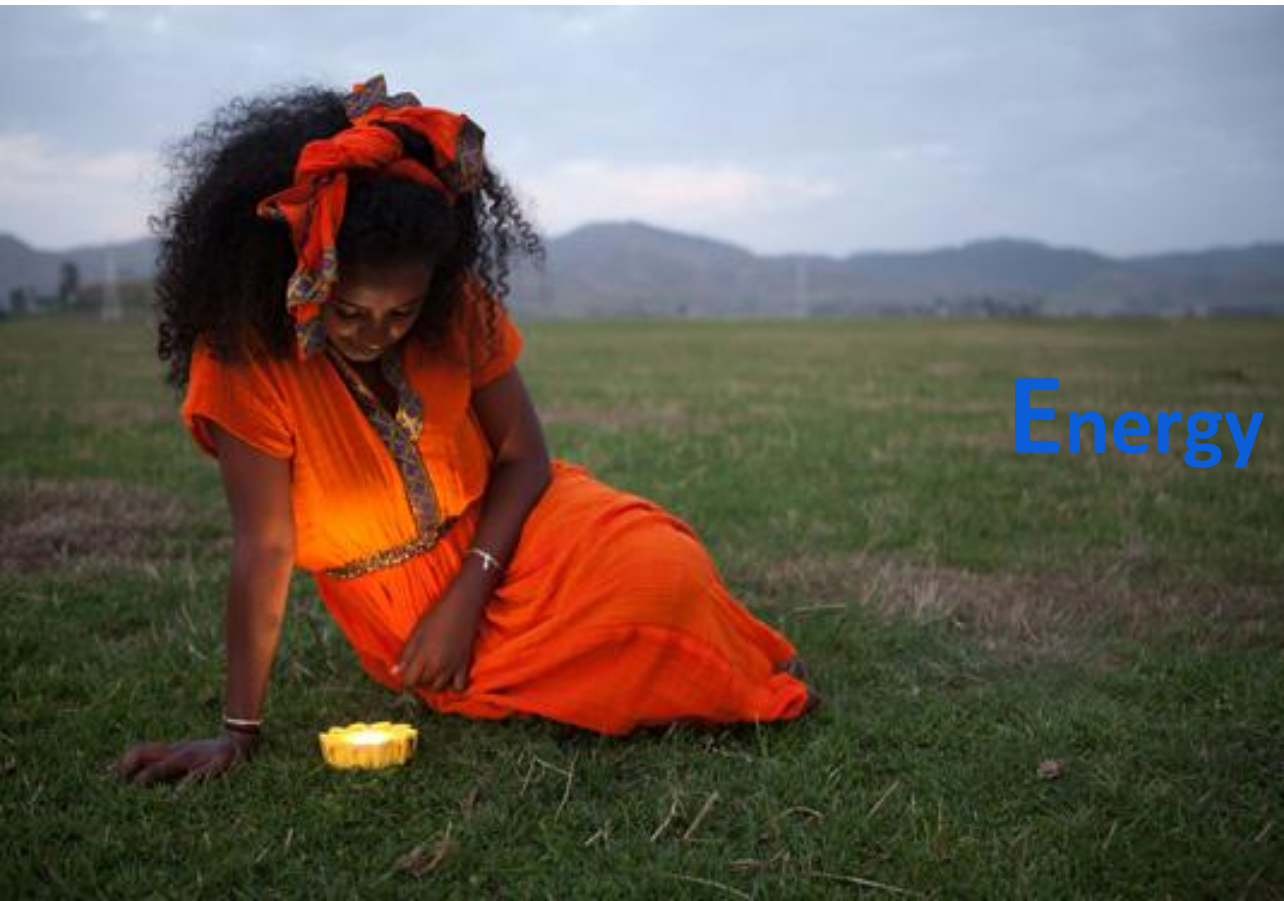


# PHILIPS

sense **and** simplicity

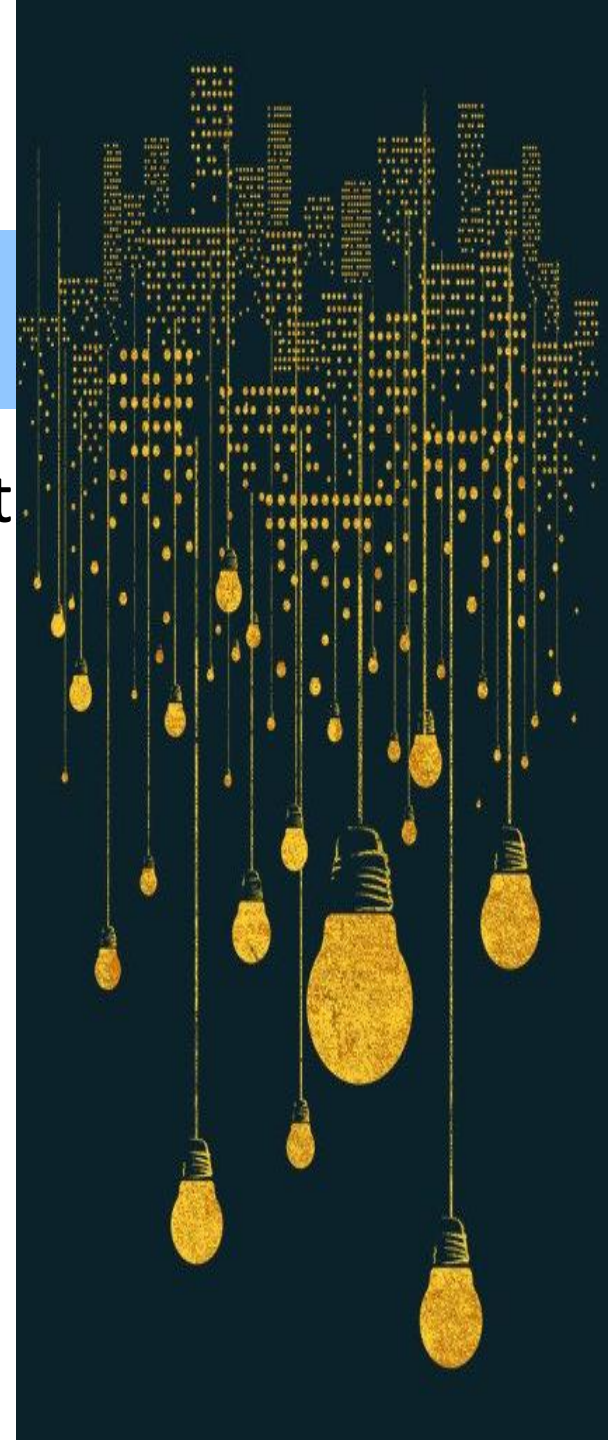


**Visual Comfort  
and  
Energy Efficient Lighting**

Ashish Bahal, Architect

## Content

- Lighting
- Parameters of Lighting – visual comfort
- Energy Efficient lighting





"Light is like a little ray of hope."

