Dark Skies: Reducing light pollution through lighting standards

Overview

The campaign to reduce light pollution through lighting standards is known as the dark-sky movement. The movement is spearheaded by the International Dark Sky Association (IDA) which advocates for lighting standards that makes more stars visible at night, reduces sky glow, and improves that quality of life for humans and wildlife. Collier County has recently begun to introduce lighting standards that incorporate dark sky concepts and the Board of County Commissioners has provided direction to continue this effort.

1. International Dark Sky Association

The IDA is the leading authority for dark sky lighting standards. The organization promotes, supports, and provides technical assistance to policy makers. The IDA’s goals are:

- Advocate for the protection of the night sky,
- Educate the public and policymakers about night sky conservation,
- Promote environmentally responsible outdoor lighting, and
- Empower the public with tools and resources to help bring back the night.

The IDA recognizes outdoor lighting is an essential function but advocates that it should be used wisely. The term “dark sky lighting” or “dark sky compliant” refers to IDA guidelines that reduce ambient lighting waste.

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2. How do IDA darks sky lighting standards work?

Dark sky lighting standards support practices within a community that remove excessive glare, light trespass, or sky glow. The IDA worked with the Illuminating Engineering Society of North America (IESNA) to prepare a Model Lighting Ordinance (MLO). The MLO identifies three main concepts, lighting zones, amount of light for a land use and the current rating classification system for luminaires. Generally, to be dark sky compliant means the light source is shielded, below the maximum wattage limit, within the specified color temperature range, and the lighting is guided by the illumination levels and uniformity ratios of the. The following are some of the ways to implement dark sky concepts found in the IDA’s MLO:

A. Lighting Zone Classifications

Table 1, below, is a composite of information from the IDA’s MLO, which includes a User’s Guide. It designates a lighting zone for different categories of land uses. The lighting zones reflect the base light level for each land use type. IDA recommends that the lower lighting level be assigned to a zoning district, with exceptions noted for specific land use types (i.e. gas stations and car dealerships). The IDA recommends that lighting zones are considered as an overlay to a zoning district. Lighting zones can also be modified and adapted to particular uses to ensure compatibility through established public procedures. For example, a church going through a conditional use near residential properties could be assessed for lighting compatibility through the public hearing process.

Similar to the Growth Management Plans Future Land Use Map, the lighting zones are to be assigned to the desired future land use. In addition, lighting zones may be assigned vertically. For example, the lighting zones within a mixed use building may be different at the street level than at the residential levels above.

IDA recognizes that outlining exemptions is important. The User’s Guide suggests making special provisions for streetlights, signs, special uses, thresholds for repairs, temporary uses, emergency conditions, etc.

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4 Ibid.
Table 1.

<table>
<thead>
<tr>
<th>Lighting Zones</th>
<th>Applicable Areas</th>
<th>Site and Structure Classifications</th>
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<tbody>
<tr>
<td>LZ0 No Ambient Lighting</td>
<td>Where the natural environment will be seriously and adversely affected by lighting or where occupants have expressed a strong desire that light trespass be strictly limited. Impacts include disturbing the biological cycles of flora and fauna and/or detracting from human enjoyment and appreciation of the natural environment. The vision of human residents and users is adapted to total darkness, and they expect to see little or no lighting.</td>
<td>Recommended default zone for wilderness areas, parks and preserves, and undeveloped rural areas. Includes protected wildlife areas and corridors.</td>
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<tr>
<td>LZ1 Low Ambient Lighting</td>
<td>Where lighting might adversely affect flora and fauna or disturb the character of the area. The vision of human residents and users is adapted to low light levels. Lighting may be used for safety, security and/or convenience but it is not necessarily uniform or continuous.</td>
<td>Recommended default zone for rural and low density residential areas. Includes residential single or two family; agricultural zone districts; rural residential zone districts; business parks; open space include preserves in developed areas.</td>
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<tr>
<td>LZ2 Moderate Ambient Lighting</td>
<td>Of human activity where the vision of human residents and users is adapted to moderate light levels. Lighting may typically be used for safety, security and/or convenience but it is not necessarily uniform or continuous.</td>
<td>Recommended default zone for light commercial business districts and high density or mixed use residential districts. Includes neighborhood business districts; churches, schools and neighborhood recreation facilities; and light industrial zoning with modest nighttime uses or lighting requirements.</td>
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<tr>
<td>LZ3 Moderately High Ambient Lighting</td>
<td>Of human activity where the vision of human residents and users is adapted to moderately high light levels. Lighting is generally desired for safety, security and/or convenience and it is often uniform and/or continuous.</td>
<td>Recommended default zone for large cities' business district. Includes business zone districts; commercial mixed use; and heavy industrial and/or manufacturing zone districts</td>
</tr>
<tr>
<td>LZ4 High Ambient Lighting</td>
<td>Areas of human activity where the vision of human residents and users is adapted to high light levels. Lighting is generally considered necessary for safety, security and/or convenience and it is mostly uniform and/or continuous. After curfew, lighting may be extinguished or reduced in some areas as activity levels decline.</td>
<td>Not a default zone. Includes high intensity business or industrial zone districts.</td>
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B. Methods for limiting the amount of light

