

The Social Implications of Light at Night.

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Introduction

- *It has been shown that Light at Night (LAN) has serious implications for both the environment and human health. What is considered here are the social implications that arise from these problems, and what needs to be done to redress these issues.*
- *Lighting is an insidious cancer of the environment that is metastasising at a rate of 6% per annum.*

So, what are the problems?

Effects on human behaviour.

Neighbour disputes.

The Lighting Industry and Municipal Lighting Authorities.

Vanity Lighting.

Human Health.

Environmental Issues.

The Economics of Light at Night.

Effects on human behaviour (1).

- Behaviour patterns change. During the hours of darkness people tend to stay in their homes
- If places are “well lit” they tend to behave more at night as they would during the day.
- Most crime of the kind we fear occurs in daylight, ergo criminals need light.
- Crime rates in illuminated areas will tend to increase.
- If light were truly a deterrent there would be little crime during the day.
- Rather than reduce crime lighting encourages it.
- Where curfews have been introduced crime has declined by as much as 50%.
- Studies that claim lighting reduces crime have been discredited.

Effects on human behaviour (2)

- Lighting only reduces the fear of crime and this is exploited by the lighting industry.
- The industry stirs up the fear of crime to promote and sell more lighting.
- This results in more and brighter lighting with concomitant effects on human health and the environment.
- People are actually safer under a blanket of darkness and when power failures occur, criminality substantially declines.

Neighbour disputes (1)

- *Light pollution is in some ways similar to noise pollution.*
- *Excessive noise has long been recognised as being anti-social and local authorities have in many cases enacted measures to deal with it.*
- *If a resident or business causes excessive noise, then neighbours may suffer lack of amenity through the absence of peace and quiet.*
- *Light pollution is just as offensive yet is rarely seen as a problem.*

Neighbour disputes (2)

- *It effects are not immediately life threatening so local authorities don't see any need to do anything about it. Few people see it as a problem.*
- *However to those directly affected it can be very distressing.*
- *Unfortunately they have little recourse to law.*
- *Some countries have blatant light pollution laws but these are frequently emasculated by exceptions rendering them largely ineffective.*

Neighbour disputes (3)

- The plaintiff needs to obtain reasonable redress within the law but so far this has not happened.
- As with noise pollution, neighbour disputes over antisocial lighting can become ugly as the delinquent party is totally insensitive to the needs and feelings of the plaintiff.
- By marketing bad and unnecessary lighting, the lighting industry actually ferments disputes between neighbours.
- The industry may further divest itself of all responsibility for the behaviour of the end user in the same way as arms manufacturers when firearms have been involved in homicides.

Example

Briga, Tabuk, Saudi Arabia. Image: C. Henshaw.



The Lighting Industry and Municipal Lighting Authorities (1)

- *Most of the problems of light pollution are caused by the lighting industry and municipal lighting authorities.*
- *Companies manufacturing lighting are simply in the business to maximise profits and to a large extent couldn't care less about the environmental issues involved.*
- *Municipal lighting departments pander to the understandable fears of the general public over criminality after having been conned by the industry into believing that more and brighter lighting reduces crime, increases security and improves safety.*
- *They are delinquent because they seem to think they have a divine right to install lighting outside homes without consulting individual residents.*
- *Those who don't want lighting outside their homes should not be forced to endure it. A resident's right to darkness should never be violated.*

The Lighting Industry and Municipal Lighting Authorities (2)

- If they protest against it they risk being branded as “over-sensitised” nerds and eccentrics whose needs can be trampled upon with impunity, and at worst as being mentally unbalanced.
- However, in areas where all-night lighting is not appropriate, such as rural, residential and suburban areas, the onus should be on road users to provide their own lighting by using a torch.

The Lighting Industry and Municipal Lighting Authorities (3)

- *As for motor vehicles, it may a truism, but they have headlights.*
- If adaptive high beam headlights were more widely adopted, then drivers would be able to see better at night without the need to install more lighting.
- Local authorities are not actually under any obligation to provide lighting (but only to maintain it in good working order if they do) nor should they be liable to injury claims if people don't take appropriate care when moving around at night.

