This presentation was live at:

Smart Buildings SHOW

18-19 October 2023 • ExCel London

DALI and Building Regulations

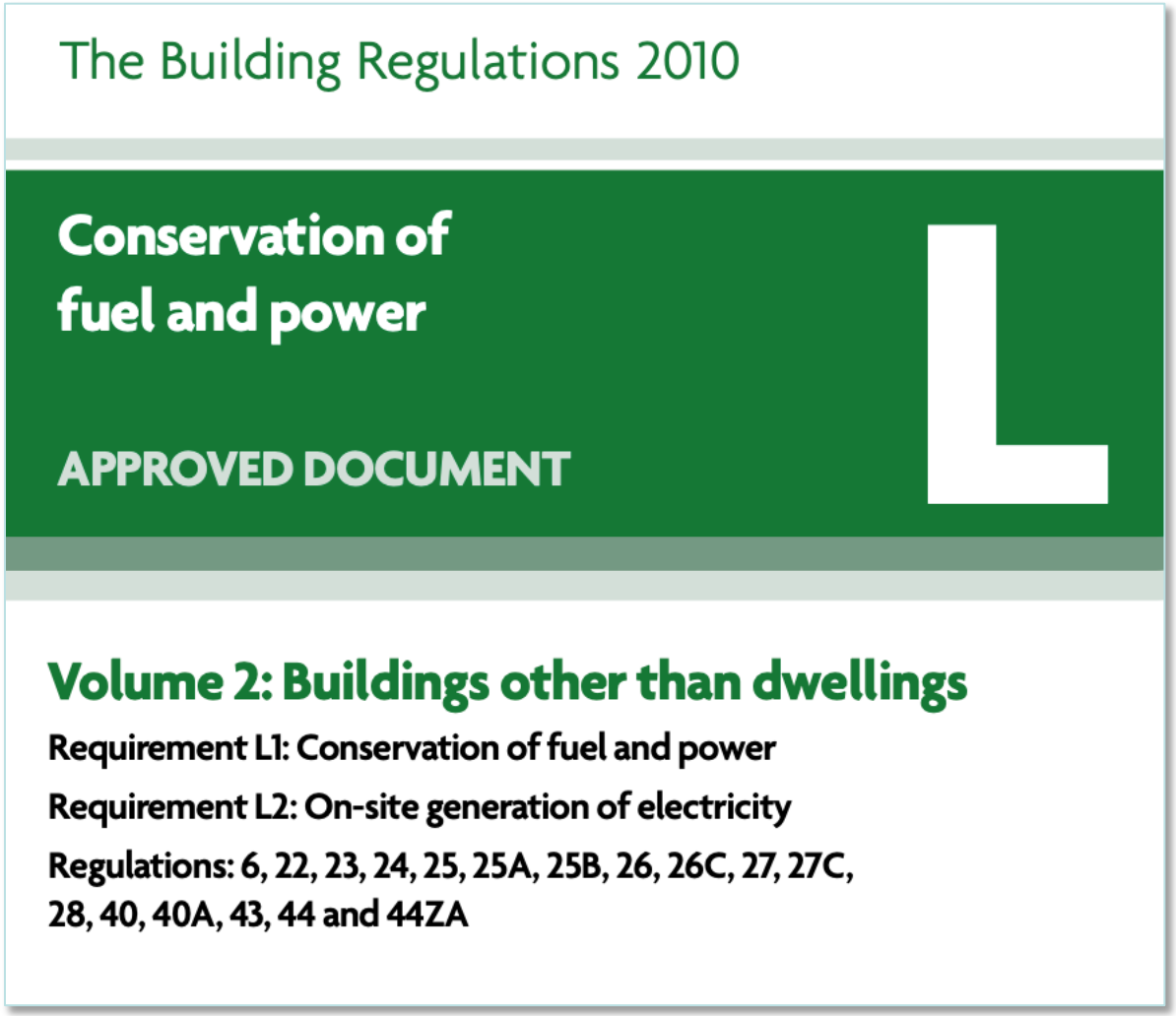
How to Comply

LUTRON®

Topics

- Overview of the requirements outlined on the building regulations
- Interpretation of the requirements using excerpts from a CIBSE approved CPD
- Going beyond the regulations at no additional cost (ish)

The Building Regulations



UK energy objectives

- 2019 - The Climate Change Act of 2008 was amended to set a ‘net zero’ target of 2050.

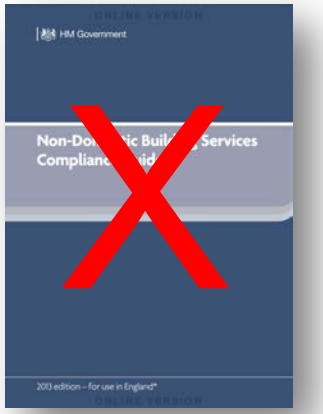
- April 2021 - UK government began to set in law world’s most ambitious climate change target
  - Cutting emissions by 78% by 2035 compared to 1990 levels
  - This would bring the UK more than three-quarters of the way to net zero by 2050
- **80 % of the buildings that will be in use in 2050 have already been built**

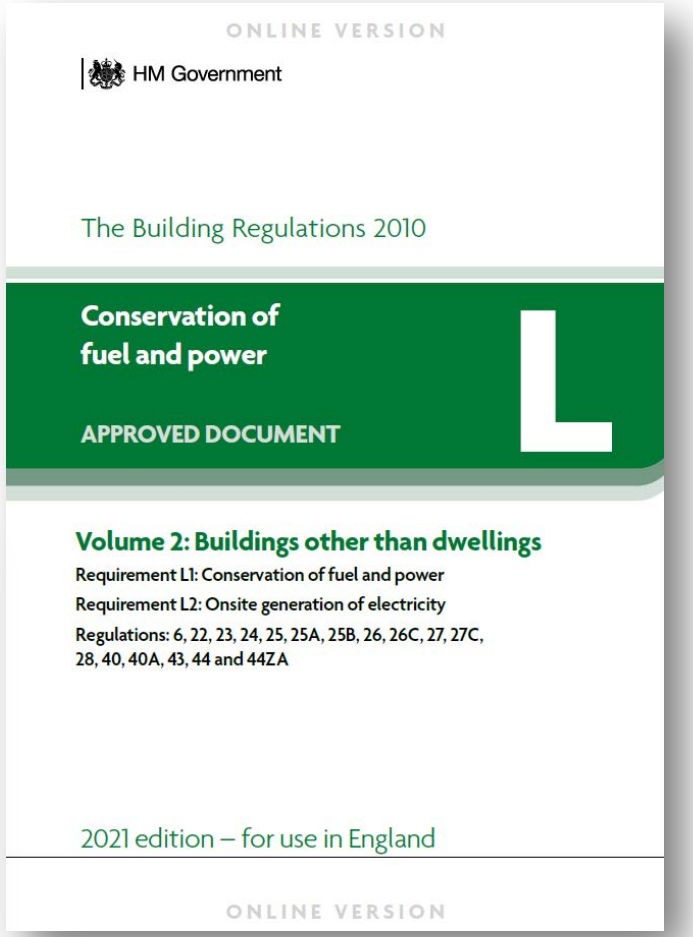
Sources: legislation.gov.uk & Department for Business, Energy & Industrial Strategy

Approved Document L - Conservation of fuel and power

Volume 2: Buildings other than dwellings

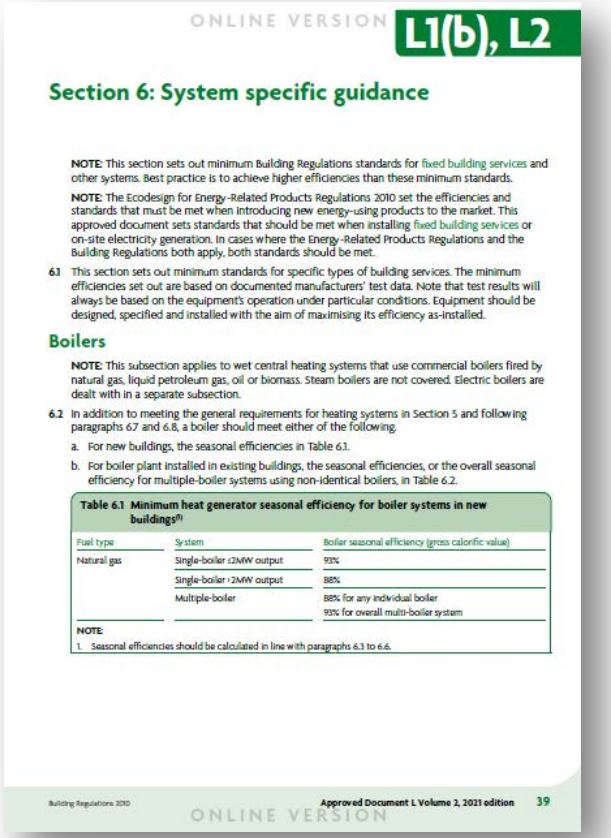
- UK's energy efficiency guidelines
  - Sets recommended path for compliance with Part L
- Latest edition published December 2021
  - Took effect 15th June 2022
  - Replaces 2013 Non-Domestic Building Services Compliance Guide
- Effects newly constructed or majorly refurbished buildings (other than dwellings)





Approved Document L - § 6: System specific guidance

- Sets out minimum Building Regulations standards for fixed building services and other systems.
  - Best practice is to achieve higher efficiencies than these minimum standards.
- Sections 6.62-6.65 pertain to lighting controls.
- Sections 6.59-6.61 pertain to lighting.



ONLINE VERSION L1(b), L2

Section 6: System specific guidance

NOTE: This section sets out minimum Building Regulations standards for fixed building services and other systems. Best practice is to achieve higher efficiencies than these minimum standards.

NOTE: The Ecodesign for Energy-Related Products Regulations 2010 set the efficiencies and standards that must be met when introducing new energy-using products to the market. This approved document sets standards that should be met when installing fixed building services or on-site electricity generation. In cases where the Energy-Related Products Regulations and the Building Regulations both apply, both standards should be met.

6.1 This section sets out minimum standards for specific types of building services. The minimum efficiencies set out are based on documented manufacturers' test data. Note that test results will always be based on the equipment's operation under particular conditions. Equipment should be designed, specified and installed with the aim of maximising its efficiency as-installed.

Boilers

NOTE: This subsection applies to wet central heating systems that use commercial boilers fired by natural gas, liquid petroleum gas, oil or biomass. Steam boilers are not covered. Electric boilers are dealt with in a separate subsection.

6.2 In addition to meeting the general requirements for heating systems in Section 5 and following paragraphs 6.7 and 6.8, a boiler should meet either of the following.

a. For new buildings, the seasonal efficiencies in Table 6.1.

b. For boiler plant installed in existing buildings, the seasonal efficiencies, or the overall seasonal efficiency for multiple-boiler systems using non-identical boilers, in Table 6.2.

Table 6.1 Minimum heat generator seasonal efficiency for boiler systems in new buildings[1]

Fuel type	System	Boiler seasonal efficiency (gross calorific value)
Natural gas	Single-boiler ≤2MW output	93%
	Single-boiler >2MW output	88%
	Multiple-boiler	88% for any individual boiler 93% for overall multi-boiler system

NOTE:

1. Seasonal efficiencies should be calculated in line with paragraphs 6.3 to 6.6.

Building Regulations 2010 Approved Document L Volume 2, 2021 edition 39

ONLINE VERSION

About Lighting

Lighting

6.59 Any fixed lighting should achieve levels of illumination appropriate to the activity in the space. Spaces should not be over-illuminated. Lighting should be designed based on CIBSE's *SLL Lighting Handbook* or an equivalent design guide.

NOTE: For smaller spaces where total lighting power is likely to be low (toilets, store rooms etc.) there is no expectation that lighting calculations should be produced.

6.60 Lighting should observe the following.

a. If it is general lighting, either:
   i. have an average luminaire efficacy of 95 luminaire lumens per circuit-watt
   ii. the Lighting Energy Numeric Indicator (LENI) method, following Appendix B.

b. If it is display lighting, any of the following:
   i. have an average light source efficacy of 80 light source lumens per circuit-watt
   ii. have a rated power usage no greater than 0.3W/m^2 in each space
   iii. the LENI method, following Appendix B.

c. For high excitation purity light sources, an average light source efficacy of 65 light source lumens per circuit-watt.

NOTE: This approved document does not include minimum standards for specialist lighting, such as theatrical spotlights, stage lighting, gobo projectors or wall-washers.

§ 6.59 – Over-illumination

Intent: Don't light a space more than necessary.

