

EXPERIENCE AND DEVELOPMENT OF REGULATIONS IN DEFENCE OF THE NIGHT SKY

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Introduction

Light pollution, or obtrusive light is now subject to legal regulation in various jurisdictions across the world. The purpose of this paper is to outline the justifications for these new laws, to highlight examples of the different mechanisms used for regulation, and the levels of success obtained or expected in defence of the night sky. The United Kingdom approach will be cited by way of a case study, and compared to other approaches in other jurisdictions such as the Model Lighting Ordinance of the USA.

A Global Definition and Justifications for Legal Regulation

Light pollution is a global problem; therefore it needs a universally acceptable definition. (One acceptable in law for the purposes of regulation, by the lighting industry and by other technical bodies who help set the parameters.) One problem with the expression “light pollution” is whether light can in itself be a pollutant in law. Indeed it could be argued that the definition of pollution be modified to expressly accept light (and noise for that matter). To avoid this problem the International Commission on Illumination (CIE) has used the expression “obtrusive light, which it defines as: “Spill light which, because of the quantitative, directional or spectral attributes in a given context, gives rise to annoyance, discomfort, distraction or a reduction in the ability to see essential information.”¹ So does this definition cover all the core issues posed by bad lighting?

First and most graphically bad lighting may catch aerosols in the sky and scatter causing “sky glow” which graphically blots out the night time stars. Tackling this effect is of course core to the protection of the night sky. It will also meet the CIE’s definition if the loss the night sky is an “annoyance or discomfort”. Moreover, the loss of the sky may be the loss of “essential information” to the professional or pro-am astronomer. However, astronomy is the “canary in the mine”, for obtrusive lighting may also lead to other problems. Indeed, it is probable that calls for legal regulation and enforcement are more likely to be successful if based primarily on these other factors rather than the loss of the night sky alone, and so they will also be outlined. This is because these other problems include the fact that wasteful lighting is wasted energy which is wasted carbon emissions (climate change). Wasted money will also adversely affect national economic competitiveness. Indeed, the Czech Republic appears to have adopted the Clean Air Act 2002 (which has never been put into practice) law partly due to the negative economic effects of wasted energy. However, this factor is not present in the CIE definition. Governments have been keen to discourage car usage, and more recently aeroplane usage due to their carbon footprints. However, the carbon cost of wasteful lighting has not as

yet been taken on board by governments, nor are there as yet any formal governmental estimates for this form of wastage from lighting, although the author suggests the following figure.

It is known that there are 22 million dwellings in the UK, if one in ten have a 500-watt floodlight there will be 2.2 million lights. Generating 1 kW-hr of electricity produces 0.43kg of carbon dioxide emissions (UK average). Most lights are on an infra-red switch, but most activate needlessly when, for example, cats or pedestrians walk by. If an average light is on for half an hour a night, then the statistic is $(2.2\text{m} \times 500 \text{ w}) \times 0.50\text{hr/night} = 550,000 \text{ kW-hr/night}$. Per year this must be multiplied by 365 = 200m kW-hr/year. If 1 kW-hr produces 0.43kg of carbon dioxide, then some 73m kg/yr of carbon dioxide is produced as a by-product from producing the electricity needed to power domestic floodlights within the United Kingdom.

If a new diesel car produces 150g of carbon dioxide per kilometre travelled, then just under 49,000 cars would have to travel 10,000 km per year to produce this figure. This means that the carbon dioxide produced by domestic floodlights alone is statistically similar to that produced by the average car usage of a large town of c. 92,500 persons (assuming one car per 1.9 persons).² The implications are clear if this figure is extrapolated to all artificial lighting, it must be a sufficiently significant form of waste to deserve regulation. What is probably stopping obtrusive lighting from having an equal level of regulation as other forms of energy misuse is the psychological factor. That is lighting is seen to be akin to safety, security and wellbeing; whilst regulation should be reserved for the direct polluters, such as cars and aeroplanes.

Other problems arise when light shines into bedroom windows and night time lighting has now been linked to cancer in humans.³ This may explain why night shift workers appear to be at a higher risk of certain forms of cancer.⁴ There may be parallels between the negative health effects caused by light as there is by noise. For example, noise has long been known to cause physiological responses in relation to the effects on sleep.⁵ Sleep is a necessity and a reduction may lead to a loss of concentration, increased irritability and generally reduced efficiency and quality of life.