"Light is beauty - without it the world would be dark and dreary."

"Light is sight and color and vibrancy. Light gives us the ability to see, and its brightness adds life to the colors and things we see."

## What light means to people?

"Light is the truth, security, life and happiness."

"Light is the oxygen for our eyes."

"Light is the smile on my daughter's face."

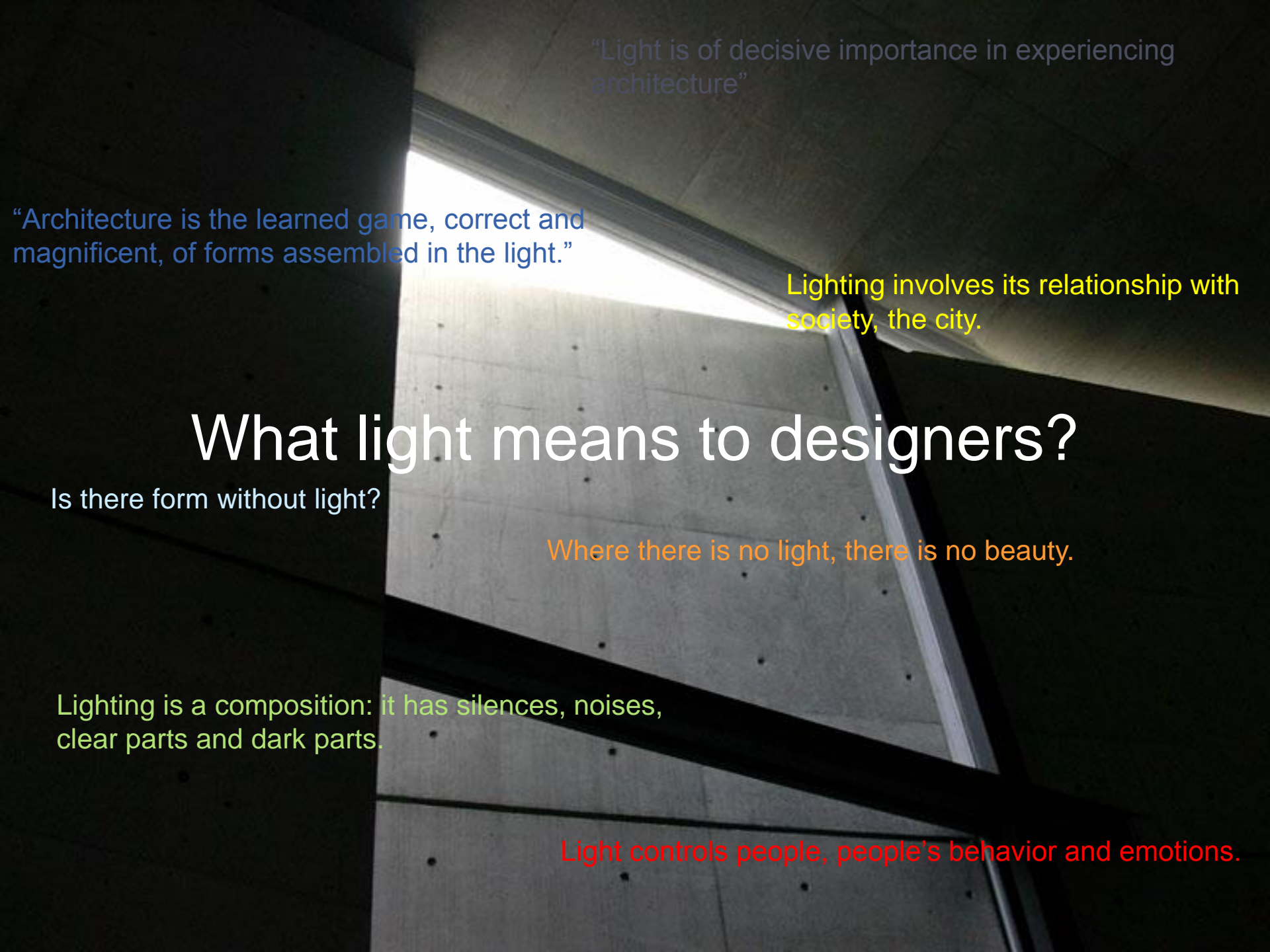
"Light is a source of energy and comfort."

"Light is holding hands on a first date."

"Light is a kiss from the Sun."

"Light makes life work."





"Light is of decisive importance in experiencing architecture"

"Architecture is the learned game, correct and magnificent, of forms assembled in the light."

Lighting involves its relationship with society, the city.

# What light means to designers?

Is there form without light?

Where there is no light, there is no beauty.

Lighting is a composition: it has silences, noises, clear parts and dark parts.

Light controls people, people's behavior and emotions.

## Light is ... Sustainable

“LED lighting can save more electricity than solar will produce”

Roland Haitz

Little Sun by Olafur Eliasson and Frederik Otessen

© frederik otessen and olafur eliasson



Bloom by Philips Design - 2008

Solar Impulse HB SIA – first solar powered intercontinental plane

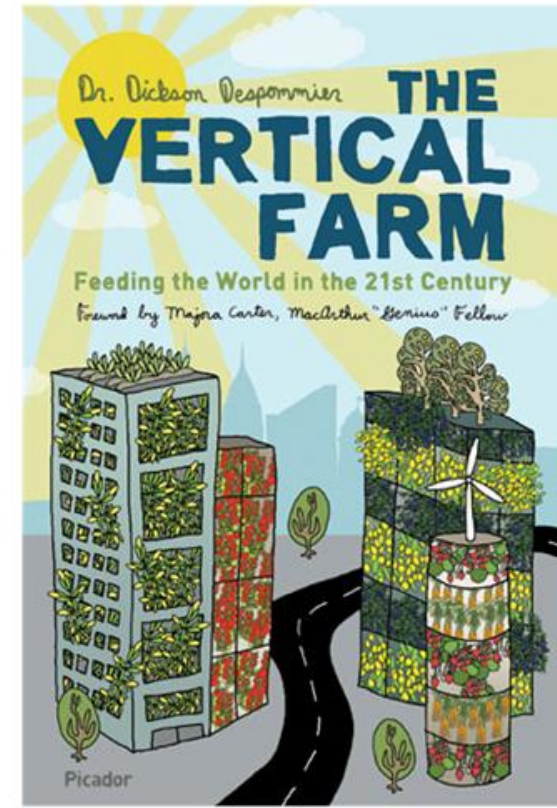


# Light is ... Better Food

A plant only uses part of the solar light wavelength to grow



Philips Horticulture



© Dickson Despommier

The Vertical Farm Project

## Light is ... Wellbeing

Light does have an incredible influence on your physical and mental state



Philips School Vision



Philips Ambient Experiences



Olafur Eliasson – The Weather Project at Tate Modern



Day & Light luminaire by Philip Bogaert

**PHILIPS**

# Light is ... Health

Patients always heal faster at the south side of the hospital



Philips Heal Well



Philips Bilirrubine Blanket



# Light is ... Experience

Digital light in all color spectrum brings unbelievable experiential possibilities



