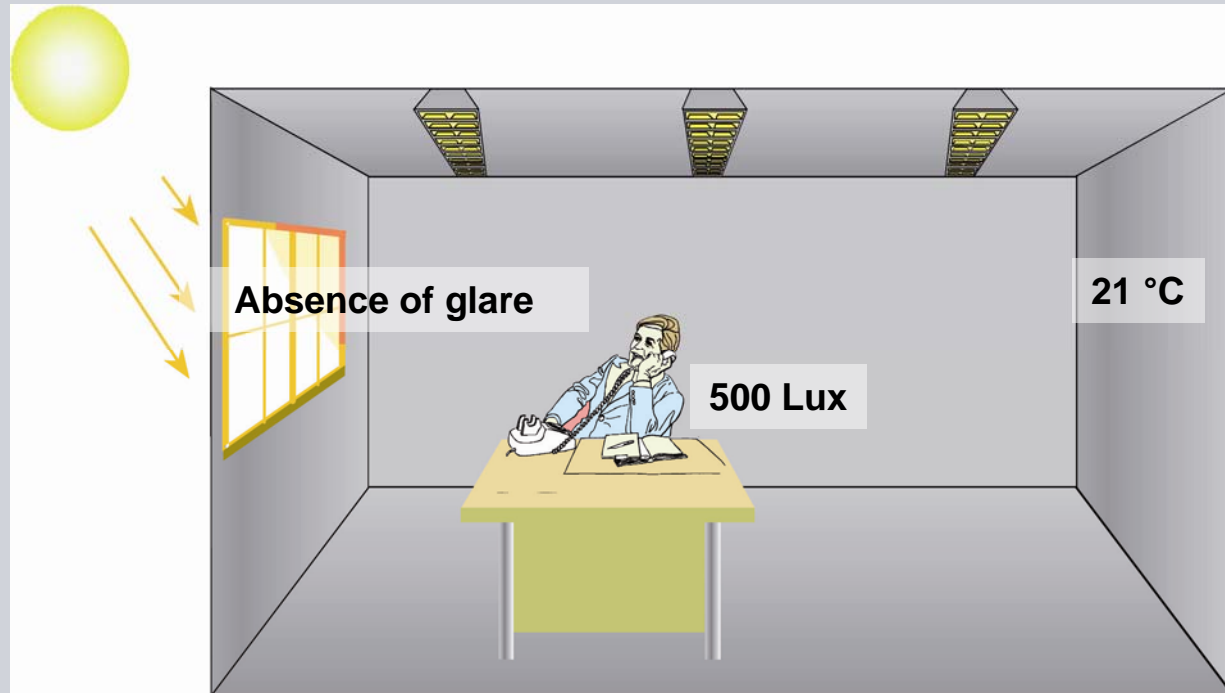


Energy-efficient lighting

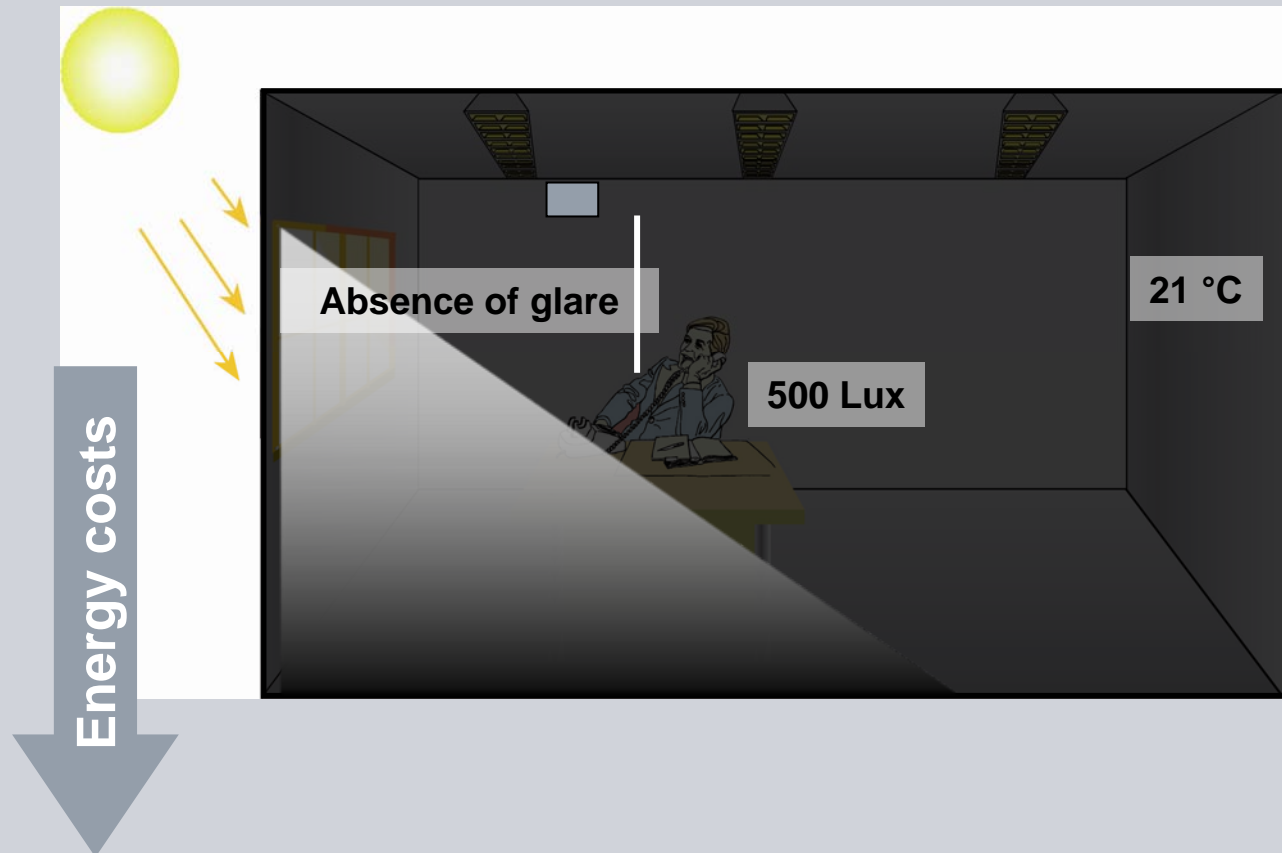
Lighting Control

Comfort requirements ...

