Effective Implementation of Technologies for High Performance Lighting

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Professional Channel
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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 – ~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
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
Turning off the photocopier at the end of the workday saves 1.2% on energy and CO₂ emissions.

Switching on energy efficient lighting saves up to 75%.
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%.**
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
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
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 ≠ 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
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:
  - **Building Area** approach
  - **Space-by-Space** approach *(in most cases)*

### Office Lighting Power Density under Standard 90.1

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

**NBCC / NLC 2010**
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

<table>
<thead>
<tr>
<th>Motion detector</th>
<th>Daylight linkage</th>
<th>Daylight integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Switch on or dim up when sensing occupants presence</td>
<td>- Reduce artificial lighting when daylight is sufficient</td>
<td>- Enable daylight to displace artificial lighting with sensitivity to occupants</td>
</tr>
<tr>
<td>- Up to 30% savings</td>
<td>- Up to 30-35% savings</td>
<td>- Up to 75% savings</td>
</tr>
</tbody>
</table>

Lights on when needed

Perfect regulation for every area

Combination of Daylight & motion detector
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.
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
- Galvanized Pole
- Pole fixing piece
LEDs have many advantages
compared to other lighting sources

Conventional lighting sources
• Incandescent
• Halogen
• Fluorescent
• Gas-discharge (example: 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

PHILIPS
Lighting System Energy Reduction Possibilities

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

- Electromagnetic Ballast and Standard fluorescent Lamp
- Electromagnetic Ballast and New technology Lamp
- Electronic Gear
- New Technology Luminaries
- Control System
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
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.
• Step 3: 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 Studies
Case Study
State Bank of India, Agra
Case Study
State Bank of India, Agra
Case Study
State Bank of India, Agra
Case Study

Elecon Engineering Company, Anand, Gujarat
Case Study

Elecon Engineering Company, Anand, Gujarat
Case Study

Elecon Engineering Company, Anand, Gujarat
Case Study
Ratnadeep Supermarket, Hyderabad
Case Study
Ratnadeep Supermarket, Hyderabad
Case Study

Ratnadeep Supermarket, Hyderabad
Case Study
ManMandir, Chennai
Case Study
ManMandir, Chennai
Case Study
ManMandir, Chennai
Case Study

ITC Maurya Hotel, New Delhi
Case Study
ITC Maurya Hotel, New Delhi
Case Study
ITC Maurya Hotel, New Delhi
Case Study
Akshaya Pvt. Ltd., Chennai
Case Study
Spencers Retail, Vizag
Case Study
Spencers Retail, Vizag
Case Study
Spencers Retail, Vizag
Benefits – tangible and intangible

Connecting to Stakeholders

- Low Opex
- Fast ROI
- Low Maintenance
- Low Inventory

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)
1. A building doesn't have to be new to be efficient.

2. Today's leading building owners are retrofitting buildings, converting existing buildings into models of sustainability.

3. While most building owners still pursue single technology improvements, market leaders bundle together energy saving technologies to get deeper savings in a more comprehensive approach.

4. Energy performance contracting is one business model that enables building owners to implement whole building retrofits and significantly lower energy consumption and operating costs. Essentially, the upgrades are paid for through energy savings over time!
Thank you