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sense and simplicity

LED Lighting - Scenario

Rajeev Chopra
Philips India Ltd.

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A Brief History of LEDs

- 1962 First LED (Holonyak at GE)
  - 0.001 lumens
- 1960's Red LEDs (HP & Monsanto)
  - 0.01 lumens
- 1970's–1980's Green LEDs, Watches, Calculators
  - 0.1 lumens
- 1990's Blue LEDs (Nakamura at Nichia)
  - 1 lumen
- 2000+
  - 10-100 lumens
- 2005
  - 1000 lumens (multichip packages)
- 2009 - General Illumination

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LEDs Are the Lighting Source for Tomorrow

Conventional Lighting Sources

- Incandescent

- Halogen

- Fluorescent

- Gas-discharge (example: neon)

LED Lighting Source

- Light emitting diodes (LEDs)

Benefits of LED Lighting

- Ultra long source life
- Low power consumption
- Low maintenance
- No moving parts
- No UV radiation
- Cool beam of light
- Digitally controllable
- Sustainability

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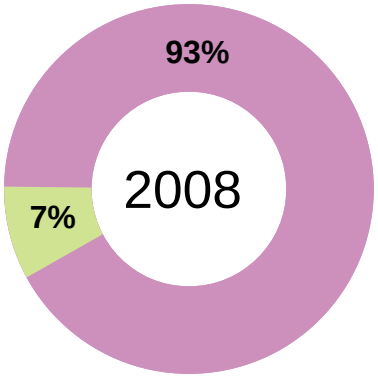
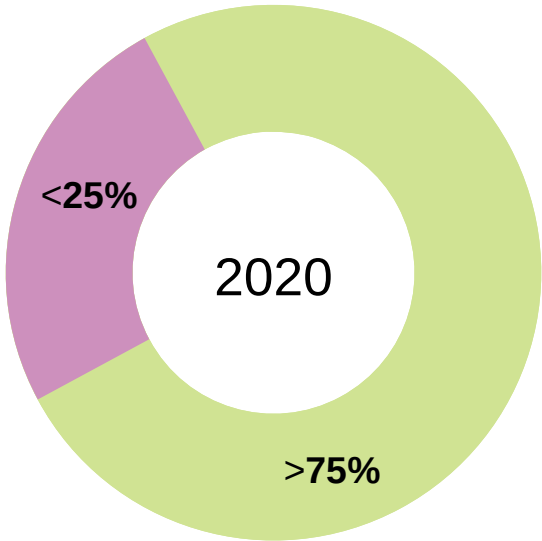
The digital revolution