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... and energy costs



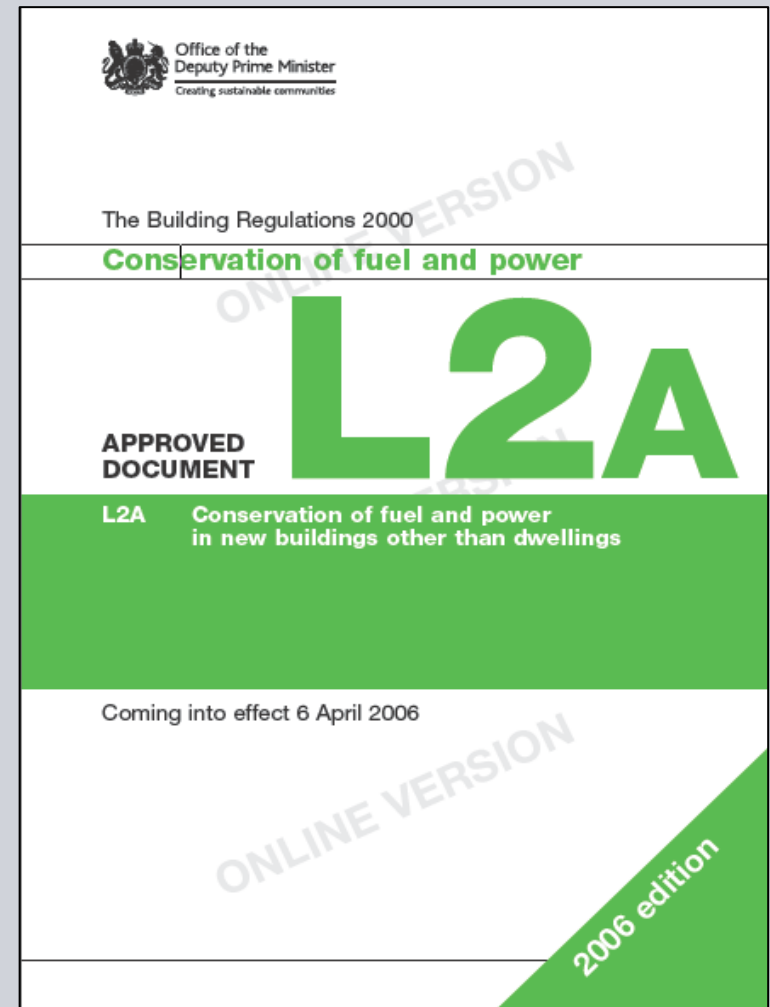
Overview of content



- Motivation
- Automation alternatives
 - Solar shading
 - Time
 - Daylight
 - Presence
- Cost efficiency
- Additional Savings
- Summary

Issues - Regulatory Framework & Building Regulations

- Implementation of “Energy Performance Of Buildings” Directive - EPBD
- Need to reduce energy consumption – cost!
- Carbon emission reduction & CSR
- Energy performance certificates
- Mandatory metering requirements
- Government initiatives
- Carbon reduction commitment - CRC



Issues - Carbon Reduction Commitment (CRC)

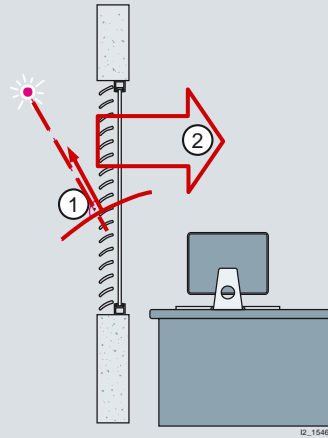
- For users of electricity > c.£500k / year across a complete organisation including all sites and subsidiaries
- Exemptions where covered substantially by EU emissions trading (or CCA)
- Applies a cost to “carbon” initially fixed @ £12 tonne CO₂e
- Payments start in April 2011 with a rebate will be payable (later)
- Value of rebate is variable depending on position in a league table (published!)
- aM&T (metering) is an “early action measure” that increases the size of the rebate

The Carbon Reduction Commitment User Guide

This document provides a step by step guide to the Carbon Reduction Commitment (CRC) – the UK's new carbon emissions trading scheme that will start operating in April 2010. It explains what the scheme is, who it applies to and how it will work.

Sun Protection, Anti-Glare Protection, Utilization of Daylight – Central weather/sun protection systems

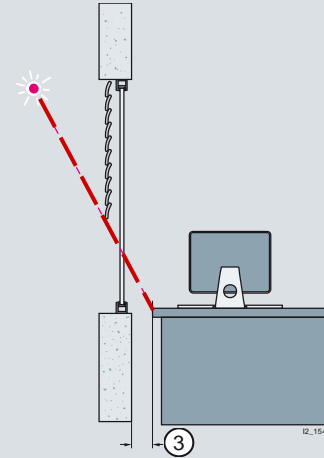
- ① Total reflection from direct sunshine
- ② Proportion of diffuse daylight



Sunlight tracking control

- When using the sunlight tracking control, the blind slats are not completely closed but track the current sun position so that the sun cannot shine directly into the room. However, the spaces between the slats allow as much diffuse daylight into the room as possible and ensure maximum daylight with minimum glare, while at the same time reducing energy costs.