Approved Document L Language:

- Any fixed lighting should achieve levels of illumination appropriate to the activity in the space. Spaces should not be over-illuminated. Lighting should be designed based on CIBSE's SLL Lighting Handbook or an equivalent design guide.
  - NOTE: For smaller spaces where total lighting power is likely to be low (toilets, storerooms etc.) there is no expectation that lighting calculations should be produced.

Interpretation:

- Designers plan for LEDs to degrade over their lifetime, resulting in spaces being over lit at initial install.
  - We need a control system that can cap the high-end output of fittings and dim in response to daylight to ensure the space is not over lit.

§ 6.65 – Separation of Display Lighting

Intent: Save lighting energy by allowing display lighting to be turned off outside of regular business hours.

Approved Document L Language:

- Display lighting should be controlled on dedicated circuits that can be switched separately from those for lighting provided for general illuminance.

Interpretation:

- Lighting to highlight displays of exhibits, merchandise or lighting used in spaces for public leisure need to be circuited and controlled separately from other general illumination in the space.

About Lighting Controls

Lighting controls

6.62 Lighting controls in new and existing buildings should follow the guidance in the Building Research Establishment's Digest 498.

6.63 Unoccupied spaces should have automatic controls to turn the general lighting off when the space is not in use (e.g. through presence detection). Occupied spaces should have automatic controls where suitable for the use of the space.

6.64 General lighting in occupied spaces should have daylight controls (e.g. photo-switching and dimming) for parts of the space which are likely to receive high levels of natural light.

6.65 Display lighting should be controlled on dedicated circuits that can be switched separately from those for lighting provided for general illuminance.

§ 6.62 – Reference BRE Digest 498

Intent: Have lighting controls that meet industry best practices

Approved Document Language:

- Lighting controls in new and existing buildings should follow the guidance in the Building Research Establishment's Digest 498.

Interpretation:

- Need to refer to BRE Digest 498 to understand addition controls requirements.

bre

DG 498
Revised 2014

Digest

Selecting lighting controls

Paul Littlefair

Lighting controls can give important energy savings and their reasonable provision is required by building regulations whenever lighting work is carried out in buildings that are not dwellings. When choosing lighting controls, it is important to take into account the type of space, how it is used and the amount of daylight available. This Digest explains how to do this and describes the common types of control and how to calculate energy savings. It will be of interest to building owners, designers, energy auditors, building services contractors and building control bodies.

Figure 1: Lighting control in SNOG stores is by programmed scene setting, with new lighting effects starting at set times throughout the day. Staff can also override the control to select different dynamic 'looks'. A master on/off control enables all the lighting to be turned on and off at the start and end of the working day (© Pharos Architectural Controls).

1 Introduction

Appropriate lighting controls form an essential part of any lighting system (Figure 1). Controls allow the building occupants to take charge of their environment. They can also give significant energy savings, up to 30 to 40% or more in some types of building[1]. Their reasonable provision is required by building regulations whenever lighting work is carried out in buildings that are not dwellings[2, 3, 4] (if more than 100 m² of floor area is being provided with new fixed lighting, the work is notifiable under The Building Regulations Part L[3]). Lighting controls in commercial and industrial buildings may also be eligible for Enhanced Capital Allowances[5], and they can help the building achieve BREEAM credits[6]. Modern types of control can help the building manager rearrange the internal spaces, avoiding costly wiring. And controls can be used to change the lighting at preset times (scene setting) giving changes of mood in, eg restaurants and public spaces.

Lighting controls should match the needs of building users. BRE IP 6/96[7] gives guidance on this issue. Control systems have to be appropriate to the type of space where they are fitted, and they need to be safe. Section 3 of this Digest explains how to select the best type of control for a particular application.

2 Types of control

A wide variety of control types are now available. These are defined in sections 2.1 and 2.2.

2.1 Manual control

Manual control involves direct control by the occupants. This can include switching, step switching or dimming. Dimming is usually preferable, because it can allow the occupants to select the level of lighting they require. Often, people might prefer a lower illuminance level, saving energy.

Manual control should be arranged so that areas with different levels of daylight (usually rows of lights parallel to a window wall) can be controlled separately; and individual workstations or work areas can also be controlled separately.

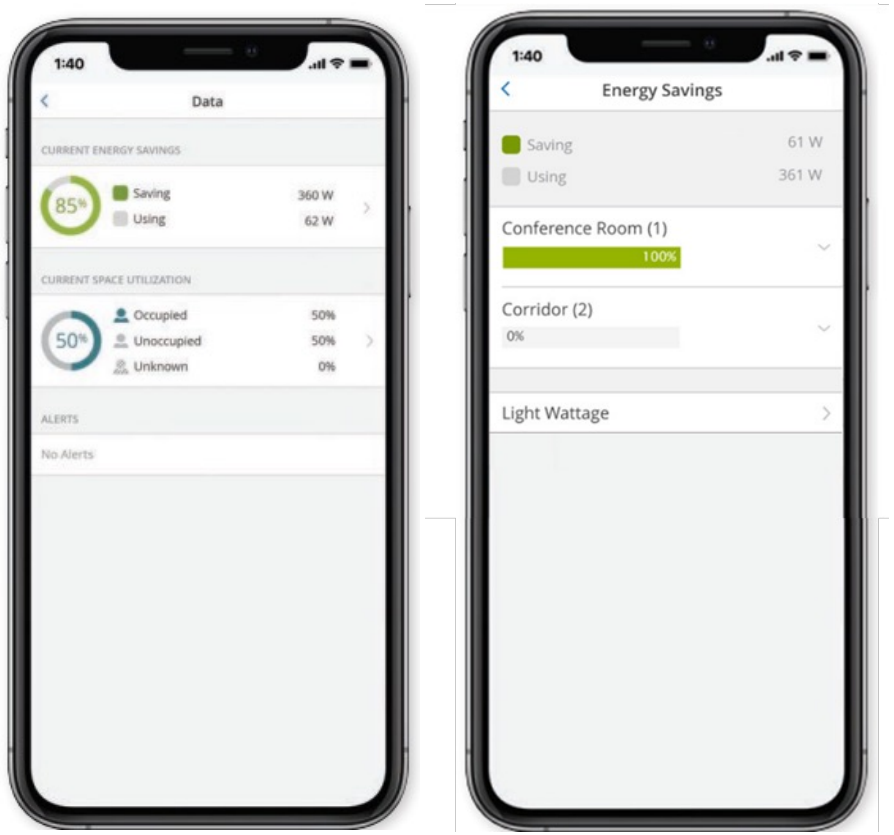
IHS

§ 6.61 - Metering of General and Display Lighting

Intent: Save energy by making building managers aware of consumption

Approved Document Language:

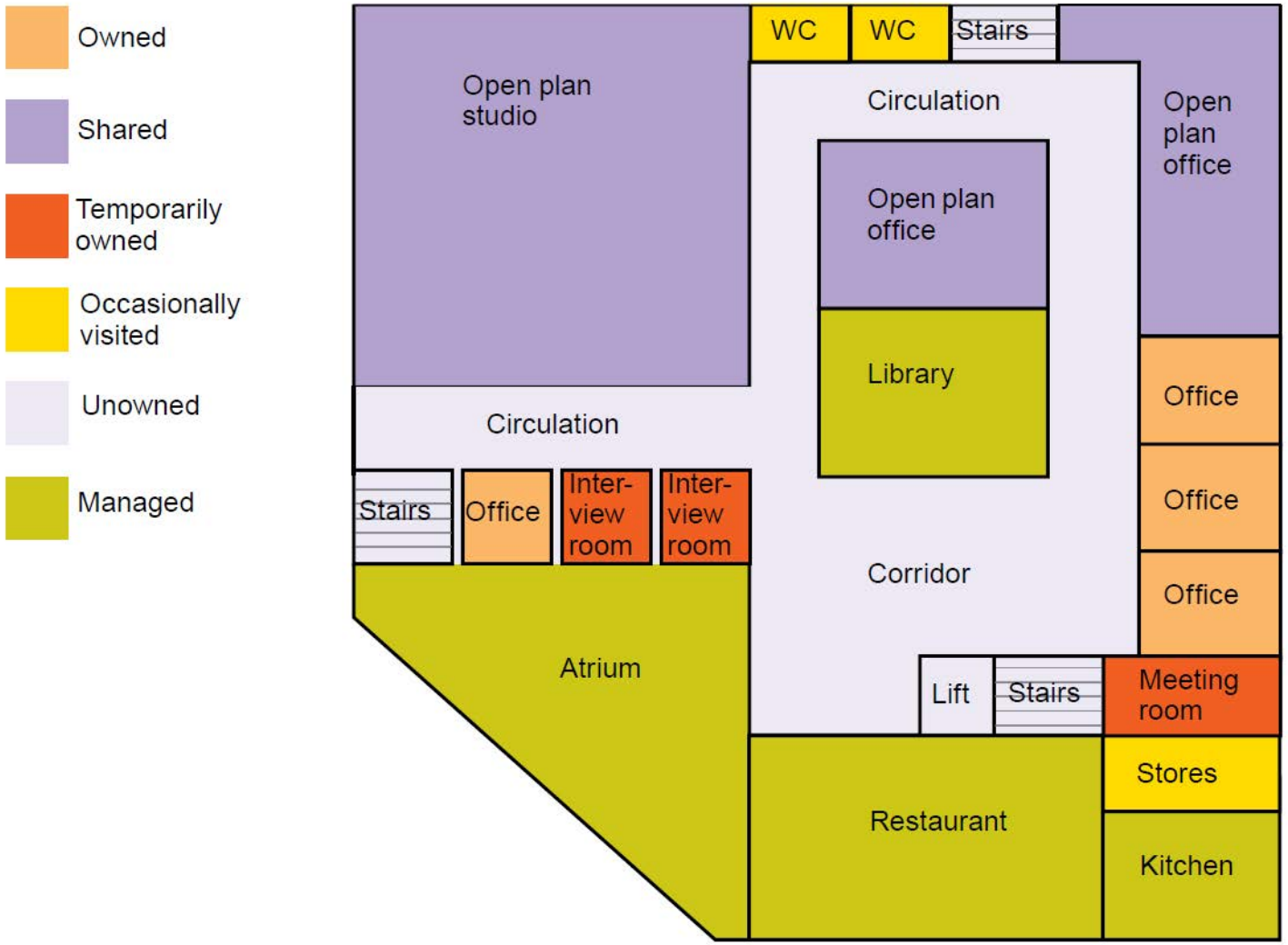
- General lighting and display lighting should be **metered** by one of the following methods.
  - a. **Dedicated lighting circuits with a kWh meter for each circuit.**
  - b. Local power meter coupled to or integrated in the lighting controllers of a lighting management system.
  - c. **A lighting management system that can both:**
    - **i. calculate the consumed energy**
    - **ii. make this information available to a building management system.**



Interpretation:

- Lighting energy consumption in the buildings needs a method of being measured at an individual circuit level and separate from other electricity used in the building.

§ 3.2 Space classification



§ 3.2 Space classification

Table 1: Space classification

Classification	Way space is used	Examples
Owned	Small rooms for one or two people. People expect to control the lighting.	Cellular office. Bed sitting room. Small workshop. Consulting room.
Shared	Multi-occupied areas. People would like to control the lighting in their part of the space.	Open plan office. Factory production area. Large workshop. Hospital ward (multi person).
Temporarily owned	People using the space on a temporary basis expect to operate the lighting controls while they are there.	Meeting room. Hotel bedroom. Rest room. Church hall. School classroom. Hospital ward (single person).
Occasionally visited	People generally stay a relatively short period each time they visit these spaces.	Storeroom. Bookstack in library. Warehouse aisle. Toilet. Bathroom. Plant room.
Unowned	Circulation areas. People expect their way to be lit, but often do not expect to operate lighting controls.	Corridor. Atrium. Staircase.
Managed	Someone is in charge of the lighting, but is usually too busy to control it. Individual users do not expect to control the lighting.	Hotel lounge. Airport terminal. Railway station. Restaurant. Large kitchen. Foyer. Public library. Shop. Sports hall. Church. Cinema/theatre. Museum/gallery. Lecture theatre.

