

A young child is smiling and holding a glowing light stick at a night festival. The background is filled with colorful bokeh lights in shades of blue, green, and yellow. The child is wearing a light-colored t-shirt with a graphic design.

Effective Implementation of Technologies for High Performance Lighting

Vivek Jain

Philips Lighting Application Services

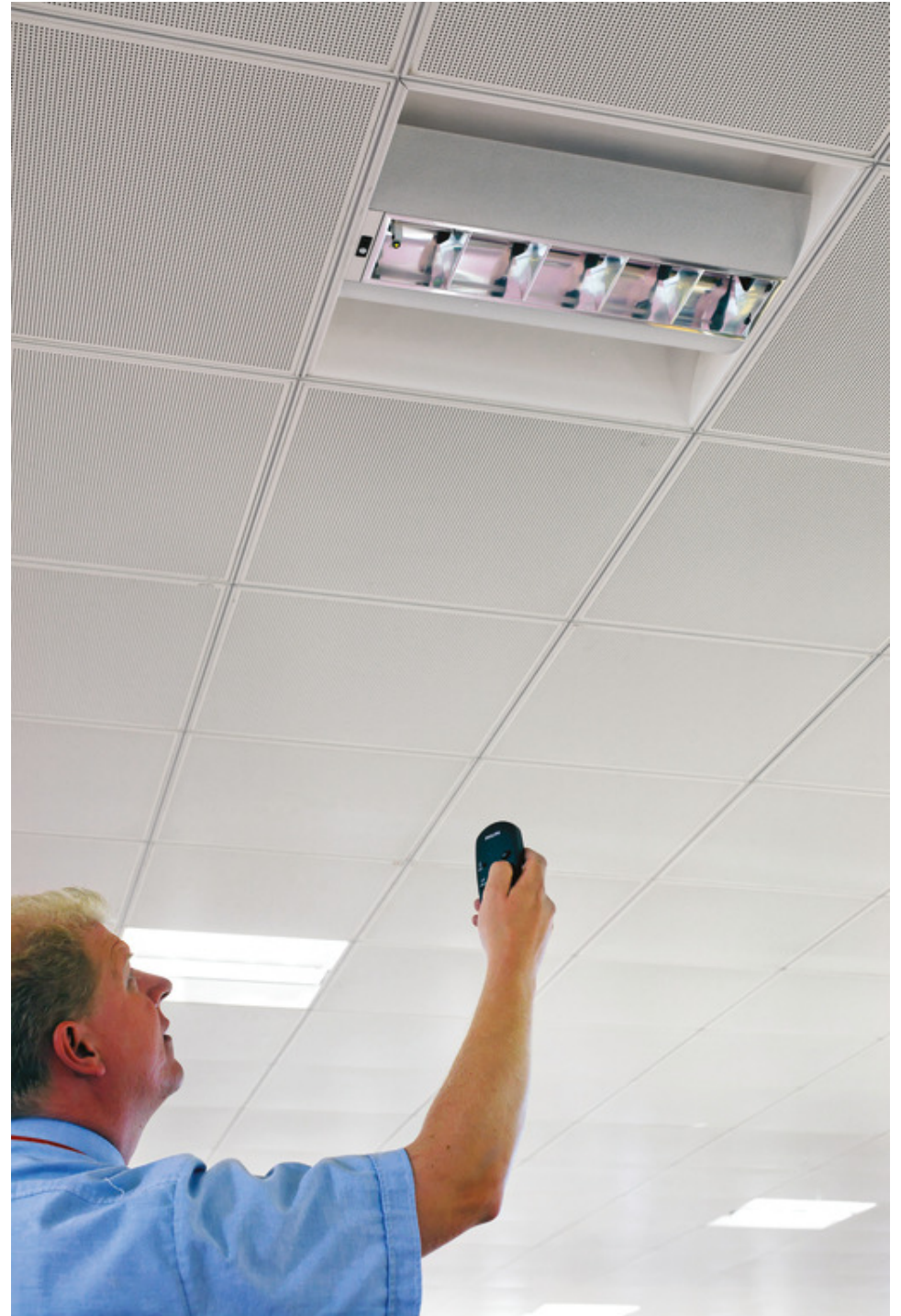
Professional Channel

March 13th, 2015

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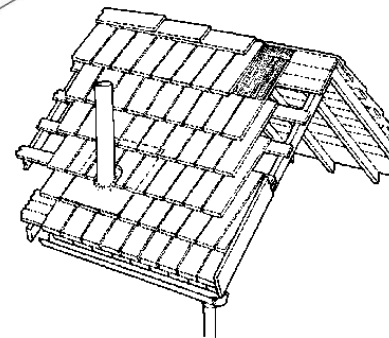
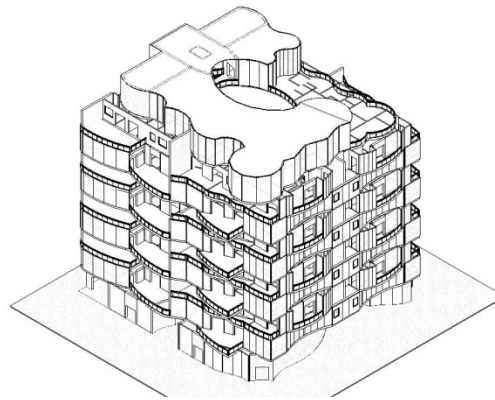
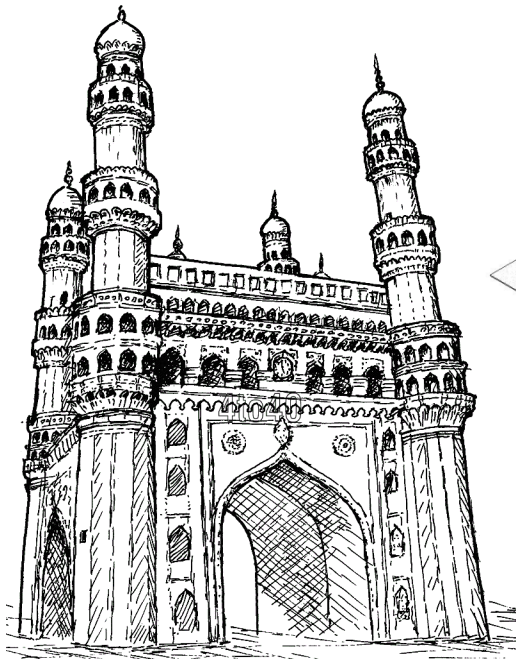
Storyline

