



**It's  
time to  
protect  
the Night**



# What is Light Pollution?

There is no doubt that artificial lighting has its place in our world and is invaluable to our businesses, homes, roads and recreation. However, when used inappropriately or excessively, artificial lighting can cause light pollution.

In broad terms, there are three types of light pollution:

## skyglow



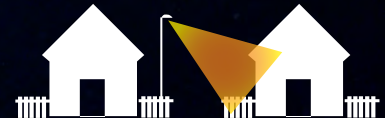
The pink or orange glow we see for miles around towns and cities, spreading into rural areas, caused by a scattering of artificial light by airborne dust and water droplets.

## glare



The uncomfortable brightness of a light source when viewed directly.

## light trespass



Light spilling beyond the boundary of the property on which a light is located, sometimes shining through windows and curtains of adjacent properties.

# Why is it bad?

## suppresses melatonin production

The impact of light pollution not only affects our view of starlight from above, but can interfere with our sleep patterns, circadian clock and melatonin production.

## disappearing stars

In the UK over 80% of the population can no longer view The Milky Way from their home due to light pollution. In Ireland, over 45% of us have also lost sight of this natural night sky phenomenon and this figure is rising due to the increase in domestic, commercial and public lighting over recent years.

## disruption of ecosystems

Wildlife, trees and insects are also affected by the interruption of our natural night and daylight cycles.

## wasteful

Our nightscape is disappearing rapidly, yet it is a valuable asset; preserving it helps us save energy, enhances our biodiversity and benefits our mental and physical wellbeing.

Here in the West of Ireland, we have some naturally dark areas that are protected for future generations to enjoy. In 2016 Mayo International Dark Sky Park featuring Ballycroy National Park and Wild Nephin received a gold tier International award for the quality of the night skies, free from light pollution.

This project shows how artificial lighting is affecting county Mayo, **highlighting areas of quality dark skies** as well as **areas affected by light pollution**.

The good news is that light pollution is one of the easiest pollutants to address.

**The first step is to raise awareness of this growing issue and identify where lighting improvements or adjustments could be made to reduce its impact.**



# Why does artificial lighting cause light pollution?

## Public Lighting (Street lights)

Full cut-off (FCO) lighting fixtures prevent light being wasted into the sky and are becoming increasingly popular due to their efficiency and because they are better directed. By full cut-off we mean that light is not radiated above the horizontal at the light source. The effects of non-cut off streetlights are shown on the illustration.



## LEDs (Light-emitting Diodes)

Artificial lighting is undergoing a radical worldwide change toward high intensity LEDs (Light-emitting Diodes). These appear to have many advantages: cheap, energy-efficient and easily controlled; however, there is an increasing body of research emerging that indicates a need for consideration and consultation before LEDs with a high colour temperature (more blue-rich) are widely installed.