The Lighting Industry and Municipal Lighting Authorities (4)

- The problem of light pollution is twofold. There are those who desire polluting lights for selfish reasons and those who seek to profit from it by creating and perpetuating the problem.
- The first group simply want to draw attention to themselves by virtue of the fact one cannot ignore a bright light any more than one can ignore a loud noise. Such people see no reason to minimise their light pollution by installing dark-sky compliant lighting nor by applying it only when needed.

The Lighting Industry and Municipal Lighting Authorities (5)

- The second group seeks to expand demand in order to maximise and perpetuate their profits.
- This is actually achieved by producing lights that make it more difficult to see. If a luminaire is directly visible it forces a change in visual acuity that makes anything less than 1% as luminous appear black.
- Thus areas not immediately adjacent to the light appear dark, creating what is known as “artificial darkness:”(Kniffen 2012). This creates a positive feedback cycle that encourages demand for more and brighter lighting in order to overcome it. Creating artificial darkness is therefore a deliberate attempt to interfere with our vision.

The Lighting Industry and Municipal Lighting Authorities (6)

- Outdoor lighting over the past few decades has expanded for only one reason, and this is due to the deliberate policy by the lighting industry of marketing lighting that actually makes it harder to see, thereby motivating demand for more and brighter lighting.
- *Consequently the standards imposed by the lighting industry, associated professional bodies and municipalities are totally inappropriate and to the detriment of both the environment and human health.*

The Lighting Industry and Municipal Lighting Authorities (7)

- The message about bad lighting and how to reduce it has been out for at least twenty years, yet manufacturers continue to churn out vast quantities of bad lighting that only makes the situation worse.
- This is despite the fact that better designs have long since been available.
- *Again, those who protest against it are variously dismissed as over-sensitised eccentrics and nerds. If a householder requires darkness within the confines of his/her own property but doesn't get it because of the insensitivity of a municipal lighting authority, then he or she has every right to be over-sensitised*

The Lighting Industry and Municipal Lighting Authorities (8)

- The intrusion of new lighting schemes into areas previously unlit or dimly lit consequently negates any improvements in lighting design that have already been made.
- Often, they try to compensate by installing full cut-off lanterns on taller poles, often in clusters, further negating any benefits the new designs provide.
- The lighting industry and those connected with it are therefore out of control and need to be reined in.

Cluster Lights

Tabuk, Saudi Arabia. Image: C. Henshaw.



The Lighting Industry and Municipal Lighting Authorities (9)

- Also, new, stringent legislation needs to be enacted to reduce light nuisance and to provide an effective avenue of redress for those adversely affected by it.
- A consultative body needs to be set up to oversee all lighting schemes, and this needs to be composed of people without any vested interest in the industry, and to redress the needs of those who might be adversely affected.
- *It is not disputed that lighting is necessary, but it should only be applied sparingly, on a needs must basis, where needed, when needed, in the correct amounts, and using appropriate smart lighting technology.*
- *Alternative methods have long since been available to improve road safety in sensitive areas without naïve recourse to street lighting. Yet they don't usually get implemented as local authorities have been conned into believing that street lighting is the best solution for these issues.*
- So what are the alternatives?

Possible solutions for sensitive areas (1)

l) Smart Road Lighting: *Credit: Studio Roosegaarde.* Note: no street lights.

<https://www.studioroosegaarde.net/project/smart-highway/photo/#smart-highway>

r) Solar Powered LED road studs. *Credit: Astucia Traffic Safety Systems.*

<http://www.clearviewtraffic.com/astucia/products-astucia/art/22/solarlite-f-series-flush-road-studs.htm>



Possible solutions for sensitive areas (2)

l) . Cat's Eyes, with their inventor, Percy Shaw. Image: Reflecting Roadstuds Ltd.,

<http://www.percyshawcatseyes.com/history>

r) The reflective devices on this rural road in Saudi Arabia. Image: C. Henshaw.

These techniques are most effective when the road surface is not illuminated.



Possible solutions for sensitive areas (3)

Concrete baffles (or heightened crash barriers) for the central reservations of motorways.

These eliminate the glare of oncoming traffic thereby obviating the need for street lighting.

