



# Outdoor Lighting

Basics of lighting

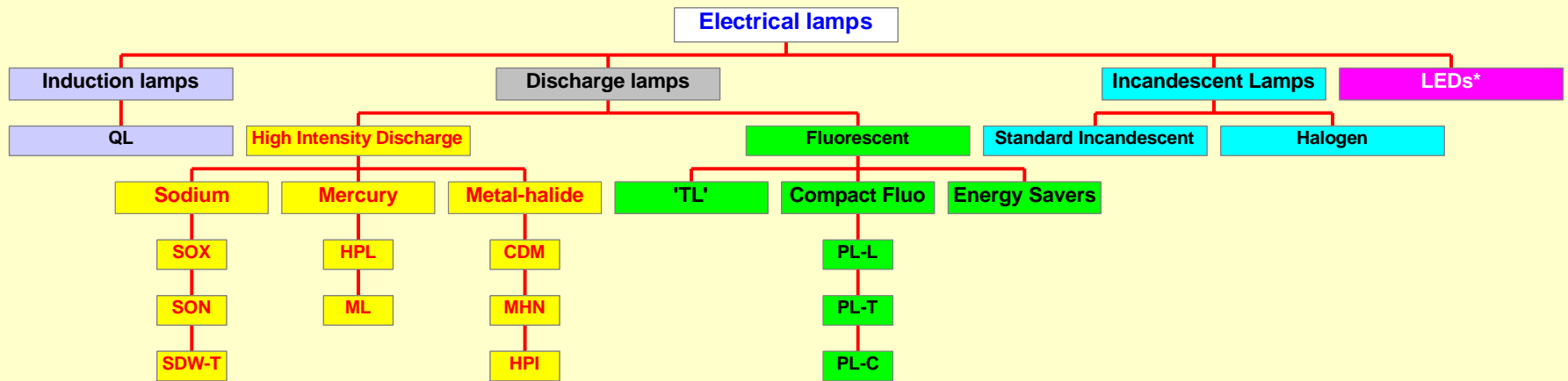


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# The Lamp Family



\* Light Emitting Diodes

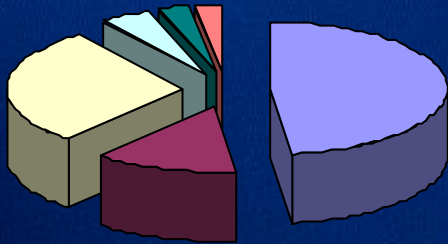
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# Lamps in Europe

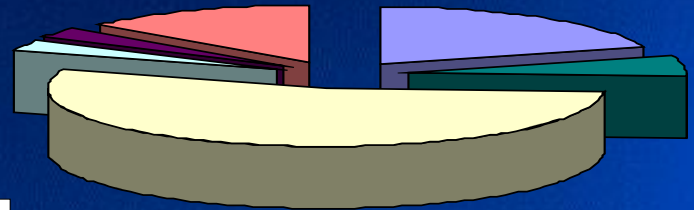
## Lamps Quantities



48 %  
13 %  
30 %  
5 %  
3 %  
2 %

■ Incandescent  
■ Halogen  
■ Fluorescent TL  
■ Energy Savers  
■ Compact Fluo  
■ H.I.D.

## Light Output



20 %  
6 %  
54 %  
3 %  
3 %  
14 %

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# Five Important Characteristics

- **Luminous efficacy** lumen/watt
- **Light output** lumen
- **Colour temperature** Kelvin
- **Colour Rendering Index** CRI
- **Service lifetime** hours

# Luminous Efficacy : Lumen/Watt

**Power consumption is responsible for :**

- >90% of total environmental impact by lighting
- A considerable part of total lighting costs