§ 3.2 Table of control types

Table 2: Recommended types of lighting control in interiors (see notes on page 8)

Space classification	Choose occupant control	If space is daylit add	If space is low occupancy add	If space is high daytime occupancy (unoccupied at night) add
Owned	Manual by door* Flexible manual*	Photoelectric dimming† Timed off manual on† Solar reset† Absence detection† (for low, intermittent occupancy spaces only)	Absence detection† Key control† Presence detection† (only in non-daylit spaces or those with photoelectric dimming) See notes 1 and 2	Absence detection‡ Presence detection‡ (only in non-daylit spaces or those with photoelectric dimming) Key control‡ Timed off manual on‡ See note 1
Shared	Flexible manual* Local manual† See note 2	Timed off manual on* P/e dimming* Solar reset† Local absence detection† (for low, intermittent occupancy spaces only) See note 2	Local absence detection† Local presence detection† (only in non-daylit spaces or those with photoelectric dimming) Timed off manual on† (in daylit spaces only) See notes 1 and 2	Absence detection† Timed off manual on† Presence detection† (only in non-daylit spaces or those with photoelectric dimming) See notes 1 and 3
Temporarily owned	Manual by door* Local manual* Flexible manual† Key control† (if used without other forms of manual control, in non-daylit spaces only)	Photoelectric dimming† Timed off manual on† Solar reset† Absence detection† (for low, intermittent occupancy spaces only)	Absence detection* Key control† Presence detection† (only in non-daylit spaces or those with photoelectric dimming) Timed off manual on† (only in spaces with set occupancy times) Timer control† (only in spaces occupied for a set time) See note 2	Absence detection* Presence detection† (only in non-daylit spaces or those with photoelectric dimming) Timed off manual on† Key control†

§ 3.2 Table of control types

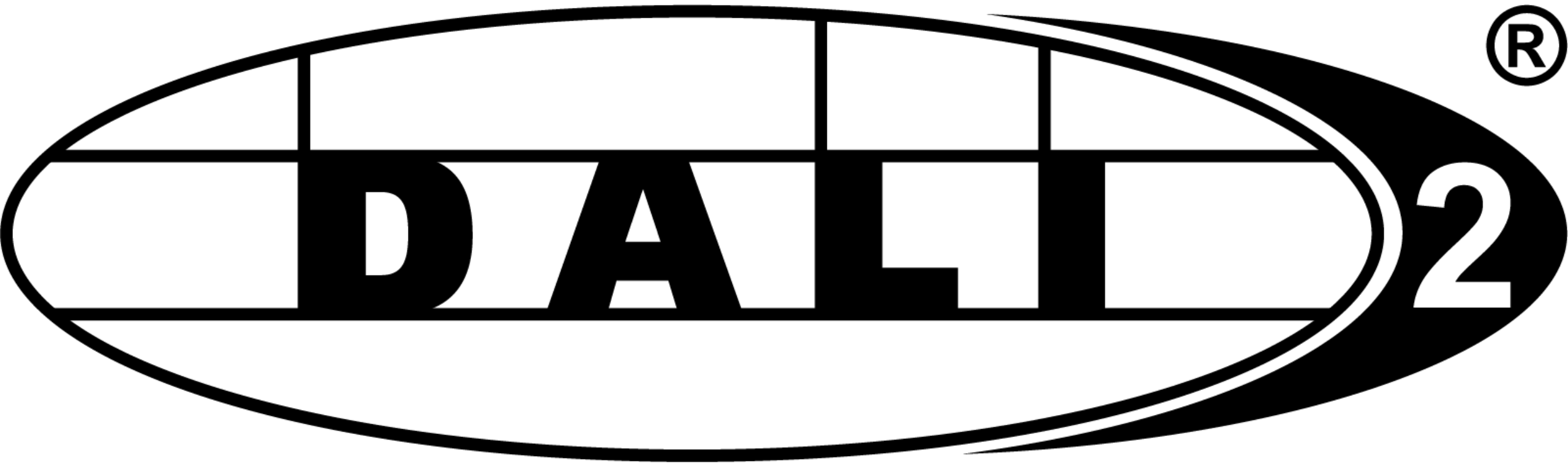
Occasionally visited	Manual by door‡ Local manual‡ Key control‡	Absence detection* Manual by door† Local manual† Photoelectric dimming† Photoelectric switching†	Absence detection* Key control† Presence detection† Timed off manual on† (only in spaces with set occupancy times) Timer control† (only in spaces occupied for a set time) See note 1	Absence detection* Presence detection† Timed off manual on† See note 1
Unowned	Manual at entrances to space‡ Local manual‡	Photoelectric dimming* Photoelectric switching*	Presence detection* Absence detection† Timer control† (only in spaces occupied for a set time) See note 4	Presence detection* Absence detection† Timed off manual on† See note 4
Managed	Centralised manual* Manual or programmed scene setting† Flexible manual† See note 5	Photoelectric dimming* Photoelectric switching†	Time switching‡ Programmed scene setting‡ Absence detection‡ Presence detection‡ See note 1	Time switching‡ Programmed scene setting‡ Absence detection‡ Presence detection‡ See notes 1 and 5

Key
* Recommended
† Assess for particular installation
‡ Consider as an optional extra.

Making Sense of all of this

How to meet regulation requirements easily…

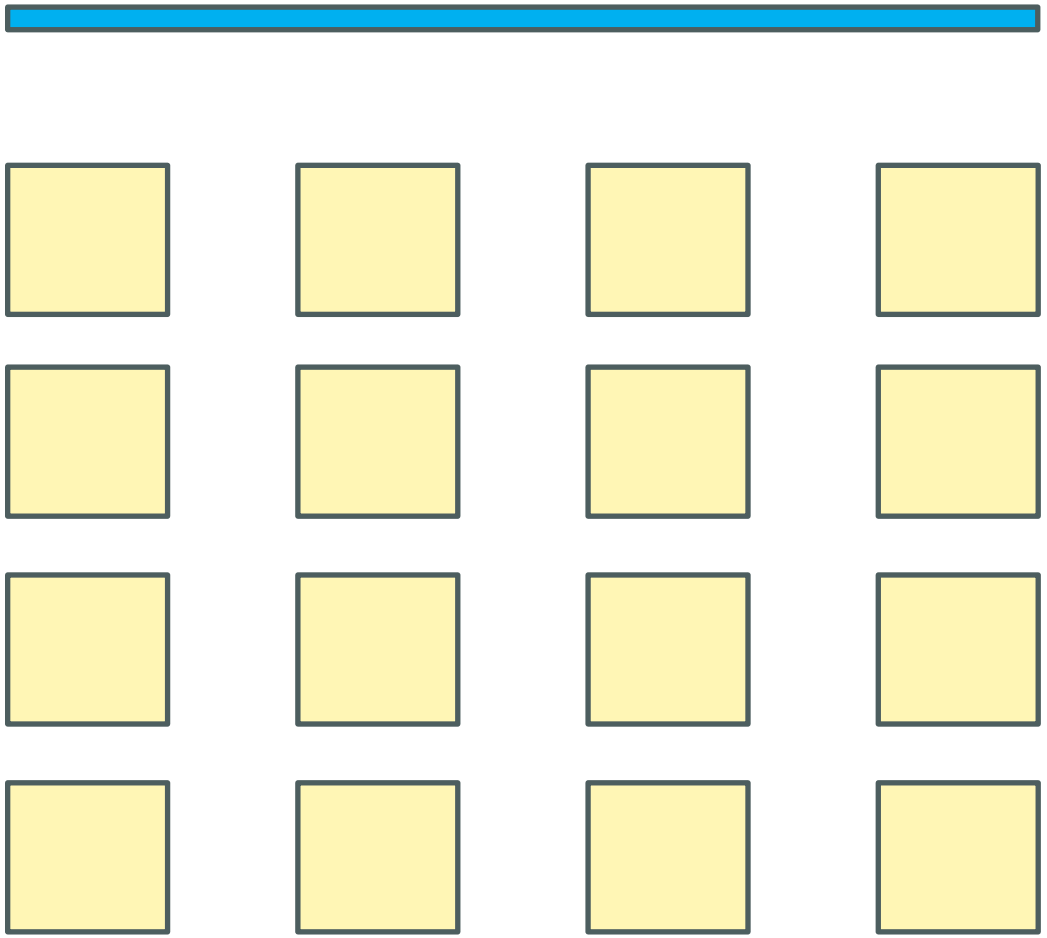
1. § 6.59 – Over-illumination
   a. Use a lighting control system that can cap high-end trim of fittings and dim in response to natural daylight.
2. § 6.61 & 6.65 – Metering and division of display lighting
   a. Use a lighting control system that can calculate and share energy usage data on independently circuited general and display lighting.
3. § 6.62 - Manual controls
   a. Use wireless, battery-operated controls for easy placement either by door, local to lighting or for flexible control.
4. § 6.62 & 6.63 - Automatic control
   a. Where there is low traffic, use absence detection.
   b. Where there is high traffic, use presence detection.
   c. In shared spaces use timeclocks.
5. § 6.62 & 6.64 - Daylighting
   a. Where there are windows, put a photoelectric daylight sensor.
6. Use a lighting control system that can easily tie together components that meet all requirements.


DALI
2
®

Why DALI?

Why DALI?

- DALI is digital
  - Once installed, we can group the lights as needed



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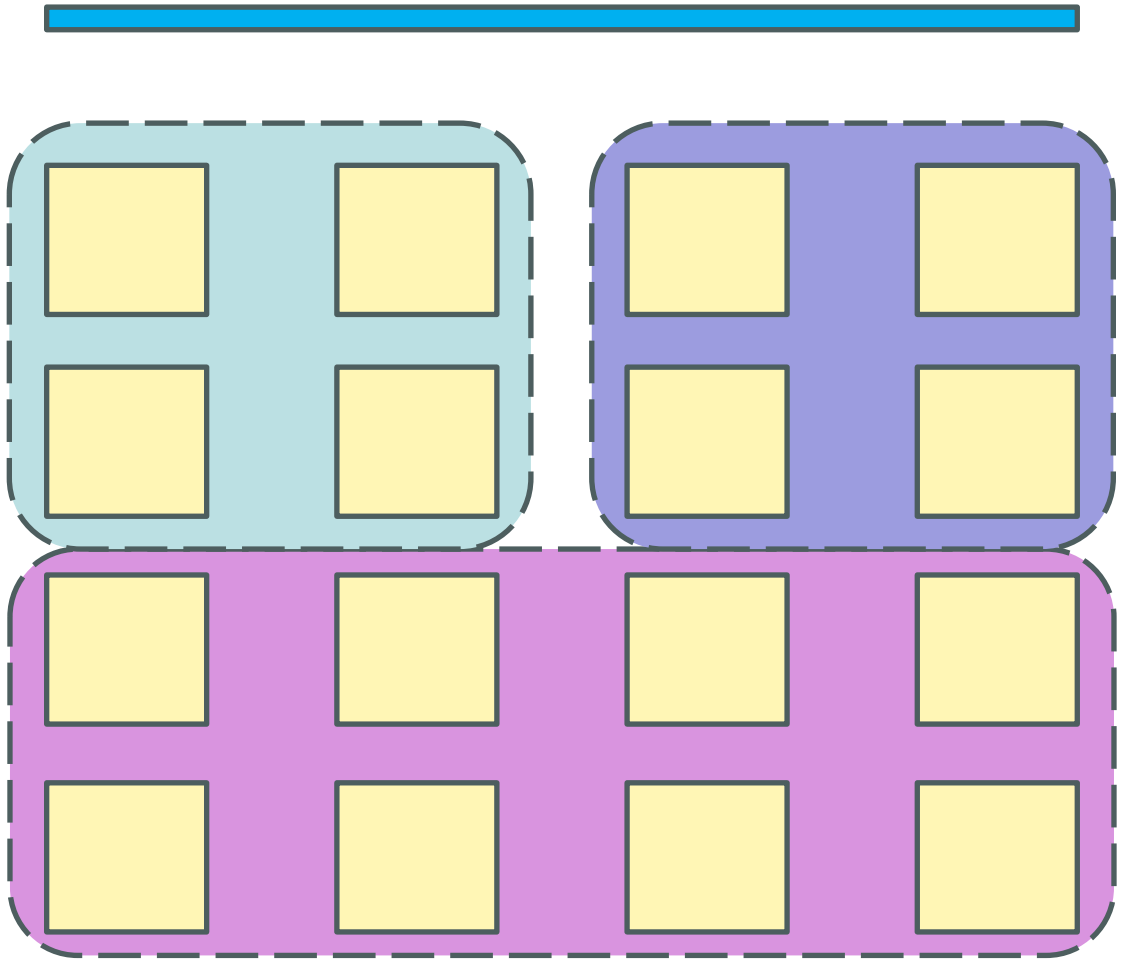
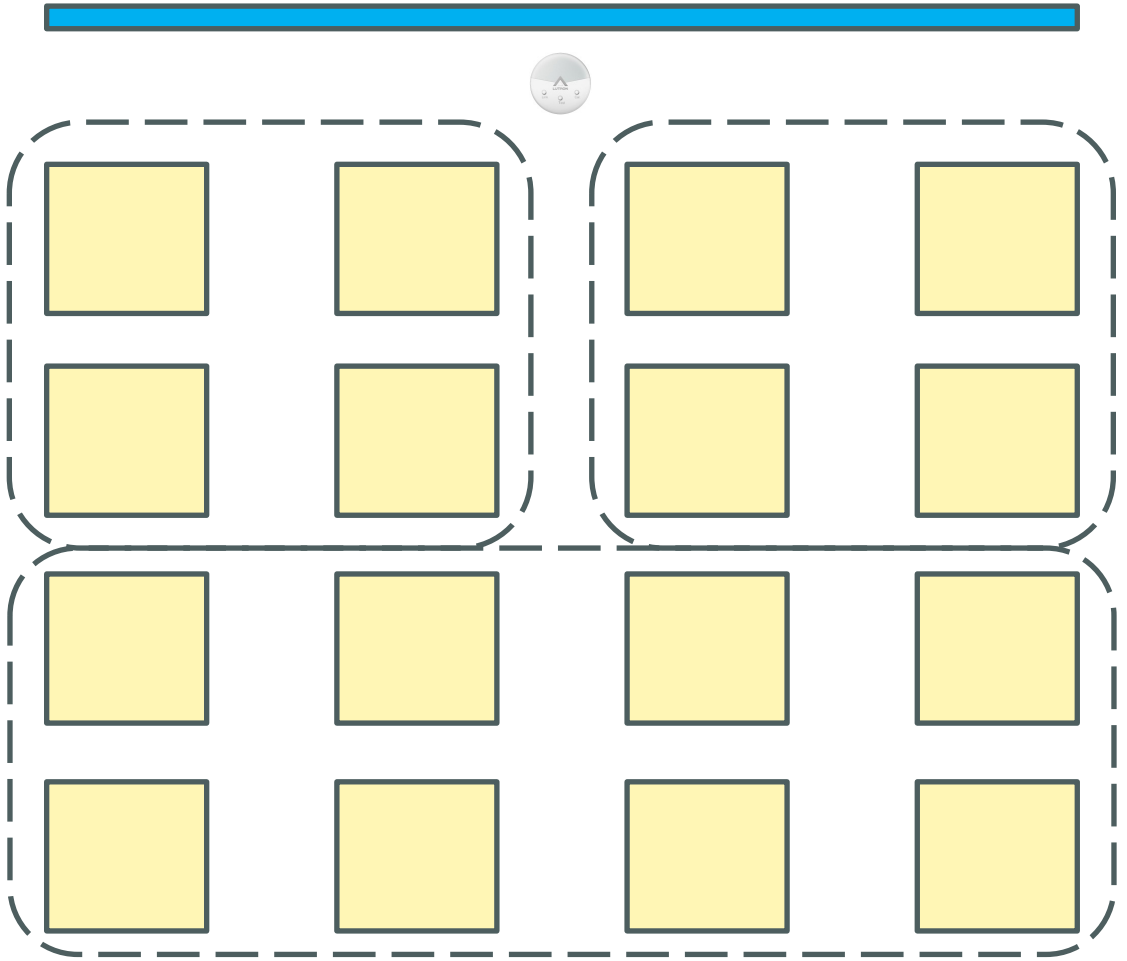