- **Green Lighting Approach**
- **Upgrade Strategy**
- **Case Studies**
- **Paradigm Shift**



Indian buildings & Sustainability

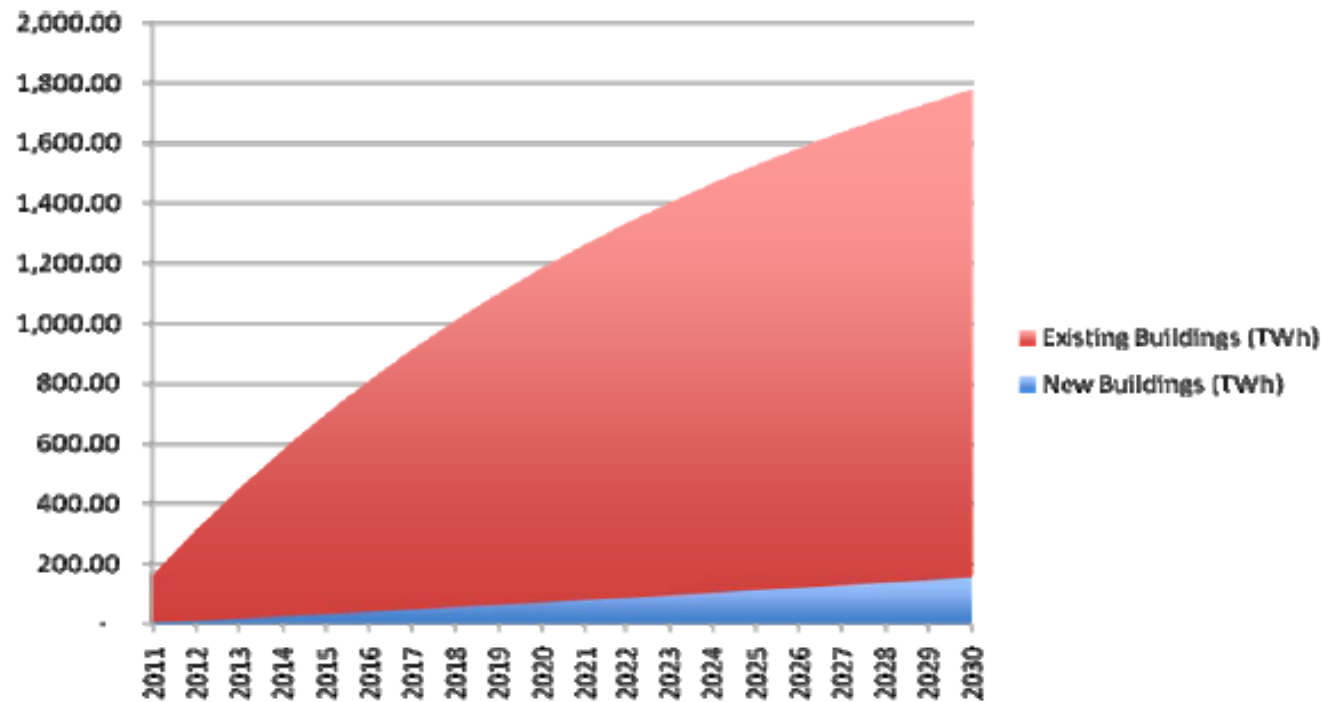
- India has rich traditions and history in holistic strategies for buildings and construction
- Despite this the sustainable buildings agenda currently receives limited attention in India.



Why Existing Buildings?

- Business as Usual Existing Buildings:
 - Energy use intensity – ~ 250 kWh/sq. m.
 - Based on benchmarked data for over 1,000 commercial buildings all over India
- Best Practice (Cost-Effective) New Building:
 - Energy use intensity – $\sim 70-80$ kWh/sq. m.
 - Actual numbers from Infosys building in Hyderabad

Cumulative Energy Consumption of New and Existing Buildings



20 years from now, as we look back, 90% of the total electricity used will be in our existing buildings

Electricity consumed annually by existing buildings today is more than the total electricity that will be consumed by all new buildings constructed over the next 20 years

Challenges to Energy Efficiency in Existing Buildings

- How do we start?
- Where do we stand?
- “But this is how we’ve always done it...”
- Absurd payback expectations – 2 year payback (50% ROI)
- Split incentives
- Lethargic behavior of Maintenance staff



Building Sector Energy Intensity

Pitfalls in the existing lighting systems for buildings of different era's

- Non-compliance to visual comfort
- Existing spaces are getting more densely populated
- Would result in need of more light
- Demand supply gap projections as a result of this



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Easy Fix

Lighting

- One of the easiest upgrades is LED lighting. Otherwise existing buildings are messy.
- It requires little upfront investment, and shows almost immediate returns.
- New lights can be installed overnight without causing disruption to occupants (in commercial). New lamps can be retrofitted (in residential)



What can we do with lighting?