**Lumen/Watt =  
a good environmental index**

# Light Output : Lumen

## Light output determines :

- Possible light levels (lux, cd/m<sup>2</sup>)
- Number of luminaires needed

## Compact intense light sources are :

- Easier to control the light
- More difficult to dim

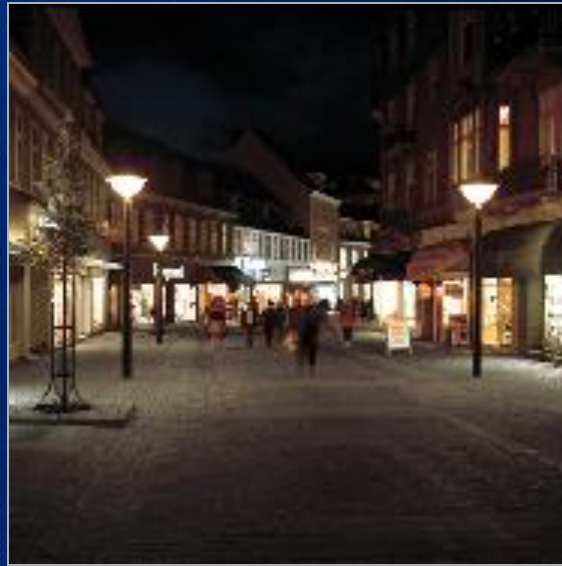


# Colour Temperature : Kelvin

Determines Light Appearance



**2000 K**  
golden yellow



**2700-3000 K**  
warm white



**4000 K**  
cool white

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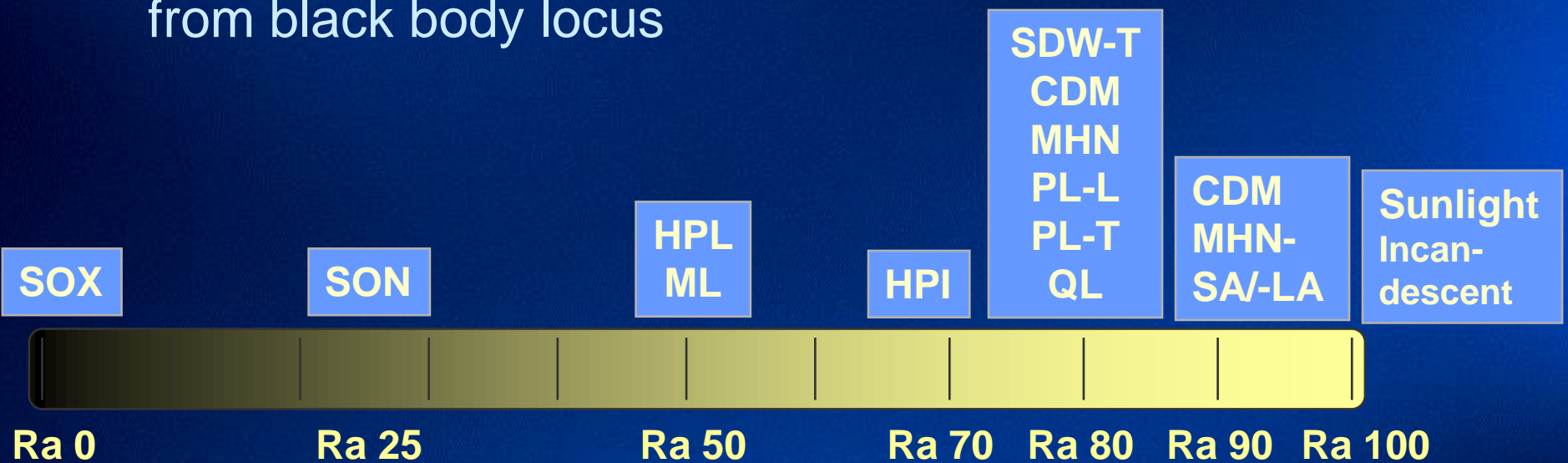


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# Colour Rendering Index (CRI)

## Ra 0-100

- Capability to render colours
- Does not specify how colours deviate from black body locus