Why DALI?

- DALI is digital
  - Once installed, we can group the lights as needed
  - When using an appropriate control system, we can adjust the light level of each group or even each luminaire based on
    - Daylight



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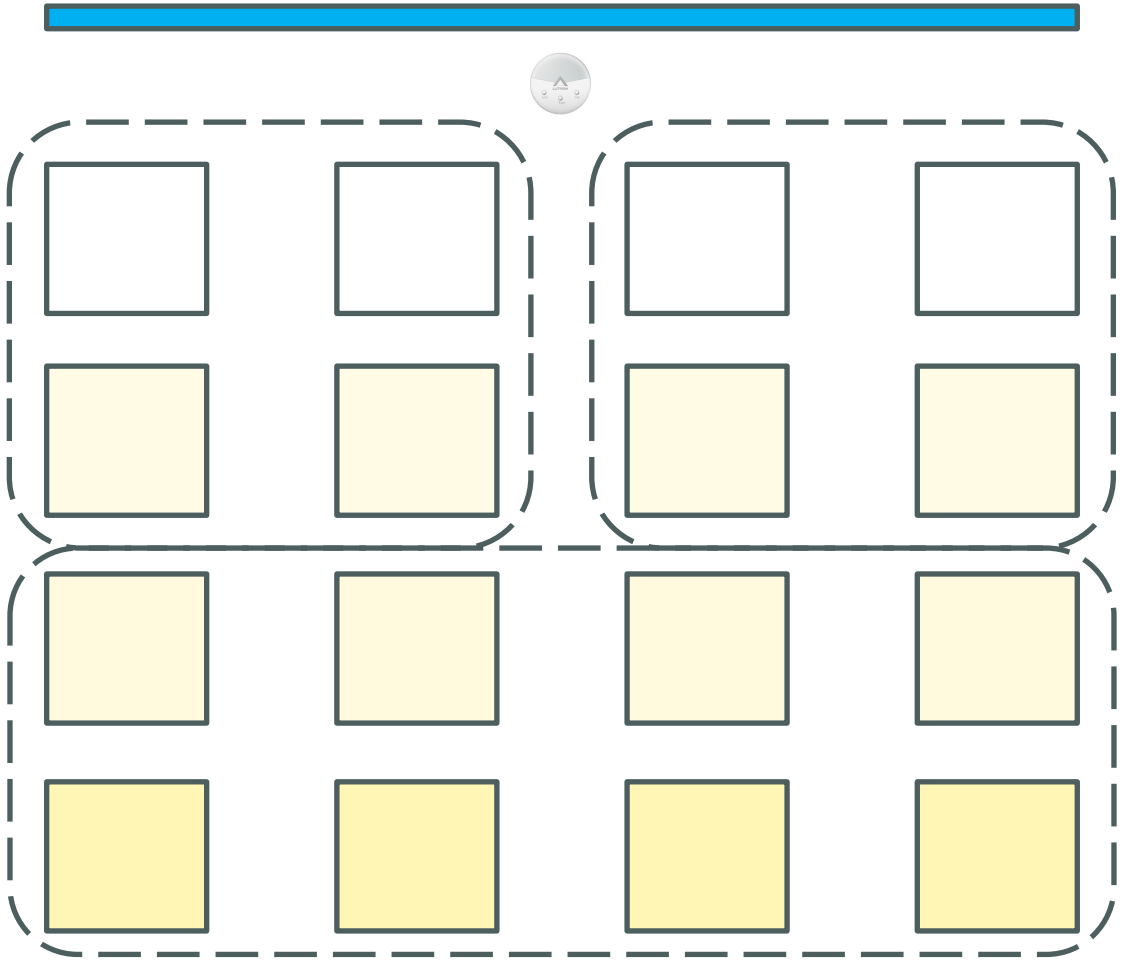

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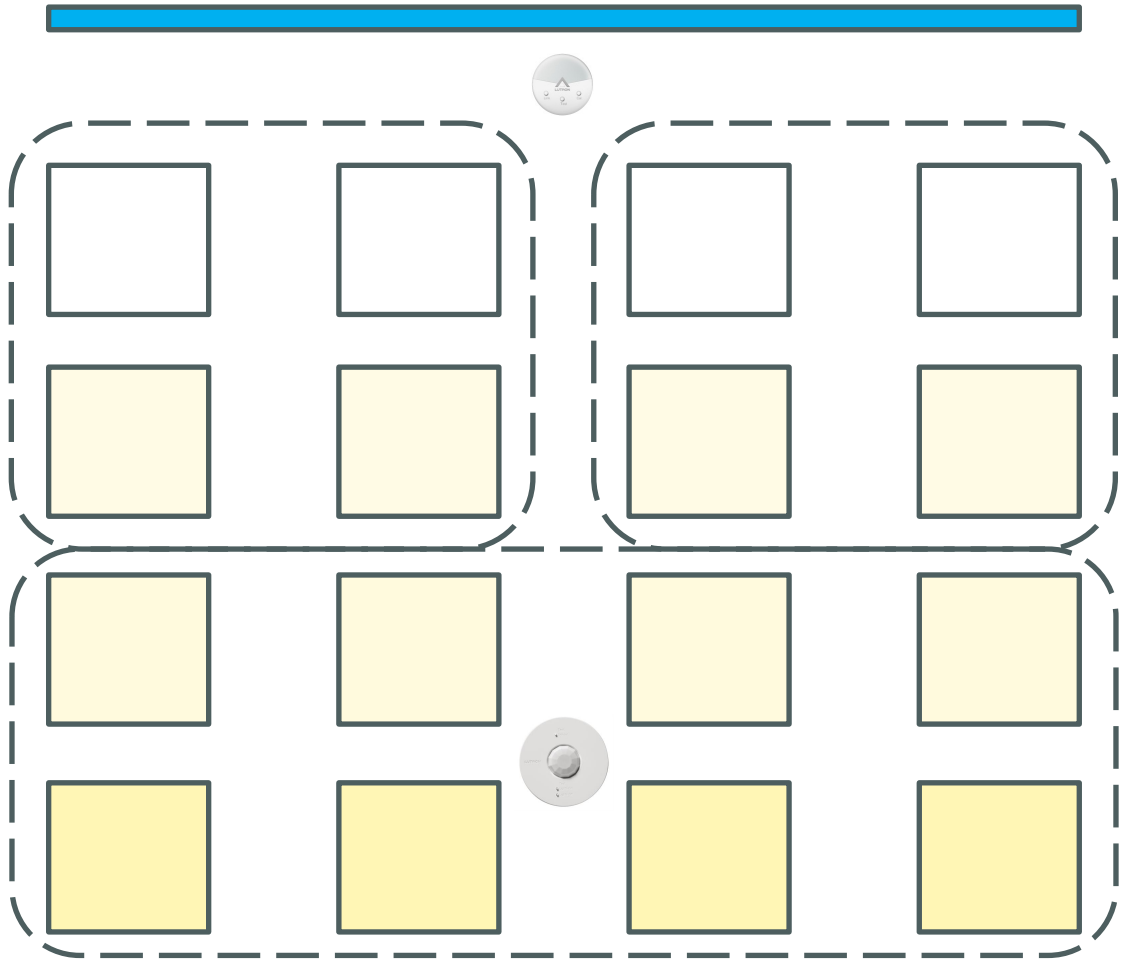
- DALI is digital
  - Once installed, we can group the lights as needed
  - When using an appropriate control system, we can adjust the light level of each group or even each luminaire based on
    - Daylight
    - Presence Detection