LED lighting is transforming the entire landscape*

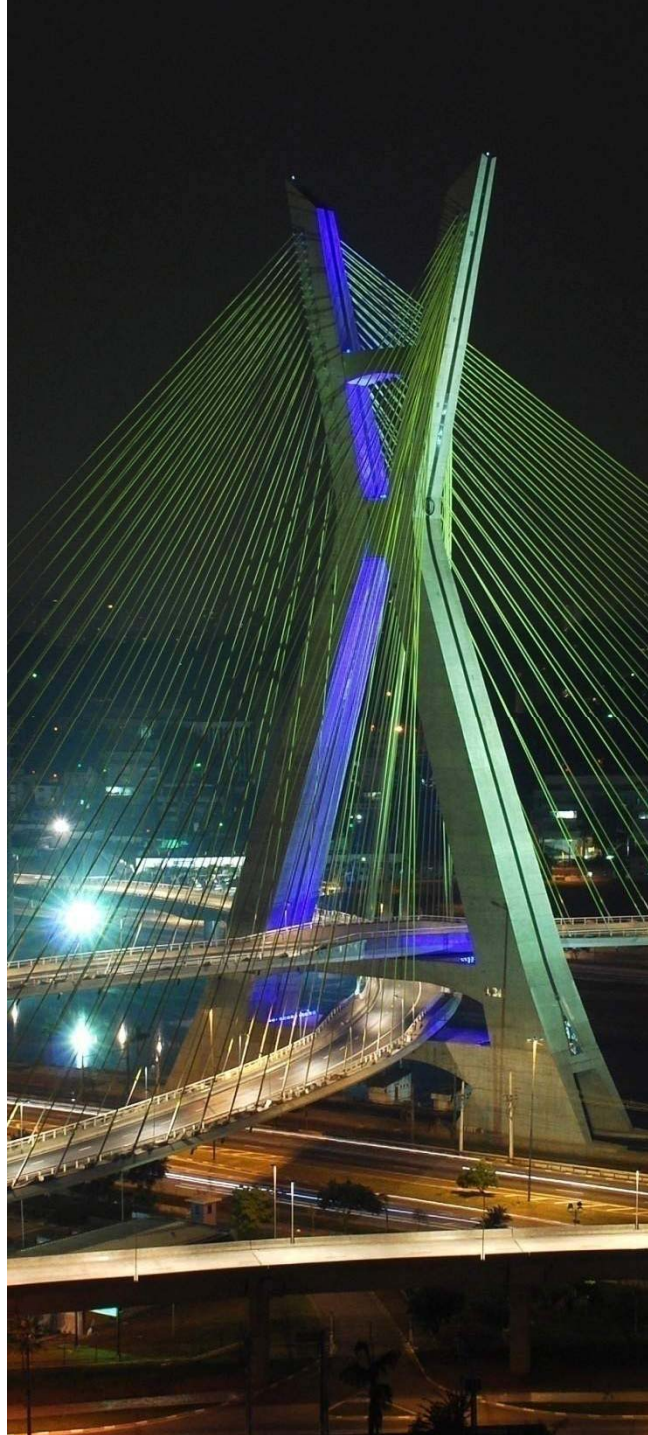




Traditional lighting

LED lighting

*Market estimate based on internal Philips study



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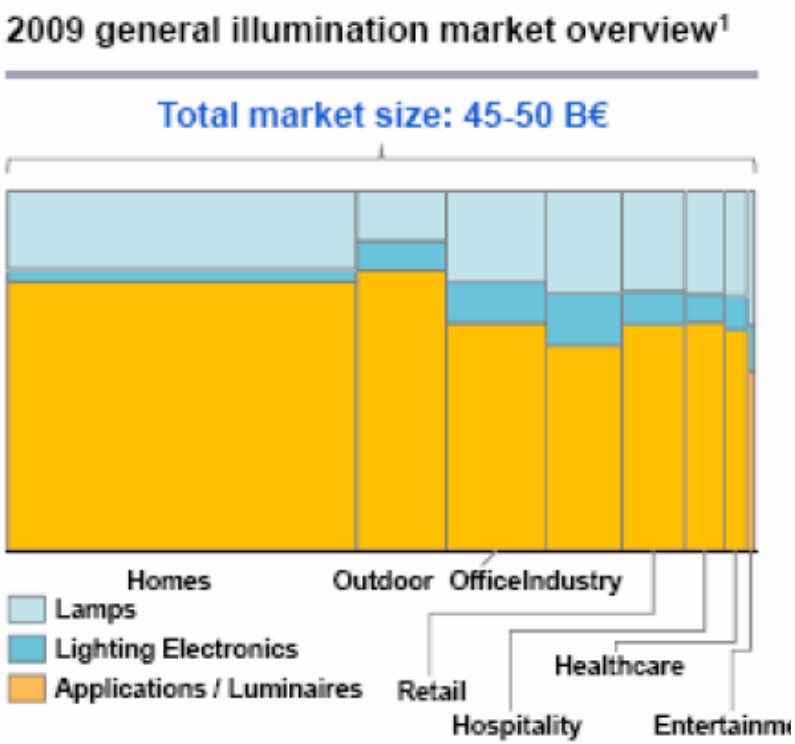
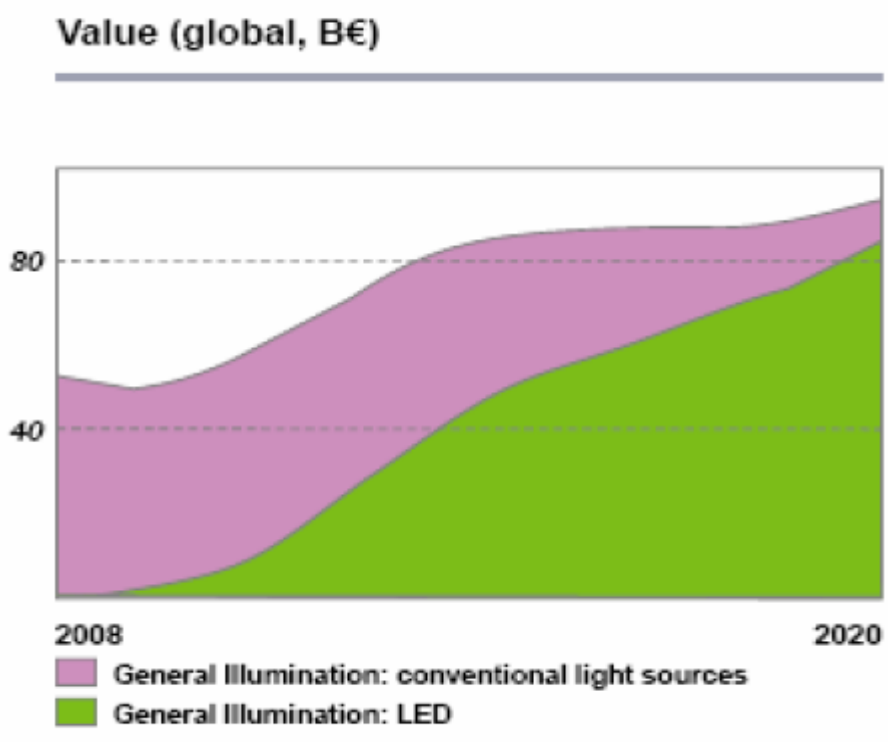
Global Trends in Lighting