Lucente by Toshiba at Milan 2010 Image © Designboom



Dennis Parren CMYK lamp Image © Dennis Parren via Designboom



Cineteca Matadero  
by Churtichaga + Quadra-Salcedo  
Image © Fernando Guerra



Luminous by Klik Systems Image © David Clare

## Light is ... Different

LEDs can completely disturb the current lighting archetypes



Glow bulbs – Next simplicity event 2005



Daylight by Daniel Rybakken  
Image via Designboom



Candles in the wind by Ingo Maurer and Moritz Waldemeyer Image courtesy of Moritz Waldemeyer



Cardboard light by Daru for Leaf Difference Image via Behance

# Simply enhancing life with light

The Philips Lighting difference



People focused



Partners in  
innovation

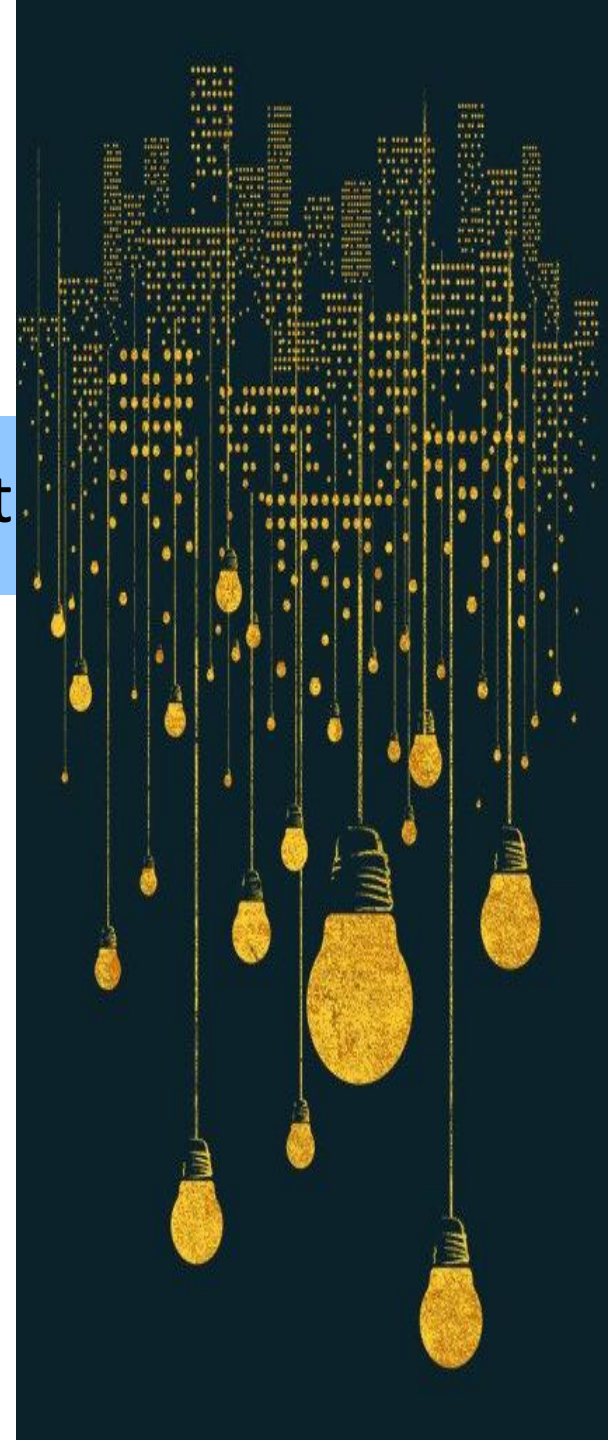


Meaningful  
solutions



## Content

- Lighting
- Parameters of Lighting – visual comfort
- Energy Efficient lighting



# Lighting Trends was driven by technology

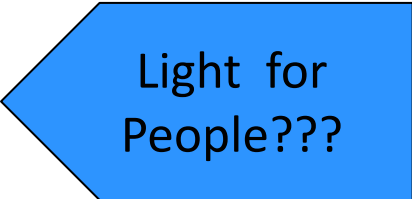
- '70's /'80
  - Standards Compliance & Product Efficiency
    - → Visual Performance
- Late 80's-90's
  - Glare , Colour Rendering
    - Visual comfort , Glare
- mid'90's -early 2000
  - Spatial Light Distribution, Optics
    - Ambience in Workspace



Light for Work



Light for Space



Light for  
People???

## **Influence on Human Being**

- Visual and Biological Need
- Impact of Lighting on Mood , Alertness and hence Performance

**In this millennium...Human Needs drive Technology to bring in Innovation**



## Visual effects of light



The visual part of light influences the way we work

- Lighting level
- Colour rendering (task recognition)
- Glare free environments
- Even light distribution
- Task, Orientation, Safety, Guidance

# Primary Lighting Objectives

1. Meet the User needs of the Space
2. Meet the Lighting Technical Standards
  - a. Visual Performance –
    - Lighting Level, Uniformity
  - b. Visual Comfort
    - Glare , Colour Rendering , Colour Appearance
3. Evaluate Energy Performance Requirement





# Factors influencing lighting design

- Function of space
- Dimension and detail of space
- Furnishing and layout
- Style& Décor
- Lighting budget





# Lighting Parameters

## Basic Parameters

- Lighting Level
- Uniformity
- Glare
- Colour
- Brightness distribution
- Modelling



