

# Dark Skies - Aberdaron Area



To: **Aberdaron Community Council**

By **Roy Milnes Heli Aberdaron Pwllheli**

Date November 2020  
Version Final v2w

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## Revision history

Date	Version	Change	Author
06 Nov 2020	0.4	Draft	R Milnes
08 Nov 2020	v1	Final - Section 3 photos updated, Section 8 supporters added	R Milnes
15 Nov 2020	V2	Section 8 more supporters added, 6.4 Dark Sky Categories added	R Milnes

## 1 INTRODUCTION

Aberdaron's location, projecting out into the Irish Sea, presents a unique location for viewing the night sky. There is growing interest in the UK's dark skies - how to protect and how to promote them.

Gwynedd, Ynys Mon and Flintshire Councils are working toward obtaining Dark Skies Certification for the AONB's of Llŷn, Ynys Mon, Clwydian Range & Dee Valley.

Project Nos <https://www.facebook.com/prosiectnos/> is a partnership between Snowdonia National Park Authority working across North Wales to save our night skies from light pollution.

However it may take two to three years to dim the lights and achieve Certification for such a large area; there is an opportunity for the Aberdaron area to take the lead now and set an example.

Mynydd Rhiw and Mynydd Cefnamlwlch form natural barriers from the sky-glow of Nefyn, Pwllheli and beyond, this gives us in the Aberdaron, Uwchmynydd, Rhiw, Rhoshirwaun and Llangwnnadrll villages a great advantage to attain Certification for the Community.

This will improve our health, our wellbeing, our local environment, our visitor numbers and save energy for the economic benefit of our Community. With action from the Community Council and co-operation of local property owners, we could start attracting Dark Skies visitors from January 2021.



Proposed Aberdaron Dark Sky Area Reprinted from Ordnance Survey 1:25k map

## 2 DARK SKIES

In one sense, it is very simple to protect dark skies: don't shine light upwards or outwards. In practice, protecting dark skies involves a combination of lighting engineering techniques, working with local authorities, property owners and, if necessary, using legislation.

Engaging people with dark skies, whether its education, tourism or community activities, much of dark sky development is about helping people enjoy and learn about the night sky.

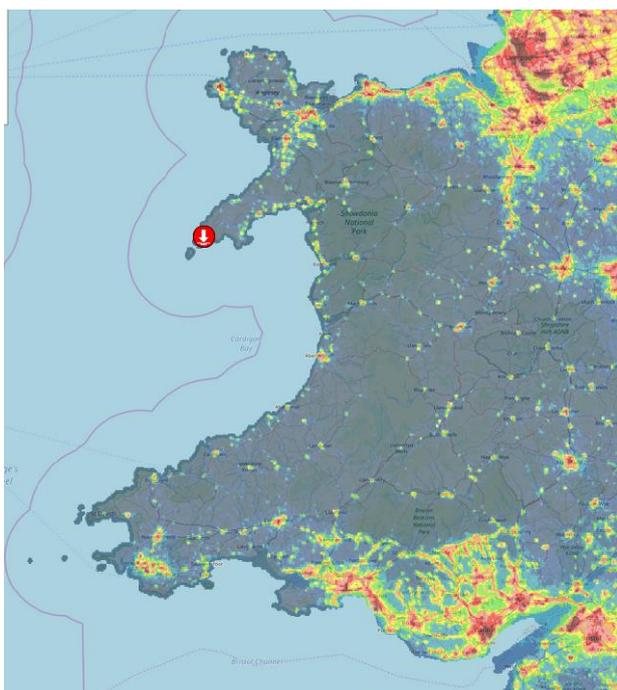
In Wales, Snowdonia, Elan Valley and Brecon Beacons are Dark Skies areas. Ynys Enlli are in the process of applying for Certification as a "Dark Sky Sanctuary".

Within the UK Galloway Forest, Sark, Exmoor, Northumberland, Coll, Cairngorms are Dark Skies areas.

World-wide there are 66 Dark Sky parks, reserves or communities accredited by the International Dark Skies Association.