- ③ Maximum depth of sunlight penetration



Shadow edge tracking

- With activated shadow edge tracking, the sun protection is not fully extended, rather it is extended for a set distance (e.g. 50 cm) to allow a specified amount of sunshine to penetrate the room.

Automation alternatives

**Time-dependent
lighting control**



**Daylight-dependent
lighting control**



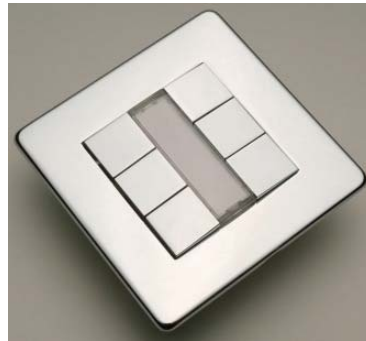
**Presence-dependent
lighting control**



Time-dependent lighting control

Switch-on

- **Event-controlled**
(pushbuttons, movements, noise)



- **Event-controlled**
(pushbuttons, movements, noise)



Switch-off

- **After time has elapsed**

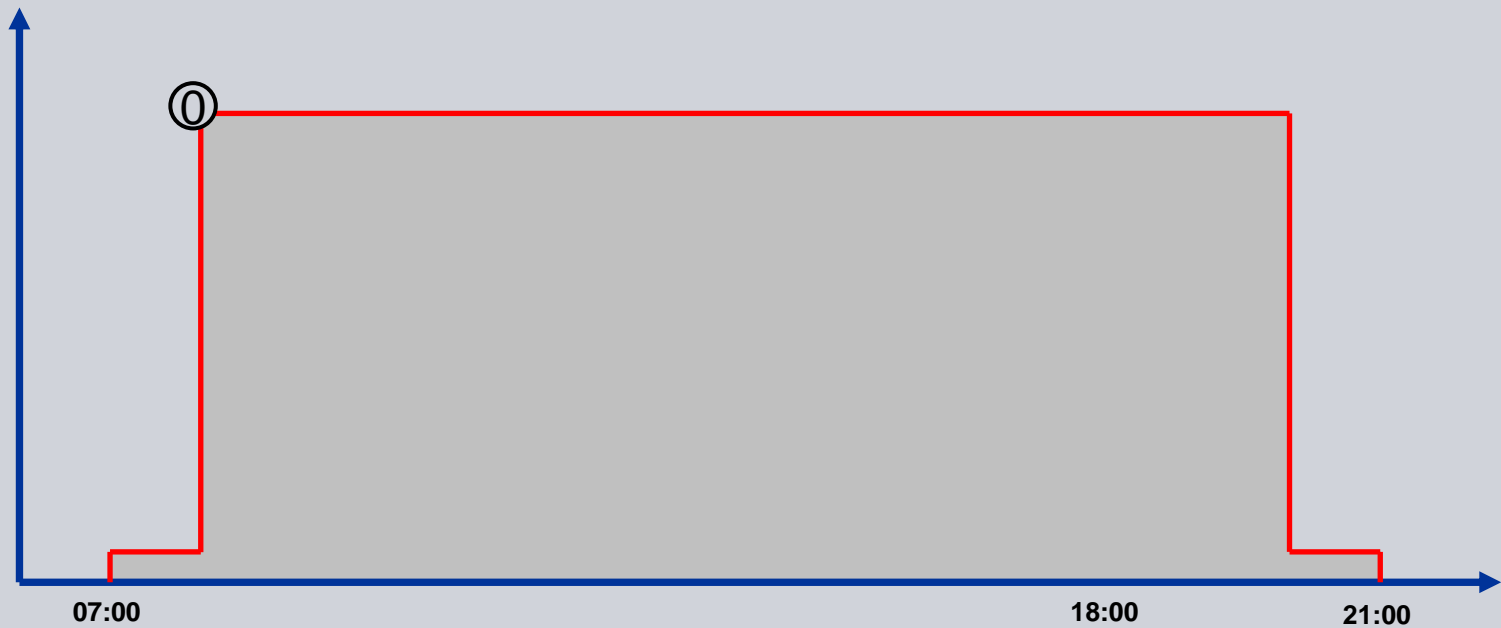


- **At a pre-set time**

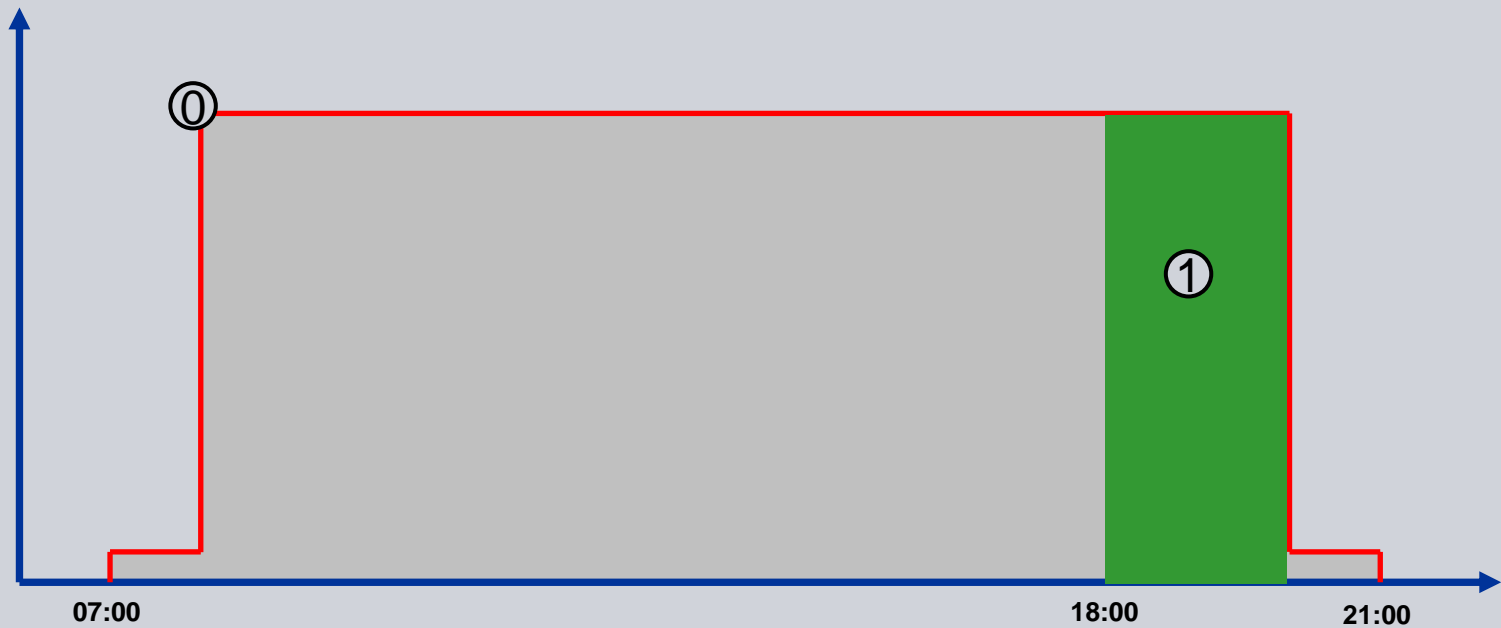


Lighting and energy requirements without automation

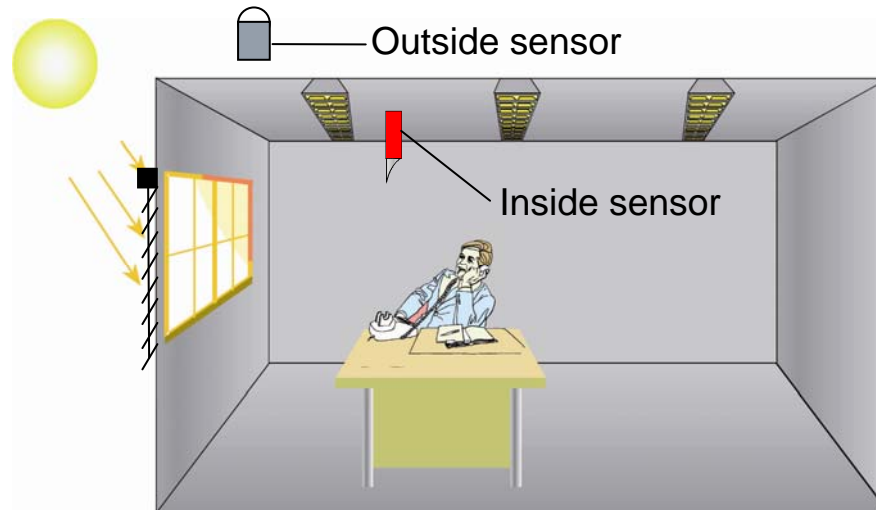
SIEMENS



Time-dependent lighting control: Potential for savings



Daylight-dependent lighting control



Outside lighting intensity

→ Lighting control

- Just one sensor (or a few sensors)
- Advanced engineering required

Inside lighting intensity

→ Lighting control

- One sensor for each room unit

Daylight-dependent lighting control – constant light level control

SIEMENS

Switch-on

- **Manually**
(pushbuttons, remote control)



- **Automatically**
(brightness, presence)