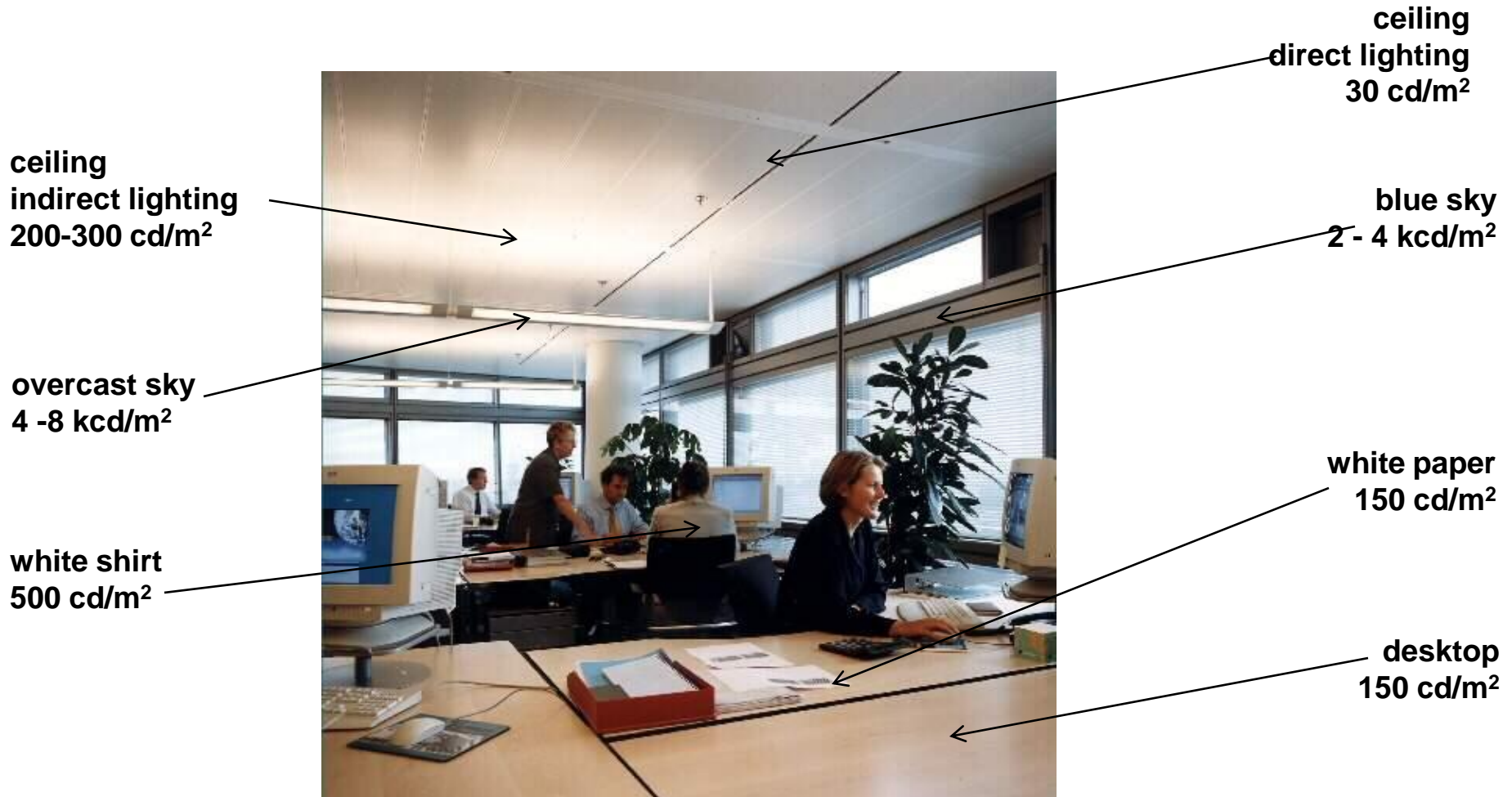
# Lighting Parameters

- Lighting Level
  - Average value specified over the surface
- Specified as range of values ( 300-500-750)
  - Lower Value
    - High Reflectance
    - Speed /Accuracy is not important
    - Task is Executed occasionally
  - Higher Value
    - Unusually low reflectance
    - Visual Work is critical
    - Errors are costly to rectify
    - Visual capacity of worker is below normal



# Luminance Distribution

Brightness distribution happens because of differences in surface reflectance





# Glare

- Various glare sources
  - Bright sources
    - Windows
    - View
    - Direct sun
    - Lamps
  - Reflective material
    - Glossy desk
    - Glossy magazine
    - Computer screen
    - Any glossy material
    - Luminaire (optics)



# Light and Productivity

Feel good, work better



# Beyond Human: Cost & Environmental Impact

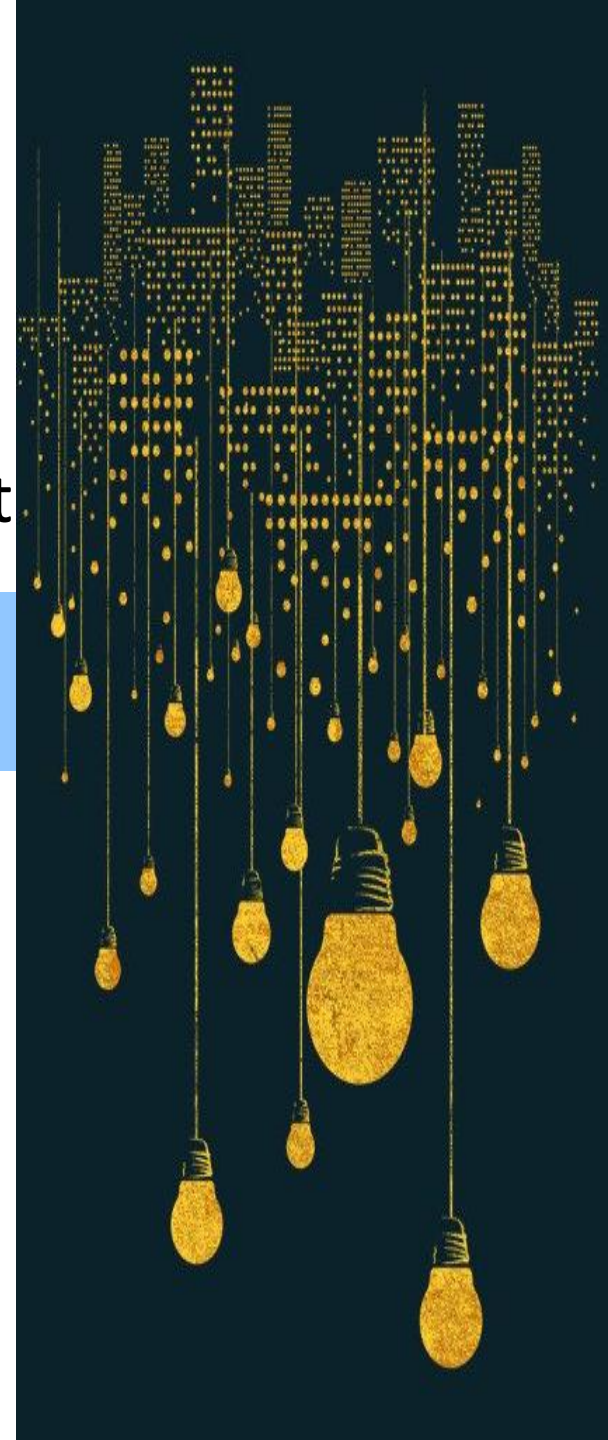
Reduce wastage of energy & impact on eco-system