## Blue-rich Light

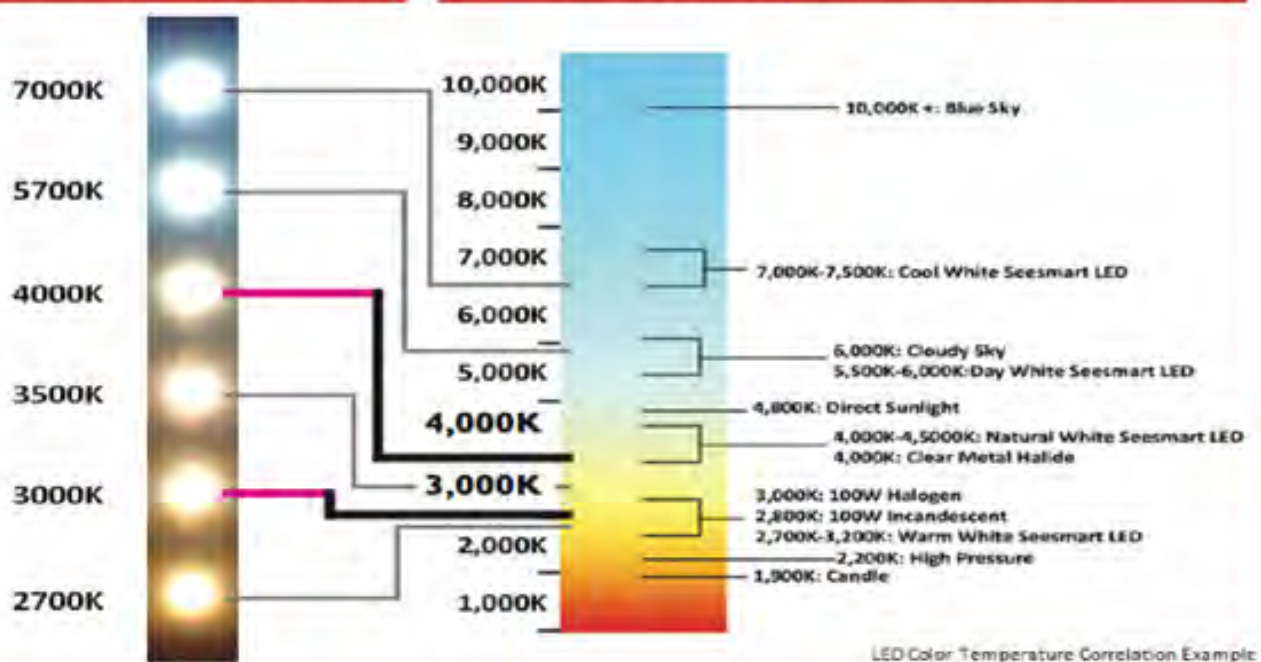
Many LEDs produce harsh blue-white light. This blue-white light reflects from grass and foliage and scatters high into the atmosphere, causing more than five times more sky-glow than previous warm orange (low colour-temperature) lights. The benefits of otherwise good downward direction of light may be negated by blue-richness, over-brightness and glare. In some cases, this causes light pollution with consequences for biodiversity and wellbeing.

## Light colour

Light colour is normally given by the equivalent temperature a body would be heated to in order to provide the same colour. To avoid sky-glow, streetlights should have a colour temperature of 2700K or less as a default specification. New technology such as narrow-band amber lighting (as recommended by the National Optical Astronomy Observatory) are good alternatives for energy efficiency as well as lower ecological impact, such as their effect on nocturnal animals such as bats.

Basic LED Reference Example

Kelvin Color Temperature Scale Chart



## Environmental Zoning

There are many solutions available to local authorities for the management of light pollution. Many local authorities in the UK have adopted Environmental Zones to classify appropriate lighting levels for designated areas such as in the table below.

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	International Dark Sky areas, UNESCO Starlight Reserves - No Lighting
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty, etc
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town & City centres with high levels of night time activity

## Why Ireland should take light pollution seriously in planning and policy for artificial lighting:

Light output from Ireland nearly doubled in the two decades to 2014.

**95%** of the country the night sky is degraded towards the horizon.

**5%** of the country which still has pristine skies should be protected as a resource, including for tourism.

**84%** of the country and **40%** of the population is under skies which are 1.5 times brighter than natural levels where even the sky directly overhead appears noticeably affected by light pollution.

**45%** of the population lives under skies 5 times brighter than normal, and where the Milky Way cannot be seen, even when directly overhead.

**18%** of the Irish population uses daytime (colour) vision at night due to light pollution.

Under overcast conditions, cities and towns with strong upward light pollution have a much higher level of light even in areas which are not directly lit. This is due to the reflection of upward-going radiation back to the ground.



## Facts and Figures

In the Republic  
there are more than  
**420,000 public lights**,  
consuming **485 GWh**  
of primary energy  
annually\*

Public lighting  
consumes up to

**35%**

of a Local Authority's total  
energy use \*

Nearly all public lighting  
is on from dusk to dawn,  
and 98% of the electricity  
use is unmetered

Roughly  
**30%**  
of the energy used for public  
lighting is lost due to  
inefficiencies

Annual cost of public  
lighting is over

**€56 million**

accounting for

**110,000 tonnes  
CO<sub>2</sub> produced\***

In **county Mayo**  
approximately

**€1 million**

per annum is currently spent  
on unmetered street lighting

## Recommendations for local authorities:

**Preserving Dark Skies:** Local authorities should not favour new lighting in existing dark areas, unless essential as part of a new development or clearly demonstrated for public safety.