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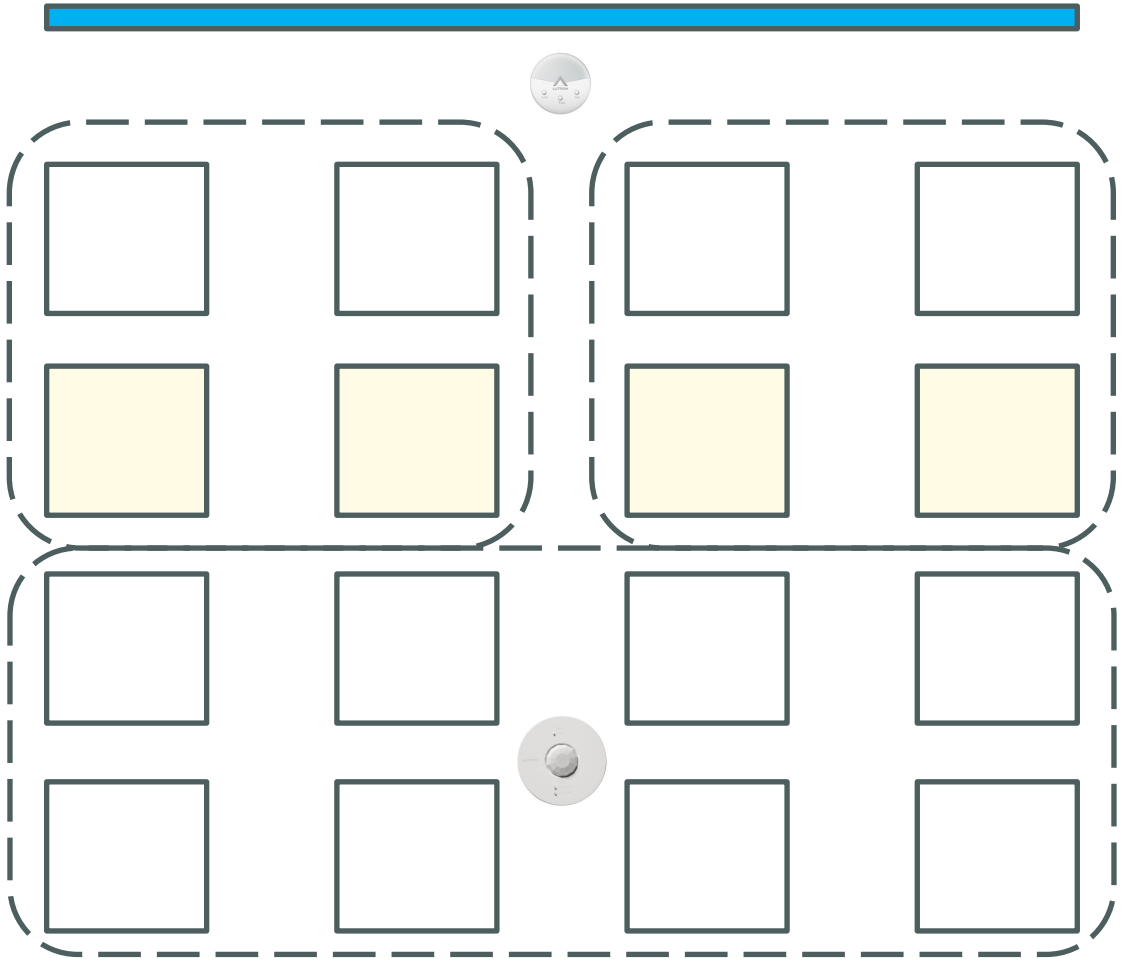

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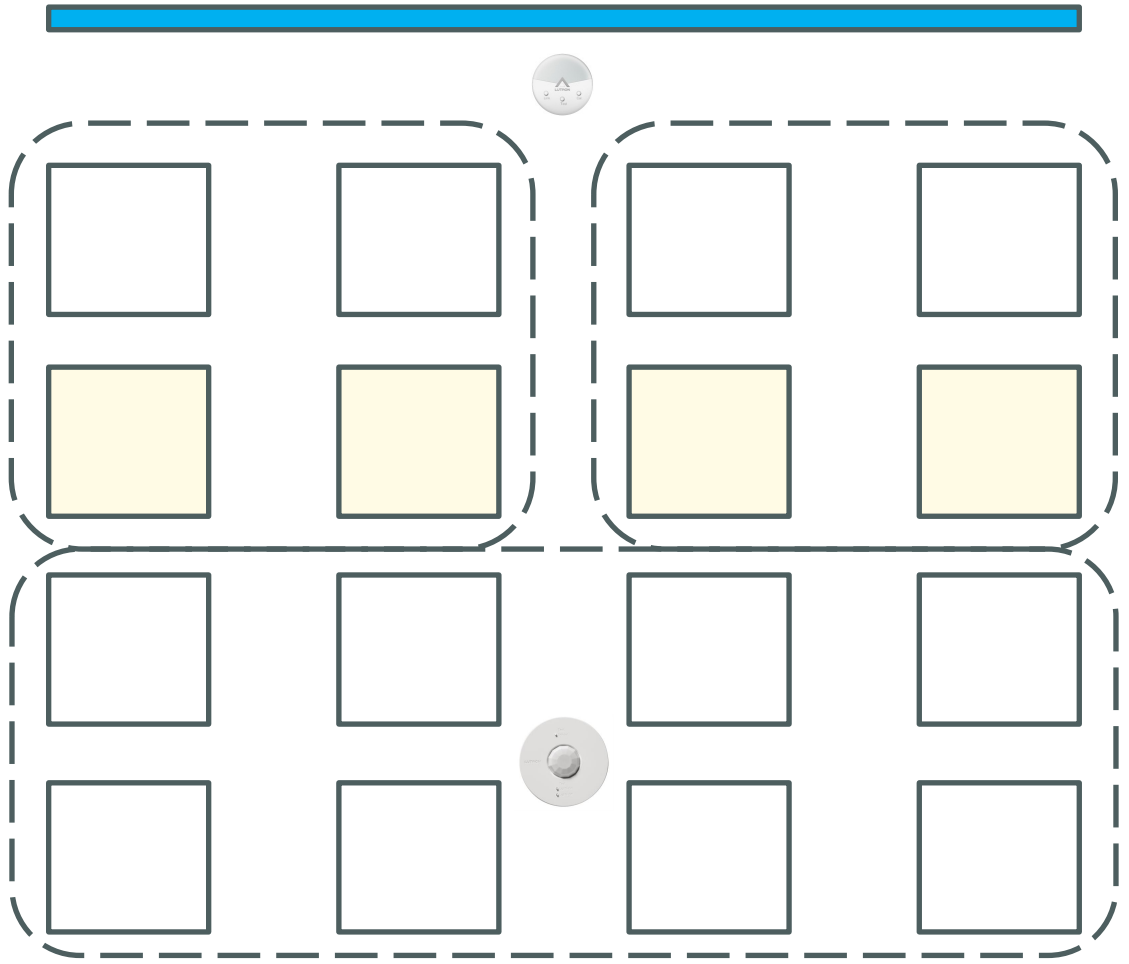
  - Once installed, we can group the lights as needed
  - When using an appropriate control system, we can adjust the light level of each group or even each luminaire based on
    - Daylight
    - Presence Detection
    - Time
    - Location
    - …



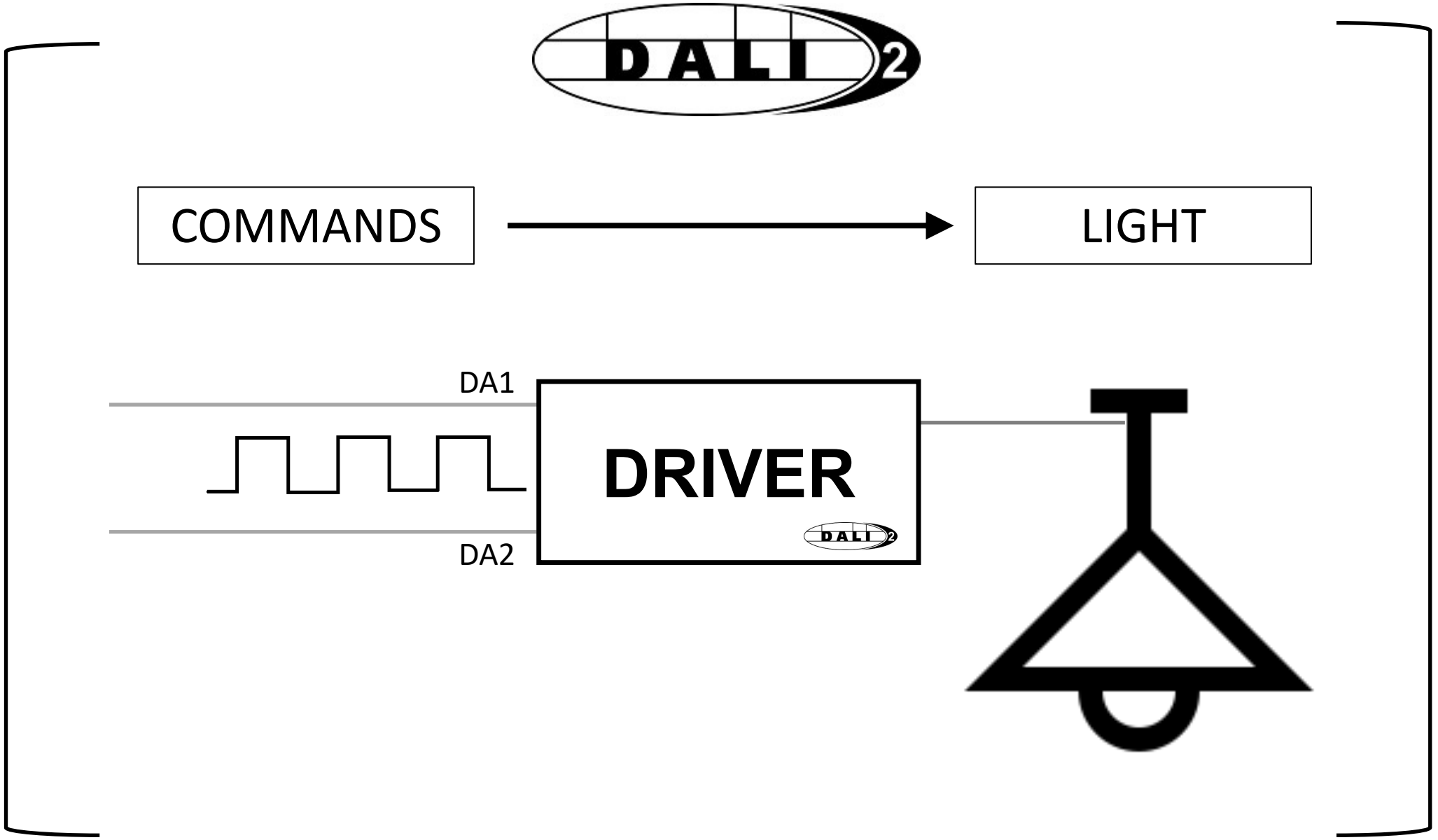
Compliance Check

1. Over Illumination
   - With DALI we adjust the light level as needed, so we can adjust the intensity as the LEDs become less efficient

2. Daylight Harvesting

3. Automatic Control
   a. Absence Detection
   b. Presence Detection
   c. Timeclocks

What about energy usage data?


DALI 2
COMMANDS
LIGHT
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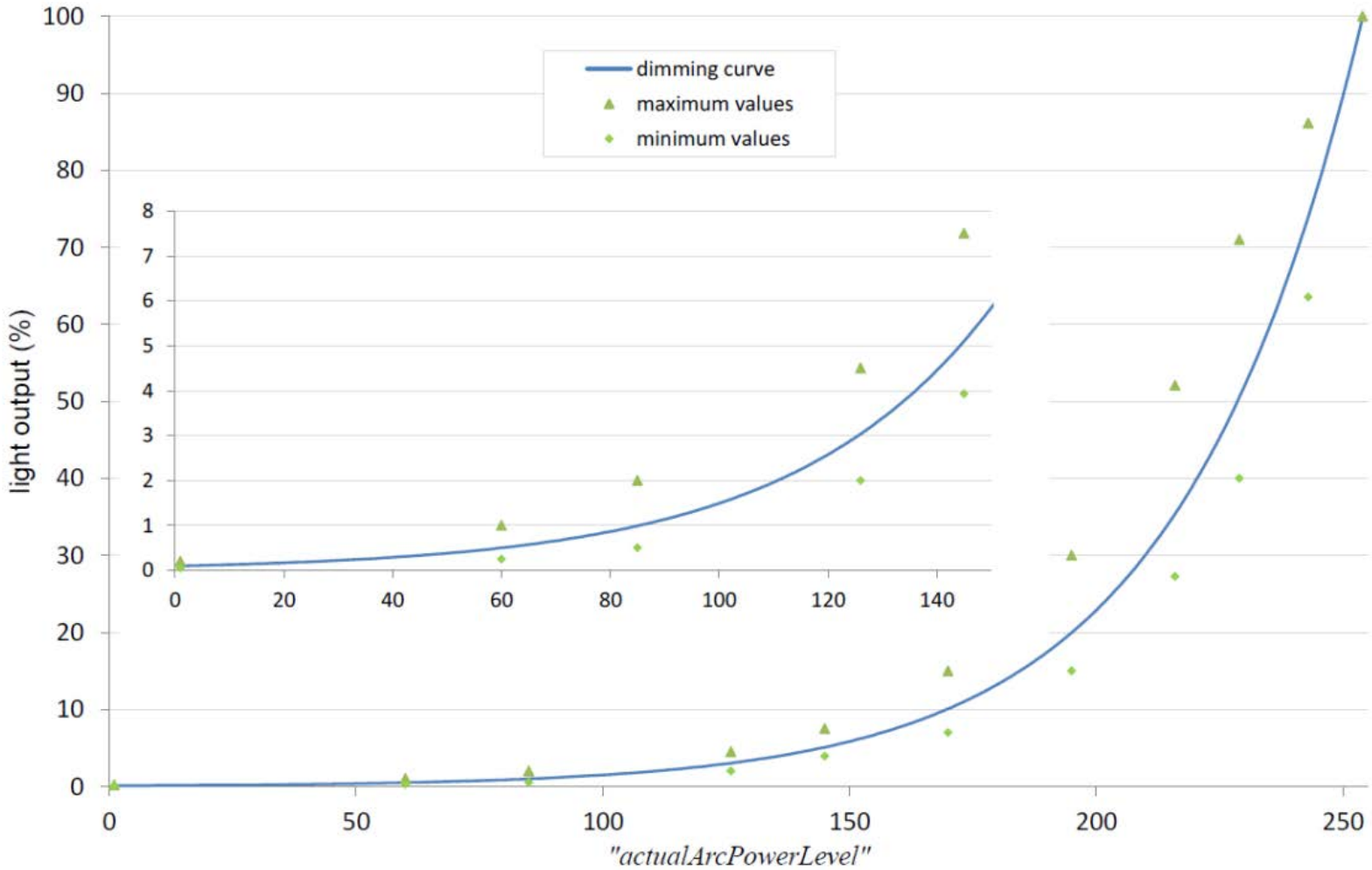
dimming curve
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120
140