## Content

- Lighting
- Parameters of Lighting – visual comfort
- Energy Efficient lighting



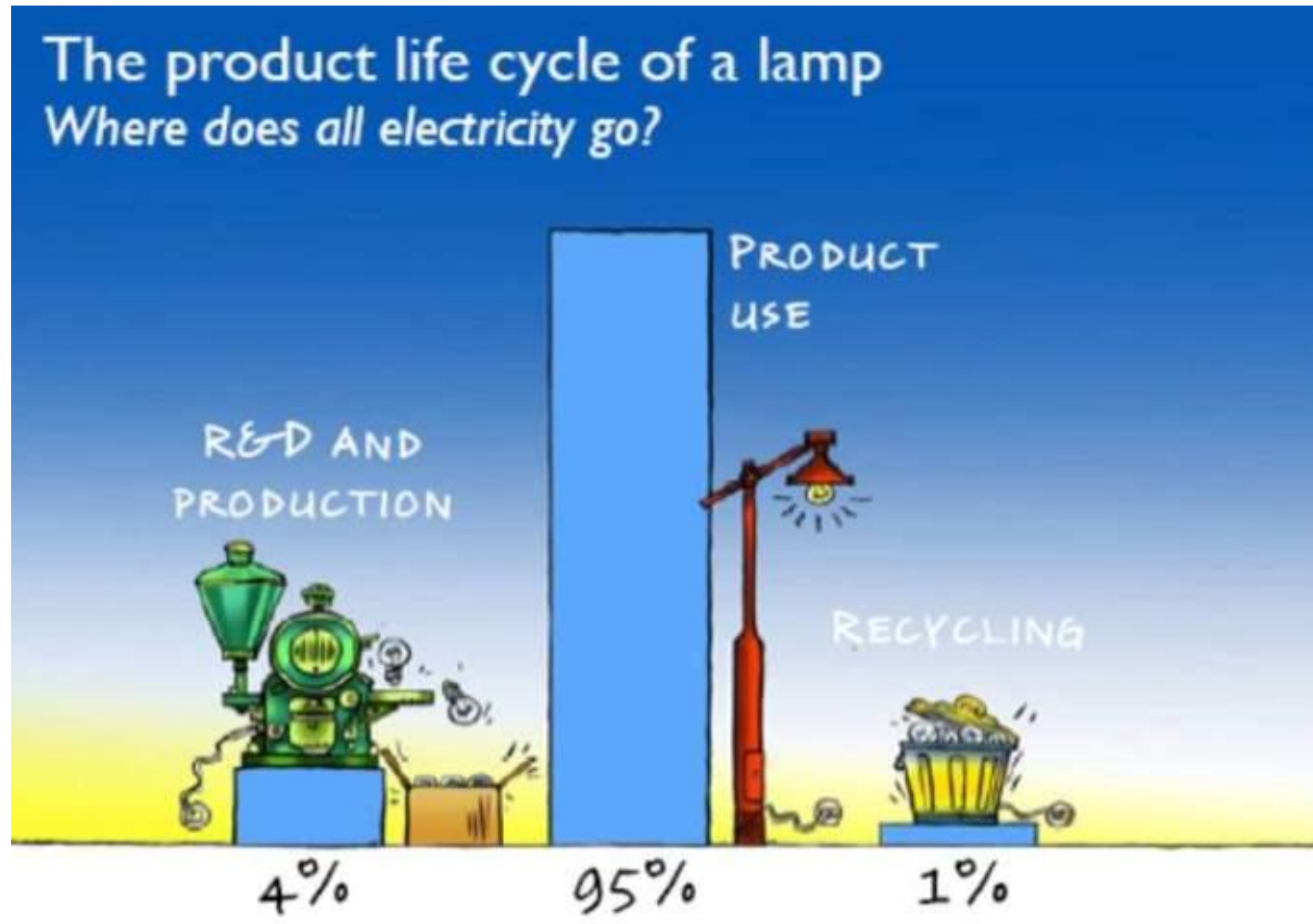
## Green Lighting Approach

1. Green Product Approach
2. Efficient Product Approach
3. Energy Saving System Approach
4. Light Pollution Reduction
5. Renewable Energy Approach



# Total life cycle impact of lighting

Up to 95% during the user phase

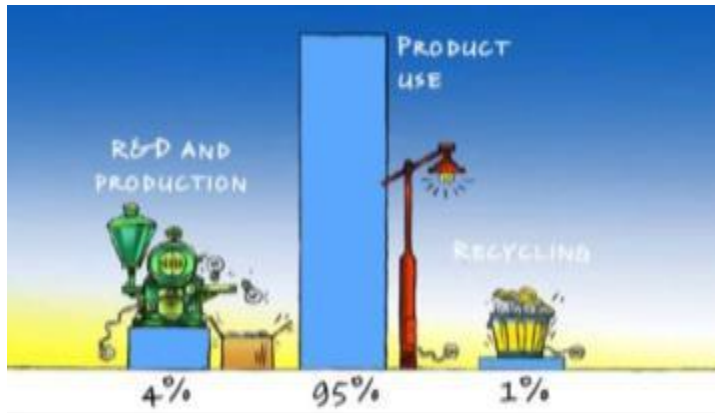






## EcoDesign

### Life Cycle approach



#### Energy Efficiency

- 10% less energy usage
- (e.g. efficacy, LOR or total power consumption)

#### Packaging

- > 10% less packaging in volume or weight

#### Hazardous Substance

- >10% less weight of one of the substances of the restricted and relevant substance list
- >10% radiation dose reduction

#### Weight

- >10 % less product weight (incl. accessories), measured in Kg.

#### Recycling and Disposal

- >10% higher content of material that can be recycled;
- Product that contains > 30% recycled material

#### Lifetime Reliability

- > 10% life time improvement

### Philips Green Focal Areas



**One or more of our GFAs must be significantly better resulting in a lower total environmental impact.**

# Life Cycle Analysis of 3 competing technologies

## Comparison basis

Number of lamps needed for 25k hr of usage

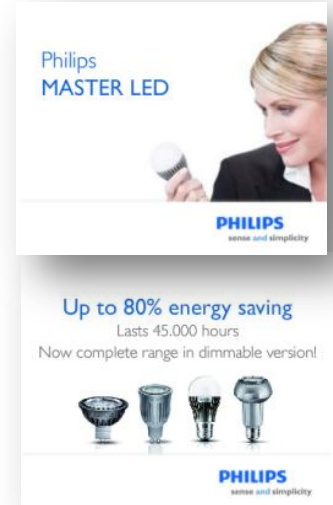
EnduraLED 12W (25k hr)



Twister T2 14W (8k hr)