Admittedly, there are comparatively few studies as yet on the problems caused by lighting, and more research would be welcomed. Moreover, with noise it appears that the subject does not need to be fully awakened to suffer the same negative effects as someone who has been deprived of sleep altogether.⁶ Indeed, the research considered

above concerning cancer risks does not restrict itself to lighting that wakes the subject, the risk factor is the effect on the human hormonal system due to the level of light entering the bedroom and the subjects eyes (which may be intermittent).

Disability glare from artificial lighting can cause problems, as the iris is designed to contract to



cut down the amount of light entering the eye, glare can cause momentary blindness and pain. This disability glare is perhaps most problematic to light shining into roads, which may temporarily blind road users. It is also particularly an issue for the elderly, as the muscles controlling the iris tend to become less efficient with age.⁷ The 500watt security floodlights commonly used by householders are usually angled outwards, so that the resulting glare removes any positive passive surveillance benefit which the lighting may have. The CfDS website highlights the effects of angling floodlighting so as to reduce these effects.⁸

Obtrusive lighting can also cause quite extensive ecological problems.⁹ Buildings are often floodlit using upwardly facing lights, often all night long. Moreover, skybeams, laser or other concentrated light beams are sometimes used as a means of advertising for businesses. Bats¹⁰ and birds¹¹ can become confused by artificial lighting, disrupting breeding cycles.¹² These animals may become drawn in by artificial light, especially in poor weather. These problems may be made worse due to many nations encouraging a move towards a 24 hour culture. Insects may also be adversely affected. Many may simply fly around light sources until they drop of exhaustion, and so fail to breed.¹³ This in turn may mean that animals further up the food chain (such as birds) suffer due to reduced prey numbers. Glow worms are also threatened by lighting, as well as by changes to habitat and pesticides.¹⁴

It is submitted that these environmental and ecological effects are potentially serious and could perhaps be a major factor in encouraging legislation. As a result it is recommended that any attempt to protect the night sky includes these wider aspects.

It is submitted that the CIE definition is succinct and well drafted so as to deal with some of the primary effects of obtrusive lighting, but it does not address some of the consequences; namely the climate change, financial, ecological or health effects that may be caused. However the definition provided by the CIE avoids any controversy surrounding these other elements as suggested above. Further, as obtrusive lighting is a multi-disciplinary subject, the technical terms encompassing all disciplines must be considered in order to avoid confusion; which it must be stressed the CIE has avoided here. One must use the correct legal terminology if asking for legal regulation, and it must be couched in the correct lighting terminology (or other technical terminology for that matter), otherwise the legislator or the lighting engineer may be confused and the resultant regulation of little use. For example many definitions of light pollution include the expression light trespass. However trespass is a legal term in common law jurisdictions such as the UK, Ireland, the USA, New Zealand and Australia. As such it has a specific legal meaning and requires a direct physical intrusion, which is as yet untested in a court of law. However, nuisance which is also a legal term, has been tested in common law courts. It is also the mechanism which has been used by the UK Government to regulate certain forms of obtrusive lighting. The author is aware of a number of cases where the use of the expression trespass has confused law enforcers in the United Kingdom.

It is recommended that the CIE definition is used, but that the important wider impact of obtrusive lighting not expressly mentioned in the definition (but dealt with earlier in this paper) is included for consideration. However this recommendation should not be taken as indicating that the author does not consider that light may be a pollutant.

Legal Approaches

The law can take several routes in order to tackle obtrusive light. It may proactively seek to regulate the types of lighting which are fitted, ideally at planning stage or by controlling the types of fitment available. Such a proactive system clearly helps to prevent problems arising in the first place. Secondly, the law may seek to retrospectively tackle the problems which existing lighting can cause, or it may attempt to do both. It is proposed that the best solution is to do both, for the proactive system will not deal with pre-existing problems.

The Law in the United Kingdom

The United Kingdom which is addressing both forms of control will now be cited as a case-study.¹⁵ England and Wales have made artificial lighting subject to the criminal law by using the pre-existing statutory nuisance regime.¹⁶ The new law is a result of various British Government consultations, where the problems caused by nuisance exterior lighting and light pollution were highlighted.¹⁷ It also follows campaigns by the British Astronomical Association's Campaign for Dark Skies and the Campaign for the Protection of Rural England (The CPRE).