Applications: ~70% and growing

CAGR 2010 - 2020: 6 %

[1] Overview excludes Automotive and Entertainment
Source: Philips Lighting

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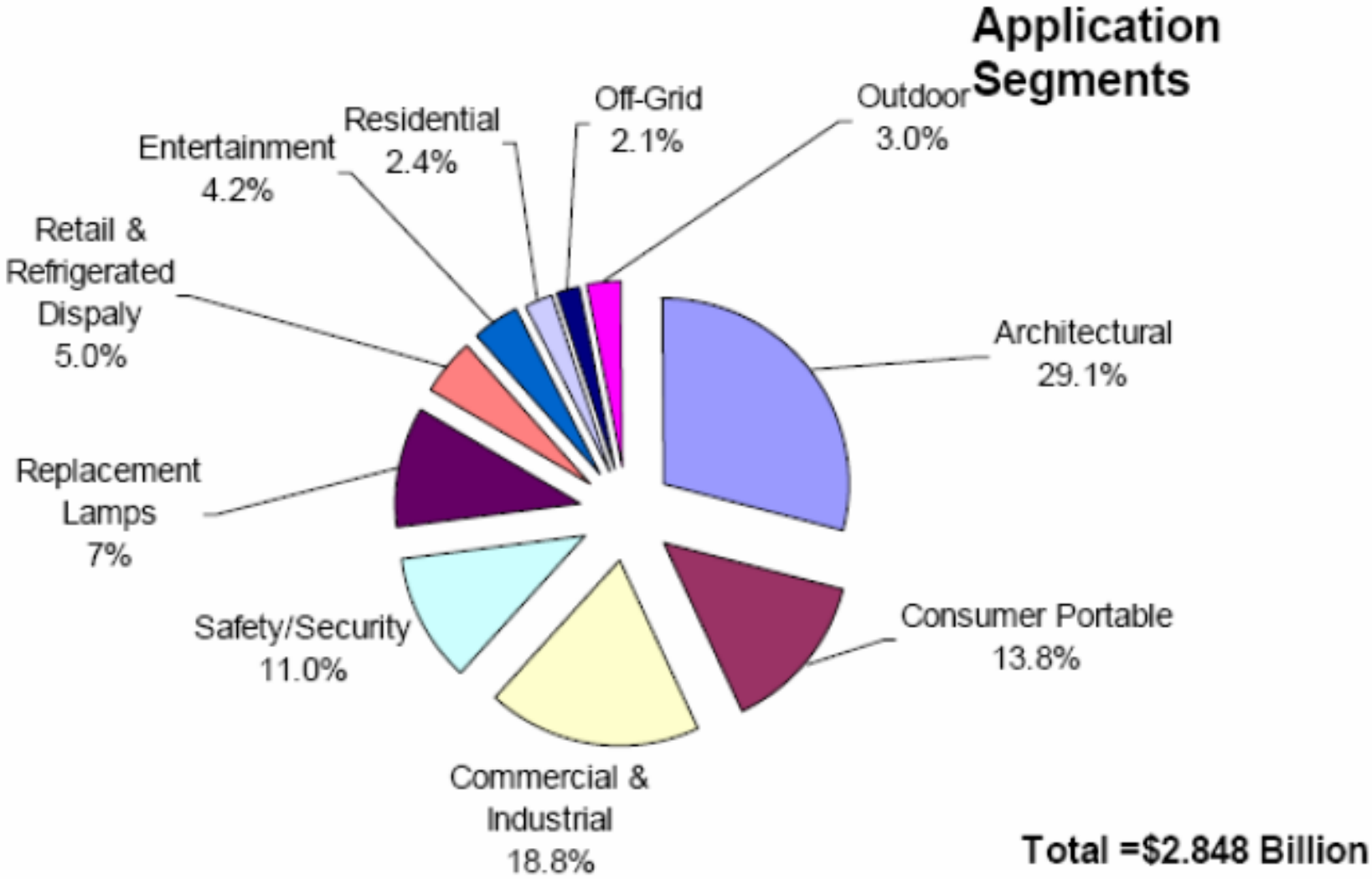
2009 Global LED Lighting Market Overview



Source: Strategies Unlimited report Mar 2010

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LEDs are reshaping the lighting industry

traditional lighting		LED lighting
technical life < economic life	⟷	economic life < technical life
limited number of options	⟷	infinite number of options
standardized products	⟷	customized products
economies of scale	⟷	economies of scope
traditional market channels	⟷	completely new channels
limited number of light points	⟷	huge number of light points