Credit: World Highways. <http://www.worldhighways.com/categories/road-markings-barriers-workzone-protection/features/safety-barriers-deliver-valuable-road-user-protection/>



Possible solutions for sensitive areas (4)

- *All of these methods have advantages.*
- *They do not consume energy once installed so they are not wasteful of fossil fuels, nor will they require much maintenance after installation.*

Possible Solutions for Urban Areas

- *So, in the event that lighting does need to be applied, what is the best option?*
- *City centres are best lit up with forty-five degree full cut-off lighting in which the luminaire is countersunk within its housing so it is not visible beyond the illuminated area.*
- *Light will not intrude above the horizontal, and unlike ninety degree full cut-off lighting will not illuminate the cloud ceiling that becomes exposed as a result of the Earth's curvature.*

Effect of Earth's Curvature

l) Image credit: Andrej Mohar.

http://www.darkskyparks.org/docs/Lastovo2010_Mohar.pdf

r) Skyglow from Tabuk, Saudi Arabia, imaged from 80km. Credit: C. Henshaw.



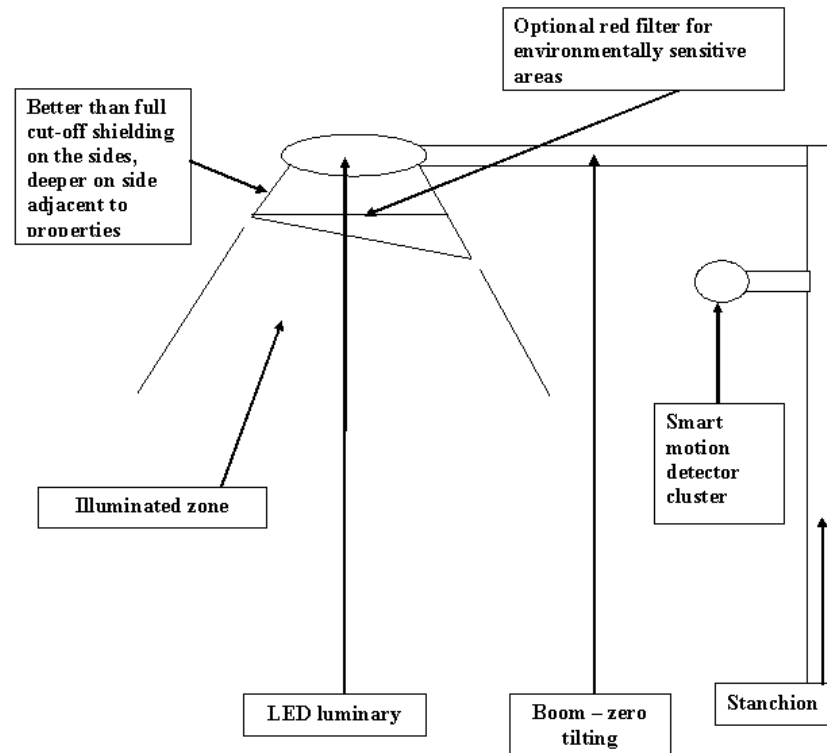
Possible solutions for residential and suburban areas (1)

- *In residential and suburban areas, lighting should be subject to curfew and motion operated. It should never exceed first floor height, to prevent intrusion into bedrooms.*
- *In areas where vandalism is not a serious issue, robust, low level, **motion operated** bollard lighting may be more appropriate.*
- *Individuals adversely affected by public lighting, such as amateur astronomers, should be able to insist on the removal of any public lighting that intrudes onto their properties. This not unreasonable.*

Possible solutions for residential and suburban areas (2)

Fig 1. Anti-Light Pollution Street Light suitable for Residential Areas.

This light is motion operated so it only comes on when it is needed.

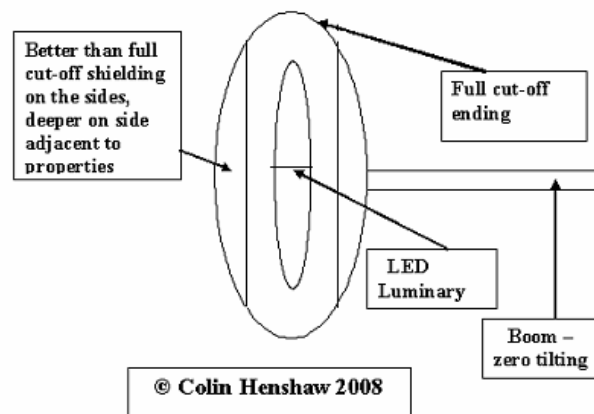


© Colin Henshaw 2008

Possible solutions for residential and suburban areas (3)

Fig 3. Anti-Light Pollution Street Light suitable for residential areas

Underside View of the Luminary and its Housing



The LED luminaire is split so as only to illuminate the area occupied by the pedestrian. This is controlled by the smart motion detector.

