LED STREET LIGHTS
LIGHTING DESIGN &
ZONING CONSIDERATIONS

Orange County Municipal Planning Federation
NYSERDA’s Clean Energy Communities Program –
Partnership between HVRC, NYSERDA, and CDRPC
LIGHTING DESIGN & ZONING Considerations

- Street Lighting Concerns & Potential
- Definitions & Consequences:
  - Blue Wavelength
  - Light Pollution
- LED Street Light Solutions

- Model Lighting Ordinance
- Street Lights Ordinance
- Recommendations for Parks & Preserved Areas

Overview
American Medical Association's Council on Science and Public Health 2016 Report

- “Not all LED light is optimal, however, when used as street lighting.”
- “Many early designs of white LED lighting generated a color spectrum with excessive blue wavelength. This feature contributes to disability glare....”

Harvard Health Letter

Blue light has a dark side

Exposure to blue light at night, emitted by electronics and energy-efficient lightbulbs, can be harmful to your health.

Updated: December 30, 2017    Published: May, 2012
LED STREET LIGHTS Possibilities

- 40% Municipal Electric Use
- 80% Maintenance Costs Cut by up to
- 60% Municipal Electric Bill
- 60% - 70% Municipal Cost Savings through Ownership
- 100,000hrs (20+ yrs) Life Span of LED Light
- 65% Reduction in Energy Use
## Conversion Path to LEDs

<table>
<thead>
<tr>
<th>DECISION POINTS</th>
<th>Municipal Ownership</th>
<th>Utility Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Costs</td>
<td>Significantly lower from reduced energy &amp; maintenance</td>
<td>Payment of “stranded costs” required</td>
</tr>
<tr>
<td>Energy Savings</td>
<td>Quicker conversion results in higher savings</td>
<td>May not be significant</td>
</tr>
<tr>
<td>Lighting Design</td>
<td>Public engagement encouraged</td>
<td>Public / municipal input typically arises with issues</td>
</tr>
<tr>
<td>Lighting Choices</td>
<td>More</td>
<td>Limited</td>
</tr>
<tr>
<td>Speed of Conversion</td>
<td>Quicker</td>
<td>At utility’s pace</td>
</tr>
<tr>
<td>Convenience</td>
<td>a) Municipal maintenance</td>
<td>Retention of current relationship</td>
</tr>
<tr>
<td></td>
<td>b) Outsourced on a per-light or annual contract basis</td>
<td>No maintenance concerns</td>
</tr>
<tr>
<td>Equipment</td>
<td>Purchase “as-is”</td>
<td></td>
</tr>
</tbody>
</table>

(Partially sourced from the [Mid-Hudson Streetlight Consortium](#) research.)
BLUE WAVELENGTH Defined

- Light visible to humans: wavelengths from 380-760 nanometers
- Lower numbers emit more blue light
- 4,000K+ LED lights: emit larger fraction of energy in blue portion of spectrum
- Blue wavelengths: associated with more scattering in human eye and skyglow
- Blue light: daytime vs night-time

(Image from “Seeing Blue,” International Dark-Sky Association)
LIGHT POLLUTION Defined

Glare: an overwhelming light that causes annoyance and can impair or reduce visual performance

Light Trespass: an undesirable condition where unwanted exterior light is projected onto neighboring property

Skyglow: brightening of the night sky

Clutter: bright, confusing, and excessive groupings of light sources

LIGHT POLLUTION

Consequences

(Infographic prepared by the International Dark-Sky Association, sourced from USDOE 2011 data.)
LED STREET LIGHT SOLUTIONS
• Supported “proper conversion to...LED lighting, which **reduces energy consumption.**”

• Encouraged “minimizing and controlling blue-rich environmental lighting by using **lowest emission of blue light** possible to reduce glare.”

• Encouraged “use of **3000K or lower** lighting for outdoor installations such as roadways,” properly **shielding** to minimize glare and detrimental human and environmental effects,” and use **dimming features** for “off-peak time periods.”
PUBLIC ENGAGEMENT Solutions

- Address light pollution concerns: street lights & existing
- Address blue light concerns
- Provide information on LEDs
- Include the public in lighting design conversations
- Work with an entity that offers:
  - a fairly robust public input process
  - has a wide selection of light wattages and shielding options
  - test installations
BIG PICTURE
Solutions

1. Light only what you need
2. Use energy efficient bulbs and only as bright as you need
3. Shield lights and direct them down
4. Only use light when you need it
5. Choose warm white light bulbs

(Infographic prepared by the International Dark-Sky Association.)