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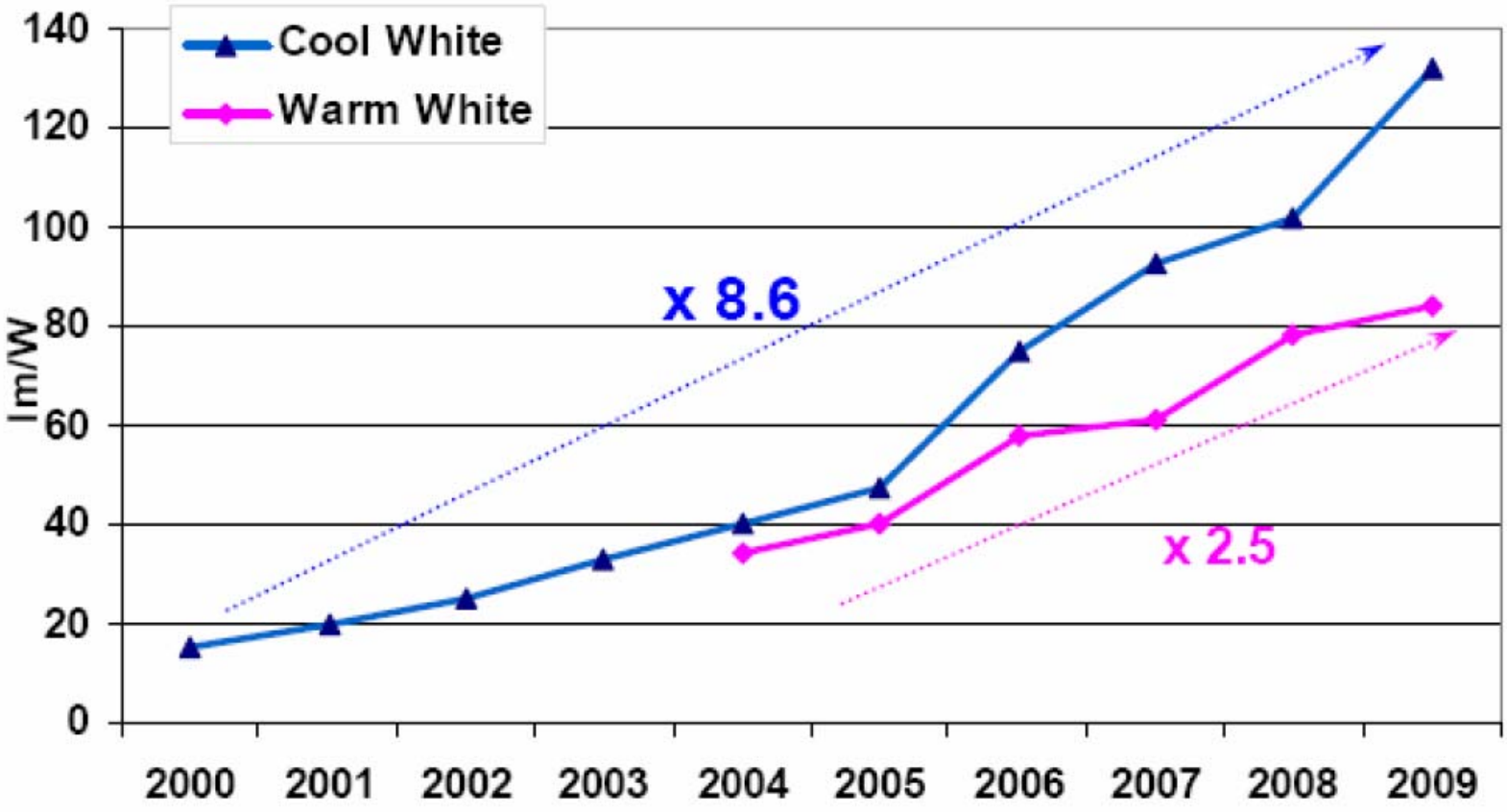
Evolution of White LEDs - efficiency



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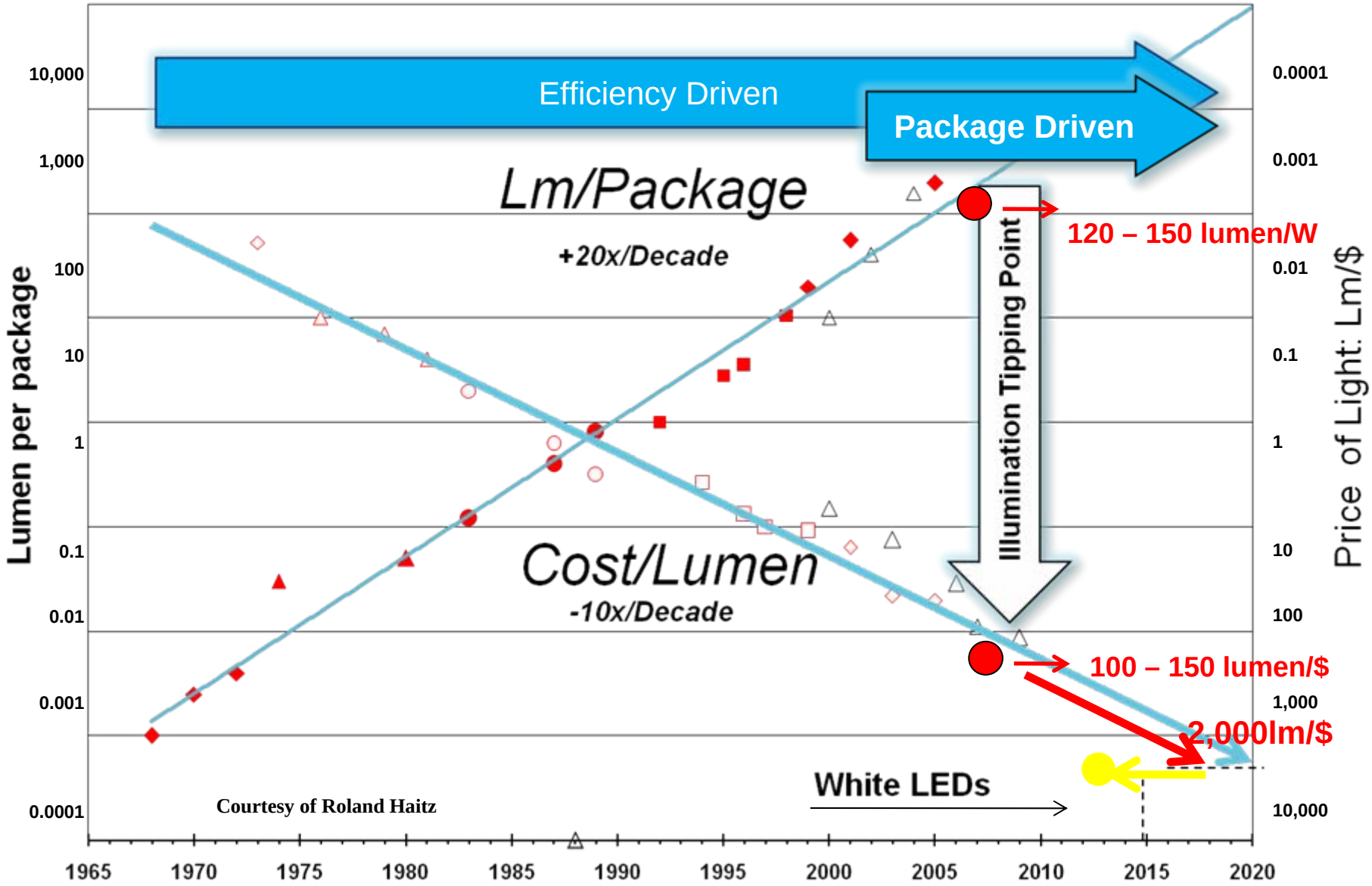
Haitz Law - LED Performance, lm/$