- 17 - 20% of the world's energy costs are towards Lighting
- More than 80% of current lighting in use in the world is based on antiquated technology which consumes more energy and indirectly causes more CO² emissions
- Even if we convert 20% of the current lighting to energy efficient lighting, we will save nearly 50 Billion Euro globally in energy costs



A night cityscape with light trails and green laser beams. The image shows a city at night with various buildings and lights. In the foreground, there are blurred light trails in orange and red, suggesting a long exposure of a moving light source. In the background, several tall buildings are visible, some with green laser beams emanating from them, creating a dramatic effect against the dark sky. The overall scene is vibrant and dynamic.

Lighting

Green

Lighting

Ca

**Turning off the photocopier at the end of the workday
saves 1.2% on energy and CO₂ emissions.**

in

**Switching on energy efficient
lighting saves up to 75%.^{**}**

line



Switching computer equipment off at the end of the workday saves 0.5%* in energy and CO₂ emissions.

Switching on energy efficient lighting saves up to 75%."

Cancel

Shut Down

75%

savings

... an opportunity not to be missed ...

What does the future hold for us?



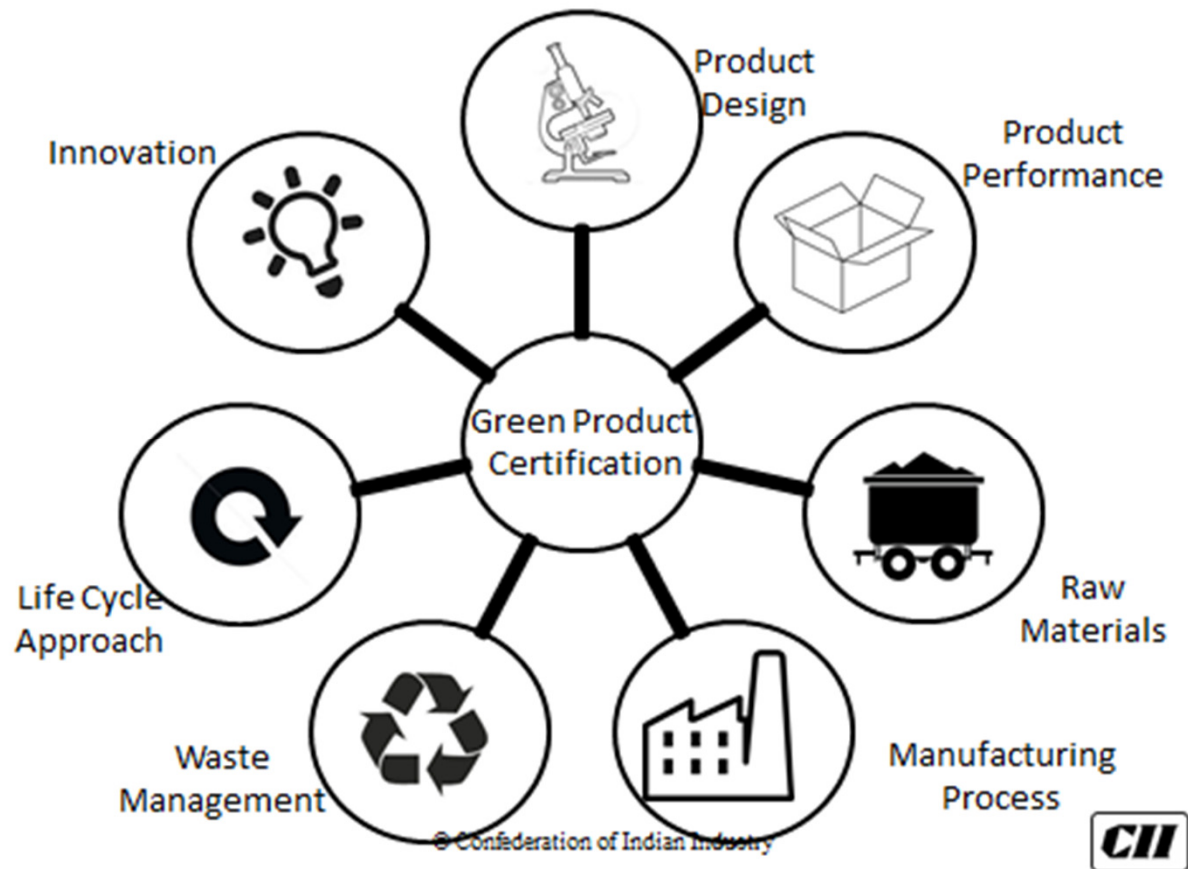
Green Lighting Approach

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



Green Products Rating

Criteria for Green Products Rating

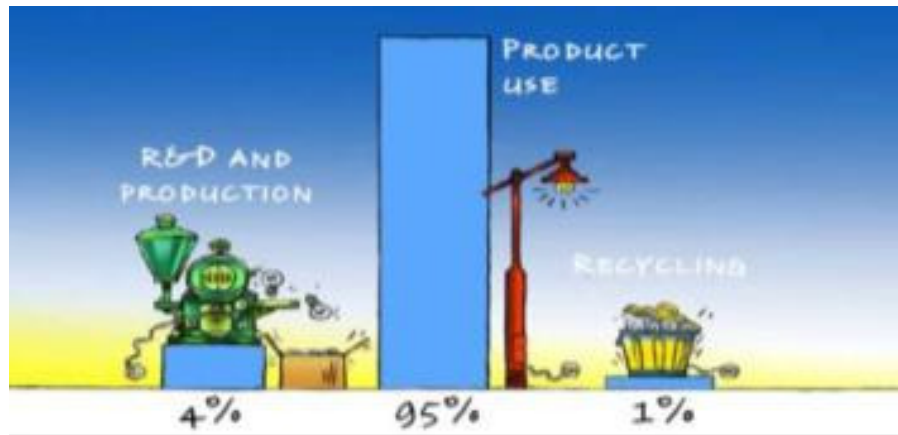


1. Green Product



Eco- Design

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

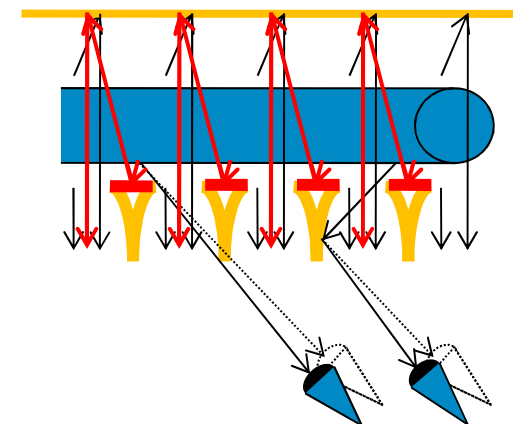
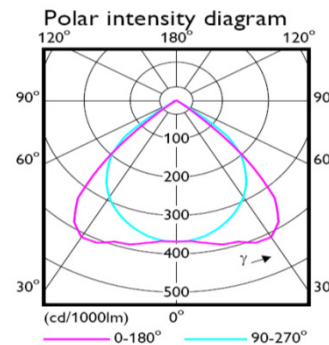


One or more of GFAs must be significantly better resulting in a lower total environmental impact.

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Luminaire Efficiency upgrade