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Local authorities should give careful consideration to the type of LED (Light-Emitting Diodes) used in public lighting and the potential impacts that higher temperature **blue-rich lighting** has on ecology and on human health.

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New street lighting should be **tested 'in situ'** before a lighting scheme is installed in a wider area to ensure that it is the minimum required for the task and does not cause a nuisance to residents.

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We encourage local authorities to investigate how **part-night** lighting schemes (e.g. switching off between midnight and 5am) or dimming could work in their areas, including examining the cost, energy and carbon savings. This should be done in full consultation with the local community.

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Local authorities should consider adopting **Environmental Lighting Zones** into their lighting policy to ensure that the appropriate lighting levels are used in each zone, with very strict requirements applying in identified dark areas.

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Local authorities should lead by example and ensure all **public buildings** and car parks do not create light pollution or light trespass.

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Local authorities should have a policy to control light pollution in their **Local Development Plan**. This policy should include identifying existing dark areas that need protecting.

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## Domestic and commercial Lighting

Floodlights are expensive to run and very inefficient, shining light over a wide area rather than just where it is required and, in some cases, creating dark shadows in the illuminated areas. Home security lights are often 10-20 times the power required in a typical domestic setting - 150w being more than sufficient in most cases.

Unshielded bulkhead lighting (wall packs) should be avoided, since the majority of the light actually shines into people's eyes, causing glare, which can actually make an area less visible and also light pollution and light trespass.



## Brightness of bulb

Traditionally most people are used to buying light bulbs (lamps) with the light output graded in units of watts (W). Watts are a measure of electrical power, not light intensity, though in the days when most bulbs were of the incandescent (tungsten) variety it provided a means for comparison. With a larger range of lamp types, a better measure is the 'lumen' (lm) output of a bulb as provided by the manufacturer. This is a measure of the total amount of light emitted from a source that lies in the most sensitive part of our vision.

Dark Sky Friendly domestic lighting should be no more than 600 lumens.

The conversion table below identifies the approximate lumen output emitted from light sources of varying wattages. Note that more efficient lamps emit the same amount of light with less electricity used.

Approximate lumen output emitted from light sources of varying wattages

BRIGHTNESS (lumen)	220 +	400 +	700 +	900 +	1300 +
Standard Bulb 	25 W	40 W	60 W	75 W	100 W
Halogen Bulb 	18 W	28 W	42 W	53 W	70 W
CFL Bulb 	6 W	9 W	12 W	15 W	20 W
LED Bulb 	4 W	6 W	10 W	13 W	18 W

Light Bulbs ← < 600 is better

## Irish Facts and Figures

**16%**

of residential electricity is used for lighting, equivalent to 195W or 20% of an electricity "unit" ≈ similar to the energy of a modern wide-screen tv

Domestic lighting costs

**€233 million**

annually, equivalent to  
**71k tonnes**  
of CO<sub>2</sub>

Per household costs for lighting are

**€230/year,**  
**≈5 kg CO<sub>2</sub>**



# Recommendations for Domestic/Commercial Lighting:

Low wattage, well-directed lights save money and do a better job.

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Home security lights – less than 600 lumens and maximum 150W (higher power creates more glare & dark shadows)

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Shielded fixtures so light does not escape above the horizontal - Unshielded bulkhead lights, no matter their luminosity, should never be installed.

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LED Lighting – chose warm colour tones e.g. “warm-white” (less than 2,700 kelvins)

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Consider using a Passive Infra Red (PIR) motion sensor light to illuminate an area only when needed.

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Angle the light downwards, make sure it only illuminates your property and does not trespass to your neighbour.

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Do not “over” light. This is a major cause of obtrusive light and is a waste of energy.

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Dim or switch off lights when the task is finished. Generally a lower level of lighting will enhance the night time scene required for safety and security.

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Ensure that fully-shielded outside lighting is used.