IDA describes the two methods to limit the amount of light:

The first method is the prescriptive method and it outlines detailed and certifiable standards for luminaire light output, as well as fixture designs that limit glare, uplight, and light trespass. It also establishes the total site lumen limit and can specifically address light trespass. The IDA states that the prescriptive method does not require engineering expertise. The prescriptive method identifies the “initial luminaire lumen” that consistent with a lighting zone. The IDA make note that the values provided are not for foot-candles, but for “initial luminaire lumens” which includes variables such as
efficiency of the light source, spreading of the light, etc. so the number is not equal to foot-candles. The IDA reports that “initial luminaire lumens” are identified on the photometric data and can be shared by an applicant through the application process.

The second method is referred to as the performance method and it allows for more flexibility in meeting the intent of the ordinance, but it is more complicated and it does not have the same easily verifiable requirements as the prescriptive method.

Depending on the complexity of a land use category, both the prescriptive and performance methods can be uses to create lighting regulations.5

C. Light Rating Systems
The IDA reports that the Illuminating Engineering Society’s (IES) original rating system for roadways used terms such as: full cutoff, cutoff, semi-cutoff and non-cutoff. These terms and the corresponding designs were intended to address brightness and glare for street lighting. However, with interest in uplight and light trespass, the IES conducted research and upgraded to a new system called BUG. BUG stands for Backlight, Uplight, and Glare. The BUG rating system is more comprehensive in controlling light pollution. Today, luminaires have a BUG rating that is comprised of the luminaire design, what direction(s) the light is aimed, and the initial luminaire lumen. The BUG system is designed so it is fast and easy to compare lights. The BUG system also includes the distance the light is installed from a property line based on multiple of the mounting height. More information about the BUG rating system is shared on the IDA’s Specifier Bulletin.6

D. Shielded Luminaries
Where the BUG rating system cannot be applied, the second best option is to address shielding. The following graphics depict what the light fixtures look like with shielding and how shielded sources can reduce glare and uplighting. Shielded light points downward and full cut-off shielding blocks upward light above 90 degrees.

5 Ibid.

E. Other Lighting Standards

The IDA recommends using other types of lighting standards to achieve the goals of dark skies, including:

- **Automatic switching requirements** – technology to turn lights off when there is enough sun to provide sufficient lighting.
- **Automatic lighting reduction requirements** – curfews as to when all outdoor lighting shall be reduced. For example, using less lighting during off-peak hours between 10 pm – 6 am.

3. Status of dark sky lighting standards in Collier County

On November 15, 2016, the BCC directed staff to establish best practices for interior and exterior lighting for County owned and/or maintained sites and structures. A preliminary draft of the proposed standards has been prepared and is under review by the County Manager’s Office. It will be available online for review by the public prior to publication at the end of February 2017.

The Growth Management Department is tasked with establishing lighting standards for private property. It is anticipated the LDC Amendment process will begin in 2017 and conclude in late 2018.

Starting in FY 2018 county departments are tasked to start developing plans to accelerate the adoption of LED lighting technology that meet the newly adopted County lighting standards.
4. Recommendations for golf course conversions projects

1. Support the BCC in adopting lighting standards, dark sky concepts and the BUG rating system.
2. Require the following within LDC section 5.05.15:
   a. Provide general guidance that lighting should be designed to reduce light pollution by limiting excessive glare, light trespass and sky glow.
   b. Require lighting is directed away from neighboring residential properties and light fixtures should be full cutoff with flat lenses.
   c. Light poles within the greenway shall be no taller than 12.5 feet.
   d. Require that lighting to be reviewed and analyzed through the Stakeholder Outreach Meetings and public hearing process, where applicable.
   e. Comply with future outdoor lighting standards as established by the County.