This measure is designed to tackle already existing obtrusive lighting. S.102 of The Clean Neighbourhoods and Environment Act 2005 has inserted para.(fb) into s.79(1) of the Environmental Protection Act 1990 to the effect that "artificial light emitted from premises so as to be prejudicial to health or a nuisance" may be a statutory nuisance. This has added lighting to the pre-existing statutory nuisance regime which has its origins in the Nineteenth Century. Light has joined existing statutory nuisances (such as noise and smells) probably because a well established regulatory framework already existed, rather than adopting a sui generis approach. (Adding light to the statutory nuisances was another of the recommendations of the Parliamentary Select Committee. However the author did not agree with this recommendation and replied at consultation stage stating that the provision would have little practical benefit for the reasons addressed below.¹⁸ However, some problem lighting is now regulated.

The new law is not intended to regulate all aspects of obtrusive light generally, but only a very specific sub-category; that is exterior lighting which meets the criteria for statutory nuisance. It is clear from DEFRA's guidance notes that:

*“ . . . although light pollution might affect the aesthetic beauty of the night sky and interfere with astronomy, it is not necessarily also a statutory nuisance. The statutory nuisance regime is not an appropriate tool with which to address light pollution per se”.*¹⁹ The following analysis will further show that the criteria for statutory nuisance does not really cover protection for the night sky,²⁰ this is largely due to the historic nature of the statutory nuisance regime which was set up in the 19th Century to deal with threats to human health such as contagion and infection. In order to amount to a statutory nuisance, the law requires the lighting to meet one of the following two criteria, it must be “prejudicial to health, or a nuisance”, (under s.102 of the Clean neighbourhoods and Environment Act 2005). In other words, there must be a negative effect on a human (health or nuisance) and so the night sky per se is not protected.

The United Kingdom's Department of Environment, Food and Rural Affairs (Defra)

was asked for an opinion by a local authority as to whether an amateur astronomer viewing the night sky from their own garden could meet the criteria.²¹ The opinion cited the accepted view that the complainant must have a reasonable day-to-day use of their property adversely affected in order to have an actionable statutory nuisance. Authority for this also comes from the 19th Century, it must be,

*“...an inconvenience materially interfering with the ordinary physical comfort of human existence, not merely according to elegant or dainty modes and habits of living, but according to plain and sober and simple notions”.*²² Otherwise there is a defence of hypersensitivity.²³

It is clear that this defence would almost certainly be used against an astronomer. However, it is also clear that astronomy as a hobby or a profession is really only adversely affected by bad lighting. Good lighting without disability glare, over lighting, or incorrectly angled luminaires will have a significantly lesser negative affect on astronomy. As a result it could be argued that there is no hypersensitivity as the defendant would only be required to improve health and safety and save energy, without any loss of social utility.

Defras opinion stated that astronomy as a hobby would be unlikely to amount to an “ordinary physical comfort”. The opinion stated that the hobby “is clearly distinguishable from ordinary physical comforts of human existence such as the need to sleep or be free from noise or dust or (poignant) smell. Accordingly the issue of abnormal sensitivity is unlikely to be of a type recognised by the common law of nuisance”.²⁴ The author disagrees with the application of this judgment to the 21st Century. It is submitted that the meaning of what amounts to an “ordinary physical comfort” must also change to reflect the mirror-image meaning in modern society, for the whole physical fabric of society has changed since this judgment. Hobbies were reserved for the wealthy in the 1850’s but hobbies are now positively encouraged today across the entire social strata of society. The UK’s Royal Astronomical Society was only formed in 1820 and the British Astronomical Association was not formed until 1890. It is proposed that it would be problematic to say that hobbies are not ordinary physical comforts today. Moreover, when is a person engaging in astronomy as a hobby? It could be argued that the opinion misses the point, for the night sky is half of the physical environment and for everyone to view not just astronomers. Either this opinion or statutory nuisance itself misses the point here.

The restrictive nature of the statutory nuisance regime is further complicated by the inclusion of a list of exempted premises: “airports, public service vehicle operating centres, harbours, goods vehicle operating centres, railway premises, lighthouses, tramway premises, prisons, bus stations and associated facilities, premises occupied for defence purposes.”²⁵ The author is unable to find a logical reason for this list, and it is submitted that the list probably owes its existence solely to the power of political lobbying. This is a pity as these premises need good lighting the



same as any other and so their exemption means that they can freely use light that creates disability glare (and so has negative health and safety implications). The exemptions are not needed as all business and listed sports facilities have the defence of “best practicable means”. This is a balance, whereby the social utility of the lighting is set off against the remaining nuisance after all reasonable measures taken to reduce the negative effects of the lighting have been taken. The UK Campaign for Dark Skies is continuing to meet with Government Ministers to discuss the removal of this list.