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# Service Lifetime : hours

## Average rated life

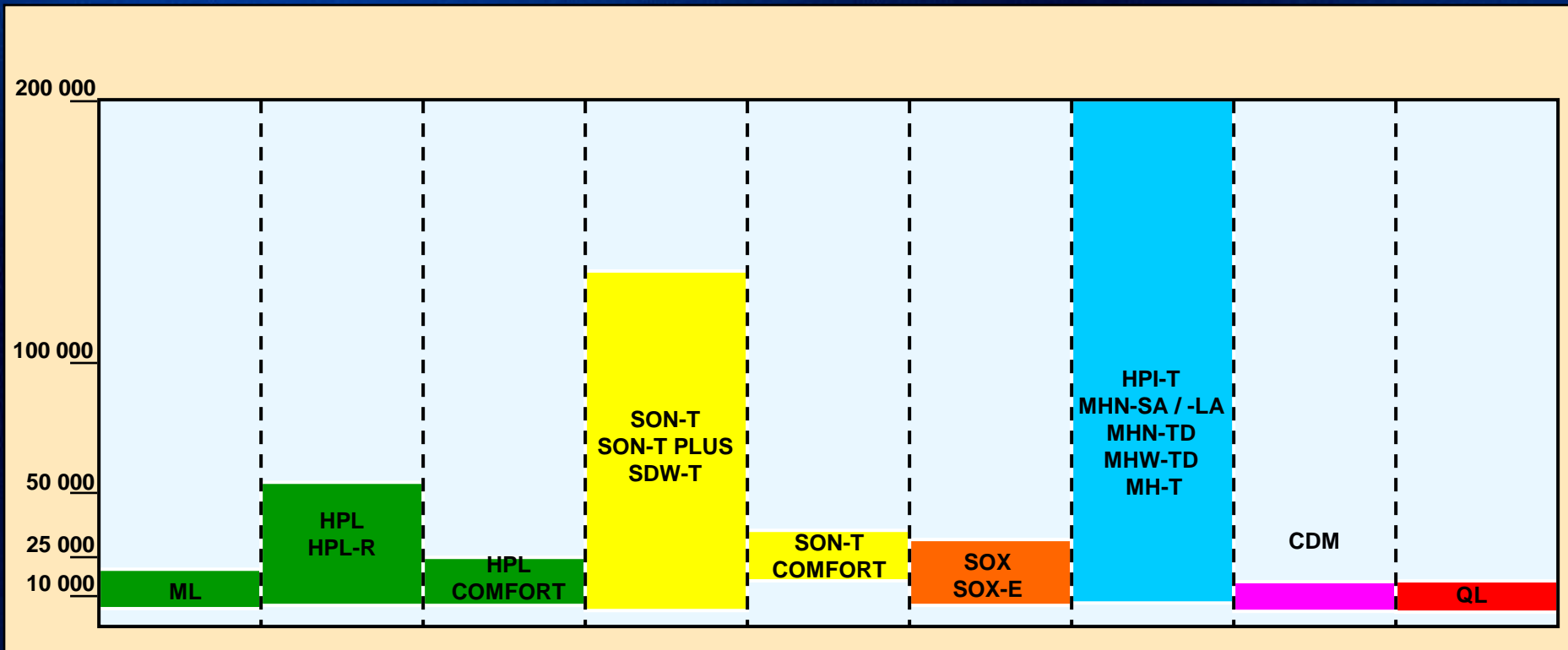
- 50% lamp failures
- Light depreciation?
- Premature failure?

## Service lifetime

- 80% retained light in installation
- Lumen maintenance x lamp survivors
- Advised period for relamping