- Omni-directional Lighting Control (OLC)-
 - High efficiency
 - **uniformity**
 - **high comfort**
- High efficiency (Light Output Ratio= LOR up to 78%) with D8H very high output louver (reflection rate is 94%); UGR<19



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Luminaire Efficiency - LED

Efficacy

How to evaluate energy efficiency ?

- Lumen / Watt differs per LED type, color temperature and CRI
- Lumen / Watt of the bare LED \neq Lumen /Watt of the luminaire due to
 - Thermal losses
 - Optical losses
 - Driver losses

What is key to understand?

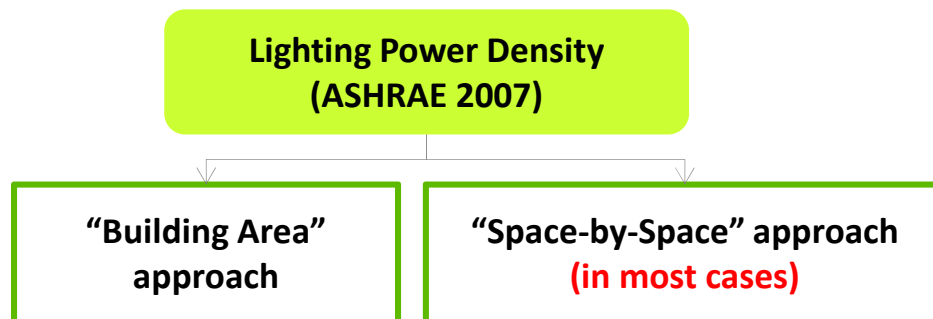
- Color temperature - Cool white LEDs are more efficient than warm white
- When comparing lm/W, make sure that the total system output and system power is taken into account



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Lighting Power Density (LPD)

- ASHRAE 90.1-2007 provides guidance of Lighting Power Density (LPD)
- LPD should include power consumption of complete fixture, including lamps and ballasts.
- 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 st 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

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

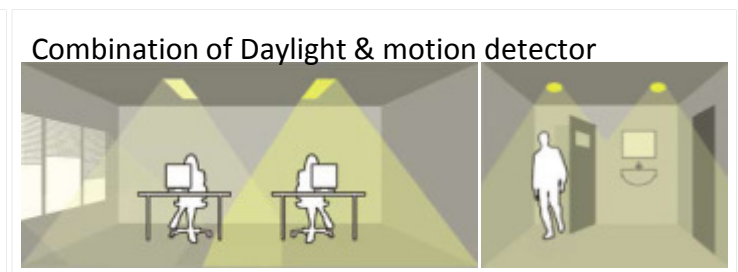
- Switch on or dim up when sensing occupants presence
- Up to 30% savings

Daylight linkage

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

Daylight integration

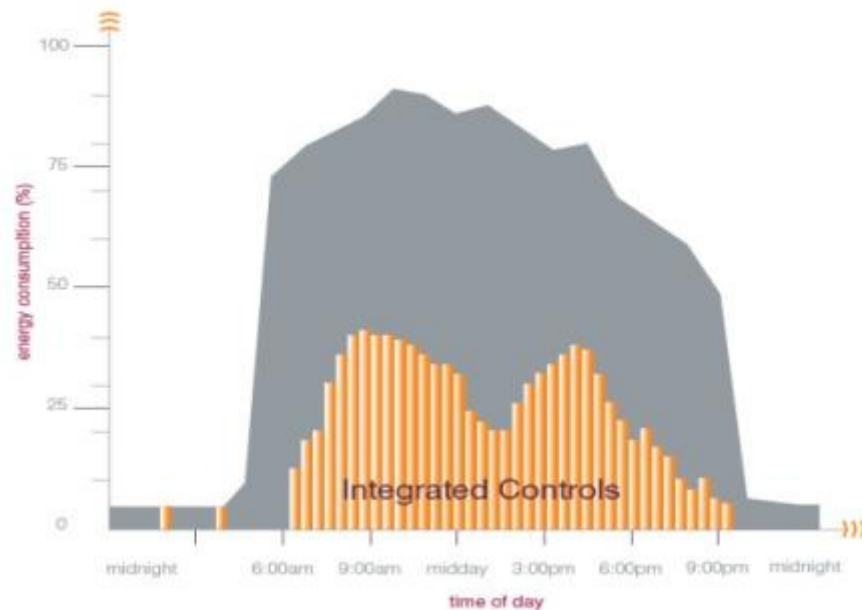
- Enable daylight to displace artificial lighting with sensitivity to occupants
- Up to 75% savings



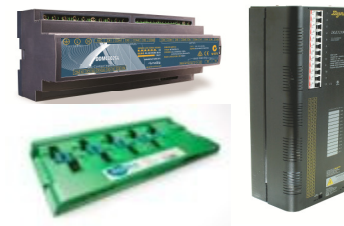
Integrate with Energy Management System

>5,000 sqm; new construction

Networked control solution for lighting control and integrating with HVAC, BMS, security, fire detection, access control, blinds, motors etc.



