Call for public inputs on a JCM proposed methodology "Installation of LED street lighting system with wireless network control" (5 April to 19 April 2016)

- Name: Dr Isaac Jamieson
- Affiliated Organisation: Biosustainable Design
- E-mail: isaac@biosustainabledesign.org
- Country: United Kingdom

1. LIGHT AT NIGHT

Night-time light levels

With light pollution prevention in mind, it is suggested that the following matters should be taken into consideration:

- **Reduced spread of light with LED units** – This can reduce light pollution but complaints have been made about LED streetlights illuminating far narrower areas than the conventional lamps they often replace. Safety concerns have been raised as a result of previously illuminated areas often now being left in darkness. Issues raised include a proposed increased likelihood of accidents and increased fear of violence, vandalism and crime in poorly lit areas (Lux 2014, 2015).

- **Extra streetlights may be required when LED units are installed** - In some instances the installation of extra streetlights and/or increasing the brightness of the streetlights is being considered to help address such potential shortfalls (Lux 2015, Holden & Swanson 2015).

- **Should general night-time light levels be reduced?** - Contrary to the common perception that reducing light levels at night usually increases crime levels and road accidents, research from the UK reports little evidence of harmful effects from dimming, part-night lighting, switching off, or changes to white light/LEDs on crime levels or likelihood of road collisions (Steinbach et al. 2015).

  Those authors reported that for areas of reduced lighting, no increase was observed for violent assault, auto theft, burglary, robbery or sexual violence. They also observed that <1% of all night-time traffic collisions arose on streets which had had their street lights switched off. This may not however be the case in all areas of the world. It generally appears that illuminating streets at night can, in many instances, actually increase the risks that both pedestrians and drivers take and make premises more likely to be burgled [Also refer to the video by Vercauteren (2015)].

As can be seen, there are contradictions in research findings on the issue of light levels at night. In the present author's opinion, there is a solution that may permit the best of both worlds to be obtained. It appears that 'Dark Sky' policies could be adopted in many areas, particularly late at night, with a large degree of success. In a number of these, the additional use of passive infrared motion sensors to provide safe illuminated passage to pedestrians whilst allowing darkness at other

times should also be considered. [Passive Infrared speed gauges might be used to ensure that vehicles do not accidentally trigger such devices. As documented later in this commentary, traditional wireless technologies should be avoided wherever possible].

2. COST EFFECTIVENESS

- **Installation of LED street lighting system**
  The potential savings in energy terms that can arise through the installation of LED street lighting need to be balanced against the costs of such units themselves and the savings that could be made by retrofitting existing units to increase their energy efficiency instead of replacing them.

- **Alternatives to LEDs -** An alternative option (put forward by Simon Nicholas), which can save considerable financial output, is retaining existing conventional streetlights that are still viable and dimming them so they use less energy (Lux 2015a).

  Another alternative that is as efficient as LEDs (as commented by Burrows (2016)) is the use of HID lamps with an energy-efficient electronic ballast, such as that produced by EnLight (www.enlight.co.uk). These can be retrofitted to existing streetlights and greatly save on potential running costs.

- **No Light** – There are a number of incidences where street lighting may actually make individuals less safe. Taking into account the findings of Steinbach et al. (2015), and the comments of Vercauteren (2015), it may prove far more cost effective, and of greater benefit to communities, to allocate some of the money that would otherwise have been spend on street lighting to improve the safety of the roads and better educate drivers and pedestrians on how to safely use the roads at night (Refer also to the Vercauteren (2015) video).

  It is important to note that the residents of the town of Wellington Shire in Victoria, Australia, have rejected the rollout of LED streetlights to keep their night sky unlit so they can retain their night-time connection with the natural environment (Waddington-Feather 2015).

3. HEALTH AND ENVIRONMENT

Wireless LED street lighting systems, health and the environment

The potential effects of such systems to health, wellbeing and the environment in general need to be further considered.

There has been much written about the potential health risks from blue-rich light from LEDs and the increased levels of glare such units can create. There is often poor guidance to specifiers on this issue.

Where possible, it appears that the specification of units with high colour temperatures (5000K) should be avoided as they can disturb biological circadian rhythms in humans, animals and vegetation. The specification of LEDs with warmer colour temperatures (≤2700K) is generally preferable to those with higher colour temperatures.

Environmental risks from light at night and wireless network control

- **Light Pollution**
    - **Light spectra and wildlife** - Additionally, it has been indicated that city planners should use light spectra that are least disruptive to wildlife (Ouyang et al. 2015).
    - **Insects and light pollution –** Research indicates that light pollution can adversely affect the navigational abilities of migrating birds. It can also contribute to the marked decline in avian insectivores' food supply. This fact has been recognised for around 120 years: "*With the exception of the finches, all the English songbirds may be said to be insectivorous, …. As the electric light is finding its way for street illumination … [insects] are slain by thousands at each light every warm summer evening, battering themselves against the globes until the ground beneath is strewn with them. The fear is expressed, that when England is lighted from one end to the other with electricity the song birds will die out from the failure of their food supply,"* (Anonymous 1897).

The potential ecological and financial repercussions of street light wireless networks on birds, insects and humans have yet to be properly addressed by industry and regulatory authorities.

- **Electromagnetic pollution**
  Radiofrequency electromagnetic fields are now recognised as a Group 2B carcinogens (WHO/IARC 2011) and can severely affect wellbeing even at low levels of exposure (BioInitiative Working Group 2012). There are already calls by some experts to have these upgraded to Group 2A or even Group 1 carcinogens (Hardell & Carlberg 2015, 2013, Sage & Carpenter 2014).

    - **Insects and electromagnetic pollution** - Insects drawn to wireless controlled street lights at night will experience far higher exposures than those already shown to induce negative effects in their species. As an example, exposures to radiofrequencies at intensities as low as 1 µW/cm² have been shown to reduce insects' reproductive capacities (Panagopoulos & Margaritis 2010).

      Reduced insect numbers can greatly contribute to the reduction in numbers of avian insectivores providing vital ecosystem services. Reduction in beneficial insect species that also provide vital ecosystem services too may be expected. In 2006, the value of

ecological services provided by insects in the United States alone was estimated at $57 billion (Losey & Vaughan 2006).

- **Birds and electromagnetic pollution** - Birds are often likely to perch on wireless street lights during the course of the day and may experience adverse effects on their health as a result of such exposures. There are a number of studies indicating adverse effects on birds as a result of radiofrequency exposures at levels far below those created by wireless devices on streetlights. Examples of these can be provided by the present author.

The sharp decrease in insect and aerial insectivore numbers in recent years has occurred in parallel with the rapid expansion of both night-time outdoor lighting and wireless communication.

In addition to providing avian ecosystem services, such as consumption of carrion, predation of invertebrates and vertebrates, plant pollination and seed dispensing, which are worth billions to the World economy, they also contribute billions to the growing ecotourism industry (World Migratory Bird Day 2012).

- **Effects of low intensity radiofrequency exposures on humans and animals**
  Even low-level exposures to radiofrequency electromagnetic fields have been linked to adverse health conditions in humans and test-animals. For a brief review of some of these studies please refer to: http://www.hese-project.org/hese-uk/en/niemr/power_density_effects.pdf

  Please also refer to the present author's presentation to the EESC covering some aspects of this important issue, as related to the effects of environmental exposures to humans: http://www.eesc.europa.eu/resources/docs/dr-jamieson---revised-presentation.pdf

There are far safer more cost affective alternatives to standard wireless LED street lights that can be pursued and specified by authorities. These include the use of stand alone intelligent lighting. Further details can be provided by the present author.

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