

# PHILIPS

sense and simplicity

## Solid State Lighting

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Philips Lighting

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## What is Solid State Lighting (SSL)?

- SSL is lighting based on Semiconductor Device called Light Emitting Diode (LED)



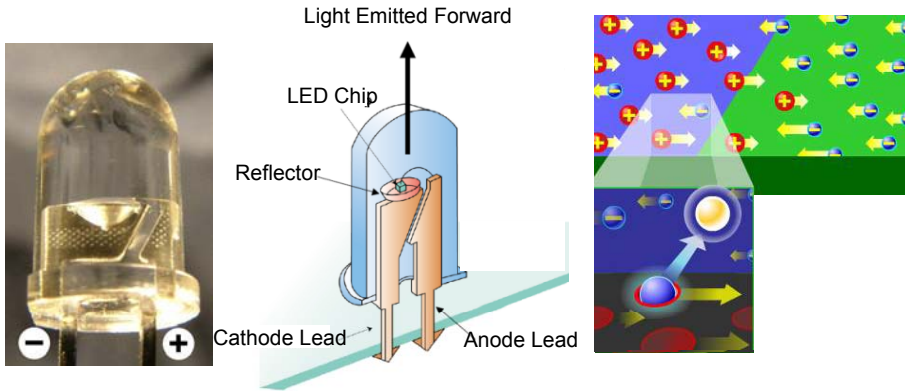
- SSL can create Dynamic Ambience & Dramatic Effects Reliably & Affordably.



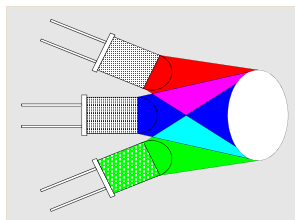
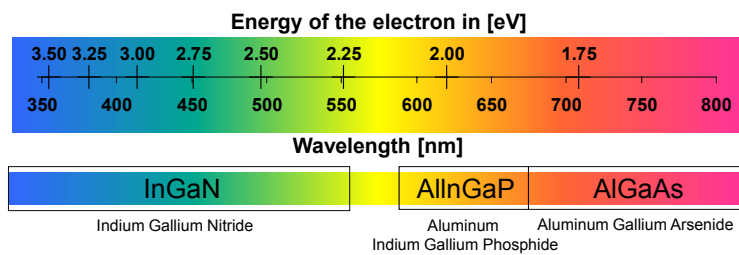
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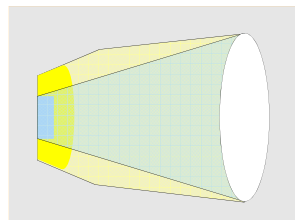
# LED Principle