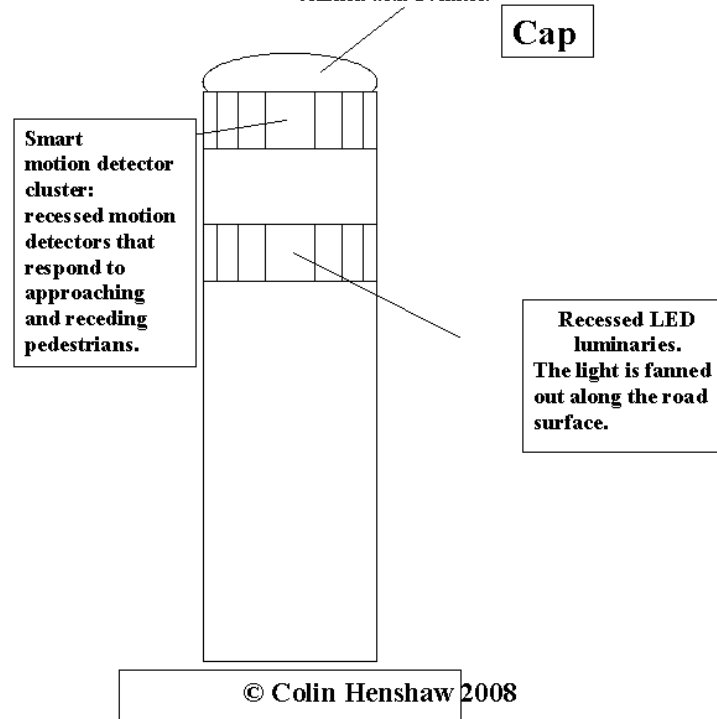
Possible solutions for residential and suburban areas (4)