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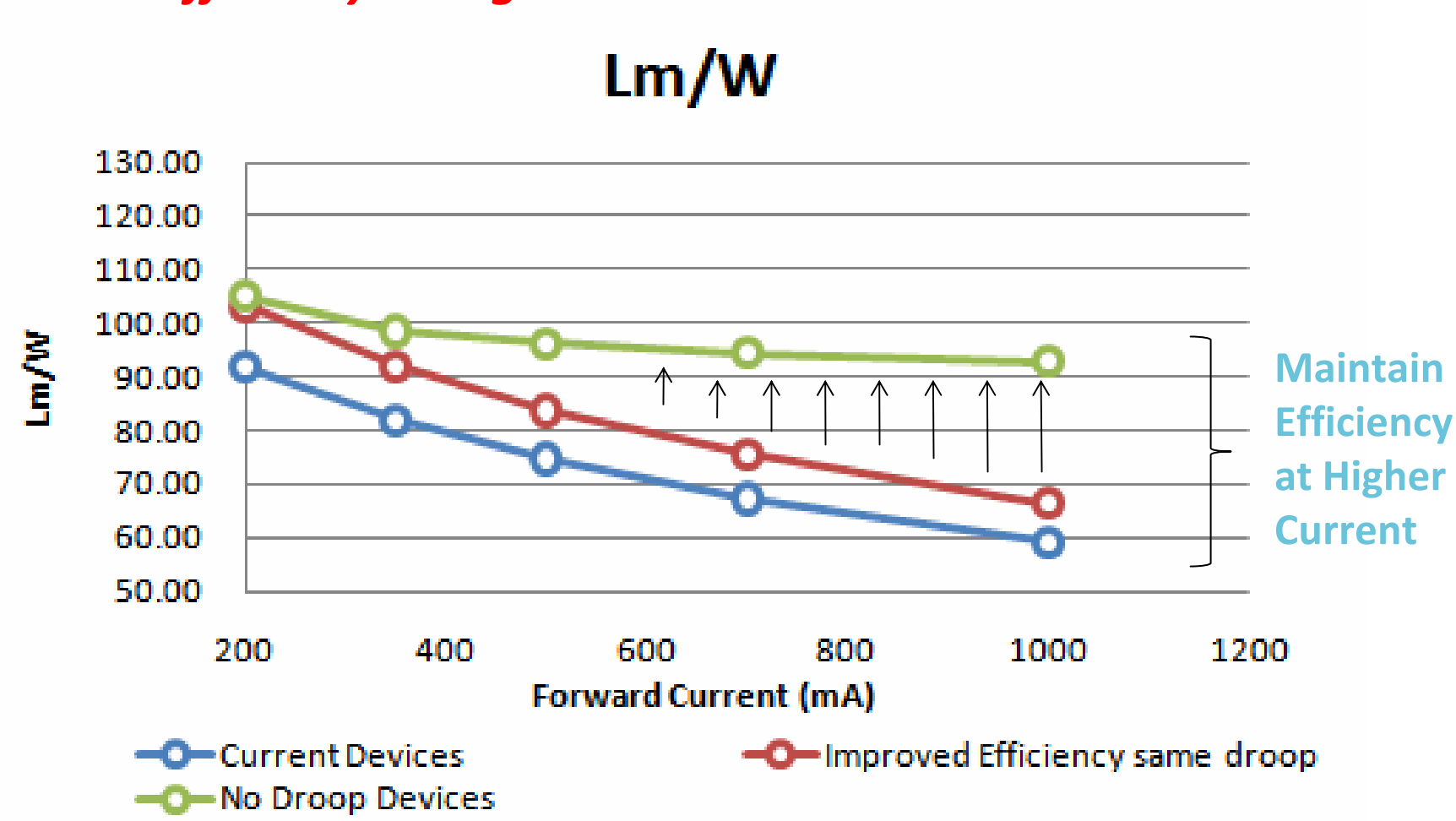
Reducing Droop