The UK at night from Space courtesy of NASA



Dark Sky Map Wales courtesy CPRE



Dark Sky Map Aberdaron courtesy CPRE

France passed a law in 2019 limiting outdoor light intensity to 3000k and prohibiting light trespass onto a neighbours property – see Appendix II

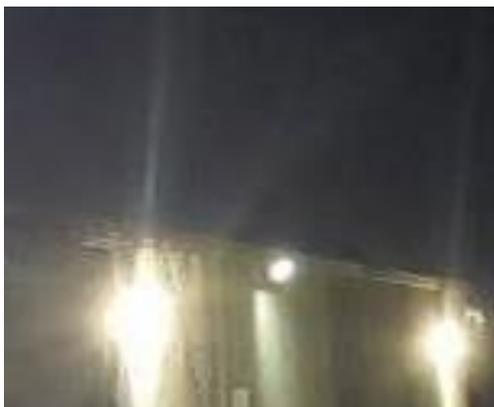
### 3 CURRENT STATUS

A random survey of local premises shows some disregard of the lighting regulations, perhaps unwittingly. However the situation is containable as long as residents, business owners and electrical contractors work with Aberdaron Community Council to limit the intensity to 2,700k and prevent light spillage outward and upward past the curtilage of their property.



Ysgol Crud y Werin - SON T lamps - on all night





The major sources of light pollution are from insensitively installed 6500k LED floodlights installed on walls and the gable ends of outbuildings.

These are relatively cheap and efficient but unless aimed down and shielded, the eye-damaging 6500k light destroys night vision.

Any person who installs a lamp like this is breaking the lighting regulations (Appendix 3).



Note:

HID-Bi-Xeon, LED and Laser vehicle headlights and Led daytime running lights can have intensities up to 6,500k.

Since these were mandated in 2011 by the EU accidents in the UK have risen.

Lightmare.org are one of the organisations campaigning against blinding vehicle lights.

### 3.1 Street Lights

Our LED street lights whilst focussed downward, they have an intensity of 4,500k exceeding the 2,700k Dark Skies recommendation.

Originally they were amber 70watt HPS SON-T 2000k which beamed light horizontally - some remain in the school playground. In 2010 the Council changed them to downward focussed ARCIP66 lanterns with white 42watt CDM-T 6,000k metal halide lamps.



Aberdaron 16watt LED street lights 2020 – these two lamps have glare shields

Around 2017 they were converted to 16watt 4,500k LED clusters. The photocells were changed from 70lux to 35lux to permit dimming to 8watts during the core of the night (24:00 – 05:30).



These are standard Aberdaron 16watt LED street lamps without glare shields

Pleasingly, Gwynedd Council's street lighting manager Colin Worth is sympathetic to our cause and is investigating the logistics and cost of reducing the intensity to 2,700k for the hundred or so lamps in our area as a pilot for Dark Skies Certification.



Aberdaron street lights during the change from amber to white downlight in 2010

## 4 LIGHT POLLUTION

Light pollution is a generic term referring to artificial light which shines where it is neither wanted nor needed. In broad terms, there are four types of light pollution:

- **Skyglow** – the pink or orange glow we see for miles around towns and cities, spreading deep into the countryside, caused by a scattering of artificial light by airborne dust and water droplets. We get some sky glow from the Abersoch/Pwllheli areas (10–17 miles) in the east, Aberystwyth (38 miles) in the south-east and even Dublin (75 miles) in the north-west but the effect is relatively minor compared to local lights.
- **Glare** – the uncomfortable brightness of a light source
- **Light intrusion** – light spilling beyond the boundary of the property on which a light is located, sometimes shining through windows and curtains
- **Light trespass** occurs when spill light is cast where it is not wanted. An example of light trespass is when spill light from a streetlight or floodlight enters a window and illuminates an indoor area, a floodlight or streetlight opposite casts light into the home.