MapView – Building services control management software



Load control devices



User interfaces

Light Pollution Reduction

- Uniform Illumination
- Zero Trespass at Project Boundaries
- No Up-lighting of Trees, Etc.
- Maintain Façade Lighting On The Building Face

Solar Street Lighting System



System Offering

- LED Solar Street Light with MPPT controller
- Solar Panel
- Battery
- Battery Box
- Galvanised Pole
- 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

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Lighting

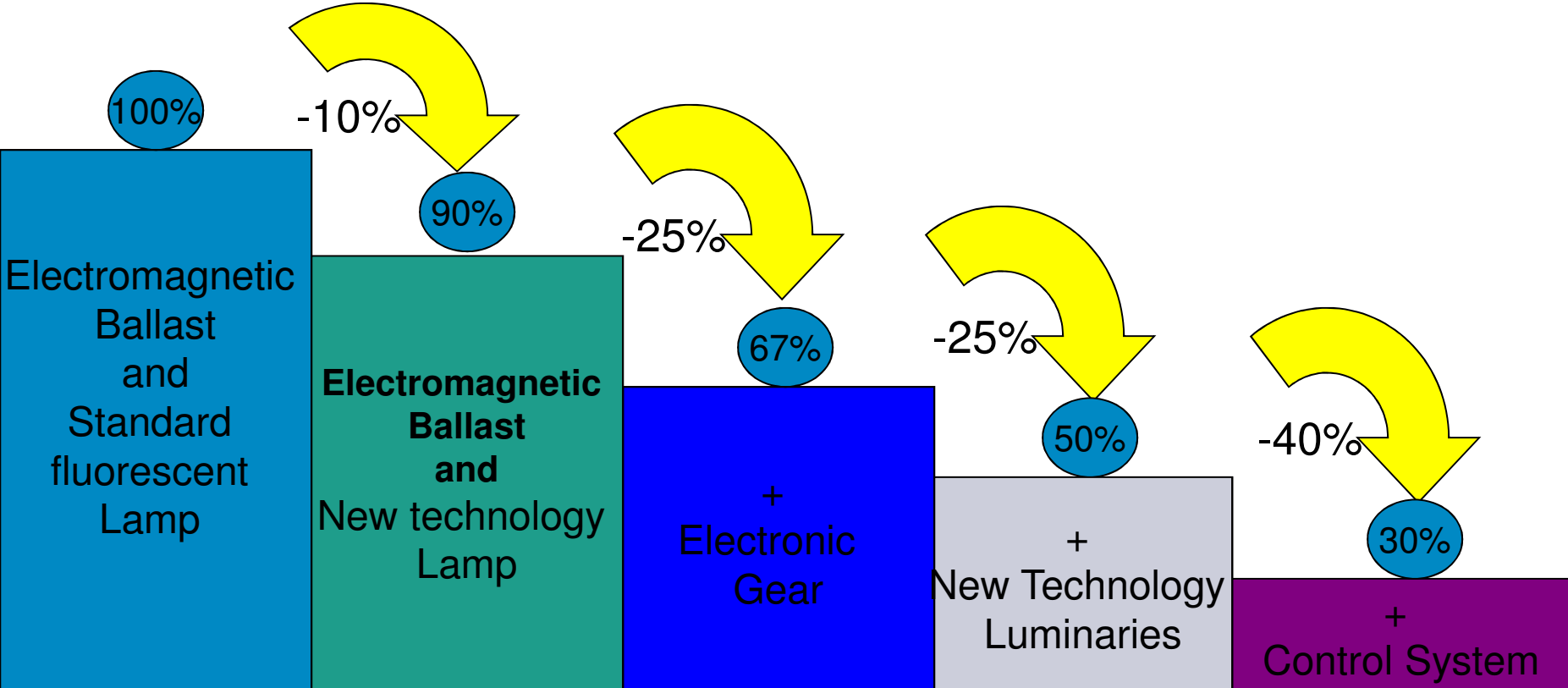
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Lighting System Energy Reduction