"More Efficiency at High Currents"



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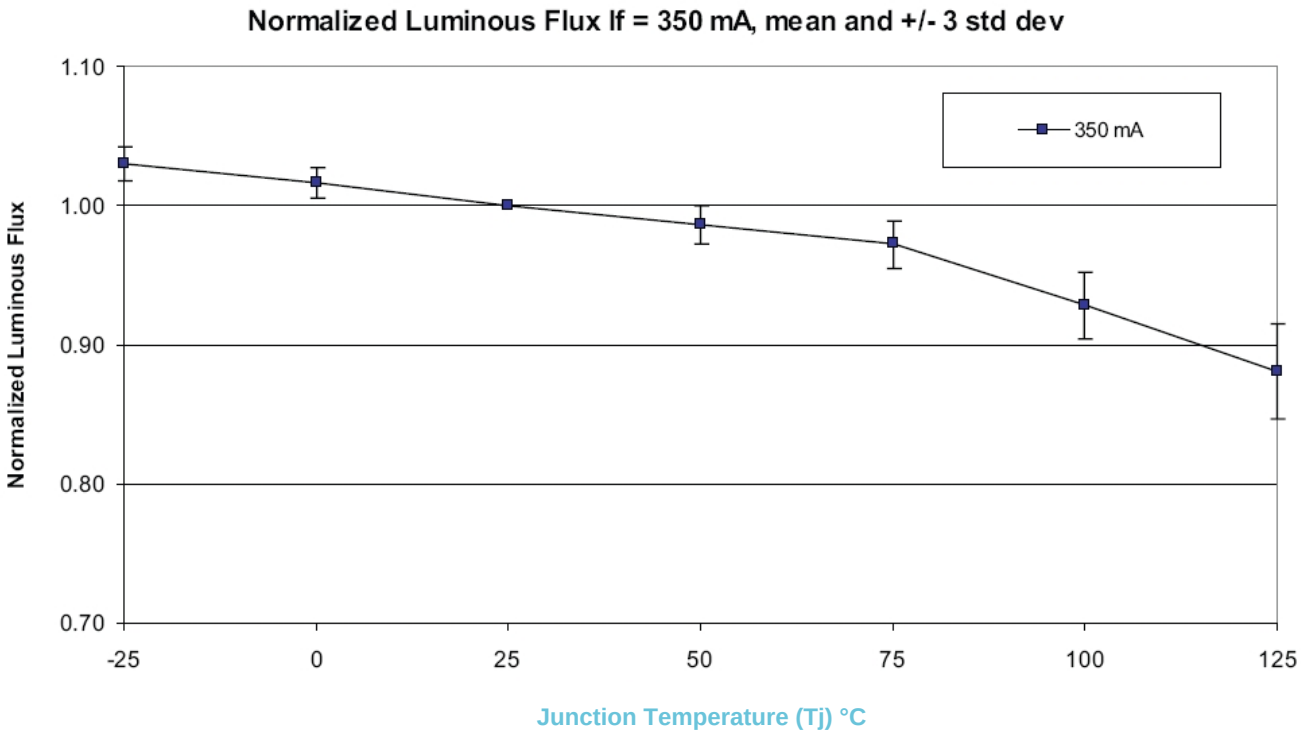
Improved Hot / Cold Factor

"More Light in the Application"

Significantly improved usable light under normal operating conditions

- i.e. 100°C junction temperature
- Simpler design effort for luminaire manufacturer