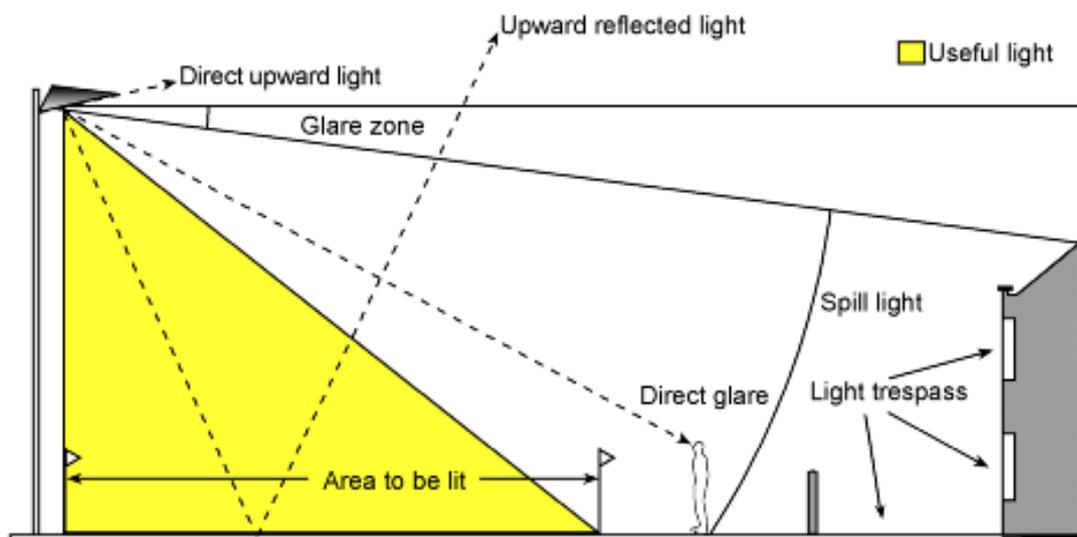
There is increasing awareness of the impact that light pollution can have on wildlife, by interrupting natural rhythms including migration, reproduction and feeding patterns. Man-made light is known to cause confusion to migrating birds, often with fatal outcomes, and many of us will have heard birds singing late into the night in trees lit by a streetlight.

A survey by CPRE found that light pollution can cause a great deal of distress to humans too, including disrupted sleep and, in some cases, has driven people to move house to get away from light pollution. Recent studies suggest that exposure to light at night can disrupt the body's production of melatonin, a brain hormone best known for its daily role in resetting the body's biological clock.

Light Pollution is caused by poorly installed outdoor lighting violating the lighting regulations by permitting the light source to be visible past the property boundary. From an economic aspect, the property owner is wasting his (or her) money by illuminating the surrounding area and the sky.



In the UK, artificial light emitted from premises so as to be prejudicial to health, joins noise and smells on the list of things that can be treated as a statutory nuisance; things against which local council Environmental Health Departments can take legal action.



The Environmental Protection Act 1990, Section 102 of the Clean Neighbourhoods and the Environment Act (2005) makes "exterior light emitted from premises so as to be prejudicial to health or a nuisance" a criminal offence.

#### 4.1 Examples of environmentally friendly external lighting



Downward shielded light not trespassing onto his neighbour's property, it should not be possible to see the light source (the lamp or reflector) outside of your property boundary.



Dwyros Campsite Aberdaron - courtesy of Alan Jones

An excellent local example of downward pointing 2,000k gateway and driveway illumination.

### Why Stay Below 3000K?



Save Energy &  
Lower Cost



Protect Health &  
Human Safety



Conserve  
Nocturnal Wildlife



Protect Natural  
Nightscapes

## 5 PROPERTIES OF LIGHT

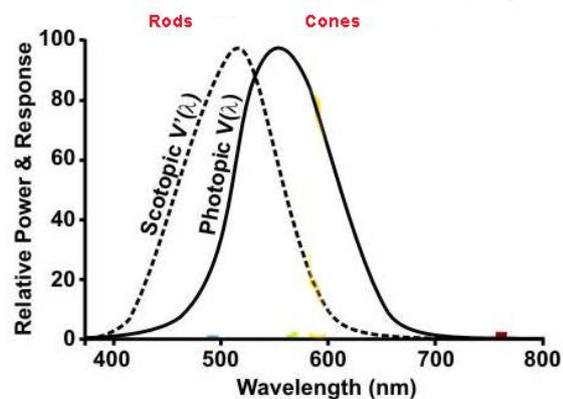
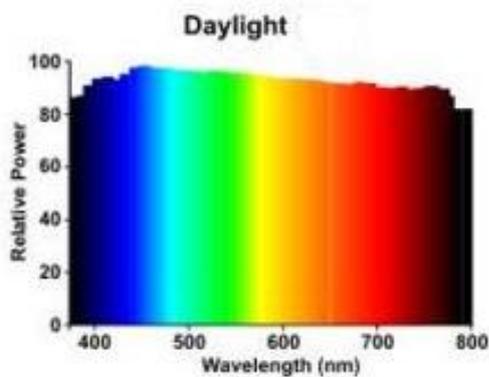
It is important to understand the properties of light and the effect upon the human eye.

The retina uses different sensors for daytime and night-time – colour sensitive cones in the day and rods (periphery of visual fields, moving objects) at night.