**Service life =  
a good quality indication**

# Luminous Flux - range

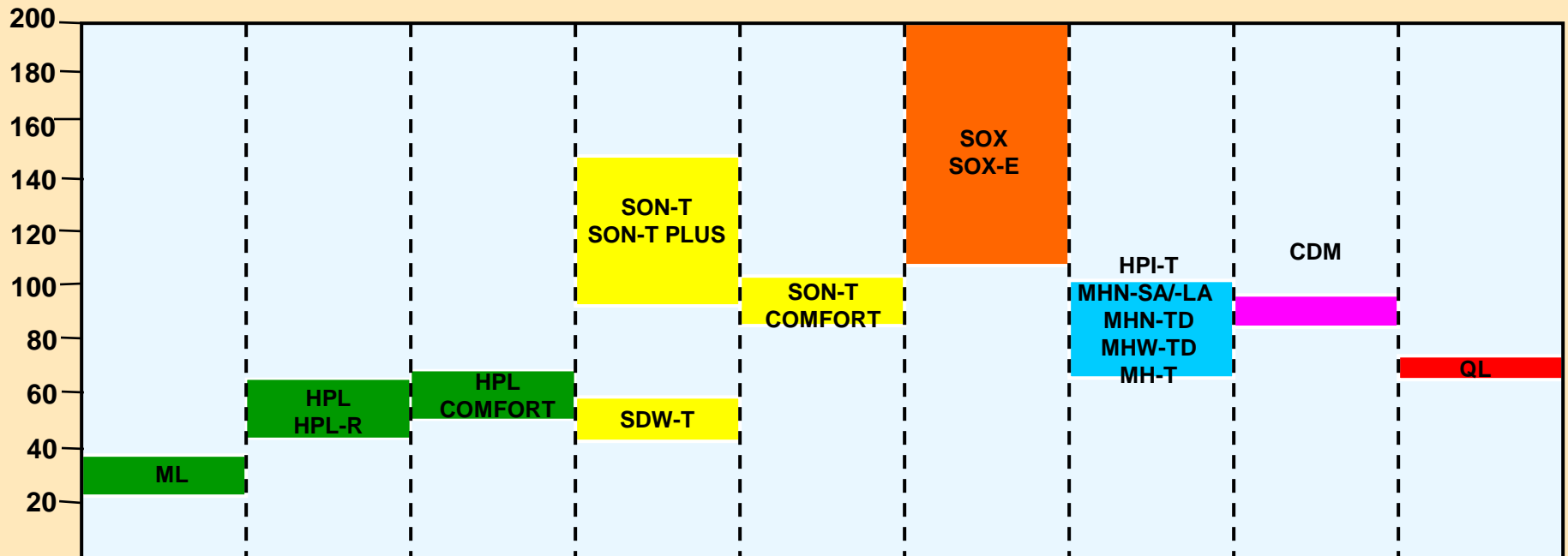


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# Lamp Efficacy - range



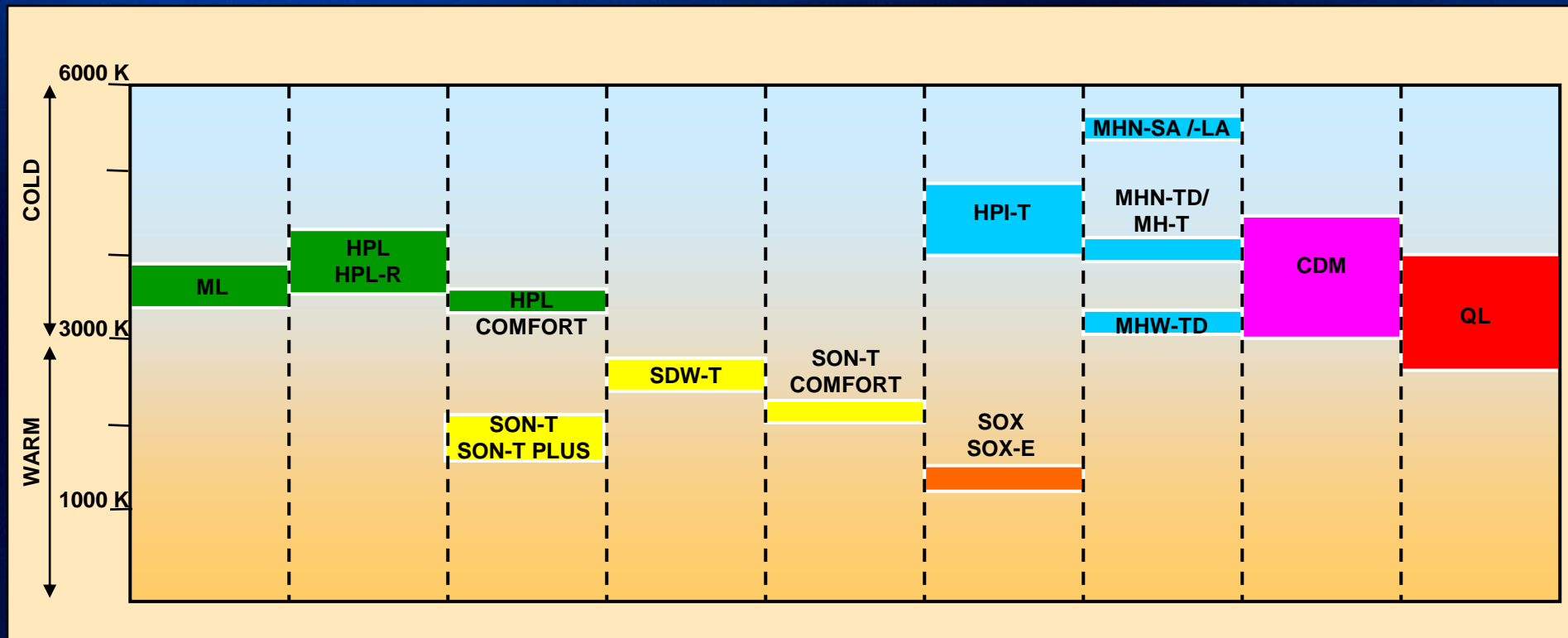
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# Colour Temperature - range