Compliance Check

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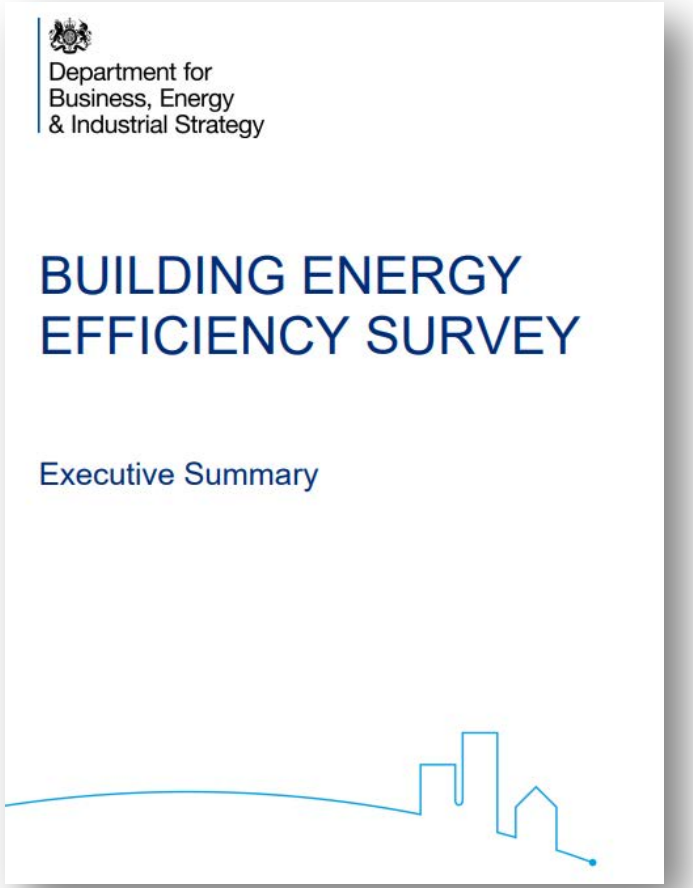
   c. Timeclocks

4. Share energy usage with the BMS

Big picture – UK energy usage

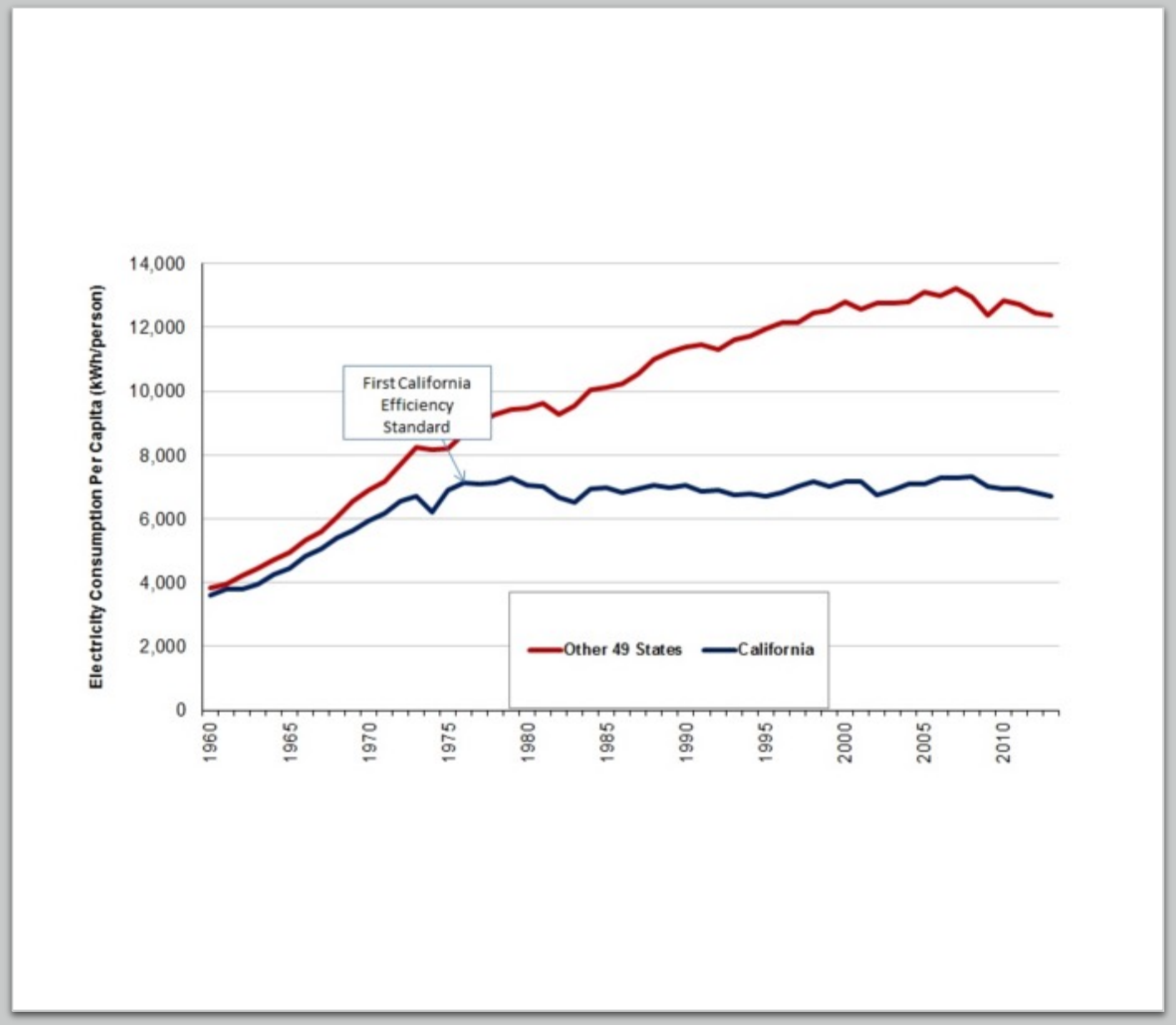
- UK buildings consume 161,060 GWh of energy each year
  - Equivalent to 37,612 kilotonnes CO2
- Internal lighting: 21,260 GWh/year
  - Second most common use, after space heating



Source: UK Building Energy Efficiency Survey

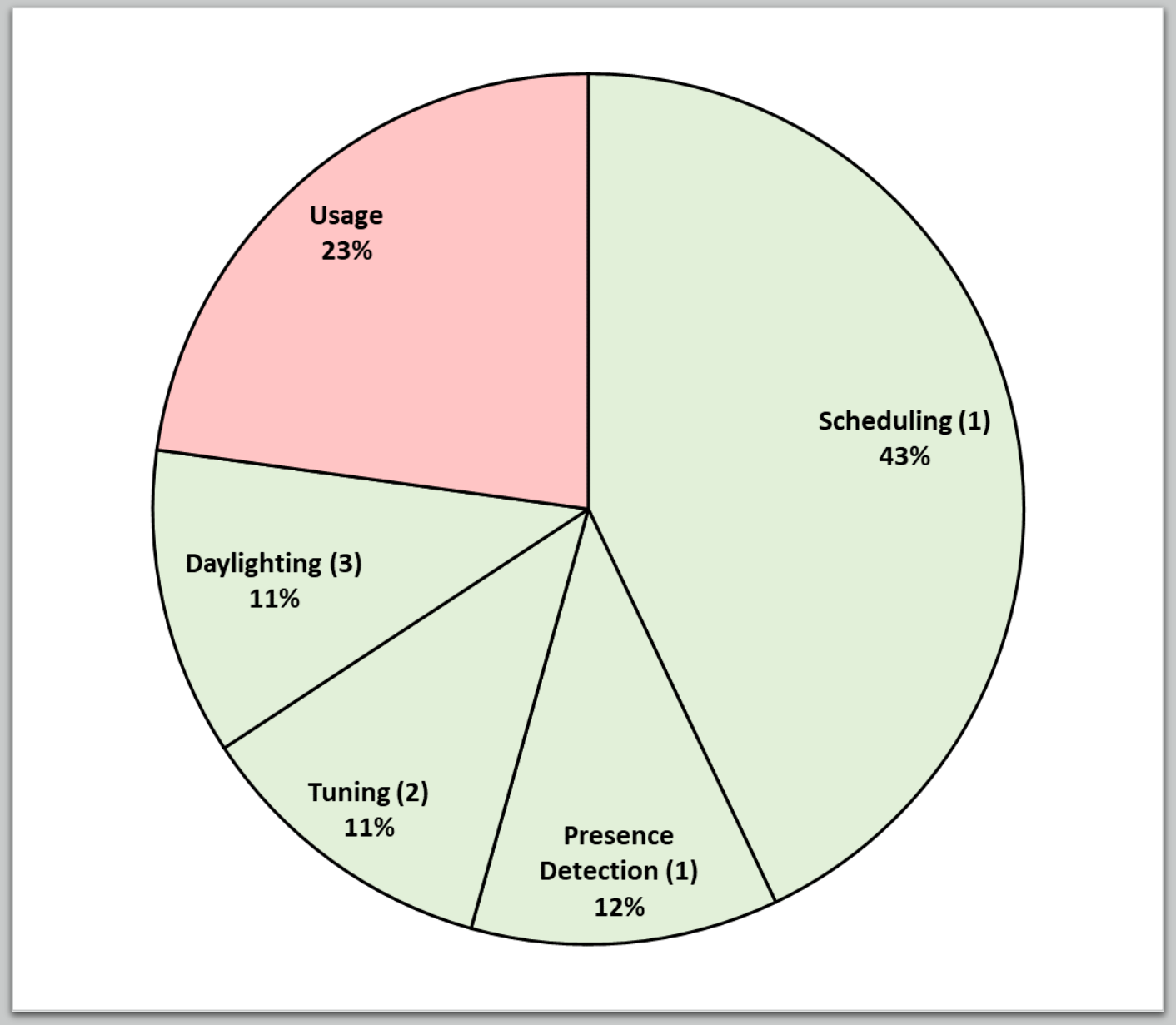
Energy Usage

- **Source:** https://www.nrdc.org/experts/sheryl-carter/legacy-art-rosenfeld-future-energy-efficiency