Beyond critical numbers of peripheral dynamic stimuli, 'working memory processes' and visual short term memory activities may suffer from capacitive de-compensation sometimes resulting in fatal cognitive and perceptual disorders. Daytime cones are sensitive to colours (central visual acuity) and essential for hazard perception (sharp vision).

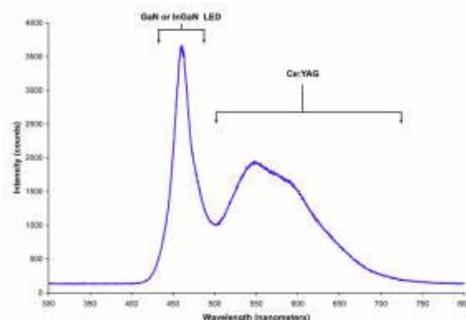
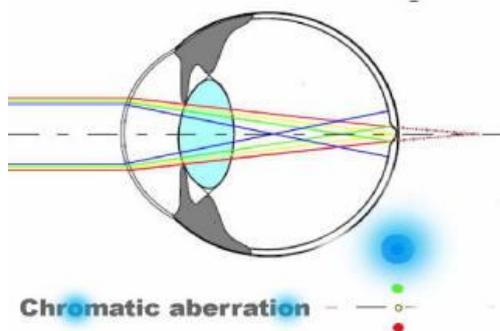
Recent studies showed that at low light levels the human eye does not function fully in the normal [photopic](#) region and its colour sensitivity shifts to the [scotopic](#) conditions (Purkinje shift or Purkinje effect).

The curve's peak is shifted towards the blue end of the spectrum thus making the eye more sensitive to LED lights at night.



Visible daylight ranges from the blue 380 nanometer to red 780 nanometer wavelengths. Below ~ 400nm is the eye and skin- damaging (temporal summation) Ultra-Violet band

Scotopic vs. Photopic sensitivity in the eye's response at night-time between rods and cones



The increasing use of high intensity 6,500k LED's for external lighting have emissions near the eye damaging blue ultra-violet end of the spectrum.

It is this "blueness" that causes unacceptable blinding disability glare, chromatic aberration and eye damage. Medical experts say the safe limit for the human eye is an intensity of 2,700k-3,000k ##. France has set a national limit of 2,700k, the International Dark Skies Association and the American Medical Association recommend 2,700-3,000k.

**Property owners (and some contractors) are installing these eye damaging 6,500k external lights to the detriment of our community and their own personal health and well being.**

## The intensity of light is determined from comparison with the temperature in degrees Kelvin of molten steel (derives from tungsten steel filament lamps)

## 6 OPPORTUNITIES, COSTS AND BENEFITS

### 6.1 Opportunities

Engaging people with dark skies. Whether its education, tourism or community activities, much of dark sky development is about helping people enjoy and learn about the night sky.

Reasons for developing the dark sky potential of an area are often one of the following:

- As a resource for practical science education and wider educational use
- As a resource for tourism activity based on the natural qualities of rural areas, providing a distinctive product - especially in the shoulder seasons
- As a natural resource to be protected as part of our wider natural environment
- Make dark skies a good focus for community activity.

There are two complementary aspects of dark sky work:

1. Protecting dark skies. In one sense, it is very simple to protect dark skies, don't shine light upwards.
2. In practice, protecting dark skies involves a combination of lighting engineering techniques, working with local authorities, property owners and legislation.



**Milky Way courtesy of Jason Huerta**

Our view of the stars - a source of infinite amazement for scientists, casual observers and the millions of us that seek out rural places to rest and recuperate.

## 6.2 Costs

If each member of the Community Council liaises with property owners in their ward to take action to comply with the outdoor lighting regulations, there is no cost.

There is a cost for Gwynedd County Council to change the hundred or so street lamps to 2,700k LED, this is to be advised and agreed with the County.

The IDA pre-application fee for Dark Skies Certification is \$250 and membership fee \$35 p.a.

## 6.3 Benefits

- Improve our health, wellbeing and safety
- Protect our eyesight
- Protect Biorhythms
- Improve our local environment
- Conserve Nocturnal Wildlife
- Protect Natural Nightscapes
- Increase "out of season" visitors
- Save Energy and costs



## 6.4 Dark Sky Categories

The IDA's Dark Sky Places programme designates the darkest regions around the world in six categories:

- International **Dark** Sky Communities.
- International **Dark** Sky Parks.
- International **Dark** Sky Reserves.
- International **Dark** Sky Sanctuaries.
- Urban **Night** Sky Places.
- **Dark** Sky Friendly Developments of Distinction.