Possibilities

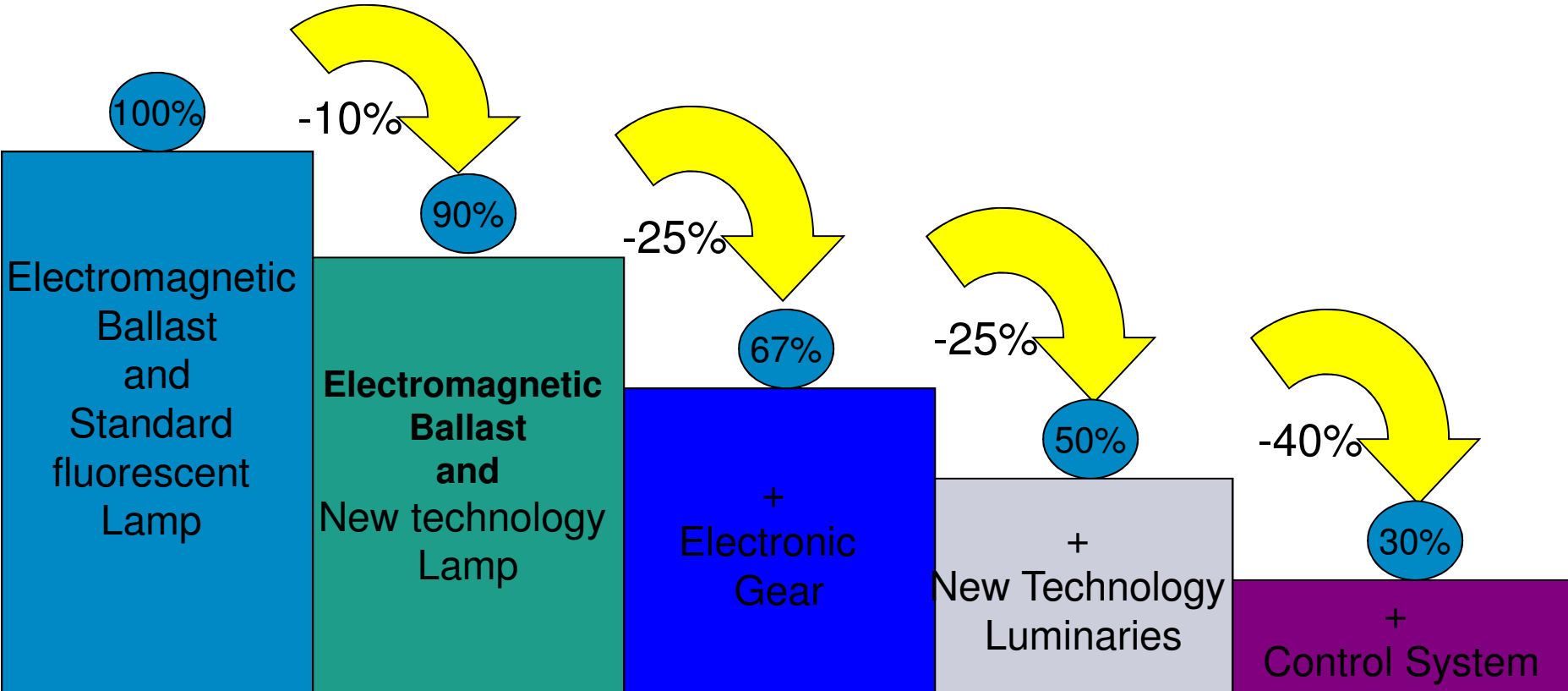
Level 1 Intervention: Replacement of **inefficient lamps** existing lamps with efficient ones



Lighting System Energy Reduction

Possibilities

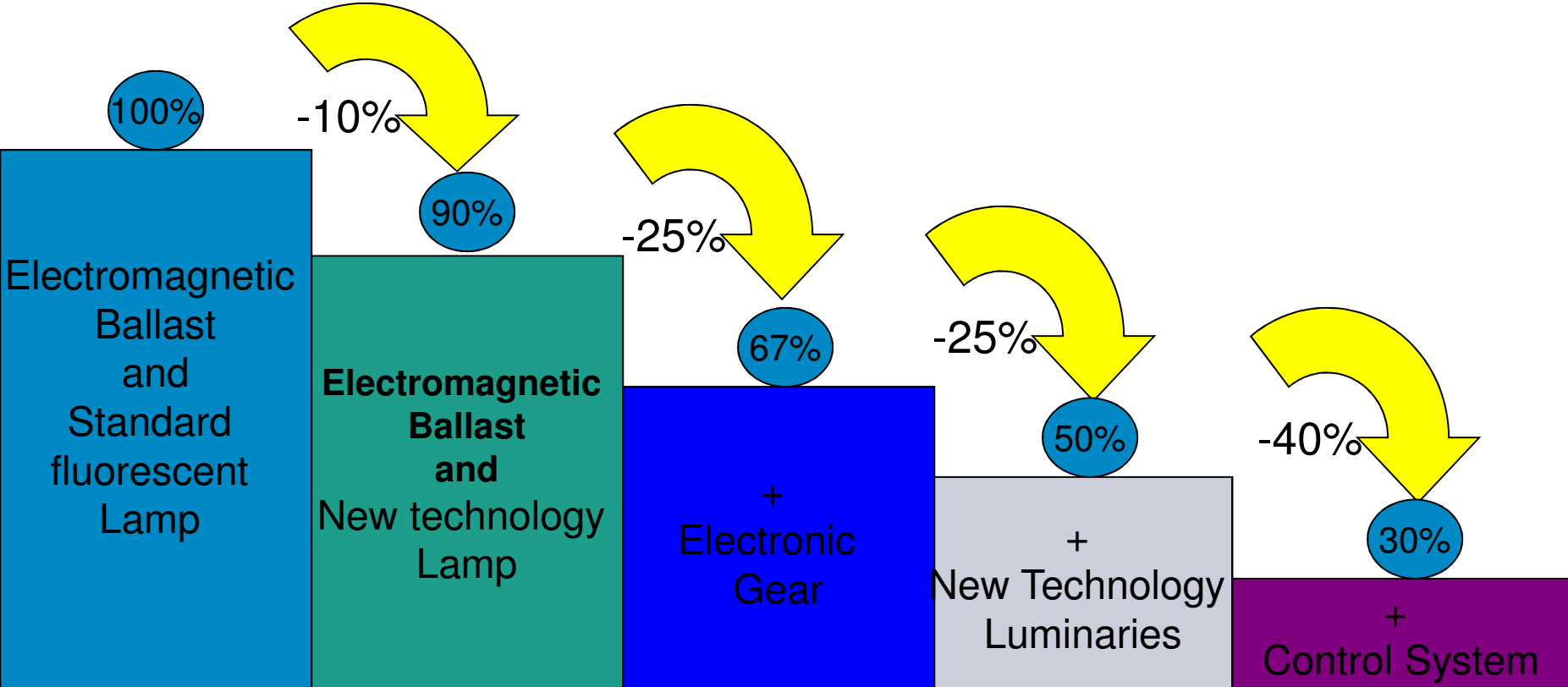
Level 2 Intervention: Replacement of inefficient lamps + luminaires with efficient ones; basic minimum controls