Motion Operated Bollard Light

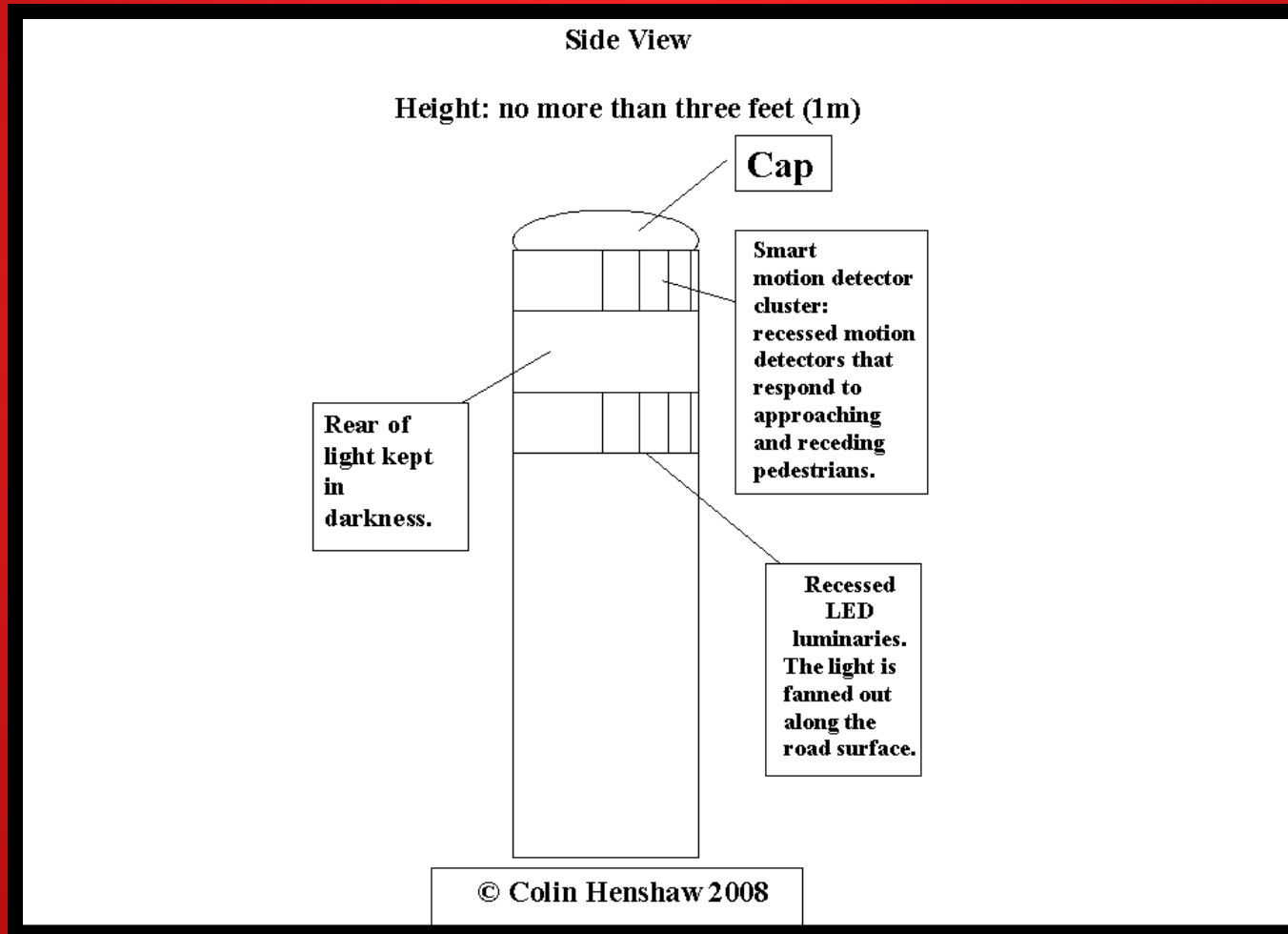
Front View

Height: no more than three feet (1m)

The light should be vandal-proof but should fall over if involved in a collision with a vehicle.



Possible solutions for residential and suburban areas (5)



Vanity Lighting (1)

- As opposed to utility lighting that may be construed as useful, this type of lighting does not serve any useful purpose at all. *Its apparent function is purely decorative.*
- Because it does not serve any useful purpose it is wasteful of energy and fuel, and adds further to the ecological damage caused by existing lighting.
- It is therefore in direct contravention of the environmental mission statements of most local authorities that aim to reduce their impact on the environment.

Vanity Lighting (2)

- *Such lighting is encouraged by the general level of ignorance of business people and elected officials about science and environmental issues, and this leads to the abuse of lighting without them actually being aware of it.*
- Others couldn't care less, being motivated by greed, profit and their own self-aggrandisement.
- Constituents will not want their hard-earned taxes squandered by ignorant elected officials and business executives on an ego trip.

Vanity Lighting (3)

- These projects are frequently expensive, yet local authorities are always expected to cut back on essential services such as health, education, welfare, care for the elderly and state pensions.
- To redress this problem elected officials should be fully conversant with environmental issues and be accountable for any abuses during their term in office.
- Public art in itself is not a problem, and there is no attempt here to discourage genuine artistic expression, however it must be environmentally friendly and this precludes its use of light at night.
- However, ill-conceived projects may expose elected officials to adverse criticism and bring municipalities into disrepute.

Illuminated Buildings

Located in Istanbul, Turkey. Image: C. Henshaw.



Skybeams

Istanbul, Turkey. Image: C. Henshaw.



The Stockport Skybeam

Image: J. Lewis, Stockport, Cheshire, England.