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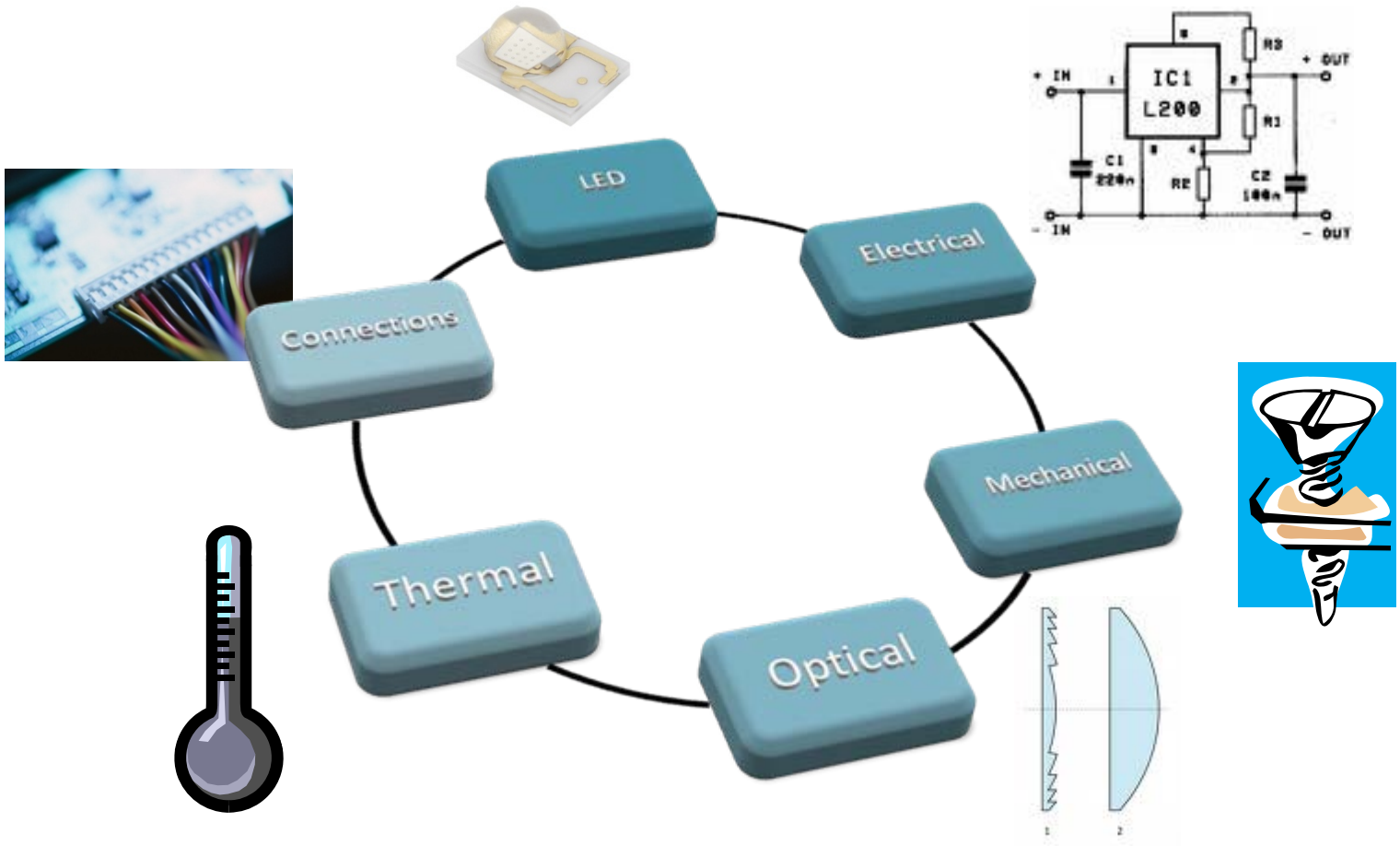
Luminaire Reliability ≠ LED Reliability



$$R_{system} = R_{electrical} * R_{connections} * R_{LEDs} * R_{optical} * R_{thermal} * R_{mechanical}$$

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LEDs in India

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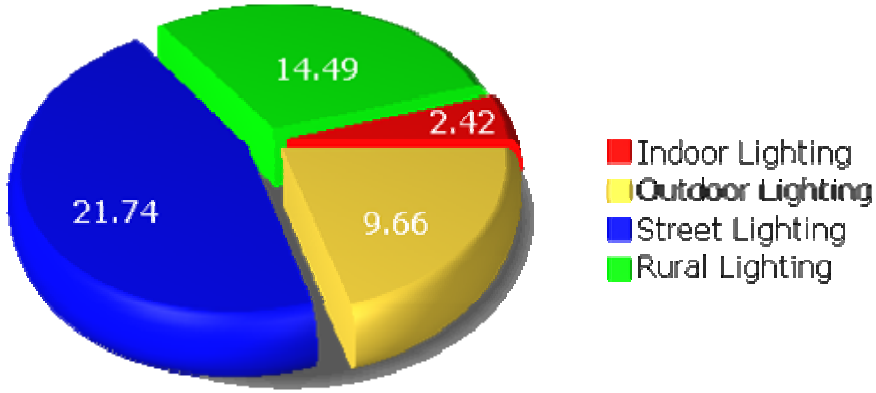
2009 Indian LED Lighting Market

- The Indian LED Lighting Market expected to reach $416.6 Million by 2014 from $48.3 million in 2009.
- Street Lighting to account for close to half the market revenues in 2012.
- Higher Integration and design capabilities will be a crucial success factor for quick adoption



Values in $ Million

Source: Frost and Sullivan report 2010

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Indian LED Lighting market estimated to grow at 53.9% till 2014 !

Growth Drivers

- Investment by the government in energy efficient lighting systems
- Decline in the average prices of LEDs
- Quick RoI to drive adoption
- Improvement in technology addressing new applications
- Global mandate to arrest global warming and migration to technologies like LED

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Implications of LED Technology for Industry

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New Opportunities opening up












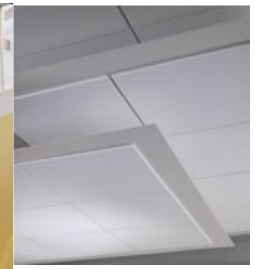

The Early Years

- Traffic Signal
- Automotive Tail Lamps
- Signage, gadgets

Current

- Architectural
- Entertainment
- Specialty, Automotive headlamp

New Opportunities

- General Illumination

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Value chain evolution to address LED Lighting

