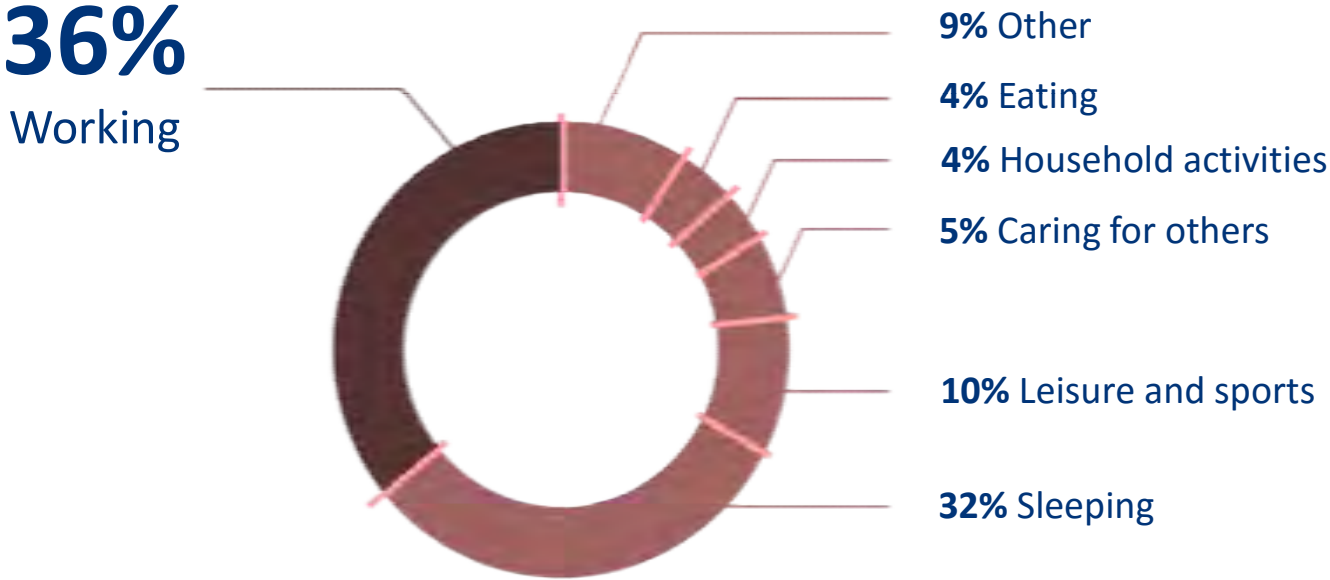- Delivering value beyond illumination brings far greater savings

Tunable white solutions
Lighting that is as fluid as your life.

innovation ✦ you

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Today people spend more time working than anything else, even sleeping*

36%
Working

9% Other

4% Eating

4% Household activities

5% Caring for others

10% Leisure and sports

32% Sleeping

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Humans need light

Light allows us to see
Light allows us to experience the environment
Light regulates our circadian rhythm
Light influences our mental functioning
Light is **much** more than the opposite of dark

Human centric lighting

Human centric lighting brings together an in-depth understanding of user needs, lighting applications and scientific insights to create evidence-based lighting solutions for optimal vision, sense of well-being and performance.

When designing lighting solutions, daylight is always an important source of inspiration, as it delivers the winning combination:

• The right light

• With the right spectral content

• At the right time

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Three scientific-based benefits
of light on life