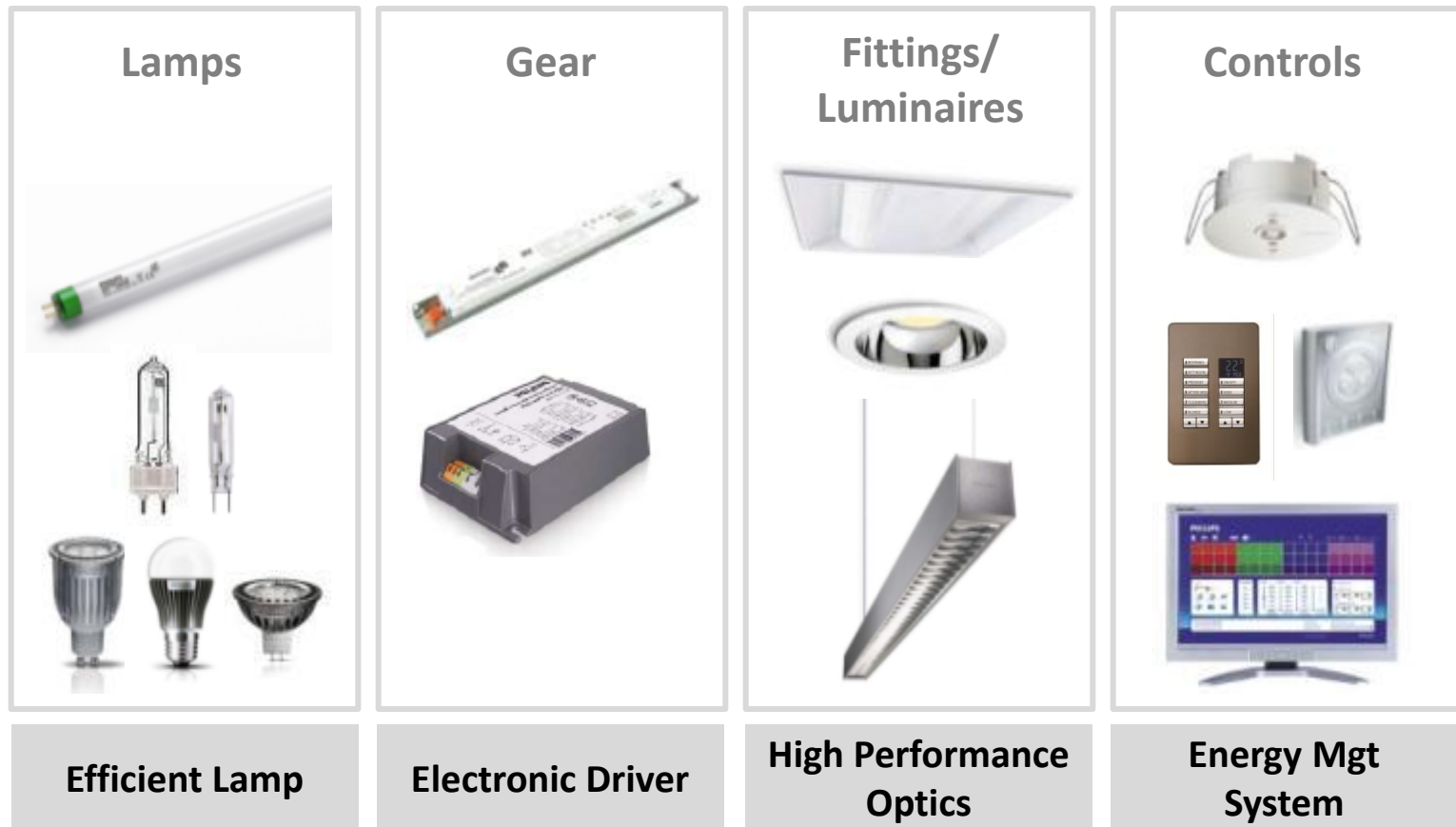


Incandescent 60W (1k hr)



# Green Lighting solutions

- Total system strategy to reduce lighting energy consumption, incl. efficient lamp, electronic driver, high performance luminaires & LED luminaires
- Controls is a must for earning more Green building points!





## Strategy 1+2- Up-lamping + Up-gearing

T5  
CDM

- T5 lamps have **low mercury** content over 50% reduction (vs. T8)
- T5 lamps are **22% more efficient** than standard T8 lamp
- New T5 Eco has additional 10% saving vs. T5 ;highest efficacy
- CDM lamps have **low mercury**, no lead
- CDM Elite is available for 20-70W, **2~4 times higher efficiency** than halogen
- **Crisp white light** with excellent colour rendering (Ra 90) and stable colour performance during lifetime
- **Reduce maintenance/** disruption **cost**-Long lifetime 12,000 hrs (avg of 20,000 hrs)



MASTERColour CDM Elite MW



T5 Eco

HFPIII



MASTERColour CDM Elite

## Strategy 3- Luminaire efficiency upgrade

- **Upto 25% greener** (CO2 emission reduction)
- **High** luminaire integral **efficacy**
- It offers **15% energy saving**
- **Totally mercury free** - Hazardous material (RoHS compliant)
- **Maintenance free**- Lifetime 50,000

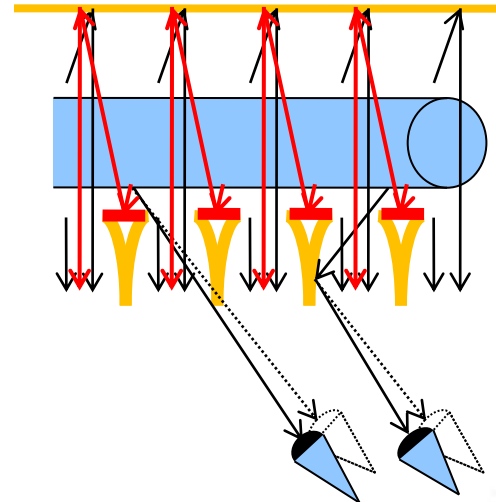
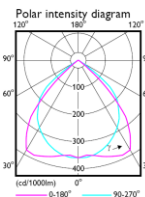
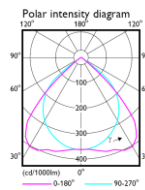
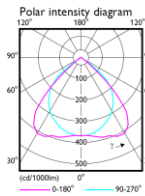
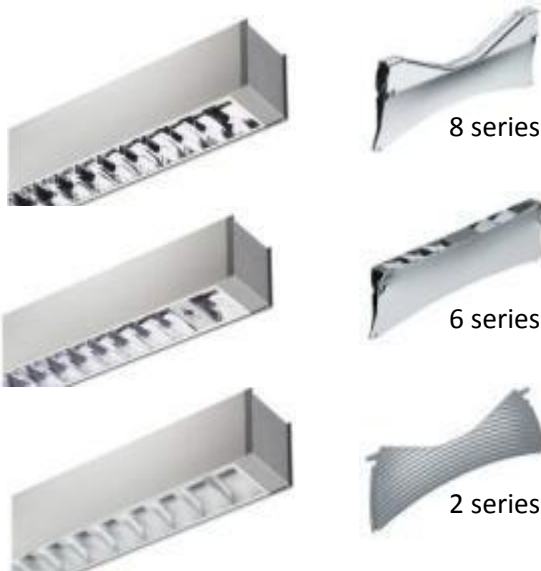


- **High efficiency** LED downlights luminaire
- It offers **50% energy saving** vs. std CFL-I downlights
- **Smaller size** of LED lighting source allow sleek luminaire choices



