



Light Pollution and The Planning Profession - Saving Energy and Reducing Community Conflict

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Wisconsin has neither statewide light pollution legislation, nor organized statewide activity to promote energy efficient exterior lighting practices. Control of light pollution is taking place case by case at the local level. Planning and zoning officials are finding themselves faced with balancing safety, energy efficiency and good neighbor relations with demands for increased exterior lighting. This article discusses what planners can do to reduce the social, economic and environmental costs of poor exterior lighting.

Light Pollution - What Is It?

Thirty years ago we thought of pollution as smoking factories, burning rivers, and dying fish and birds. Today, the causes of environmental degradation are more closely linked to our individual behaviors. Light pollution caused by poor exterior lighting is a good example of how something that we take for granted can affect our environment.

Poorly designed exterior lighting commonly wastes 30% - 40% of its electrical demand by over-lighting and illuminating the surrounding area with glare. While satellite images of the United States at night have captured the public's imagination, recent analysis of data collected by those satellites, as well as estimates based on street lighting in Dane county, suggests that 1% of total

Wisconsin at Night from Space electrical sales in Wisconsin (650,000Mwh) is wasted lighting the night sky.



Light pollution is also an increasing source of conflict between neighbors and businesses, and urban and rural residents. Glare from streetlights, commercial lighting and unshielded residential security lighting trespasses on private property and disrupts sleep. Sky glow from large urban areas, industrial facilities and prisons, obscures the night sky, a basic natural resources. Good exterior lighting practices can help to avoid these conflicts, save energy, improve our quality of life, and preserve our natural heritage.

Light Pollution- You Know it When You See It

Glare: The first principle of good exterior lighting is to illuminate only what we wish to see, and nothing else. When we see light from the fixture itself rather than what the fixture is meant to illuminate, we are observing glare. Poorly-designed or poorly installed lighting causes glare that can severely hamper the vision of pedestrians, cyclists, and drivers, creating a hazard rather than increasing safety.



While glare is both the most common lighting problem, it is also one of the easiest to detect and fix. It can be eliminated by shielding light fixtures so that direct rays of light cannot reach our eye. This allows the eye to maintain its nighttime sensitivity. Shielded lights also improve security by allowing us to use our peripheral vision to see objects and movement in dark areas that would otherwise be obscured by glare.

Light Trespass: Glare is also the most common cause of light trespass. Light trespass occurs when a light fixture on one property illuminates an adjacent or nearby property. Light trespass is not a legal concept, but rather a description of the nuisance impact upon someone else's property of improperly shielded or aimed lights. We all have seen streetlights, commercial lights or residential lights spilling over onto adjacent property causing illumination where it was not meant to be. Poorly designed outdoor lighting shines onto neighboring properties and into bedroom windows, invading privacy, hindering sleep, and creating an unattractive look to the area.



Lighting and Security: Dusk-to dawn security lighting has become common. We've all noticed mercury vapor lamps on farms and garages that shine on long after the residents are asleep. These lights create deep shadows that can hide criminal activity. Security lights on adjacent properties can also provide sufficient illumination for prowlers and vandals.



The National Institute of Justice 1997 report to the US Congress states "We can have very little confidence that improved lighting prevents crime, particularly since we do not know if offenders use lighting to their advantage... In short, the effectiveness of lighting is unknown." Motion sensors and appropriately lighted entryways can provide better safety than glaring dusk-to-dawn security lights.

Lighting and Energy Use: With improved lighting design comes improved energy efficiency. A properly shielded streetlight can provide the same illumination at the pavement while using one third less electricity. The same is true for residential and commercial lighting: as lighting effectiveness goes up, energy needs go down. This is especially true when motion sensors and curfews are used to curtail unneeded dusk-to-dawn lighting.

Widespread adoption of more efficient exterior lighting practices is estimated to reap energy savings in Wisconsin of as much as 200,000 megawatt hours per year (\$10 million @\$50/Mwh), with comparable reductions in air pollutants from coal-fired electrical generation.

Light Pollution - A Planning Approach

While education and awareness raising are important, controlling light pollution often requires some regulation. Take for example the Town of Koshkonong in Jefferson County. Concerned about sky glow from the proposed expansion of an industrial park in neighboring Fort Atkinson, and faced with an increasing number of dusk-to-dawn security lights that threatened the rural character of the township, residents of the Town of Koshkonong investigated ways of controlling light pollution. The Town of Koshkonong adopted an outdoor lighting ordinance to:

“... define practical and effective measures by which the obtrusive aspects of excessive and/or careless outdoor light usage can be minimized, while preserving safety, security and the nighttime use and enjoyment of property. These measures will curtail the degradation of the nighttime visual environment by encouraging lighting practices that direct appropriate amounts of light where and when it is needed, increasing the use of energy-efficient sources, and decreasing the wastage of light and glare resulting from over-lighting and poorly shielded or inappropriately directed lighting fixtures.”

The ordinance regulates the type, placement and brightness of residential and commercial light fixtures in the township. Successful implementation of this ordinance over the coming years should result in a nighttime environment free of glare and over-lighting.

In addition to regulating specific types of lighting fixtures and installations, other communities have adopted area-wide controls on exterior lighting. The goal of this approach is to limit the total amount of light used for a commercial or residential development, while providing flexibility for lighting designers. The city of Flagstaff, Arizona includes this language in its lighting ordinance:

“Total outdoor light output (excluding streetlights used for illumination of public rights-of-way) of any development project shall not exceed 100,000 lumens per net acre, averaged over the entire project. Furthermore, no more than 5,500 lumens per net acre may be accounted for by lamps in unshielded or partially-shielded fixtures ... except that lamp(s) emitting no more than 4,720 lumens per single family dwelling unit or duplex dwelling unit for residential outdoor lighting purposes are exempt from the shielding requirements...”

