



Reducing Energy Cost, Including Energy Efficient Lighting

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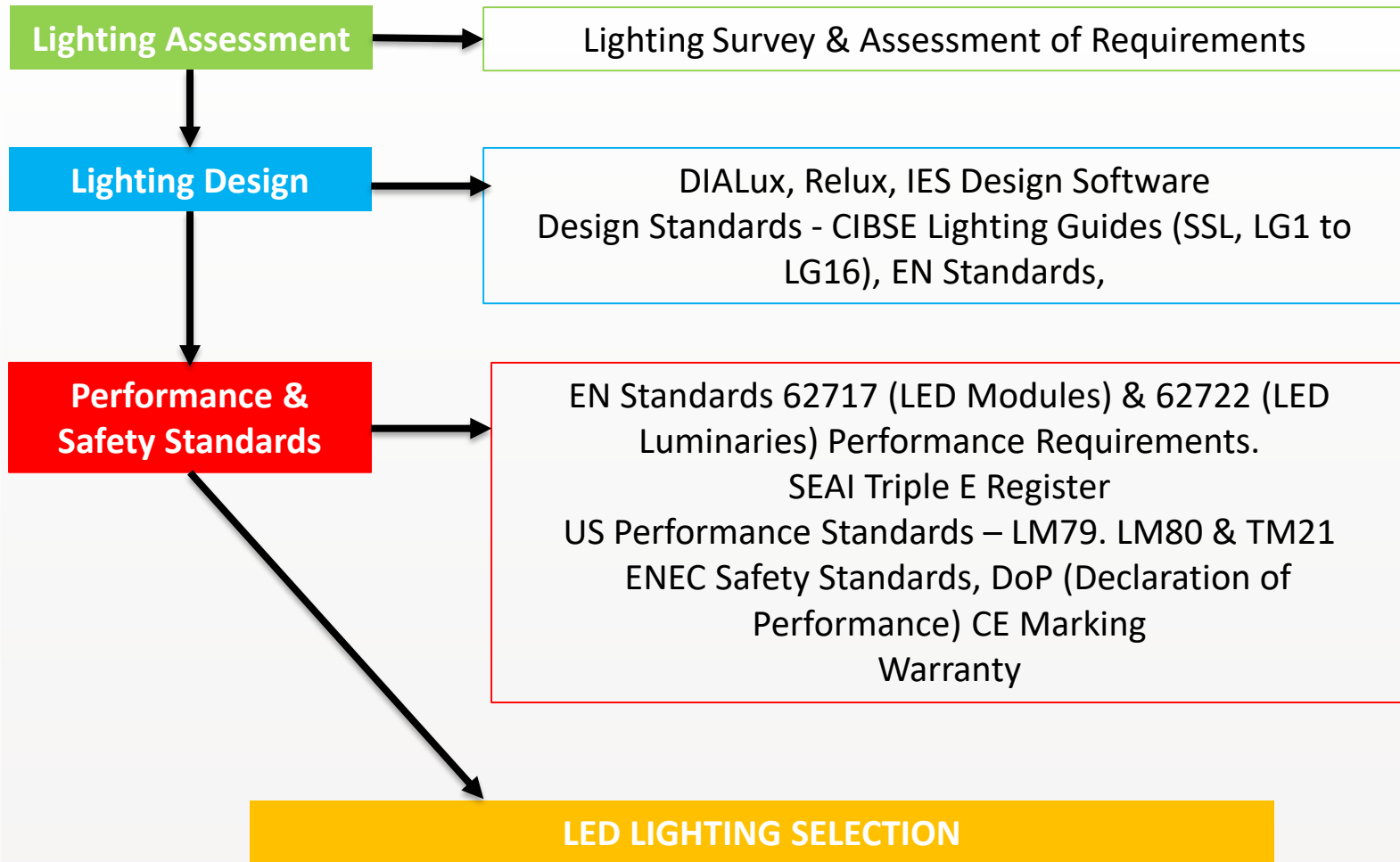
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1. The LED Lighting Retrofit Process
2. Common Issues / Challenges & Practical Considerations
3. Luminaire and Lighting Specification
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The LED Lighting Retrofit Process



Retrofit Process



Options for Lighting Retrofit



Lamp/Tube Replacement	Luminaire Replacement	Redesign Lighting
Lowest cost	Most common retrofit	Largest energy savings
May need to disconnect ballast or accept losses	Original lighting design maintained	Minimum energy to deliver required lighting levels
Lighting performance may not be acceptable	Could end up with more lighting than you need – controls essential	Can significantly reduce number of luminaires
Luminaire condition may mean replacement is necessary anyway	Wiring, earthing, switching, ceiling condition, emergency lighting may all be design issues	Challenges for certain roofs with wires penetrating or for old suspended ceilings