Lighting System Energy Reduction

Possibilities

Level 3 Intervention: Replacement of existing lighting system with state of art lighting system with integrated control system



Light Mantra –Retrofit Project

Point to Point Replacement

- Easy and quick , watts saving , not translated to energy saving ,
- Value - ROI , Image- Communicate to employees

Redesigned Lighting

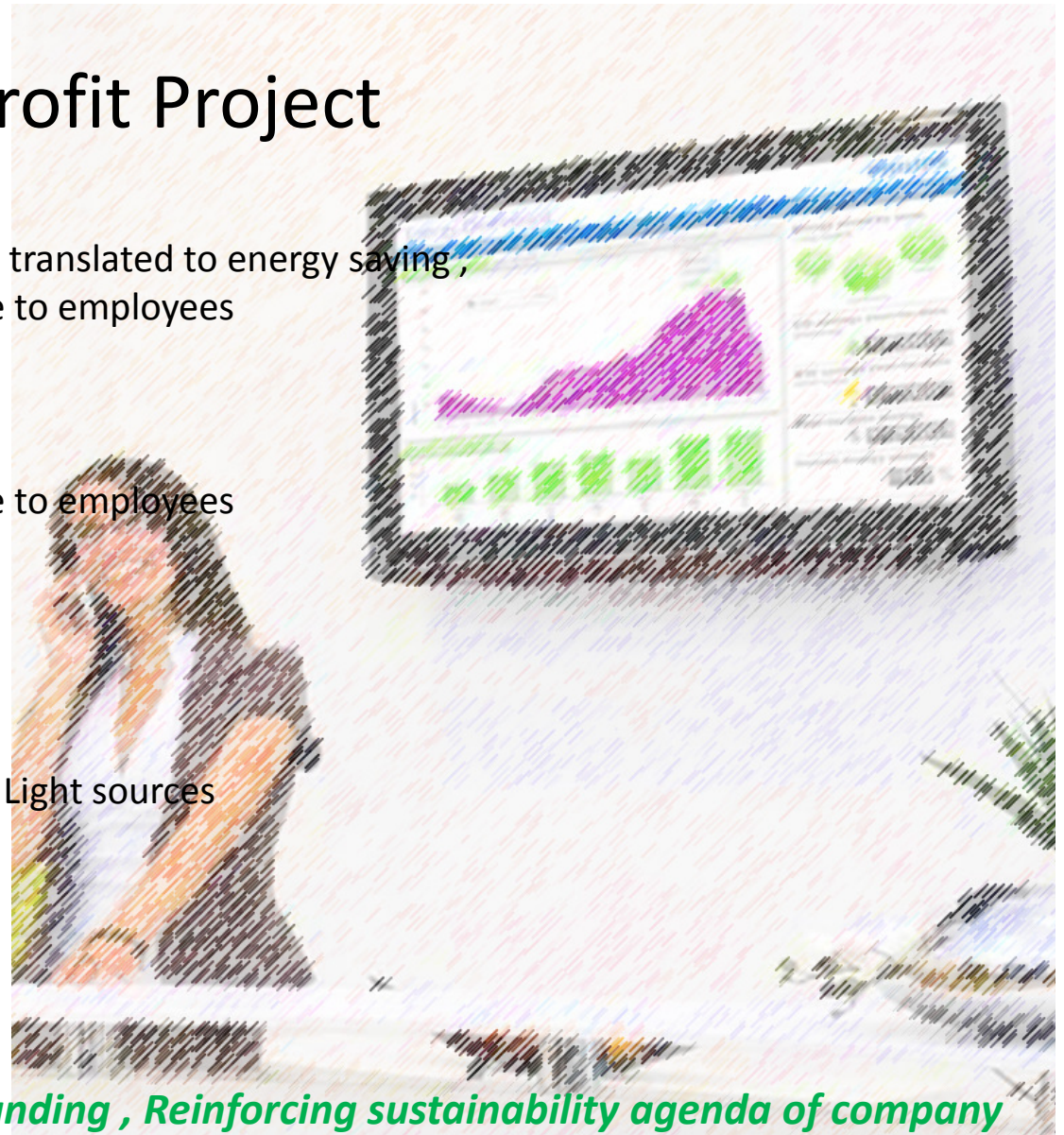
- Rigorous, Clear energy saving
- Value - ROI , Image- Communicate to employees

From Watts to Energy

- Retrofit + Zonal Controls

Dynamic Efficiency

- Intelligent networking of Retrofit Light sources



Beyond energy saving – Employee branding , Reinforcing sustainability agenda of company

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Lighting System Refurbishment Process

Steps

- Step 1: Establish the existing visual comfort levels maintained in the building
- Step 2: Compare it with the recommended levels by different Indian Codes
e.g. IS 3646, NBC, SP41, SP32 etc.
- Step3: Establish the base line energy level of the lighting system
 - Calculate the existing energy level
 - Project modified figures for the lighting system refurbished with the existing lighting fixtures only to meet the visual comfort
 - Show the increase in lighting system energy to comply with code requirements

Lighting System Refurbishment Process

Steps

- Step 4: Establish TCO (Total Cost of Ownership) for Level 1/ 2/ 3 intervention as compared to the base energy levels (Level 1/ 2/ 3 intervention shall be code compliant)
- Step 5: Select the Intervention Level based on the budgetary constraints
- Step 6: Develop a staged plan for selected intervention

Lighting Services - example

Some Philips Lighting Services are available separately. All of them can be combined into a tailor-made turnkey package that delivers completely coordinated solution design, project execution and lifecycle support - from start to finish.