# Light Colours & White Light



RGB Mixing



Blue Emission w/ Phosphor Coating

## Comparing SSL to other lighting sources

### Conventional lighting sources

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



**NEON**

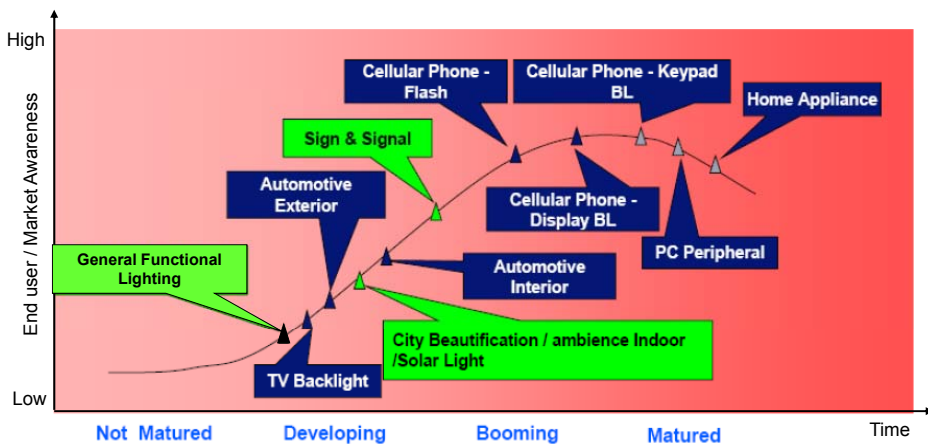


### SSL - Light Emitting Diode (LED)

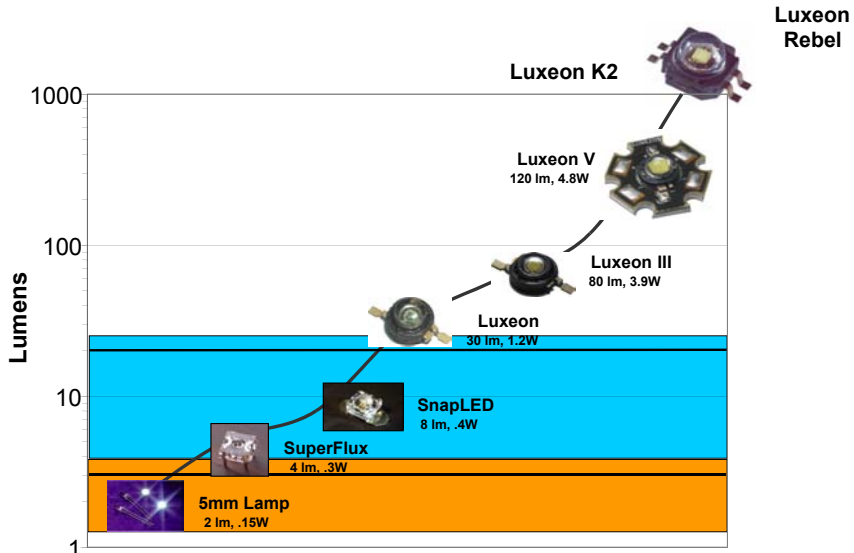
- Advantages of LEDs
  - Long lasting
  - Low maintenance
  - Energy efficient
  - Robust and vibration proof
  - Directed light (= increased efficiency)
  - Dynamic (digitally) color control
  - Turn on instantly
  - No mercury
  - No IR and UV radiation in the beam
  - Cool beam of light
  - Small,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



## SSL Application Curve



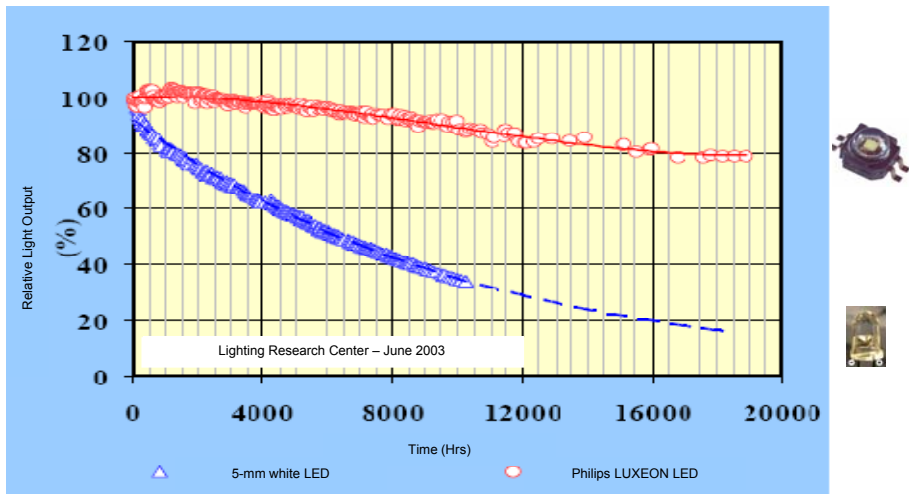
# 5mm LED to Luxeon Rebel



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# Lumen Maintenance in LEDs



**LEDs do NOT last forever !!!!**

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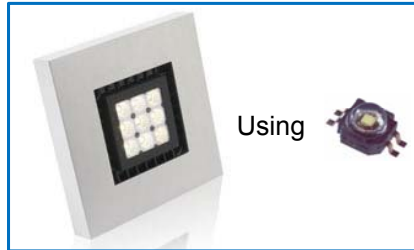
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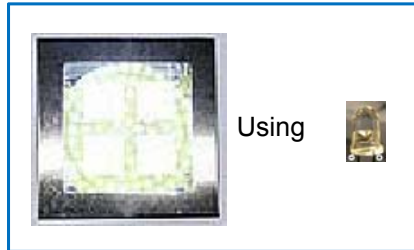
LEDs do NOT last forever !!!!