- Forecasted savings not materialising / inaccurate surveys
- Proposed LED retrofit do not meet forecasted quality
- Lighting quality / credentials, technical support & quality of specification
- Incidental costs – suspended/high ceilings, painting, associate electrical works, fire detection, existing wiring limitations, other services
- External fittings
- Building occupants and behaviour

Luminaire and Lighting Specification

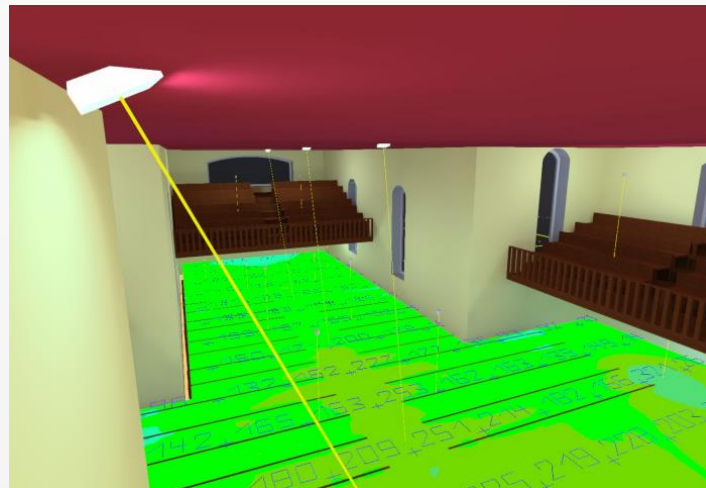


- Need to consider the following:

Lighting Specification	Luminaire Specification	Control Specification
Lighting type / dimensions	Standards / Triple-E Register	Sensor specification
Colour Temp – 3000-4000K	Efficacy	Control Interface
Lux Level (300-500 lux)	Colour Temperature	Commissioning Setpoints
Switch Arrangement, functionality	Colour Rendering Index	Control Compatibility
Wattage	McAdam Step	Light Sensor Operation
Lumen Output	Lifespan	
Maintained Illuminance	Glare	
	Warranty	

Performance Criteria

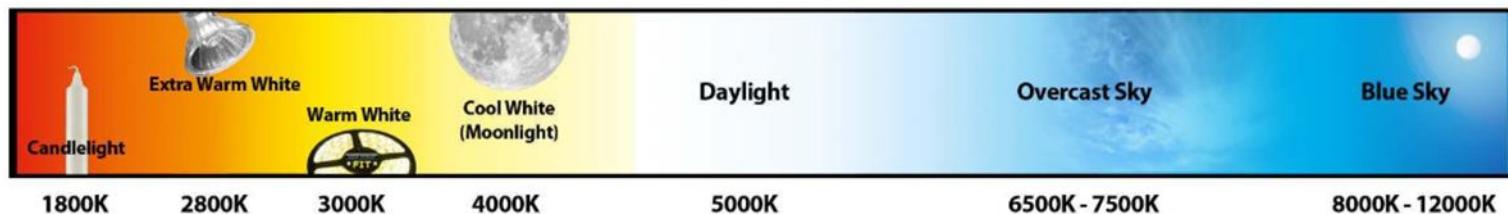
- Colour Temperature
- Colour Rendering Index (CRI)
- Lifetime of LED Fitting
- Efficacy
- MacAdam Step
- Glare



Colour Temperature

- Correlated Colour Temperature (CCT) Defines the Colour of the Light from the Fitting
- Majority of Indoor Applications are between 3000K and 4000K
- Higher CCT Fittings have Higher Efficacies. Typically LED's range from 2500K to 6500K
- Colour Consistency should also be considered (MacAdam Step 3 or less)
- CCT should not be Confused with CRI (Colour Rendering Index)

Colour Temperature Chart



Colour Rendering Index (CRI)

- Colour CRI is the Measure of the Effect on Appearances on Colours
- The Figure is Expressed as an Index of 0 – 100. Natural Outdoor Light CRI = 100
- EN12464 Light and Lighting. Lighting of Workplaces, Indoor work places recommends a CRI >80. High spec. LED's CRI >90.
- Some spaces (Healthcare) require CRI >90.
- CRI >80 is usually acceptable in most applications