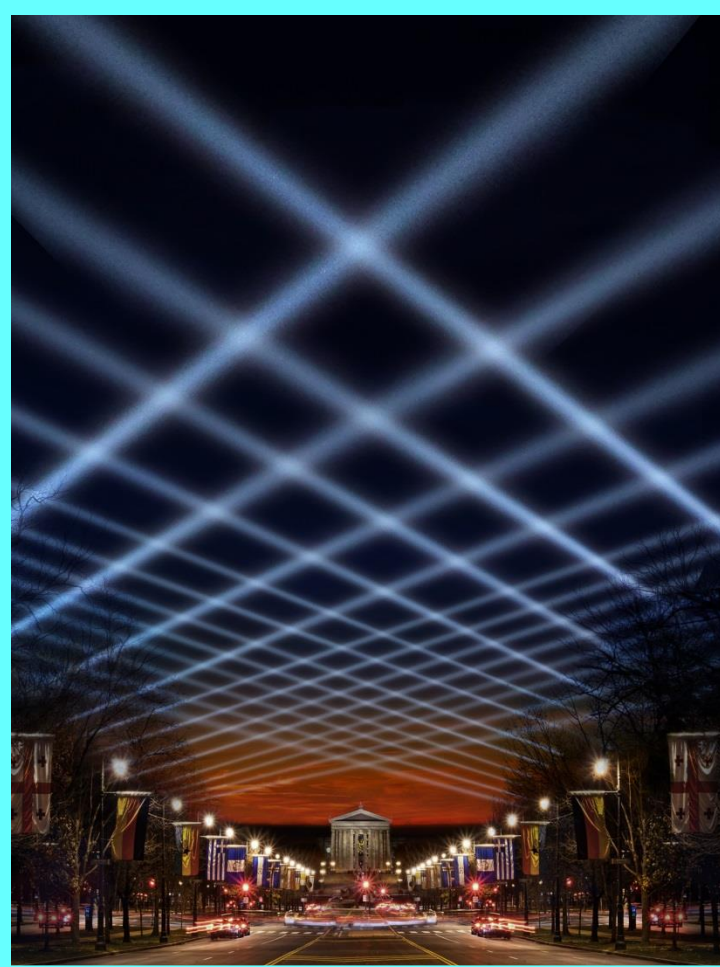
Illuminated Regeneration Follies (1)

Illuminated tree, Bowdon, Cheshire, England. Image: C. Henshaw.



Illuminated Regeneration Follies (2)

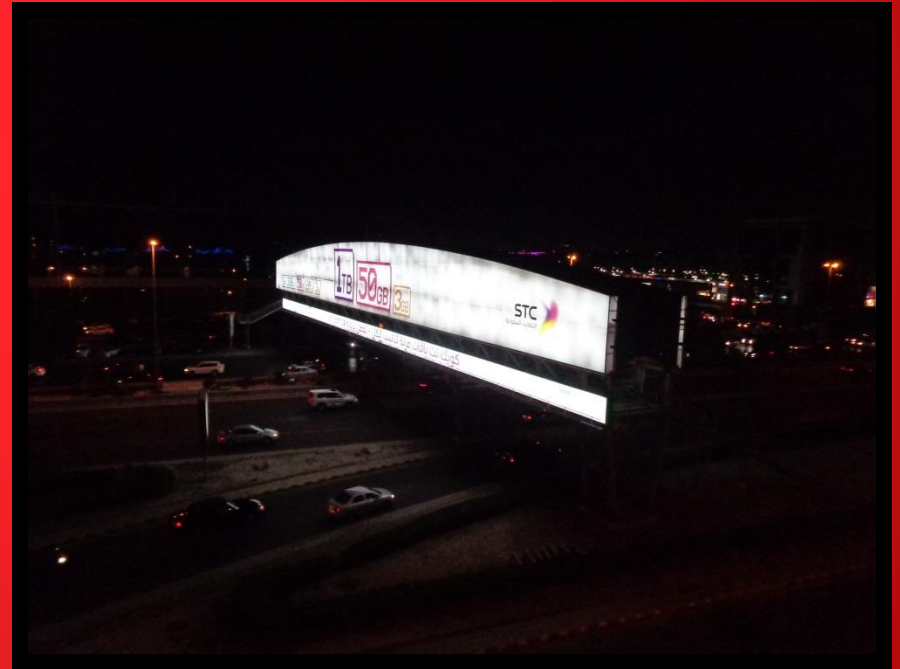
Multiple skybeams over Philadelphia. *Credit:* <http://www.openairphilly.net/concept>



Advertising

Illuminated advertising such as the kind shown below should not be permitted in rural, residential or suburban areas or near places where people sleep.

Illuminated pedestrian footbridge, Medina Road, Jeddah, Kingdom of Saudi Arabia. Image: C Henshaw.



Other issues (1) Human Health

- Light at night, especially towards the blue end of the spectrum *suppresses Melatonin production by the pineal gland*. This can be remedied by the application of low colour temperature (ideally 2000K and not exceeding 2700K) amber LED lighting.
- *Melatonin is oncostatic, meaning it suppresses cancers*. The incidence of breast and prostate cancers is now known to be higher in illuminated urban areas.
- Tamoxifen, used to treat breast cancer is rendered useless in the presence of illumination.
- *In sensitive individuals lighting can mimic increased summer day-length, causing cravings for carbohydrates leading to obesity and cardiovascular disease*.