Switch-off

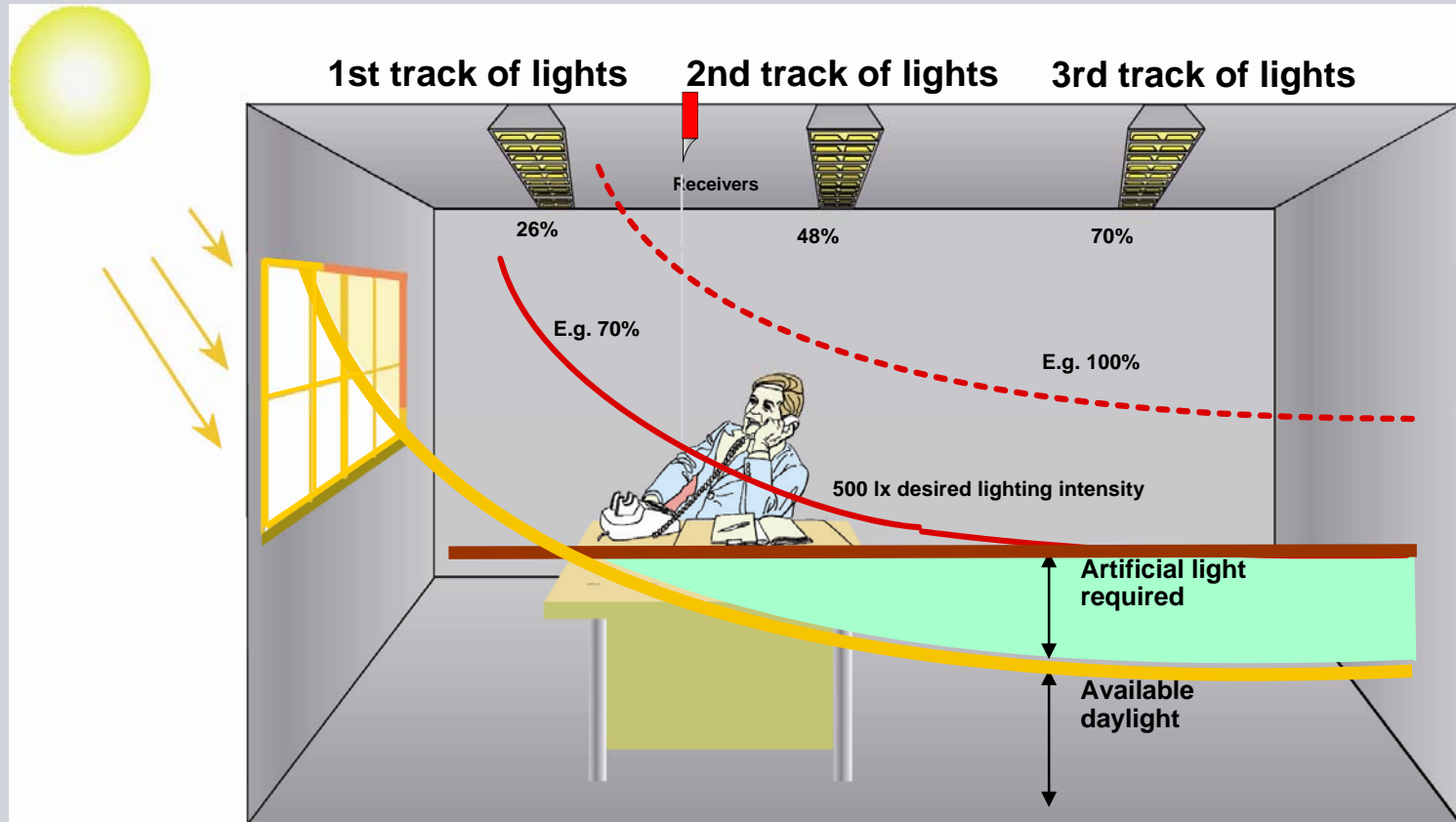
- **Automatically**
(brightness)



- **Automatically**
(time, brightness, presence)



Daylight-dependent lighting control – constant light level control



Daylight-dependent lighting control – constant light level control

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ZONE 3	0%
ZONE 4	30%
ZONE 5	90%



Constant light level control

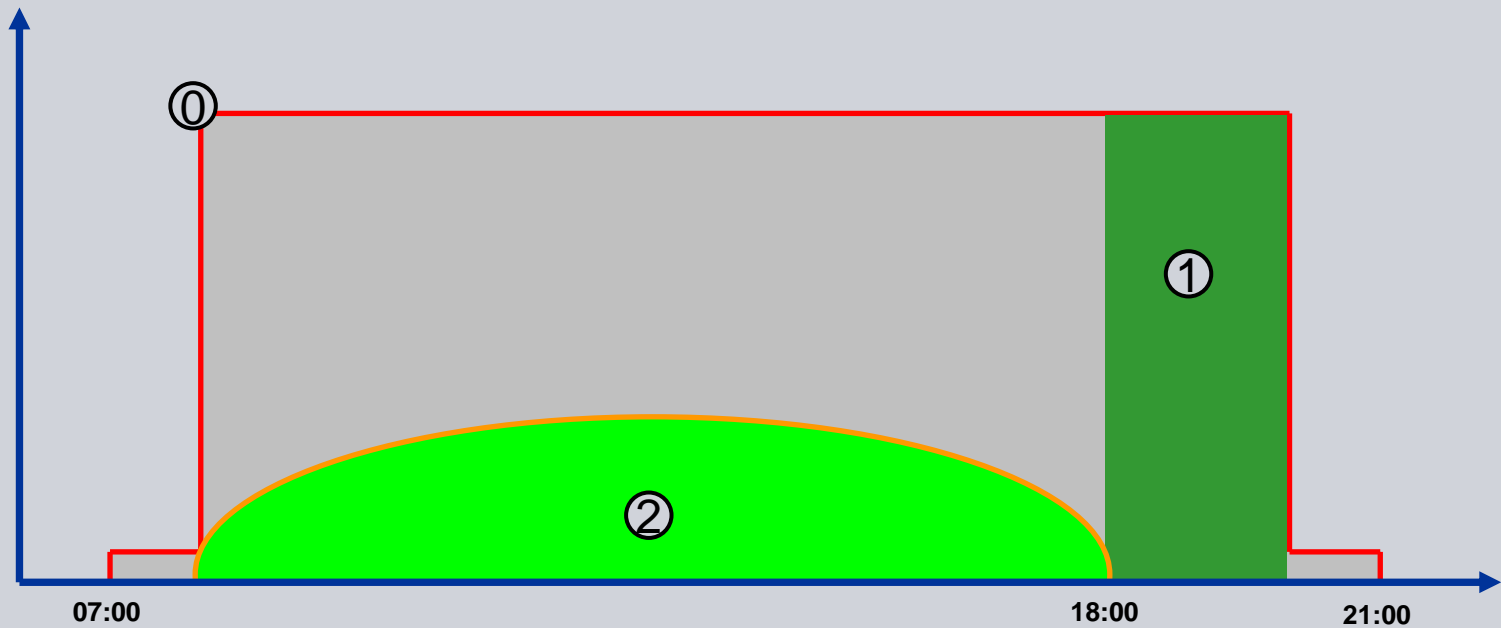


KNX/DALI Gateway

Utilisation of daylight

- Reduced energy expense for lighting
- Utilization of the difference between the design value and the maintenance value of the light intensity
- If ECGs from noteworthy manufacturers are used, the service life of the lamps is not influenced by dimming.