# Strategy 3- Luminaire efficiency upgrade

- Omni-directional Lighting Control (OLC)-
  - High efficiency for energy: **effective**
  - Wide delta-shaped beam: **best uniformity**
  - All-around low-brightness: **high comfort**
- TBS 869 has a very high efficiency (Light Output Ratio= LOR up to 78%) with D8H very high output louver (reflection rate is 94%); UGR<19

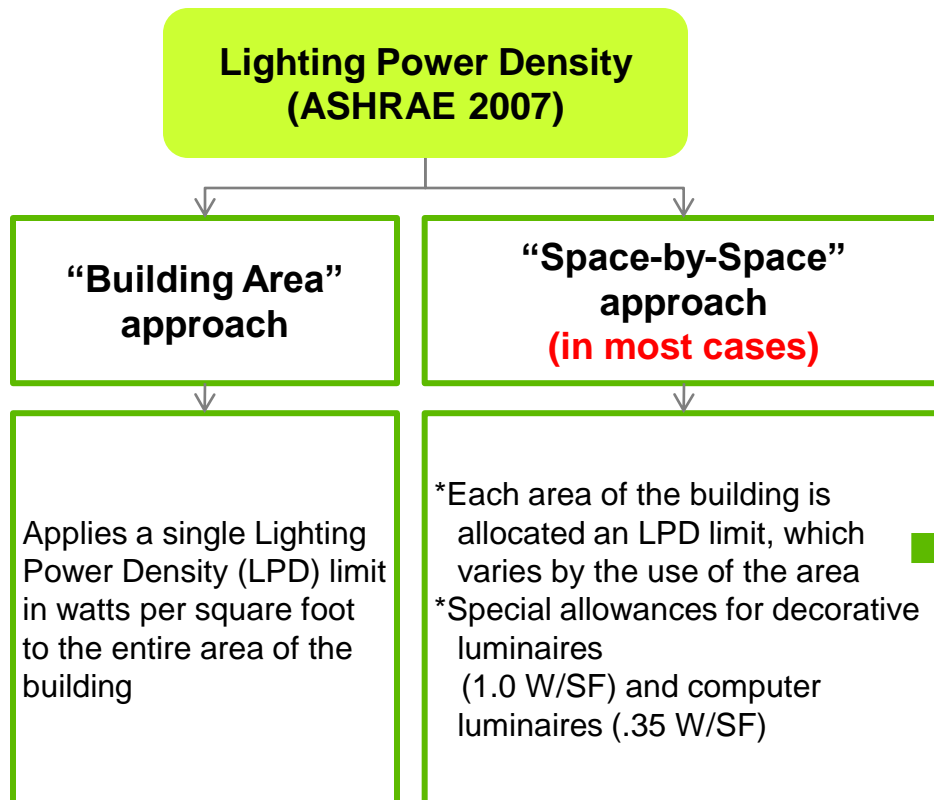


TBS 869



# Lighting Power Density (LPD)

- ASHRAE 90.1-2007 provides guidance of Lighting Power Density (LPD)- the maximum amount of power that can be used for lighting. It varies by the use of the building or the spaces within it.
- Two methods for calculating the LPD-



Office Lighting Power Density under Standard 90.1		
	(W/SF)	Convert (W/sqm)
Space	2007 LPD	2007 LPD
Enclosed office	1.1	11.8
Open office	1.1	11.8
Conference/ Meeting	1.3	14.0
Training	1.4	15.1
Lobby	1.3	14.0
Atrium (1 <sup>st</sup> three floors)	0.6	6.5
Atrium (additional floors)	0.2	2.2
Corridor	0.5	5.4
Active stairway	0.6	6.5
Active storage	0.8	8.6
Restroom	0.9	9.7
Electrical/ Mechanical	1.5	16.1
Food preparation	1.2	12.9
Dining	0.9	9.7
Laboratory	1.4	15.1
Building area method	1.0	10.8

# Strategy 1- Apply Lighting Control (<5,000 sqm)

- **Automatic saving-** Lighting are on when needed
- **DALI system** is the most widely used digital control system in the world

## Motion detector

- Switch on or dim up when sensing occupants presence
- Up to 30% savings

## Daylight linkage

- Reduce artificial lighting when daylight is sufficient
- Up to 30-35% savings

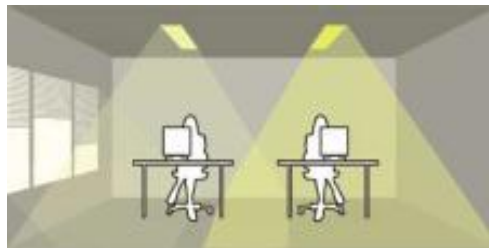
## Daylight integration

- Enable daylight to displace artificial lighting with sensitivity to occupants
- Up to 75% savings

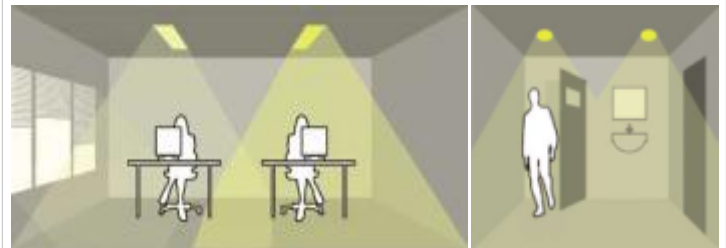
Lights on when needed



Perfect regulation for every area



Combination of Daylight & motion detector



OccuSwitch



LuxSense



OccuPlus

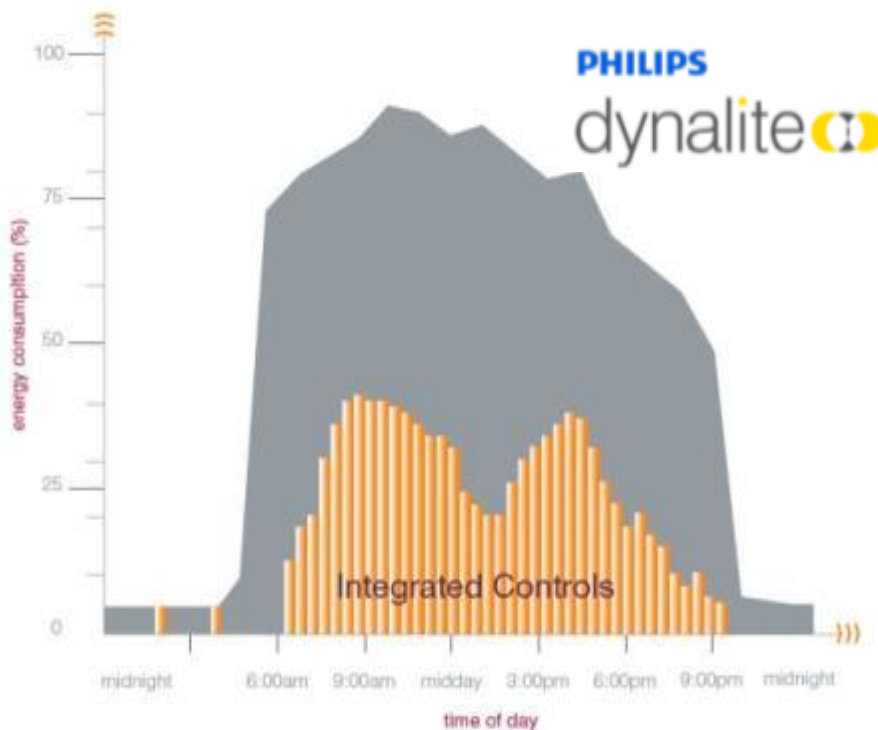


Actilume

# Strategy 2- Integrate with Energy Management System

(>5,000 sqm; new construction)

- A comprehensive facility-wide **networked control solution** developed specifically for lighting control, for scaling and integrating extensively with HVAC, BMS, security, fire detection, access control, blinds, motors and other electrical loads systems to provide a comprehensive solution.