Lighting

Case



examples

Case Study

State Bank of India, Agra



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Case Study

State Bank of India, Agra



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Case Study

State Bank of India, Agra



Case Study

Elecon Engineering Company, Anand, Gujarat



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Case Study

Elecon Engineering Company, Anand, Gujarat



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Case Study

Elecon Engineering Company, Anand, Gujarat



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Case Study

Ratnadeep Supermarket, Hyderabad



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Case Study

Ratnadeep Supermarket, Hyderabad



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Case Study

Ratnadeep Supermarket, Hyderabad



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Case Study

ManMandir, Chennai



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Case Study

ManMandir, Chennai



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Case Study

ManMandir, Chennai



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Case Study

ITC Maurya Hotel, New Delhi



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Case Study

ITC Maurya Hotel, New Delhi



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Case Study

ITC Maurya Hotel, New Delhi



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Case Study

Akshaya Pvt. Ltd., Chennai



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Case Study

Spencers Retail, Vizag



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Case Study

Spencers Retail, Vizag



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Case Study

Spencers Retail, Vizag



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Lighting

Paradigm Shift



Benefits – tangible and intangible

Connecting to Stakeholders

Low Opex,
Fast ROI

Low Maintenance,
Low inventory

Facilities

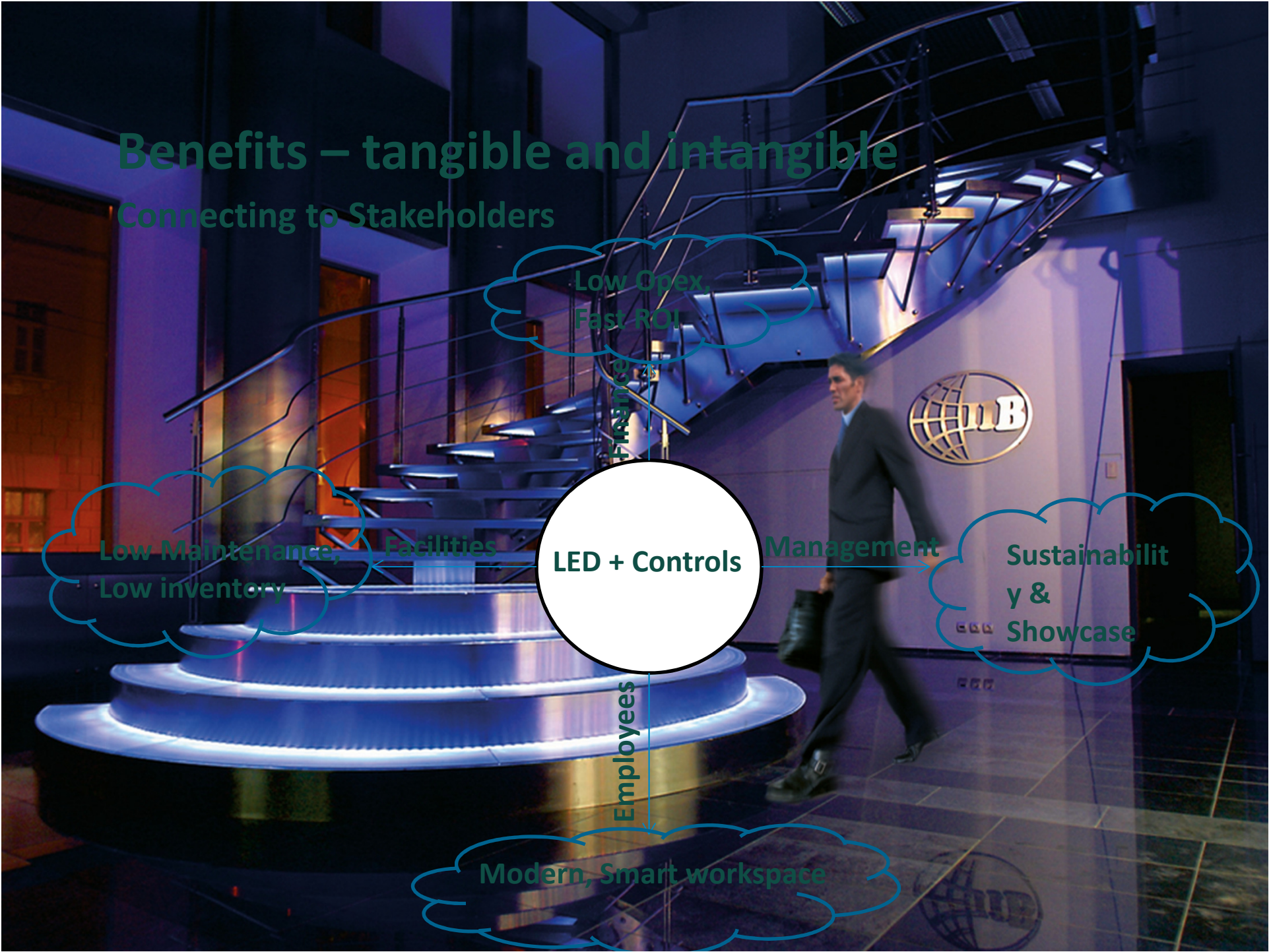
LED + Controls

Management

Sustainability &
Showcase

Employees

Modern, Smart workspace



Benefits – tangible and intangible

- Reduction in Carbon footprint
- Reduction in electrical & HVAC Load
- Increased efficiency of electrical systems
- Lesser maintenance
- Improved ambience / Lighting Levels
- Happier and Productive Employees
- Sprucing of green branding
- Engagement of employees with green employer brand
- Awareness of green technologies
- Showcase of leadership as a green operation



Challenges

- Willingness and limited knowledge of owners
- Finance – investment capital
- Incomplete / inconsistent data for the facility, as existing
- Availability of trained electricians
- Limited work place disruptions
- Ceiling adaptations, electrical re-work
- Disposal of existing products (waste management)





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Thank you