Daylight-dependent lighting control: Potential for savings



Presence control



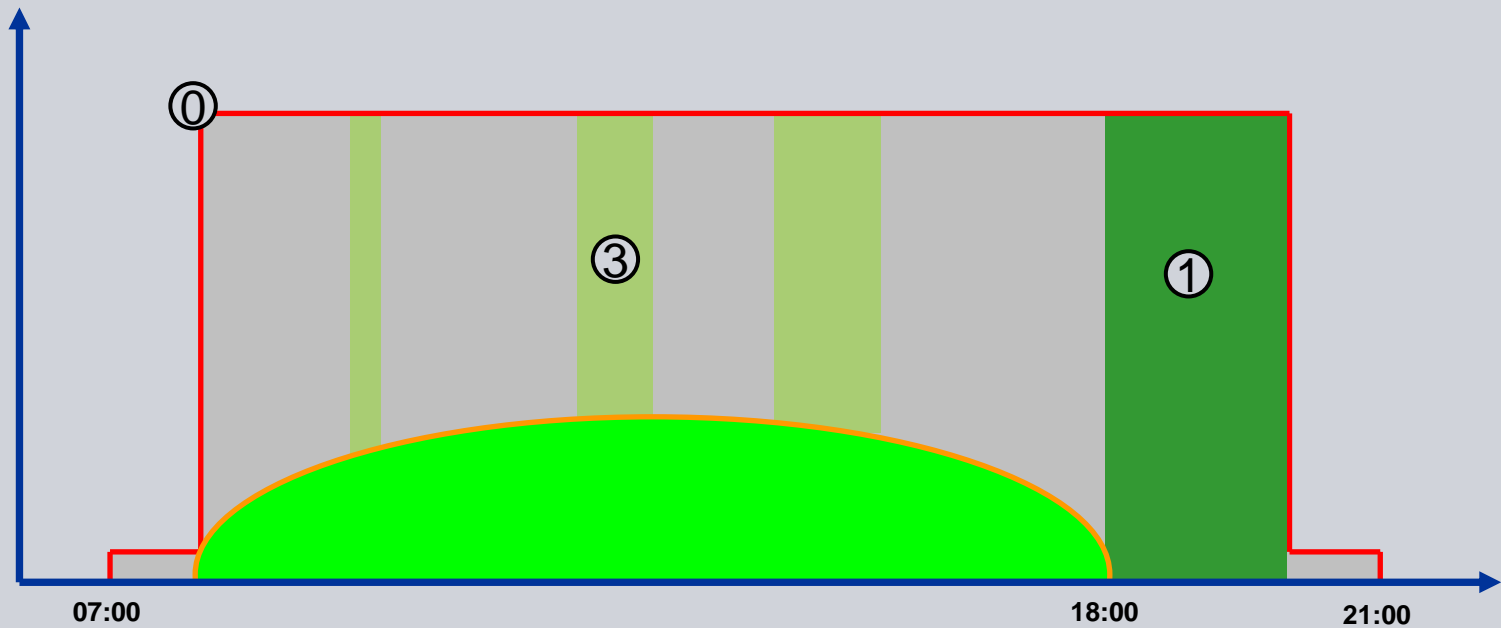
Automatic detection of presence in the room

- Reduced energy costs for
 - Lighting
 - Heating and cooling

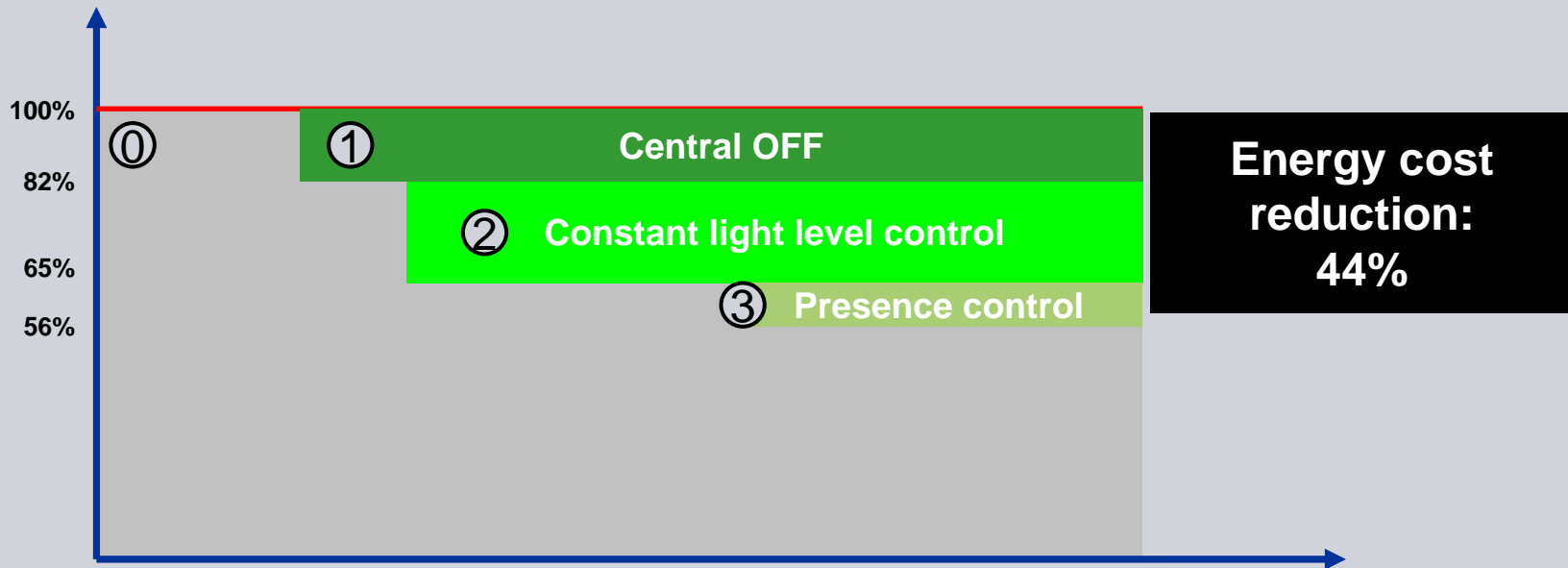
→ Up to 50% reduced energy use possible (when used in a integrated system using set-back temperature levels)