Incorrect



Last Longer Than



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Driving Current => Luminous Efficacy

Current (mA)	350 <sup>a</sup>	1000 <sup>a</sup>	2000 <sup>b</sup>
Luminous Efficacy lm/W	150	112	86
White Flux (lm) CCFL 4600K	138	331	562

Example only

Higher Current through LED does not mean Higher Light Output

3 Watt LEDs are NOT brighter than 1 Watt LEDs !!!!

Notes

a: Pulsed measurement (pulse width: 10  $\mu$ s; duty factor: 1%)

b: Single pulse measurement (pulse width: 20 ms)

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3 Watt LEDs are NOT brighter than 1 Watt LEDs !!!!



Not Valid For LEDs



Driving 3 LEDs @ 1W each

Is Better Than



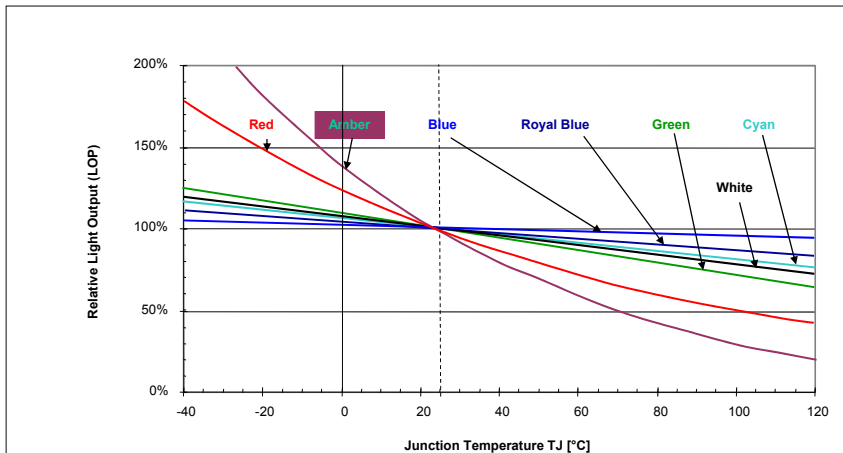
Driving 1 LED @ 3W

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Junction Temperature v/s Light Output



**LEDs generate heat but do not radiate heat !!!!**

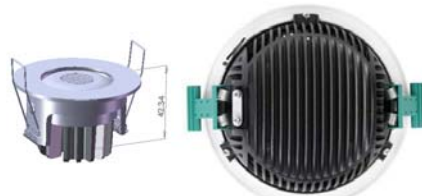
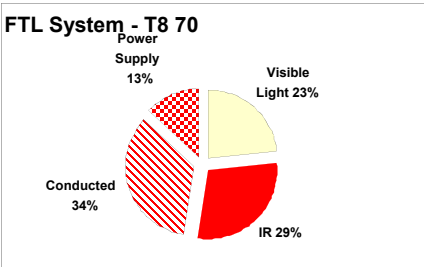
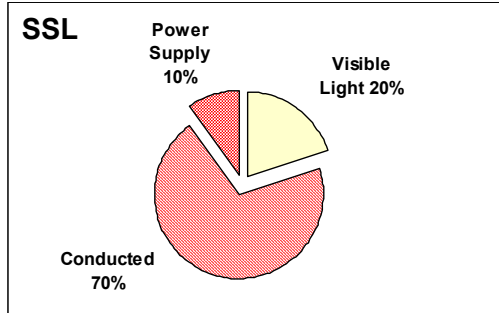
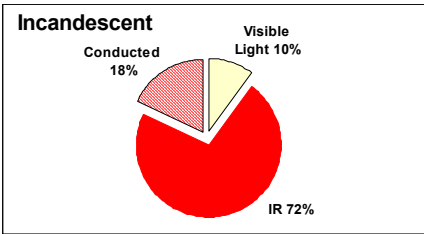
Proper heat-sinking is MUST for extracting generated heat

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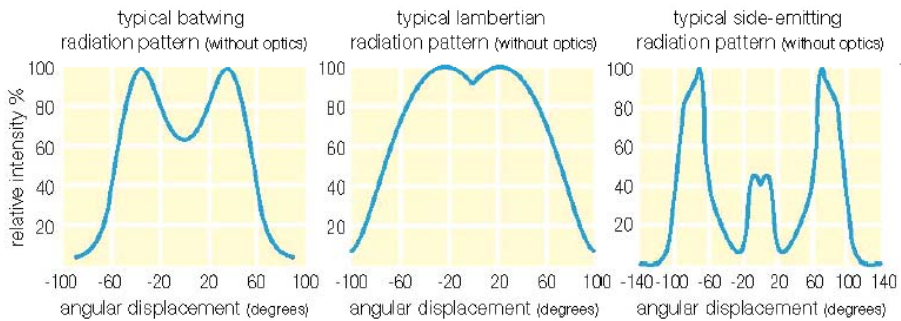
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## LEDs generate heat but do not radiate heat !!!!