Human Health (2)

- *Urban lighting can interfere with the chemical reactions that clear the air of pollutants discharged by factories and motor vehicles.*
- *Nitrates are responsible for breaking down ozone and smog, but lighting destroys them leaving the pollutants unaffected.*
- *Consequently they accumulate in the atmosphere and exacerbate conditions such as asthma, bronchitis, emphysema and cystic fibrosis.*
- **Urban lighting powered by burning fuel, releases nanoparticles of siliceous dust that contribute to strokes, heart attacks, lung, bladder and kidney cancers, asthma, chronic obstructive pulmonary disease, lupus and rheumatoid arthritis.**

Human Health (3)

- *The expansion of lighting systems, particularly in the developing world, will kill off large quantities of insects upon which the majority of bats feed.*
- *Bat populations will then decline. Bats also feed on large numbers of mosquitoes that are not attracted to lighting.*
- *As bat populations decline, mosquitoes will then increase in numbers, thereby encouraging the spread of mosquito-borne diseases such as malaria, dengue fever, and Japanese encephalitis in areas where they had previously been eradicated or where they had never existed before.*

Environmental Issues (1)

- It is well established that lighting is attractive to insects.
- Urban lighting can be seen from a great distance and will sweep up insects over a wide area.
- Insects will spiral around lights, especially those with a high blue spectral component (especially mercury, halogen, and LED lighting) until they are either too tired to feed or to procreate. (Again, amber coloured LEDs will reduce this problem, especially if they are motion operated).
- Consequently their numbers will decline and this will have concomitant effects on higher order consumers (spiders, amphibians, reptiles, birds and small mammals) that are dependent upon them for food.

Environmental Issues (2)

- Since insects are pollinators this will cause reduced plant populations and diversity, which will initiate a positive feed-back cycle in which fewer plants will further exacerbate the already declining insect population.
- Since many crops are dependant on insects, the threat of crop failures becomes worrying especially at a time when the human population is increasing rapidly.
- Excessive and unnecessary lighting is annoying amateur and professional astronomers who find it increasingly difficult to operate in or near cities. Even low levels of light pollution will eliminate natural phenomena such as the Milky Way, Zodiacal Light, and Gegenschein, that should always be visible on any dark moonless night.

Gegenschein

This image was taken from a dark location in Saudi Arabia. Image: C. Henshaw, November 2013.



Environmental Issues (3)

- *Astronomers, therefore, are like the proverbial canaries in a coal mine, and if they are experiencing difficulties making observations through excessive light pollution, then the world has a serious problem.*
- *Municipal lighting authorities are rarely sympathetic to their needs and will not take the action required when obtrusive lighting violates their homes.*
- *This needs to be rectified and any obtrusive lighting removed on request. Unpolluted darkness at night within the confines of one's property should therefore be regarded as a universal human right. When this right is denied by the lighting industry, municipalities, business interests, or even inconsiderate neighbours, then a human rights violation has occurred.*
- *Human rights violations occur when governments or non-state actors deny or ignore basic human rights including civil, political, cultural, social and economic rights.*
- *Astronomy has been an integral part of human culture for thousands of years, so the right to participate in it should be protected.*

Environmental Issues (4)

- Industry sources say 19% of all energy consumption goes on lighting. In reality it is probably much more.
- In the Italian town of Certaldo, electricity consumption due to street lighting is at least 60%: (Fiaschi, et al, 2012). Other communities are probably similar or worse, especially in developing countries where environmental concerns are of little or no consequence.
- Energy used for lighting comes in part from fossil fuels, so lighting contributes substantially to carbon emissions leading to global warming and climate change.
- One way to mitigate climate change is simply to eliminate all unnecessary lighting. It's not rocket science!
- However, as with other environmental issues, activists are up against powerful corporate interests that want to maintain the status quo in order to maintain profitability.