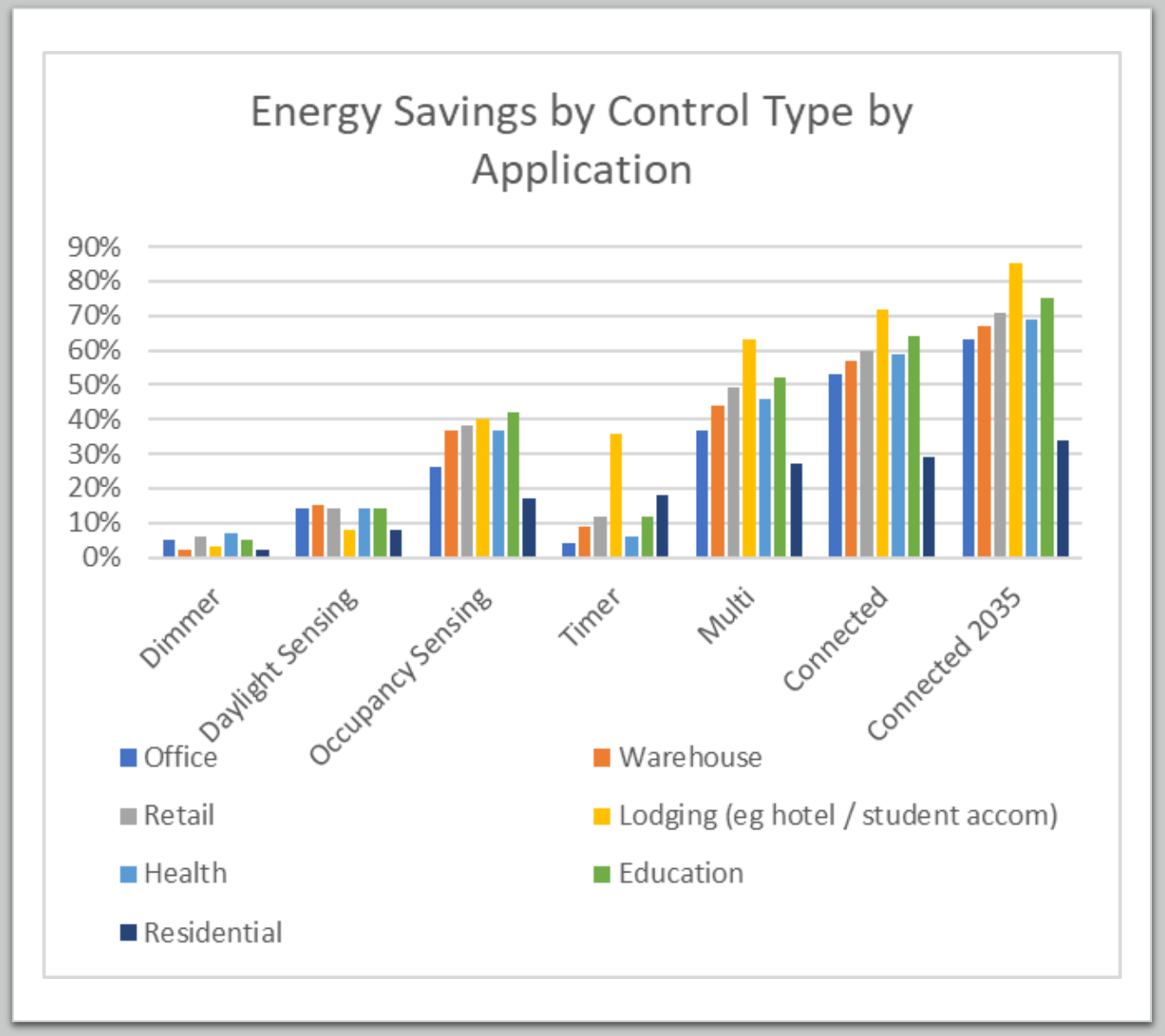


Energy Usage

- **Sources**:
  - VonNieda B, Maniccia D, & Tweed A. 2000. An analysis of the energy and cost savings potential of occupancy sensors for commercial lighting systems.
  - Williams A, et al. 2012. Lighting Controls in Commercial Buildings. Leukos. 8(3) pg 161–180.
  - Reinhart CF. 2002. Effects of interior design on the daylight availability in open plan offices.



Energy Usage



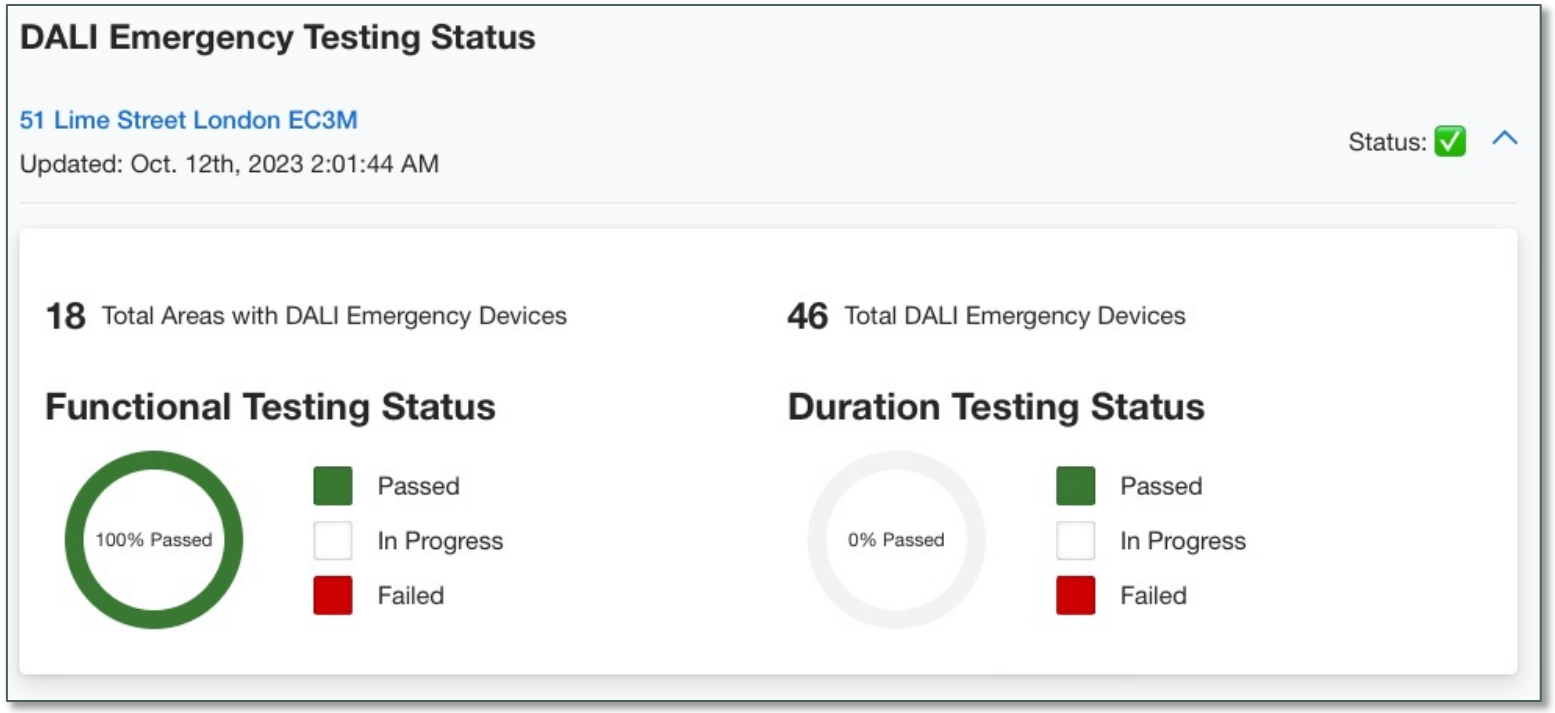
Energy Usage

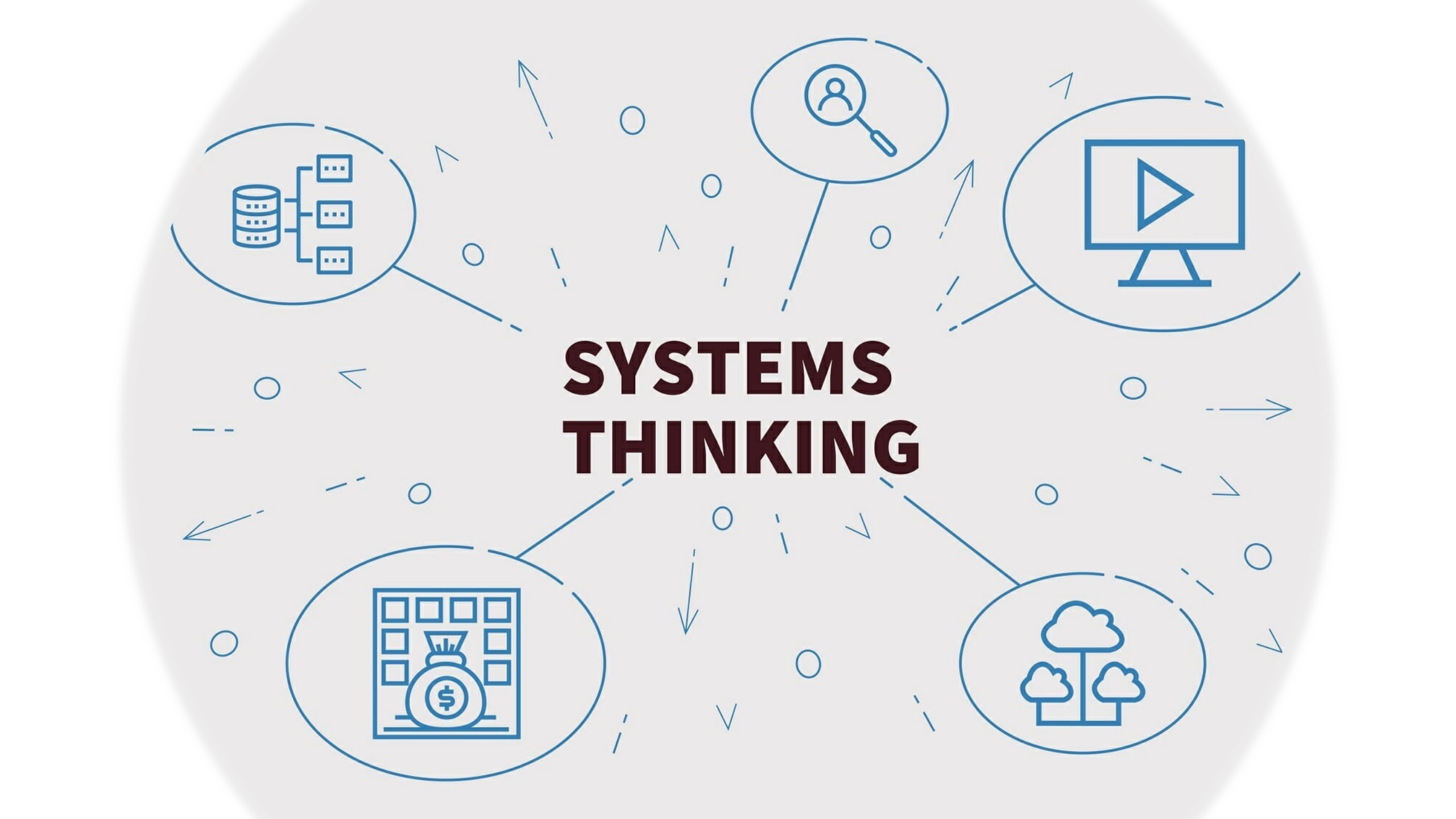
Table F.4 Energy Savings for each Control Type by Application