Ynys Enlli are applying for the high grade of a Dark Skies Sanctuary.

The Llŷn, Ynys Mon and Clwydian/Deeside AONB's are applying for a Dark Skies Park

These require two years of readings to prove the quality of the night sky.

Applying for Community Certification is faster and easier and the most appropriate for Aberdaron.

## 7 ACTION AND IMPLEMENTATION

The Community Council have an opportunity to provide a beneficial service to all residents and businesses in the Aberdaron area.

If the Council are supportive of this project, the next steps should be:

- Join the International Dark Sky Association (IDA) [www.darksky.org](http://www.darksky.org) £\$35 p.a.
- Phase 1 Send an “Initial Enquiry” to the IDA by 30 November 2020 with the \$250 fee
- Liaise with residents in your ward to take action against offending lights – deadline 31/12/2020
- Liaise with Colin Worth, Gwynedd Council Street Lighting Manager, to convert lamps to 2,700k
- Liaise with Dani Robertson, Prosiect Nos Officer, and Bleddyn Jones, AONB Officer
- Phase II Submit a formal Application to the IDA as a Community Scheme
- Phase III Receive IDA Certification
- Publicise progress regularly: Press TV British Astronomical Association <https://britastro.org/>



### INTERNATIONAL DARK SKY PLACE (IDSP) APPLICATION PROCESS

#### PHASE I: INITIAL INQUIRY

Applicant reviews eligibility with IDA staff; notifies IDA of intent to pursue IDSP application

**Average Timeline: 45 days\***

**STEP 1: The applicant reviews certification process; indicates interest in the program**

>Anytime; via [darksky.org](http://darksky.org)

**STEP 2: The applicant receives an assessment of site eligibility and IDSP category recommendation from IDA staff**

>Within 30 days of initial inquiry submission; Via communication with IDSP staff

**STEP 3: After eligibility is determined by IDA staff, the applicant notifies IDA of intent to pursue formal Dark Sky Place certification**

>Timeline varies based on eligibility and guideline requirements; Applicant confirms intent with IDSP staff via written communication

#### PHASE II: FORMAL APPLICATION

With support from IDA staff, applicant actively works to meet the application requirements.

**Average Timeline: 1-3 years**

**STEP 1: The applicant works closely with IDSP Manager to develop application in accordance with appropriate guidelines**

>Anytime, ongoing; Via email with IDSP staff/manager

**STEP 2: With IDSP Manager approval, the applicant submits an application for Dark Sky Places Committee (DSPC) review**

>On or before submission deadline for review at the following committee meeting; Via submission to IDSP Program Manager

#### PHASE III: CERTIFICATION

Applicant waits while review is in process

**Average Timeline: 90-150 days**

**STEP 1: Application is reviewed by DSPC. One of the following outcomes occur:**

- >Application is approved by DSPC - application is submitted for approval by IDA Board of Directors
- >Application is approved by DSPC with conditions - application is revised, applicant may resubmit anytime for re-review by DSPC
- >Application is rejected - updated application may be eligible for submission at future deadline

**STEP 2: DSPC submits recommendations to IDA Board for final approval**

>Board approves or returns the application 10 business days after DSPC approval

**STEP 3: New IDSP is certified upon Board Approval**

>Announcement is coordinated with IDA staff at the applicant's discretion

*\*Phase I timeline varies depending on eligibility status and complexity of proposed place*

<https://www.darksky.org/wp-content/uploads/bsk-pdf-manager/2019/12/IDA-IDSP-Application-Process.pdf>

Getting Dark Skies Certification can take between 1 and 3 years dependant upon community action

Start the process <https://www.darksky.org/our-work/conservation/idsp/become-a-dark-sky-place/>