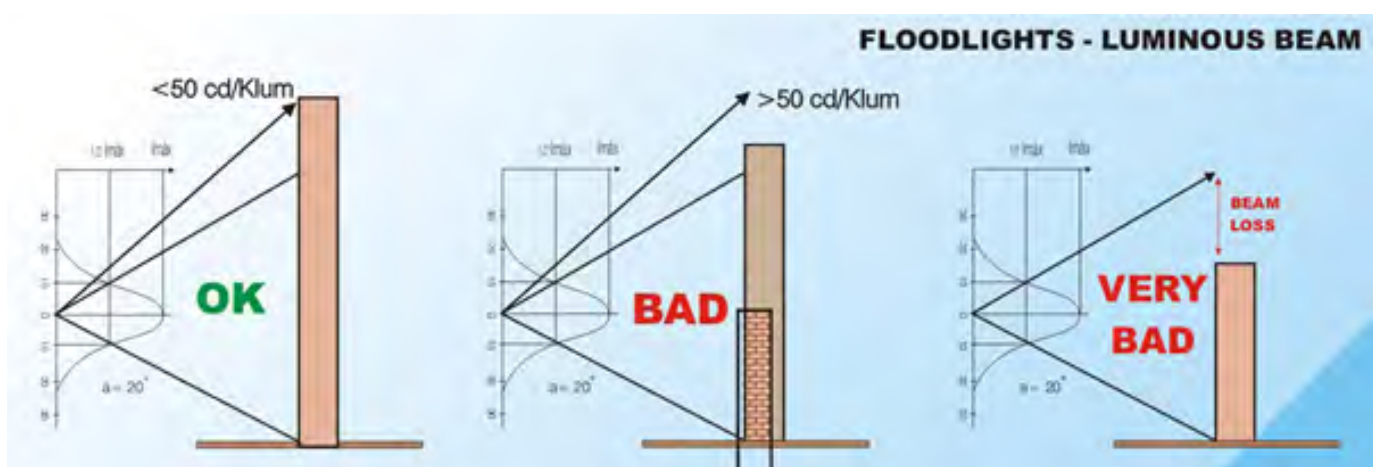


## Heritage /Facade Lighting for Public buildings

The use of artificial lighting, particularly flood lighting, on historical heritage buildings can be excessive and a significant contributor to light pollution and light waste. In some cases the architectural beauty of the buildings design is literally overshadowed by excessive lighting and some poorly placed light fittings can have an adverse impact on wildlife and natural heritage.

Ornamental lighting of public buildings, monuments and public spaces must prevent light from falling beyond the area intended to be lit, and should never be directed skywards. Architecturally sensitive tones such as passive, warm coloured lights should be considered before blue-rich white lights, and only where deemed necessary.

Lights should be adapted to the size and location of the object intended to be lit. If necessary, visors, shields, deflectors and cowls should be installed to guarantee lighting is limited to only the area of focus (see illustration below).



## Considerations for Lighting Heritage/Public Buildings:

Many heritage buildings were designed with natural light levels in mind. Consider the distance and general direction from which the object is observed.

Possible inconveniences to other users of the surrounding area (intrusive light, glare).

Consideration for Wild life (eg. Bats, Moths, Swifts, Fish and other species impacted by artificial lighting).

Ornamental lighting position, aiming and optics.

Lighting levels according to recommendations and the colour of the object to be lit.

Energy saving and installation switch-off.

# It's time to protect the Night

## Project Manager & Author:

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## Data and statistics:

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Trinity College Dublin

## Mapping and document presentation:

LUC ([www.landuse.co.uk](http://www.landuse.co.uk))



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For more information on citizen science  
projects on light pollution and for responsible  
lighting guidelines please contact:

@ [mayodarksky@gmail.com](mailto:mayodarksky@gmail.com)

or

f [www.facebook.com/mayodarkskies](https://www.facebook.com/mayodarkskies)

For more information on Mayo Dark Sky Park:

[www.MayoDarkSkyPark.ie](http://www.MayoDarkSkyPark.ie)

## Sources:

[https://www.britastro.org/dark-skies/pdfs/CfDS1410\\_E\\_Good\\_Lighting\\_Guide.pdf](https://www.britastro.org/dark-skies/pdfs/CfDS1410_E_Good_Lighting_Guide.pdf)

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Prof Brian Espey, School of Physics, Trinity College Dublin

\* Public lighting figures published by SEAI 2012 & 2017