Environmental Issues (5)

- Improved smart lighting design, curfews, motion operated systems plus stringent legislation to control lighting abuse will help to mitigate this problem.
- Unfortunately, in response to energy concerns the lighting industry develops more efficient, brighter lighting in order to appear sensitive to concerns over excessive energy consumption.
- Unfortunately this in itself does not resolve the issue of light pollution.
- CFL and LED lights are cheaper to run, consequently consumers can now afford to operate more and brighter lights (Jevon's Paradox). Consequently, lighting levels may increase to the detriment of the environment. This needs to be rectified by legislation.

Economic Issues (1)

- Unnecessary municipal, commercial and other forms of lighting are a waste of money.
- *One industry source states that street lighting takes up thirty-eight percent of a municipality's budget while another says it is as high as sixty percent, amounting to around 59,760TWh per year in Europe.*
- Obviously then, current lighting practices are very wasteful, both in financial terms, and in terms of fuel efficiency. Savings can be made by the installation of more efficient, smart light fittings that throw all the light on the area intended to be illuminated, rather than up into the sky.
- Local authorities can (and are beginning to) save money by introducing curfews on lighting.

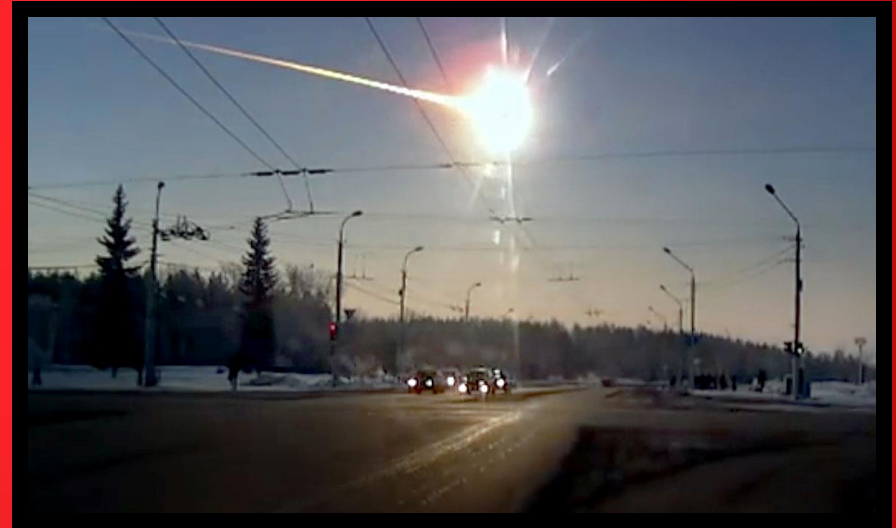
Economic Issues (2)

- If such technology could be universally implemented, then lower wattage lighting can be installed and much of this waste eliminated without causing lack of amenity.
- This will lead to considerable financial savings, and the money redeployed into essential areas frequently exposed to cut-backs such as health, education, welfare, pensions and sensible urban regeneration.
- Crass vanity projects proposed by incompetent municipalities and commercial interests often cost hundreds of thousands of pounds/dollars/euros.
- Constituents will not want to see their taxes spent on such projects when they see essential services such as health, education, welfare, care for the elderly and state pensions repeatedly threatened with cut-backs. In addition such ill-conceived projects bring local authorities into disrepute and public ridicule.

Consequences of Inertia

Chelyabinsk fireball: <http://cdn.phys.org/newman/gfx/news/hires/2014/thepowerofth.jpg>

- If astronomers fail to prevent the next asteroid strike due to all-pervading global light pollution then we will only have ourselves to blame.
- It is only a matter of time: not a question of if, but when.
- The apocalypse is out there, so we can't afford to be complacent. The dinosaurs and Chelyabinsk bear witness to that.



Conclusions (1)

- **Lighting has been shown to have serious environmental, medical and social implications.**
- **Consequently, a universal culture change is needed in our attitudes towards exterior lighting.**
- **Similar paradigm shifts have already been seen in public attitudes towards drink-driving, the wearing of seat-belts and crash helmets, vivisection and blood sports, though it took many years of campaigning and parliamentary debate to achieve success.**
- **Dark skies that are easily accessible are essential if we are to detect potentially hazardous asteroids that may threaten the planet.**

Conclusions (2)

- An attempt has been made here to reveal the extent of these problems, and workable solutions offered that will resolve these issues without causing loss of amenity.
- The harm caused by excessive and unnecessary lighting has been well established, and urgent steps now need to be taken in order to rectify the damage.
- Thank you for your time and trouble.