<https://www.darksky.org/get-involved/>

## 8 SUPPORTERS

- Dani Robertson - Snowdonia National Park Proiect Nos Officer
  - Bleddyn Jones - Gwynedd County Council AONB Unit
  - Aberdaron Tourist Link
  - Noel Davey – Secretary, Caernarfonshire Branch Campaign for the Protection of Rural Wales
  - Gareth Roberts - Aberdaron County and Community Councillor
  - Iain Roberts – Gwesty Ty Newydd Hotel and Community Councillor
  - Geraint Jones Aberdaron Bakeri and Community Councillor
  - Alun Harrison – Gwesty Ship Hotel
  - Gareth and Anna Jones – Eleri Stores and The Beach Cafe
  - Natalie a Stephen Harrison - Sblash Fish Bar and Caban Pysgod
  - Catrin a Alan Williams - Gwythrian Farm
  - Alun Jones - Dwyros Campsite
  - Elizabeth a Charles Evans - Afallon
  - Stephen Bull - Manager Aberdaron Advent Camp
  - Steve Porter - Astronomer
  - Mari Huws a Emyr Owen - Bardsey Island Trust
  - Elfyn Jones - Goleuo Llŷn Lighting
  - Malcolm Roberts - Pendre
  - Ian and Sue Kemp – Awel y Mor
  - Rev Janet Fletcher Associate Vicar – St. Hywyn’s Church
  - Keith Jones – The National Trust
  - Simon Goddard - Ysgubor Bach Holiday Cottages
  - David Graves – Ty Isaf
  - Denise and Ian Picot – Tyn Cae Holiday Accomodation
  - Dylan Roberts - Llys Awel
  - Christopher Rudge – Rhydlios Farm
  - Professor Peter Heilig - University of Vienna
-

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**The susceptibility of the retina to photochemical damage from visible light.** Evidence Based Medicine: *Prog Retin Eye Res.* 2012 (1):28-42 Hunter JJ, Morgan JJ, Merigan WH, Sliney DH, Sparrow JR, Williams DR. 'Both effects occur following exposure to visible light at irradiances that were previously thought to be safe.' (Amer Natl Standards Inst. 2007)

**Cyclic intensive light exposure induces retinal lesions similar to age-related macular degeneration**

Dong Z, Li J, Leng Y, Sun X, Hu H, He Y, Tan Z, Ge J. *PS1 bigenic mice.BMC Neurosci.* 2012 Mar 24;13(1):34. [Epub ahead of print] The longitudinal 'multicenter study' Retinal Light Damage in Traffic Participants, particularly in 'weaker ones' yields results already. Permanent damage will be documented in foreseeable future. Epigenetic imprinting of undesired side-effects affecting future generations are to be expected.

## 10 APPENDIX I - FRANCE ADOPTS NATIONAL LIGHT POLLUTION POLICY

France Adopts National Light Pollution Policy Among Most Progressive In The World 01 January 2019



View over Paris, at dusk, from the Maine-Montparnasse tower. Photo by Benh Lieu Song, licensed under CC BY-SA 2.0.

*by John Barentine, IDA Director of Public Policy*

A [new law](#) came into effect in France on the first day of 2019 that sets an important standard in western Europe for the protection of nighttime darkness through controls on the emission of light in outdoor spaces. The “Decree of 27 December 2018 on the prevention, reduction and limitation of light pollution” is a significant step forward in establishing robust national-level policies that can help turn the tide away from growth rates in the past decade approaching ten percent per year in terms of both the lit area of European countries and the intensity of upward-directed light that can be detected from space.<sup>[1]</sup>

The Decree supersedes and repeals the [existing national law](#) in France, dating to 2013. It consists of two parts. The first establishes technical requirements for the design and operation of outdoor lighting installations and imposes these regulations on both public and private property owners. It contains a number of prescriptions that apply to various lighting situations, from parks and gardens to building exteriors and parking facilities. The second part specifies eleven sites of astronomical observatories throughout France that receive special consideration for the highest level of protection. The Decree is an expression intended to affect the implementation of the French [Code of the Environment](#), [Labor Code](#), and the [Rules of the Road](#).

Importantly, the Decree fully sets forth, for the first time, clear intent in establishing meaningful national regulations “designed to prevent, limit and reduce light pollution, including excessive disturbance to persons, fauna, flora or ecosystems, causing energy wastage or preventing observation of the night sky.”<sup>[2]</sup> Its applicability extends to all lighting in France, taking aim at even cherished traditional applications such as the lighting of the exteriors of monuments and churches. However, it does so in a way that, in our opinion, is sensible and realistic, allowing for such applications while minimizing their impact through limits on the intensity and duration of use. This is result of extensive public consultations with stakeholders through the process of crafting the Decree, in order to craft a policy that respects the requirements of French law while remaining sensitive to the needs and desires of the French people.