There are two known pathways through which light can affect our well-being:
- Visual – The visual cortex, via the photoreceptors (rods and cones) in the retina of the eye
- Non-visual – The central biological clock (SCN), via a third photoreceptor: melanopsin
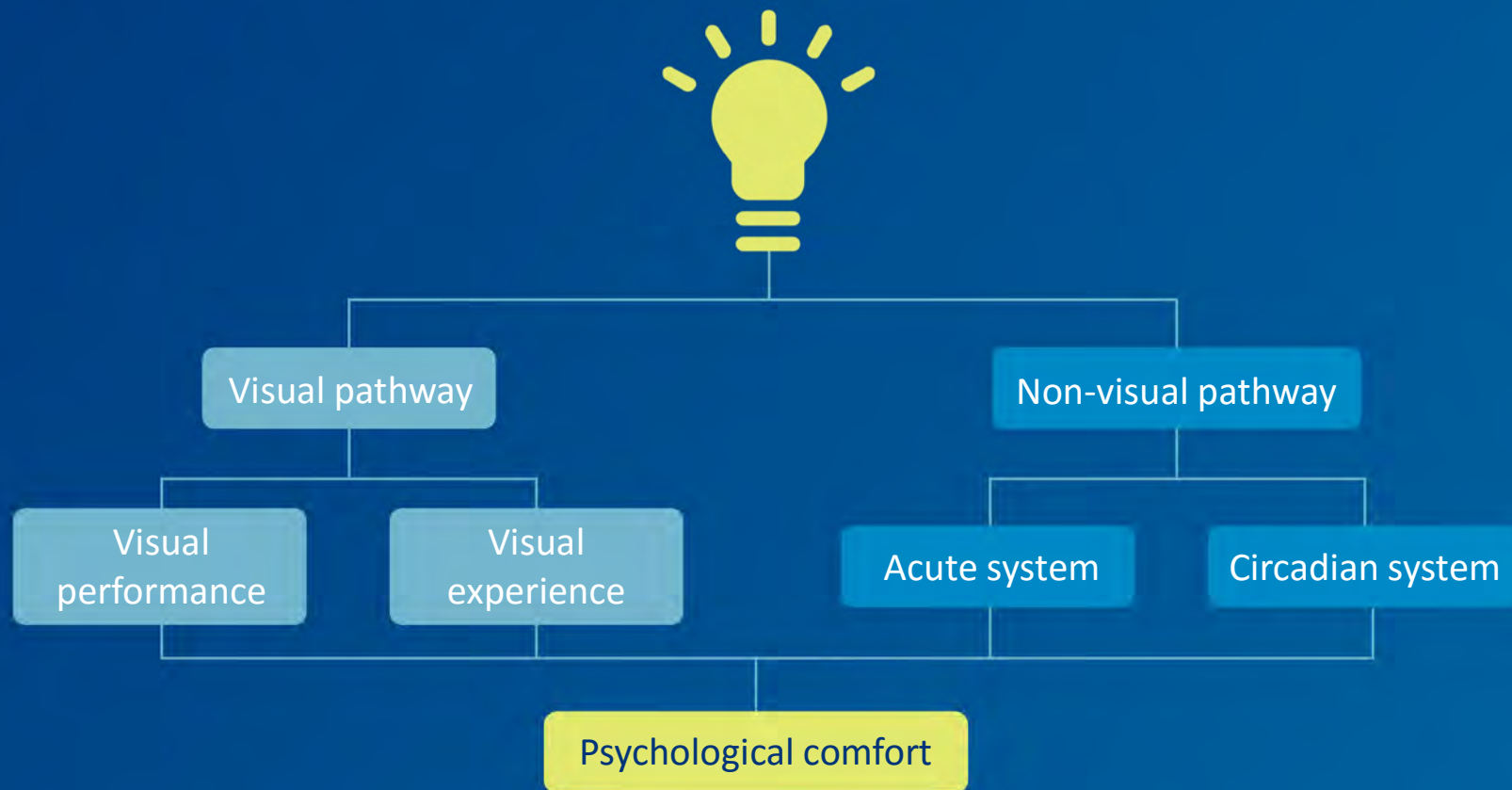
See better
(visual)

Feel better
(emotional)

Function better
(biological)

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Optimal support of the two pathways
affects people's work attitude during the day

Visual pathway → Visual performance, Visual experience

Non-visual pathway → Acute system, Circadian system

Psychological comfort

Visual pathway
See and experience the world around you

50% of our brain capacity is used for vision. It costs energy and it needs training.

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