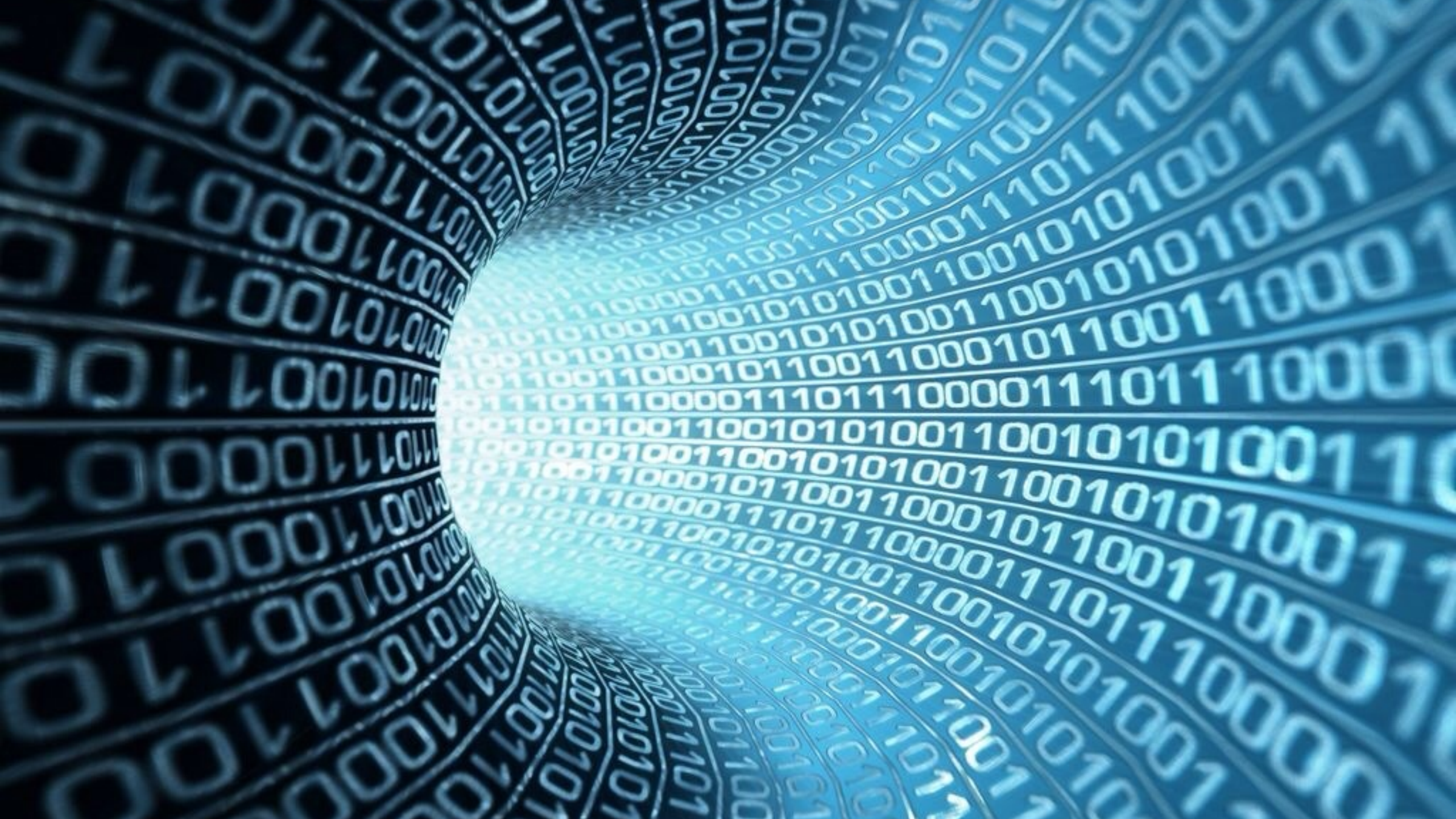
Applications	Dimmer Only	Daylighting Only	Occupancy Sensor Only	Timer Only	Multi	EMS	Connected Lighting	
							2017	2035
Commercial - Office	5%	14%	26%	4%	37%	46%	53%	63%
Com/Ind - Warehouse	2%	15%	37%	9%	44%	55%	57%	67%
Commercial - Retail	6%	14%	38%	12%	49%	59%	60%	71%
Commercial - Lodging	3%	8%	40%	36%	63%	70%	72%	85%
Commercial - Health	7%	14%	37%	6%	46%	57%	59%	69%
Commercial - Education	5%	14%	42%	12%	52%	62%	64%	75%
Residential	2%	8%	17%	18%	27%	28%	29%	34%
Industrial	23%	9%	27%	49%	65%	69%	71%	83%
Area/Roadway	14%	4%	19%	17%	35%	46%	47%	55%
Parking Lot	20%	4%	17%	17%	35%	48%	50%	58%
Garage	20%	4%	15%	5%	22%	40%	41%	48%
Building Exterior	14%	4%	19%	17%	35%	46%	48%	57%

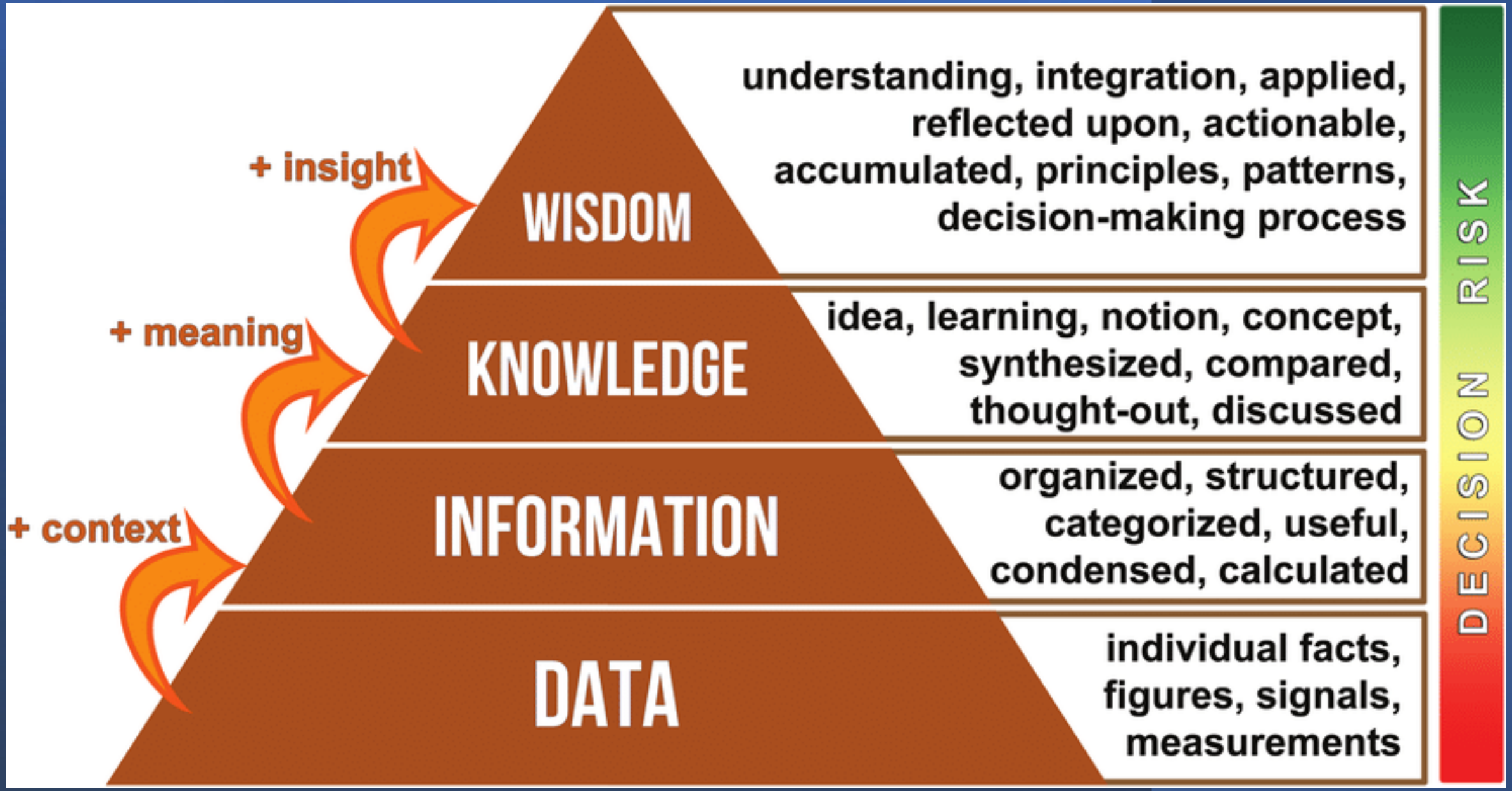
Added value

- Emergency Monitoring




SYSTEMS
THINKING




+ insight
+ meaning
+ context
WISDOM
KNOWLEDGE
INFORMATION
DATA
understanding, integration, applied, reflected upon, actionable, accumulated, principles, patterns, decision-making process
idea, learning, notion, concept, synthesized, compared, thought-out, discussed
organized, structured, categorized, useful, condensed, calculated
individual facts, figures, signals, measurements
DECISION RISK

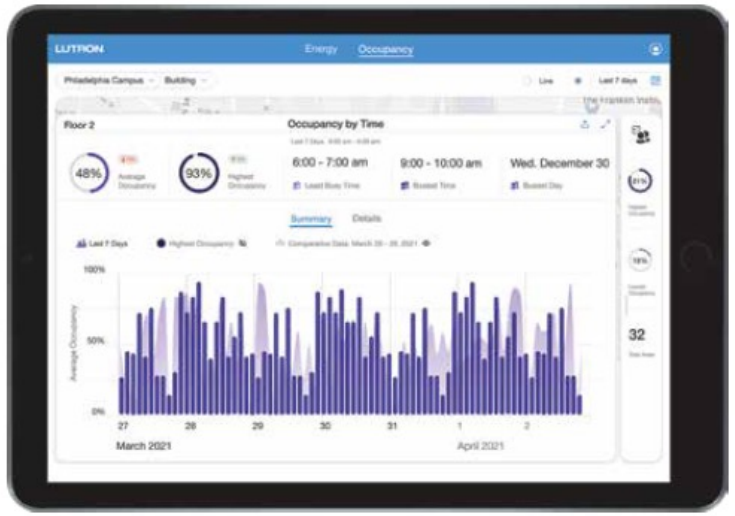
Dashboard

Intuitive floorplan view

Energy Usage Reporting

Compare multiple spaces

Occupancy Reporting



Export data for custom reports

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Make real-time changes

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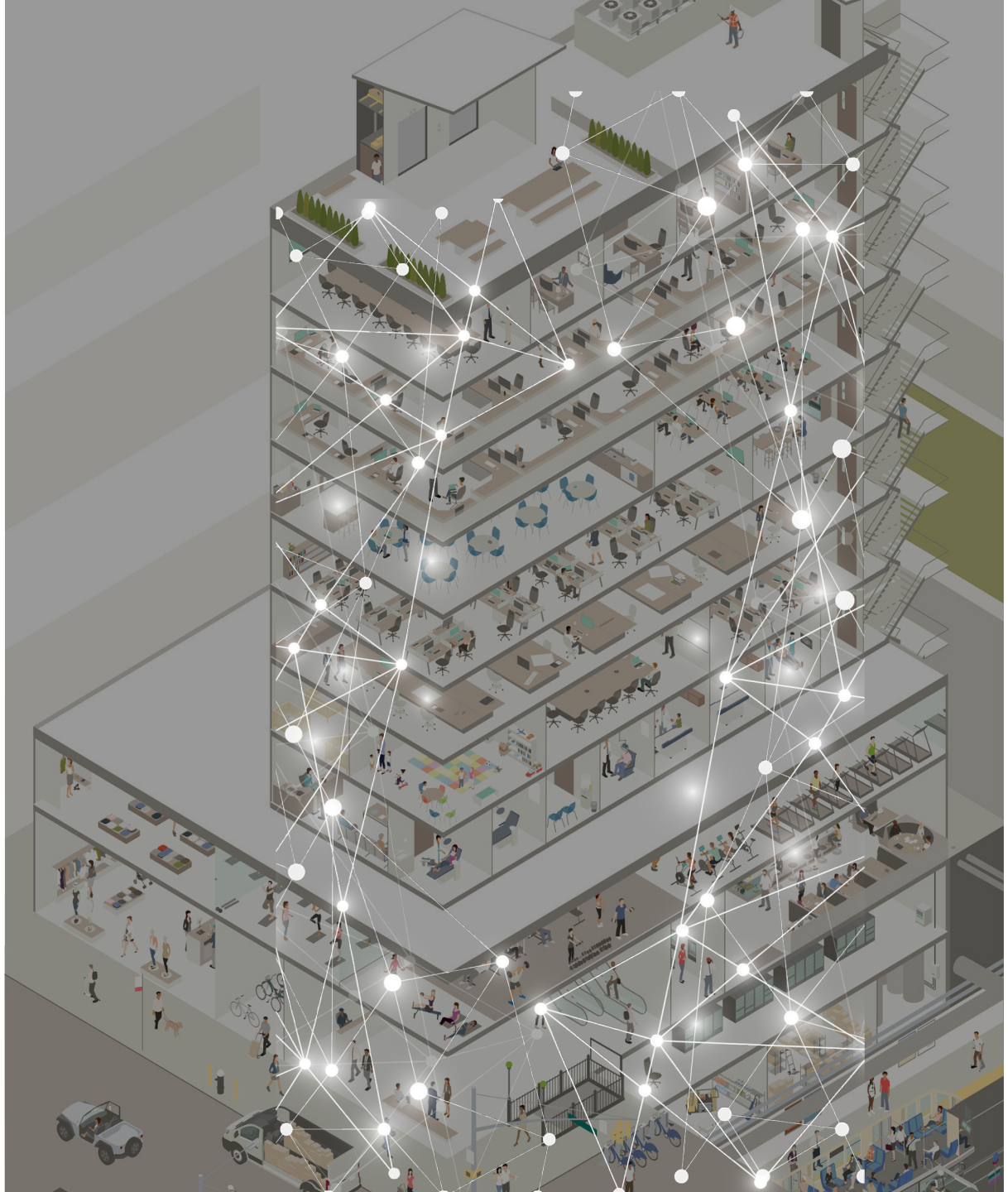
The future is connected



Questions?

Additional information and resources:

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UK regulations website:

www.lutron.com/UKBuildingRegulations


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Smart Buildings SHOW

9-10 October 2024 • ExCeL London

We look forward to seeing you in 2024