Presence-dependent lighting control: Potential for savings

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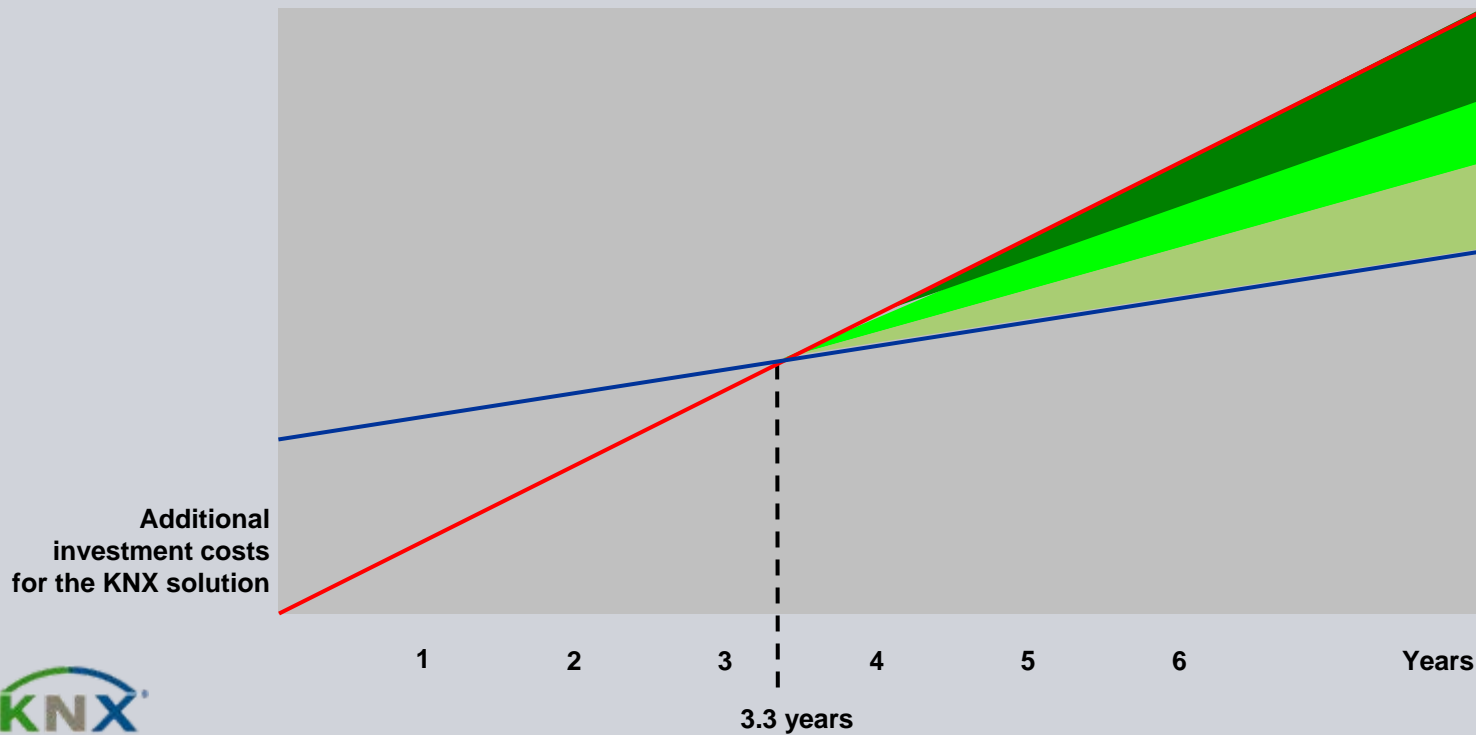