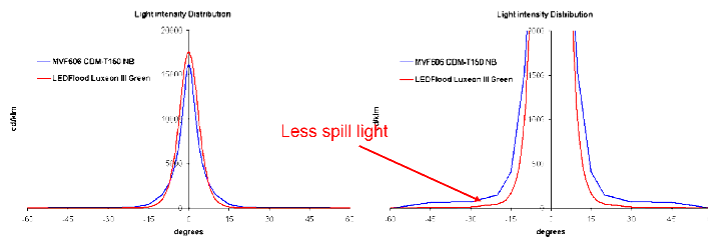
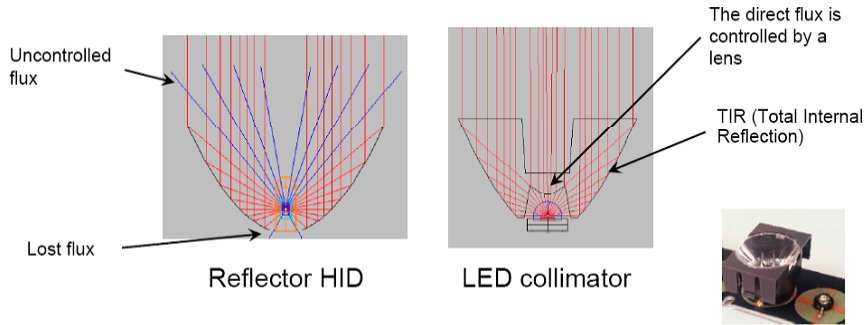
Heat Sinks on SSL Products

## Directed Light – Advantage LED

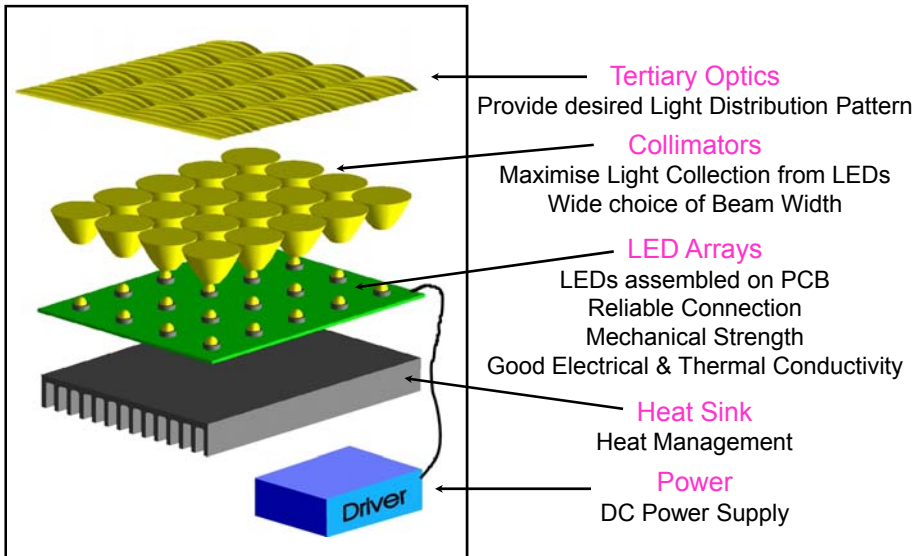


Spatial Radiation Patterns from LEDs

## Directed Light with Optics – Increased Efficiency



## SSL Luminaire – Is a Integrated Product



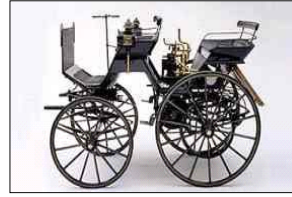


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## Early Adaptors & Hybrids



Horse Drawn Carriage



Horseless Carriage



LED Bulb



LED Tube

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## Current SSL Luminaires



BC07 12 LUX



BC0855 LUX

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