The provisions of the Decree are largely consistent with guidance for outdoor lighting that IDA has promoted for many years, respecting advances in lighting technology that enable effective and efficient lighting of outdoor spaces while minimizing the direct impact to the nocturnal environment. The provisions include:

- **Outdoor lighting curfews.** Curfews specify times of the night at which lighting must be dimmed or extinguished completely.<sup>[3]</sup> These depend on the type of application and the setting in which lighting is employed, with a possibility that “more restrictive local adaptations” can be made at the direction of local officials.<sup>[4]</sup> Limited exceptions are made for public displays of lighting during holiday periods, and the use of motion sensing switches is encouraged.<sup>[5]</sup>

- **Limits on the allowed emission of light directly into the night sky.** The Upward Light Ratio (ULR) is limited in most cases to less than 1% of the total emission of a given fixture.
- **Reduced influence of glare.** Outdoor lighting must conform to a requirement that at least 95% of the light emission is confined to angles at or below approximately 14.5 degrees from the horizontal.<sup>[6]</sup> This substantially cuts down on light in the so-called ‘glare zone’ of lighting and discourages lighting design that intends to direct light to areas especially far from the installation point of the fixture.
- **Restrictions on the emission of blue light.** The Decree requires that, in all instances, the correlated color temperature (CCT) of light not exceed 3000 Kelvins (K).<sup>[7]</sup> CCT is the standard lighting industry way of quantifying the amount of harmful blue light that a fixture emits, where a larger number means fractionally more blue light; 3000K is identical to the current IDA guidance as part of our [Fixture Seal of Approval Program](#). Additional requirements for protected areas such as nature reserves and parks sets the CCT threshold at 2700K for the “built environment” of towns and villages, and 2400K otherwise.<sup>[8]</sup>
- **Allowable illumination levels.** In order to prevent use of excessive lighting that can compromise public safety, the Decree limits the amount of light used in any installation to no more than 35 lumens per square meter of illuminated target surface.<sup>[9]</sup> For suburban and rural settings, the allowed limit scales downward proportionately to as low as 10 lumens per square meter.
- **Light trespass into dwellings is prohibited**, regardless of its source.<sup>[10]</sup>
- **The use of skybeams, lasers, and similar high-intensity light is generally prohibited.**<sup>[11]</sup>
- **Nighttime lighting of waterways is generally prohibited**, including light shining out to sea.<sup>[12]</sup>

These policies position France ahead of all but a handful of nations in terms of their comprehensive nature. They are to be phased in beginning on the first day of 2020, and compliance with all of the Decree’s provisions is mandatory by the start of 2025. To aid in enforcing the new rules, it obligates property owners to supply to compliance officials relevant “ information necessary to verify the conformity of lighting installations.”<sup>[13]</sup>

French light pollution activists have largely hailed the promulgation of the Decree. Among the groups that helped craft it, the [Association Nationale pour la Protection du Ciel et de l’Environnement Nocturnes](#) (ANPCEN) calls the result a good start, the aim of which is “not to regulate per se, but to reduce the harmful effects of our public and private outdoor lighting for the French people and for the environment,” it said in a statement. But, it argues, the new regulation does not go far enough. Given the rate of advance of lighting technology, the rules will certainly be in need of revision within a few years and, it notes, “municipalities in particular will not change out their [lighting] infrastructure several times in a row.”

IDA applauds the government of France for enacting the Decree. “The new rules governing outdoor lighting in France are an important step forward in managing the pressure for new and dubiously necessary outdoor lighting installations,” said IDA Executive Director Scott Feierabend. “We are encouraged by this result, while urging the French government to continue educating citizens regarding their rights and responsibilities in complying with the changes.”

There are concerns that the availability of highly energy-efficient light-emitting diode (LED) products is promoting the installation of new lighting where it is not needed, simply because the cost of providing it has fallen considerably in recent years. Given evidence that France, like most other developed economies, is experiencing an economic rebound effect from the rapid adoption of LED technology,<sup>[14]</sup> public policies like the Decree are essential in order to slow the advance of artificial light at night into new spaces, both public and private.

The challenge ahead for France, as for any country pursuing such policies, is to ensure that they are adequately implemented and enforced, and that any provisions found to be unworkable in practice are revised appropriately in future decrees. For its part, the ANPCEN vows to continue its work to be “very vigilant and mobilized on the actual transformations that will result.”

<https://www.darksky.org/france-light-pollution-law-2018/>

<https://www.legifrance.gouv.fr/eli/arrete/2018/12/27/TREP1831126A/jo/texte>

## 11 APPENDIX 2 AMERICAN MEDICAL ASSOCIATION ADOPTS GUIDANCE TO REDUCE HARM FROM HIGH INTENSITY STREET LIGHTS

Strong arguments exist for overhauling the lighting systems on U.S. roadways with light emitting diodes (LED), but conversions to improper LED technology can have adverse consequences. In response, physicians at the Annual Meeting of the American Medical Association (AMA) today adopted [guidance](#) for communities on selecting among LED lighting options to minimize potential harmful human and environmental effects.