Energy-cost reduction through lighting control



Presence-dependent lighting control: Return on investment

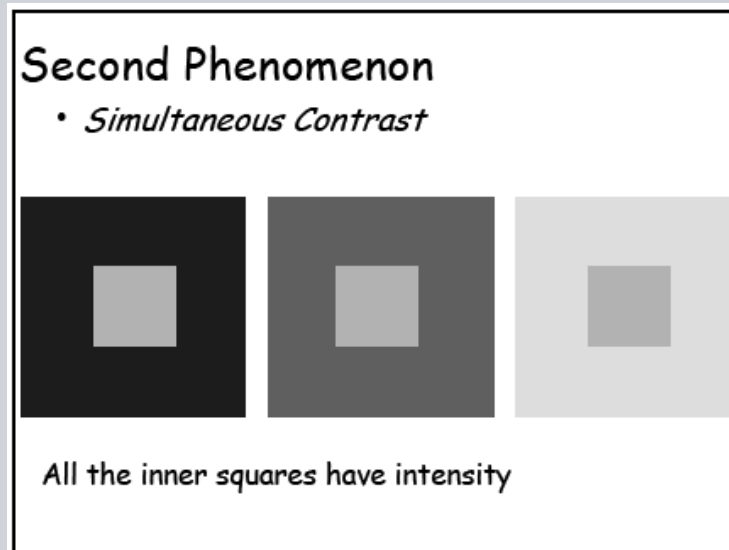
SIEMENS



Sources for the calculation: DIN V 18599, Osram, Intep Integrale Planungs GmbH

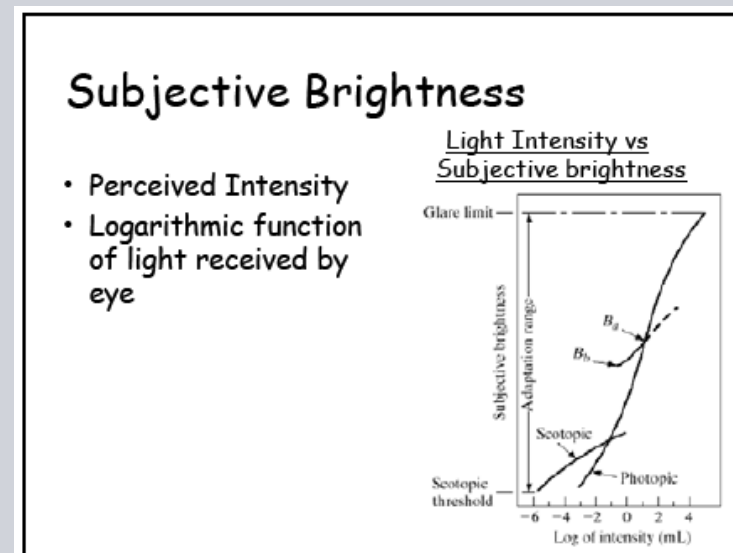
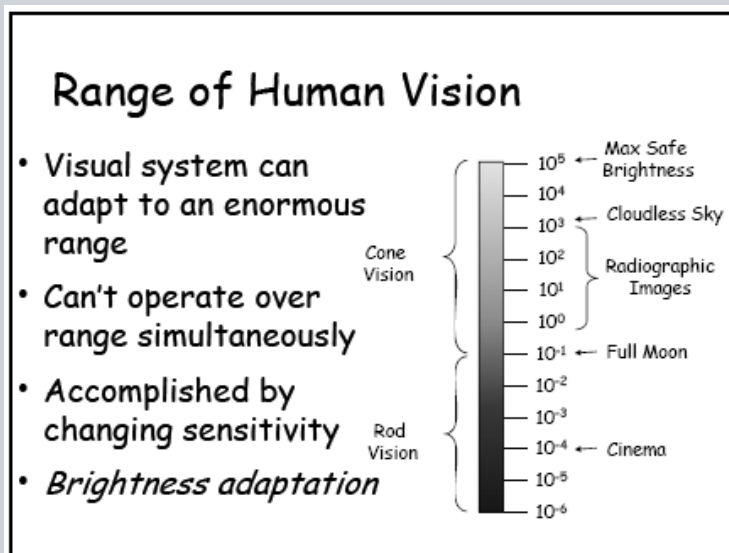
Additional savings: 2-Level set-point control in constant light control systems

- When background light levels are “dark” the actual differential with the lighter area is perceived to be brighter (known as “Simultaneous Contrast”)



Additional savings: 2-Level set-point control

- Sensors are not as sensitive as the eye which can see a much wider spread of the light spectrum. As the percentage of artificial light increases the sensor (which is set at 50% artificial and 50% natural light) does not react in the same way as the human eye.



- A **lower set-point** for constant light control can therefore be used in the sensor

Additional savings: Integration of automatic emergency light testing



Manual Key Switch Operating v Automatic testing Costs

Conventional emergency testing using a key switch each controlling 5 luminaires:-

• Functional test once a month at £1.80 (6 min at £18/hour to check each of 100 emergency luminaires) x11 monthly tests	£1,980	
• Full discharge test once a year at £3.60 (12min at £18/hour to check each of 100 emergency luminaires) x1 annual test	£360	
• Review log book monthly 12 times pa x4 hours at £18/hr labour cost	£864	
Total annual operating cost key switch system		<u>£3,204</u>

Auto test system:-

• Review log book monthly 12 times pa x2 hours at £18/hr labour cost	£432	
Total annual operating cost reviewing automated system		<u>£432</u>

Annual Operational Savings (per 100 E/M lamps) **£2,772**

Summarising

- The three Energy saving aspects of automatic lighting control can be accumulated to give a net result of 44% (depending on available natural light).
- Additional Energy savings can be achieved by implementing a 2 level set-point strategy (zero product cost).
- Large operational cost savings can be achieved by integrating an automatic emergency lighting test facility when self-contained units are used.
- Not included (but available) is the use of a common sensor array across different functions e.g. combined presence & light detector giving an independent set-back temperature signal. This will improve the payback period of an integrated system
- The blind control will not only reduce glare but aid in the solar shading, thus reducing the cooling requirement of the building. This saving has been excluded from the calculations

Thank You

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