Further, there is no statutory nuisance if there is no land owner being adversely affected able to bring the action (as the issue is whether a human has been adversely affected). This is particularly important for astronomical heritage sites, such as stone circles and temples on public land. There will also be no statutory nuisance if the amateur astronomer is not on their own property as they are not being affected in the use of their own property. Also will the professional astronomer meet these criteria, or will they be deemed to be unreasonable users who should go abroad?

Perhaps more success will be had by dealing with lighting at the planning stage. England and Wales are working on a proactive guidance note for obtrusive lighting at planning stage. However, the structure of planning guidance is currently under review with the “Planning for a Sustainable Future: Consultation”²⁶ underpinning the “Planning for a Sustainable Future: White paper”.²⁷ There is at present no central government advice on obtrusive light to aid planners or business developers and the result has been a very mixed approach by local authorities. It was hoped that there would be a Lighting Annex to Planning Policy Statement 23: “Planning and Pollution Control (2005) (PPS23). The annex in whatever form it ends up will be subject to full consultation including the astronomical community. This annex was recommended by a Parliamentary Select Committee Report of the UK House of Commons.²⁸ However, work on the annex is on hold pending the outcome of the wider planning consultations. Scotland has recently adopted its “Controlling Light Pollution and Reducing Lighting Energy Consumption”,²⁹ which is a best practice guide. However the Scottish guide was written without any consultation with the astronomical community in the United Kingdom and it makes no reference to the night sky.

The planning stage offers an opportunity to create lighting zones. However this approach is not without problems, in as much as light travels considerable distances. Therefore permitting higher levels of upward light in urban centres will not stop it travelling and adversely affecting the sky in national parks or other areas which will no doubt be subject to more restrictive lighting schemes. The United States enjoys a considerable land mass and so this problem may mean that their national parks may be much further away from cities than most of their European counterparts, although the deterioration of the night sky at professional observatories such as Mt. Palomar underscores the distance that lighting really can travel to have a negative effect. However, there is no clear alternative to lighting zones and they are also recommended by the UK Institute of Lighting Engineers in their Guidance Notes for the Reduction of Obtrusive Light.³⁰

Further, Derek McNally of the IDA and the Royal Astronomical Society has stated:

“It is all the more regrettable that direction on light as a nuisance being considered by Defra and CLG (Communities and Local Government) seems out of step with growing

interest in the public for the preservation of dark skies, development of fledgling tourist businesses offering access to dark skies in the UK and the beginnings of a movement in N. America of the concept of Dark Sky Preserves (e.g. at natural Bridges National Monument in the USA and others in Canada) and Dark Sky Parks (e.g. Mt. Megantic in Canada). Only the Dark Sky Park concept is of interest in the UK context given the amount of light pollution now existing over virtually all the readily accessible UK... In view of the inadequacy of the 2005 legislation... attention should be turned to the establishment of Dark Sky Parks.”³¹ The author would fully support such parks.

The Model Lighting Ordinance of the USA

The International Dark Skies Association and the Illuminating Engineering Society of North America (IESNA) is finalising a Model Lighting Ordinance for the USA.³² This ordinance aims to tackle all aspects of bad lighting. The draft version of the MLO intends to define five lighting zones, prevent over lighting, limit high angle brightness, restrict light encroachment and to limit skyglow. The MLO is designed to be a comprehensive preventative measure and as it is being co-drafted by representatives of the US lighting industry it should be workable by the lighting industry. Interestingly limits on lighting installed for public benefit shall not be imposed; however, communities shall be encouraged to evaluate and improve their public lighting systems based on MLO recommendations.³³

Conclusion

In time it is hoped that obtrusive lighting will reduce, but it is clear that this is not going to be voluntary practice, legislation is needed. It is hoped that the United Kingdom’s combined approach will have a positive effect, and that it, the US Model Lighting Ordinance and other approaches round the world will encourage other jurisdictions to learn from these different experiences. However the time has come for a global approach to this global problem. It is also hoped that knowledge of the wider environmental and ecological effects of obtrusive lighting may lead to meaningful central European action, and that a future EU Directive could regulate artificial lighting on these grounds. Currently the global approach is patchy and further conferences and discussion groups will help to work towards global action to tackle obtrusive lighting.

Acknowledgements

The author would support the setting up of National or International Dark Sky Parks and the inclusion of obtrusive light at top level international environmental meetings.

Notes and References

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