Solutions provider

- Solutions designed around people
- Modular, flexible, interoperable
- Selling to specifiers and end users
- Business model innovation
- Services innovator
- Integrated project management
- Intelligent lighting systems
- New software standards

Systems integrator

- Partnership with our customers
- Efficient integration of products
- Leveraging lighting controls
- Cost effective systems

Product champion

- Standard products
- Standard product lifecycles
- Technology driven
- Selling to trade channels
- Industrial scale

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Industry risks

- Lack of LED standards in industry
- Mis-declaration of technical information
- Performance and reliability issues in actual field conditions
- Blindly substituting conventional lighting with LED , irrespective of their suitability

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Implications of LED Technology for Users

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Creating new effects

Buckingham Palace – London, United Kingdom
Lighting Design: Philips Lighting

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Replacement for energy savings

Town Hall – Rotterdam, The Netherlands
Lighting Design: Primo Exposures

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Embedding in Architecture

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ANANDPUR SAHIB GURUDWARA

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Gadkari Rangayatan - Thane

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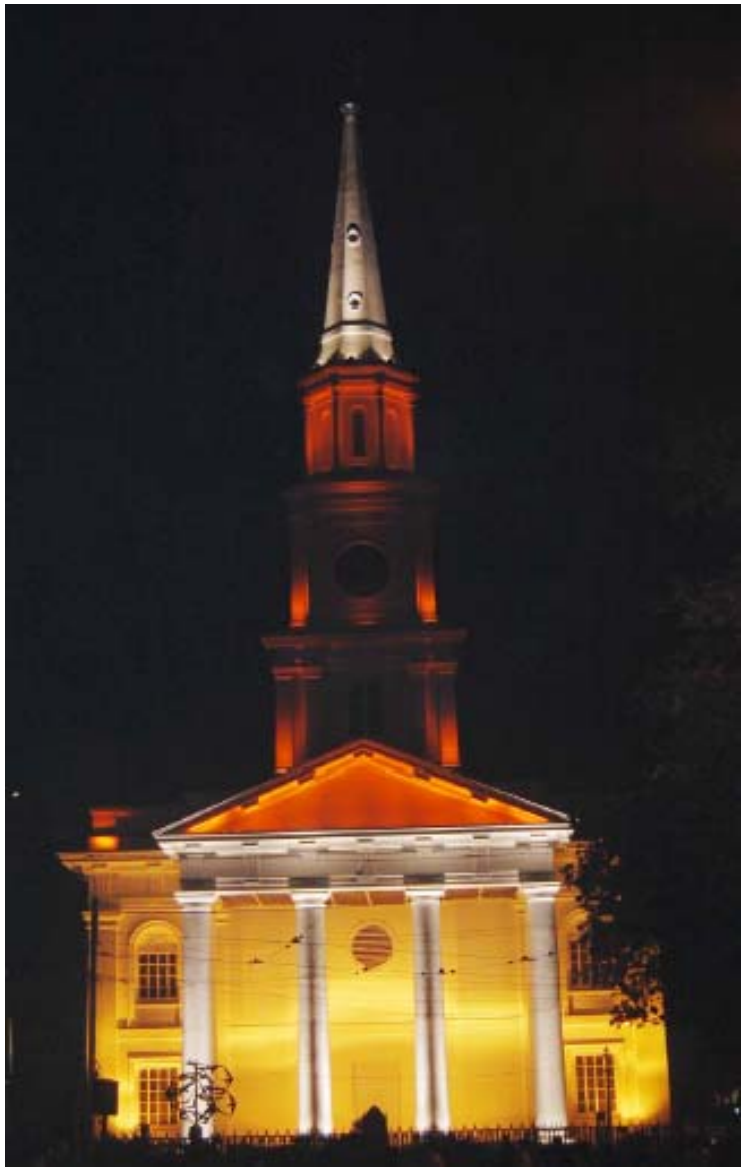
St.Andrews Church - Kolkata



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Benefits for Users

- Reduce Energy consumption and operating costs
- Promote Sustainable image with clients / customers
- Meet commercial Energy consumption requirements
- Use modern architectural elements
- Minimize maintenance and service costs

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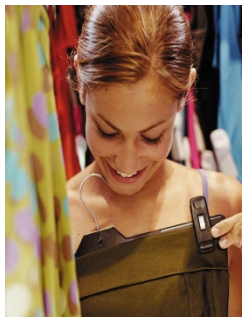
Ideal applications

- all accent applications

  small display units like jeweler displays, art, shelves
- retail, hospitality and offices
  commercial settings
- ambiance creation
  chandeliers and sparkling lights
- 24/7 operation
  corridors, lobbies
- hard to maintain or replace
  escalators, elevators, high ceilings



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Risks for End Users

- LEDs not meeting claims of manufacturer / supplier
- Cheap LED solutions not giving real benefits of LED solutions – less light output / low life
- Colour perception of interiors not appearing similar with LEDs from different manufacturers
- Evaluations not done for actual real conditions of applications – Ambient temperatures / Humidity / power fluctuations.

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Conclusion

- LED Technology is still evolving fast and will continue to develop at a very fast pace

- Manufacturers need to establish the standards for LED lighting in this scenario

- Users should adopt LED Lighting solutions after due evaluation of the performance of the products on comparable conditions


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