<table>
<thead>
<tr>
<th>Existing fixtures (watts)</th>
<th>Optimal LED replacement range (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50w HPS</td>
<td>20-28w</td>
</tr>
<tr>
<td>70w HPS</td>
<td>20-28w</td>
</tr>
<tr>
<td>70w MH</td>
<td>20-28w</td>
</tr>
<tr>
<td>100w HPS</td>
<td>35-42w</td>
</tr>
<tr>
<td>100w MH</td>
<td>20-28w</td>
</tr>
<tr>
<td>100w MV</td>
<td>15-28w</td>
</tr>
<tr>
<td>150w HPS</td>
<td>48-54w</td>
</tr>
<tr>
<td>175w MV</td>
<td>20-28w</td>
</tr>
<tr>
<td>175w MH</td>
<td>48-54w</td>
</tr>
<tr>
<td>250w MV</td>
<td>25-54w</td>
</tr>
<tr>
<td>250w MH</td>
<td>90-100w</td>
</tr>
<tr>
<td>250w HPS</td>
<td>85-100w</td>
</tr>
<tr>
<td>400w MV</td>
<td>35-80w</td>
</tr>
<tr>
<td>400w MH</td>
<td>90-120w</td>
</tr>
<tr>
<td>400w HPS</td>
<td>85-120w</td>
</tr>
<tr>
<td>1000w HPS</td>
<td>85-120w</td>
</tr>
<tr>
<td>1000w MV</td>
<td>85-100w</td>
</tr>
</tbody>
</table>

(Recommendations from Mid-Hudson Streetlights Consortium.)
- Certified to minimize glare while reducing light trespass and skyglow.
- Fully shielded to minimize amount of blue light in nighttime environment.
MODEL LIGHTING ORDINANCE Overview

- **Model Lighting Ordinance** developed by International Dark-Sky Association and Illuminating Engineering Society of North America
- Designed to help municipalities develop outdoor lighting standards that reduce
  - glare,
  - light trespass, and
  - skyglow
- Innovations:
  - Use of 5 lighting zones to classify land use
  - Limits amount of light used for each property
  - Uses IES’s BUG classification
• Designed to work closely with ANSI/IES RP-8
• Precise lighting calculations required for designing street lighting prevents application of MLO
• Ordinance text speaks to (pp42-44):
  • Preventing most uplighting from street lighting systems
  • Development of a Master Lighting Plan
  • Establishment of a warranting process
  • Restricting light distribution to 90 degrees or below
STREETLIGHT ORDINANCE
Best Practice

- Black Diamond, Washington Zoning Chapter 18.70 Lighting/Dark Sky (folder)
  - Clear intent
  - Types of light pollution mentioned
  - Applicable to all exterior lighting fixtures and streetlights
  - Provides for compliance and conformance
  - Reasonable exemptions
  - Ample definitions
  - Good visual examples
  - Concern: motion-activated, intermittent home security lighting exempted

- Town of Warwick, Zoning Regulations for Lighting, Section 164-43.4 (folder)
  - Clear intent
  - Strong plans submission and compliance section
  - Generally very complete and detailed
  - Concern: short list of definitions
  - Connected to Comp Plan

- Town of Deerpark Zoning Law
  - Concern: lighting related definitions not provided; use of non-standard wording
Selection of lighting zones should be based on the type of light environments your community wishes to achieve, not existing conditions.

**Lighting Zones:**
- **LZ0:** no ambient lighting
- **LZ1:** low ambient lighting
- **LZ2:** moderate ambient lighting
- **LZ3:** moderately high ambient lighting
- **LZ4:** high ambient lighting

**Zoning Considerations (p5):**
- **LZ0:** wilderness areas, parks and preserves, undeveloped rural areas
- **LZ1:** rural and low density residential areas
- **LZ2:** light commercial business districts and high density or mixed-use residential districts
- **LZ3:** business districts in large cities
- **LZ4:** high intensity business or industrial zone districts
MODEL LIGHTING ORDINANCE

- Lighting Controls & Curfews (pp9-10):
  - Requires all outdoor lighting to have lighting controls barring daylight operation
  - Curfews – reduce or eliminate lighting after a certain time

- Non-Residential Lighting (pp11-18):
  - For non-residential lighting and common spaces in multi-family locations
  - Limits light used, minimizes glare, sky glow, light trespass
  - Detailed explanation of BUG rating provided to limit light trespass and glare

- Residential Lighting (p19):
  - Includes requirements for residential landscape lighting

- Special Permit Lighting (p21):
  - Guidance for lighting types that are intrusive of complex in impacts

- Existing Lighting (p22):
  - Criteria for becoming compliant

- Enforcement & Penalties (p23):
  - Recommend promoting compliance through education and submission requirements

- Tables: Allowances by lighting zone
PARKS & PRESERVED LANDS Lighting Zones

- Proposes 2 additional restrictive zones:
  - NDZ: naturally dark zone
  - LZ00: absolute minimal level of lighting
  - LZ0: discontinuous lighting
  - LZ1: continuous lighting

- Zoning Considerations (p5):
  - NDZ: no illumination in undeveloped areas in parks
  - LZ00: no continuity of lighting; minimal disruption of nocturnal wildlife habitat; lighting where critical for human safety
  - LZ0: developed areas in parks
  - LZ1: model level of lighting to meet visitor expectations, safety concerns, and park operational needs

Developed by the National Park Service National Night Skies Team for the Grand Canyon