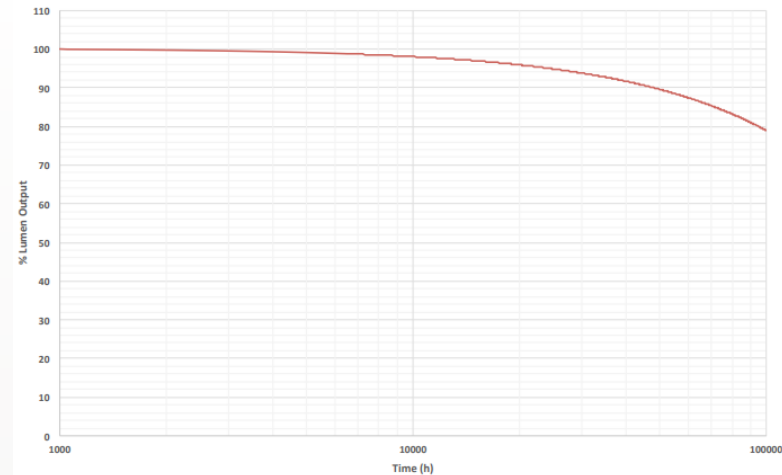


Lifetime of an LED Fitting



- Displayed as L70, B50 – 60,000hrs, L80, B40 – 100,000hrs.
- This is a measure of how many hours an LED will operate before its lumen output drops to a defined % of the initial output.
- An LED fitting is considered end of life when it reaches 70% of its initial output, i.e. L70. L80 & L90 values are now available on the market.
- The “B” value is the secondary lifetime indicator and indicates the % of chips in a luminaire that are likely to fail or have an output less than 70% (for L70) after the indicated number of hours, 50,000hrs.
- Both L and B values are based on statistical data and not hard test data. Minimum test time is 6000 hrs where luminous flux is recorded every 1000 hrs.
- When specifying look for high L values and low B values

LUMEN DEPRECIATION CURVE



RATED LIFE	
L70/B10	100,000 hours
L80/B10	95,000 hours
L90/B10	48,000 hours
60kHr Value (TM-21)	L87/B10

- One of the main selection criteria for retrofit projects
- Luminaire lumens per circuit watts (lm/cW)

$$\frac{\text{Total Lumen Output} \times \text{Light Output Ratio}}{\text{Power Consumed by the Source}}$$

- LED fittings have a light output ratio of 1
- Minimum efficacies must be achieved for LED fittings to even be considered for SEAI Triple E status. SEAI best practice 130 lm/cW
- Glare should also be considered, however it is not a definable parameter for a fitting.

Best Practice LED's

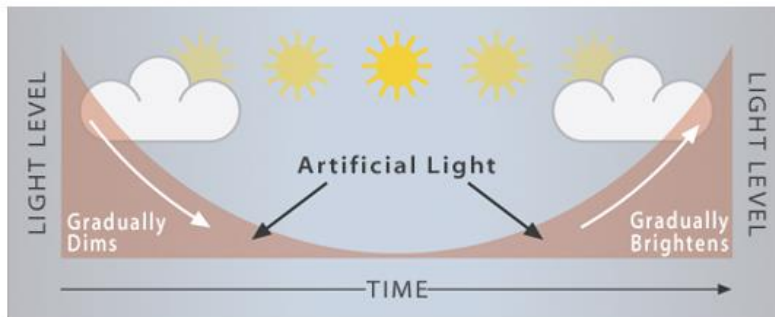


Best Practice Luminaire Spec	
Standards / Triple-E Register	YES
Efficacy	130 lm/W
Colour Temperature	4000 K
Colour Rendering Index	>80
McAdam Step	3
Lifespan	Median Useful Life: L70B50 Minimum Driver Lifespan: 50,000 hours
Control compatibility	DALI
Warranty	5 years

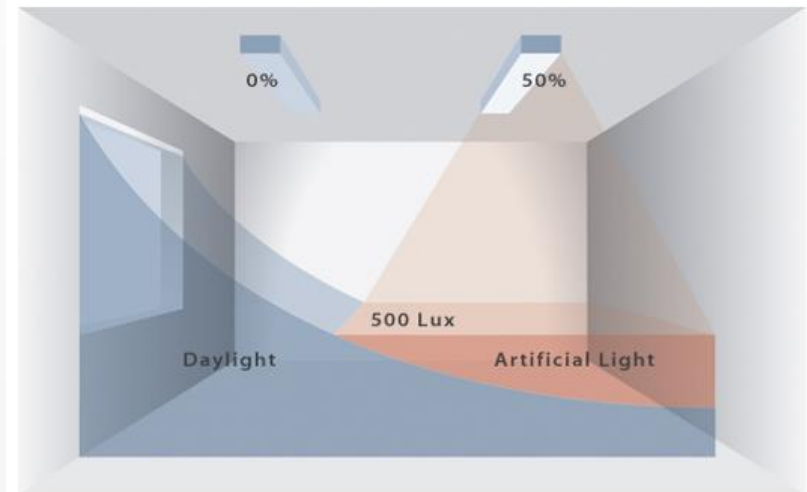
Smart Control – Light Sensor Operation

- Smart LED fittings with daylight sensing
- Natural daylight from windows and rooflights is taken into account by smart pod sensors
- As daylight increases, artificial lighting levels decrease
- All changes in light levels are made gradually, for the comfort of the users

DAYLIGHT LINKING



GRADUAL DIMMING AND BRIGHTENING



EXPLOITING DAYLIGHT

Other Areas to Reduce Energy Costs

- Switch Billing Supplier
- Solar PV
- Farm House Retrofit



Thank You