MapView – Building services control management software



Load control devices



User interfaces



## 4. Light Pollution Reduction

### **Uniform Illumination**

- Uniformity vs. High Light Levels
- Attempt to maintain max 1.5fc for average illumination.

### **Zero Trespass** at Project Boundaries

- Illumination at property lines should be 0fc.
- Exceptions made for areas of high brightness (street adjacency, etc.)

### **No Up-lighting of Trees, Etc.**

- v2.1 allows for minimal up-lighting only in areas of high ambient brightness if all other criteria are met.

### **Maintain Façade Lighting On The Building Face**



# Solar Street Lighting System



## System Offering

1. LED Solar Street Light with MPPT controller
2. Solar Panel
3. Battery
4. Battery Box
5. Galvanised Pole
6. Pole fixing piece

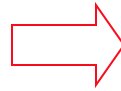
## LEDs have many advantages *compared to other lighting sources*

### Conventional lighting sources

- Incandescent
- Halogen
- Fluorescent
- Gas-discharge  
(example: neon)



NEON



### Light Emitting Diode (LED)



#### Advantages of LEDs

- Long lasting and low maintenance
- Energy efficient
- Dynamic (digitally) color control
- Small (design flexibility)
- Directed light (= increased efficiency)
- Robust and vibration proof
- Turn on instantly
- No IR and UV radiation in the beam
- Cool beam of light
- Low voltage
- No mercury



Energy  
Consumption



Hazardous  
Substances



Less  
Weight



Recycling  
and  
Disposal



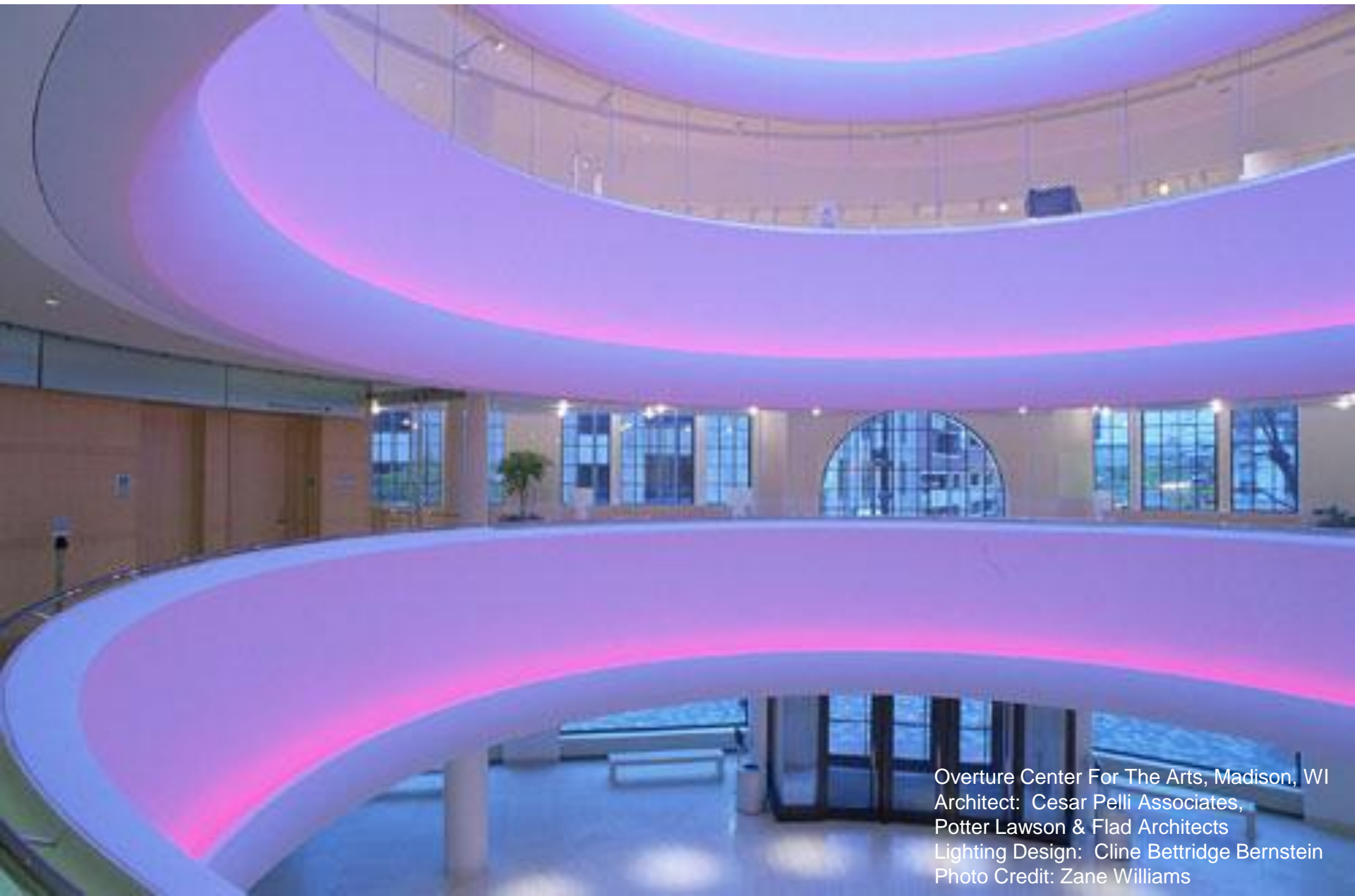
Lifetime  
Reliability



TRABALHANDO NA ZONA DE RISCO  
SAÚDE E SEGURANÇA







Overture Center For The Arts, Madison, WI  
Architect: Cesar Pelli Associates,  
Potter Lawson & Flad Architects  
Lighting Design: Cline Bettridge Bernstein  
Photo Credit: Zane Williams





**Advocate Lutheran Hospital**  
Chicago Illinois



“Light is like fire, a good servant, but a poor master.....It behooves anyone who is involved in the design and specification of lighting systems to be aware of [the] impacts of light on human health”



*“Light is the key to well-being.”*

*Le Corbusier*