In this case the ordinance invokes specific design standards to control the amount of light used and the types of fixtures permitted (N.B. a 100 watt incandescent bulb produces about 2,000 lumens of light).

In many cases where county or local zoning exists, exterior lighting regulation can be easily added to existing building codes or nuisance ordinances. When a community wishes to address exterior lighting in a comprehensive manner however, a stand alone exterior lighting ordinance that covers all lighting issues is often preferred.

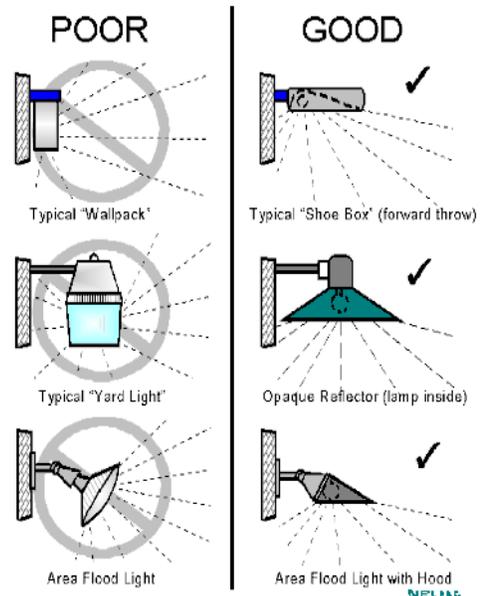
Incorporating language from accepted lighting design standards is a good way to avoid conflict and litigation during implementation of the regulations. The Illuminating Engineering Society of North America (IESNA) provides recommended practices for the lighting industry, which can be found in IESNA RP-33-99 *Lighting for Exterior Environments*, a reference most lighting professionals should be familiar with.

Concepts for Regulating Exterior Lighting

Residential Lighting: The goal of regulating residential exterior lighting should be to eliminate glare and light trespass, while encouraging the use of low wattage bulbs and motion detectors to save energy. Most residential lighting ordinances prohibit glare from any fixture of over 2,000 lumens.

To meet this requirement all lights of over 2,000 lumens on residential property must be fully shielded and aimed below the horizontal. Ordinances also prohibit light trespass onto neighboring property. It is customary to provide an exemption for fixtures that exist at the time of enactment, until the subsequent repair or replacement of these fixtures.

Examples of Some Common Lighting Fixtures



Commercial Lighting: While some businesses may feel that attracting customers with bright lights is as simple as attracting moths to a flame, responsible lighting designers know that a safe and attractive nighttime environment can be achieved without wasting energy and creating glare on surrounding properties. Specifying recessed canopy lighting, internally lit signs and full-cutoff luminaires will prevent the glare that is most annoying to neighbors and passers by.

Requiring adherence to IESNA design recommendations RP-33-99 lighting *For The Exterior Environment* is also an effective way to control commercial over-lighting. By requiring a conditional use permit for lighting designs that deviate from IESNA recommended practices, local control can be applied to individual installations.



Service Stations and Car Dealerships: We've all noticed a gradual increase in illumination from service stations, convenience stores and car dealerships. While IESNA recommends 10 foot candles(fc) of illumination around gas pump islands as adequate for safe automobile fueling, it has become common to see brightly lit stations with 75-80fc coming from glaring luminaires attached to the underside of the canopy.

While these installations use 7-8 times more light and electricity than needed, the glare from these over-lit canopies is a problem for more than their neighbors:

“Service stations lighted to high illuminance levels may pose adaptation problems for customers leaving the station and re-entering the much darker street..nearby” (IESNA RP-33-99).

In other words, motorists may suffer from temporary night-blindness as they drive away after filling their tanks.

The same is true for car dealerships that use high intensity dusk-to-dawn lighting to advertise their wares. While IESNA recommends 10-20fc of illumination for car dealership lots, there are many examples of well designed installations where the lighting designer used cutoff lighting to provide 150-200fc of illumination on the lot, ten times the recommended amount of light and electricity. These lots can spill 30-50fc of light along the adjoining roadway, ten times the level recommended for street lighting.

Municipal Lighting: More and more communities are replacing old drop-lense street lights with new full-cutoff luminaries.



Using the same amount of electricity, full-cutoff street lighting can put 30 percent more light on the roadway surface, while eliminating glare and light trespass. This increase in efficiency gives municipalities the opportunity to re-evaluate the placement and wattage of their streetlights to provide better quality lighting at a reduced cost. Recommended street lighting practices are found in IESNA RP-8-00.

Municipal sports lighting provides another opportunity for communities to improve the quality of the nighttime environment. Light poles that are too low to the ground, combined with unshielded high-power spotlights cast glare across neighborhoods and the countryside. Proper design and installation can provide for safe sporting conditions without an impact on surrounding properties. Sports lighting practices are found in IESNA RP-6-88.



Sources of Information for Controlling Over-Lighting and Glare

Fortunately, there is guidance available to assist planning and zoning officials with decisions regarding exterior lighting application:

SHWEC: The UW-Extension assists communities and businesses to save energy while improving the quality of their exterior lighting. Educational programs and model lighting code language are available from:

The Solid and Hazardous Waste Education Center.
610 Langdon Street, Room 528
Madison, WI 53703-1195
608/262-0385

IESNA: The Illuminating Engineering Society of North America provides recommended design standards for the lighting profession:

IESNA
120 Wall Street, 17th Floor
New York, NY 10005-4001
212/248-5000
www.iesna.org

IDA: As the central clearinghouse for information on light pollution The International Dark-Sky Association has compiled a web-based resource of exterior lighting information and model ordinances from around the country:

IDA
3225 North First Ave.
Tucson, AZ 85719
520/293-3198
www.darksky.org

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