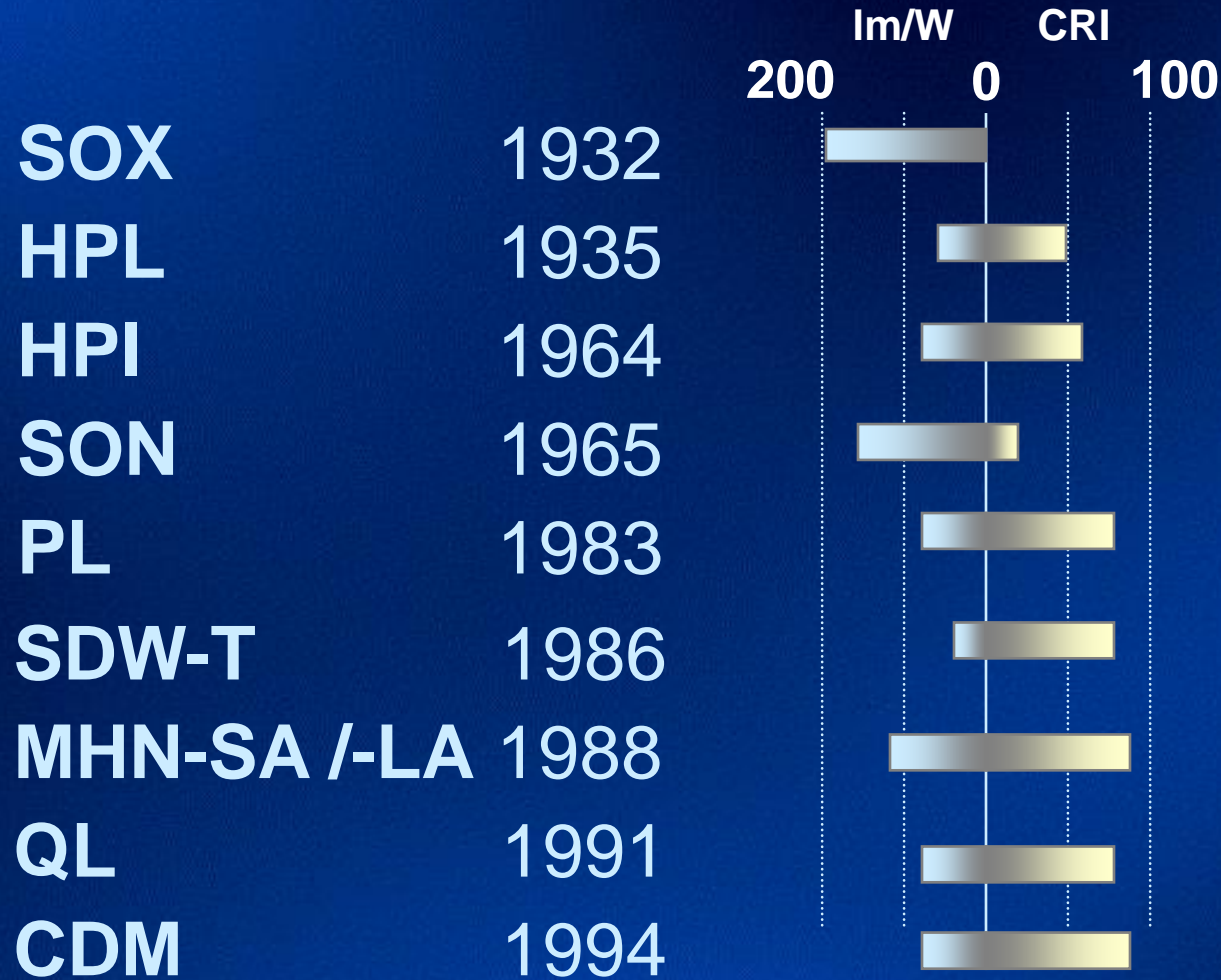


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# Development – Discharge Lamps