Converting conventional street light to energy efficient LED lighting leads to cost and energy savings, and a lower reliance on fossil-based fuels. Approximately 10 percent of existing U.S. street lighting has been converted to solid state LED technology, with efforts underway to accelerate this conversion.

"Despite the energy efficiency benefits, some LED lights are harmful when used as street lighting," AMA Board Member Maya A. Babu, M.D., M.B.A. "The new AMA guidance encourages proper attention to optimal design and engineering features when converting to LED lighting that minimize detrimental health and environmental effects."

High-intensity LED lighting designs emit a large amount of blue light that appears white to the naked eye and create worse nighttime glare than conventional lighting. Discomfort and disability from intense, blue-rich LED lighting can decrease visual acuity and safety, resulting in concerns and creating a road hazard.

In addition to its impact on drivers, blue-rich LED streetlights operate at a wavelength that most adversely suppresses melatonin during night. It is estimated that white LED lamps have five times greater impact on circadian sleep rhythms than conventional street lamps. Recent large surveys found that brighter residential nighttime lighting is associated with reduced sleep times, dissatisfaction with sleep quality, excessive sleepiness, impaired daytime functioning and obesity.

The detrimental effects of high-intensity LED lighting are not limited to humans. Excessive outdoor lighting disrupts many species that need a dark environment. For instance, poorly designed LED lighting disorients some bird, insect, turtle and fish species, and U.S. national parks have adopted optimal lighting designs and practices that minimize the effects of light pollution on the environment.

Recognizing the detrimental effects of poorly-designed, high-intensity LED lighting, the AMA encourages communities to minimize and control blue-rich environmental lighting by using the lowest emission of blue light possible to reduce glare. The AMA recommends an intensity threshold for optimal LED lighting that minimizes blue-rich light. The AMA also recommends all LED lighting should be properly shielded to minimize glare and detrimental human health and environmental effects, and consideration should be given to utilize the ability of LED lighting to be dimmed for off-peak time periods.

The guidance adopted today by grassroots physicians who comprise the AMA's policy-making body strengthens the AMA's policy stand against light pollution and public awareness of the adverse health and environmental effects of pervasive nighttime lighting.

AMA June 14 2016

<https://www.ama-assn.org/press-center/press-releases/ama-adopts-guidance-reduce-harm-high-intensity-street-lights>

## 12 APPENDIX 3 - REGULATIONS

In the UK, artificial light emitted from premises so as to be prejudicial to health joins noise and smells on the list of things that can be treated as a statutory nuisance; things against which local council Environmental Health Departments can take legal action.

The law makes 'exterior light emitted from premises so as to be prejudicial to health or a nuisance' a criminal offence.

Section 102 of the Clean Neighbourhoods and Environment Act (2005)

Environmental Protection Act 1990

BS EN 12464-2:2014 Light and lighting. Lighting of work places. Outdoor work places

BS 5489-1:2013 Code of practice for the design of road lighting

CIE (1997) CIE 126-1997 Guidelines for minimising sky glow (CIE: Vienna) CIE (2003) CIE 150-2003 Guide on the limitation of the effects of obtrusive light from outdoor lighting installations (CIE: Vienna)

CIBSE / SLL Lighting Guide 6: The exterior environment 2016

Institution of Lighting Engineers: Guidance Notes for the Reduction of Light Pollution 2002

Construction (Design and Management) Regulations 2015

Directive 2005/32/EC of the EU Parliament and of the Council (Energy-using Products Directive)

Directive 2009/125/EC of the European Parliament and of the Council (Ecodesign Directive)

Equality Act 2010

<https://www.darksky.org/our-work/lighting/lighting-for-citizens/3k/>

American Medical Association (AMA) 2016

REPORT OF THE COUNCIL ON SCIENCE AND PUBLIC HEALTH CSAPH Report 2-A-16  
Subject: Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting  
Presented by: Louis J. Kraus, MD, Chair CSAPH Rep. 2-A-16 -- page 5 of 8

Recommendation

"That our AMA encourage the use of 3000K or lower lighting for outdoor installations such as roadways. All LED lighting should be properly shielded to minimize glare and detrimental human and environmental effects, and consideration should be given to utilize the ability of LED lighting to be dimmed for off-peak time periods".