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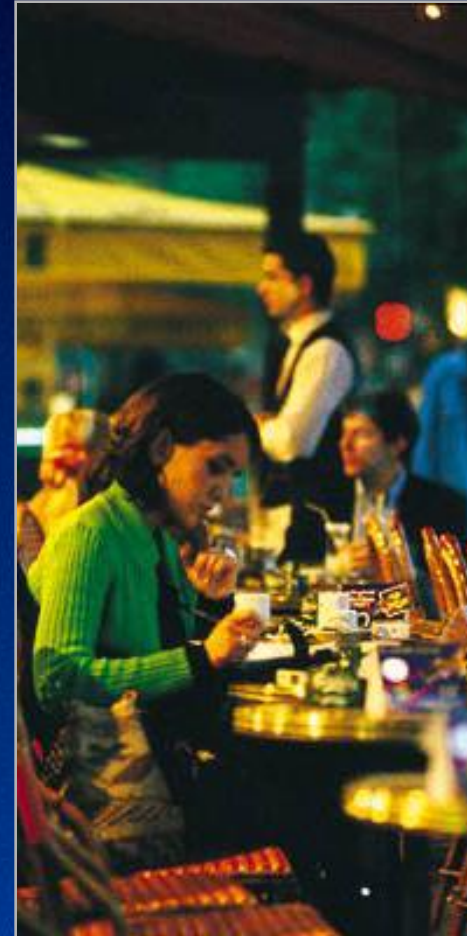
# Lighting Requirements

## Functional lighting

- Safety
- Security
- Orientation

## Decorative lighting

- Attract people
- Create identity
- Create atmosphere / ambience
- Attract attention





# Lighting Requirements

## Application segments

- Functional Road & Tunnel Lighting
- Decorative Outdoor Lighting
- Sports Lighting
- Area Lighting
- Horticultural Lighting

# Functional Road & Tunnel Lighting

## Functional lighting

- Traffic safety
- Total cost of ownership
- Energy consumption
- Spot or group replacement



## Suggested light source

- MASTER SON PIA
- MASTER SOX-E
- MASTER PL-L Outdoor

| Requirements |         |
|--------------|---------|
| Efficacy     | ★ ★ ★   |
| Output       | ★ ★ ★   |
| Colour Temp. | ★       |
| CRI          | ★       |
| Service life | ★ ★ ★ ★ |

# Decorative Outdoor Lighting

## Lighting for people

- Residential areas
- Shopping areas
- City centres
- Parks & greeneries
- Facades & monuments



## Suggested light sources

- MASTER Colour City
- MASTER White SON
- MASTER PL-L Outdoor
- MASTER PL-T /-C
- MASTER QL
- MASTER HPI-T Plus
- ArtColour MH-T Pro

### Requirements

Efficacy



Output



Colour Temp.



CRI



Service life



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# Sports Lighting

## Recreational

- Functional lighting

## Competition/Professional

- High colour quality
- Limited burning hours

## Light sources

- MASTER SON PIA
- MASTER HPI-T Plus
- HPI-T Pro

## Light sources

- MASTER MHN-SA
- MASTER MHN-LA

### Requirements

|              |       |
|--------------|-------|
| Efficacy     | ★ ★ ★ |
| Output       | ★ ★   |
| Colour Temp. | ★     |
| CRI          | ★     |
| Service life | ★ ★ ★ |



### Requirements

|              |       |
|--------------|-------|
| Efficacy     | ★ ★   |
| Output       | ★ ★ ★ |
| Colour Temp. | ★ ★ ★ |
| CRI          | ★ ★ ★ |
| Service life | ★     |

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# Area Lighting

## Functional lighting

- Working areas
- Storage areas
- Transshipment areas
- Shunting yards



## Suggested light sources

- MASTER SON PIA
- MASTER HPI Plus
- HPI-T Pro

### Requirements

|              |       |
|--------------|-------|
| Efficacy     | ★ ★ ★ |
| Output       | ★ ★ ★ |
| Colour Temp. | ★     |
| CRI          | ★ ★   |
| Service life | ★ ★ ★ |



# Horticultural Lighting

## Functional lighting

- Plant Irradiation



## Suggested light sources

- MASTER SON-T PIA Green Power
- MASTER SON-T PIA Agro

### Requirements

|              |      |
|--------------|------|
| Efficacy     | ★★★★ |
| Output       | ★★★★ |
| Colour Temp. | ★    |
| CRI          | ★★   |
| Service life | ★★★★ |