

## Making Outdoor Spaces Shine with Sustainable Lighting Solutions



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# Sustainability

- Sustainability is defined as meeting the needs of the present generation without compromising the ability of future generations to meet their own needs.

# How Does Lighting Impact the Environment

- Green House Gas Emissions from Electricity consumption.
- Toxicity from Mercury and other Hazardous material.
- Material Consumption and Disposal.

# **Sustainable Lighting**

## **How do we reduce the Environmental Impact?**

- More Energy Efficient Lighting Systems
- Lower or no Mercury.
- Long Lamp Life/Recycling.

# Which Technologies are Sustainable?

- Obsolete/Not Sustainable
  - Probe Start Metal Halide
- Not Obsolete/Better
  - High Pressure Sodium
  - Pulse Start Metal Halide

# Which Technologies are Sustainable?

- Sustainable Lighting
  - High Efficiency HID
  - Induction Lighting
  - High Quality LED
  - Lighting Controls

| Light Source                        | Lumens/Watt   | Lamp Life (hrs)       | Mercury Content |
|-------------------------------------|---------------|-----------------------|-----------------|
| <b>Probe Start Metal Halide</b>     | <b>40-70</b>  | <b>10,000-20,000</b>  | <b>20mg+</b>    |
| <b>Pulse Start Metal Halide</b>     | <b>60-90</b>  | <b>20,000</b>         | <b>20mg+</b>    |
| <b>High Efficiency Metal Halide</b> | <b>90-120</b> | <b>Up to 30,000</b>   | <b>20mg+</b>    |
| <b>Induction Lighting</b>           | <b>80-100</b> | <b>100,000</b>        | <b>5mg-10mg</b> |
| <b>LED</b>                          | <b>50-90</b>  | <b>25,000-100,000</b> | <b>0</b>        |

# What is Induction Lighting

- An **Induction Lamp** is similar to a fluorescent lamp in that mercury in a gas fill inside the bulb is excited, emitting UV radiation that in turn is converted into visible white light by the phosphor coating on the bulb. Fluorescent lamps, however, use electrodes inside the bulb to strike the arc and initiate the flow of current – each the arc is struck, the electrodes degrade a little, eventually causing the lamp to flicker and then fail.
- Induction Lamps differ in that they do not use internal electrodes, but use a high-frequency generator with a power coupler. The generator produces a radio frequency magnetic field to excite the gas fill.



# Induction vs. High Pressure Sodium



# LED FIXTURES



**Replaced 1000watt MH  
with 309watt LED**

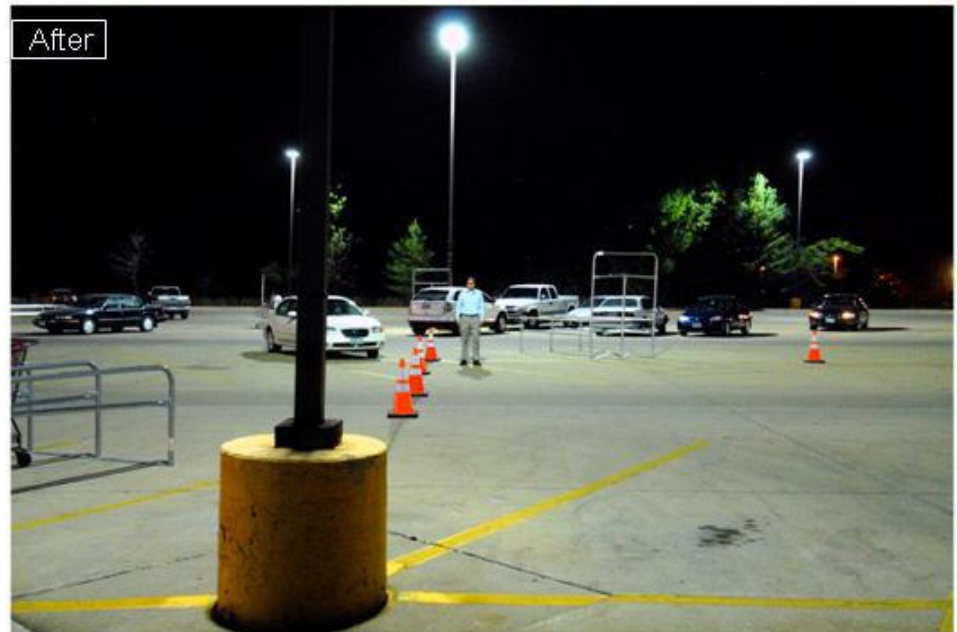
**-One for One  
Replacement**

**-Utilized existing Poles**

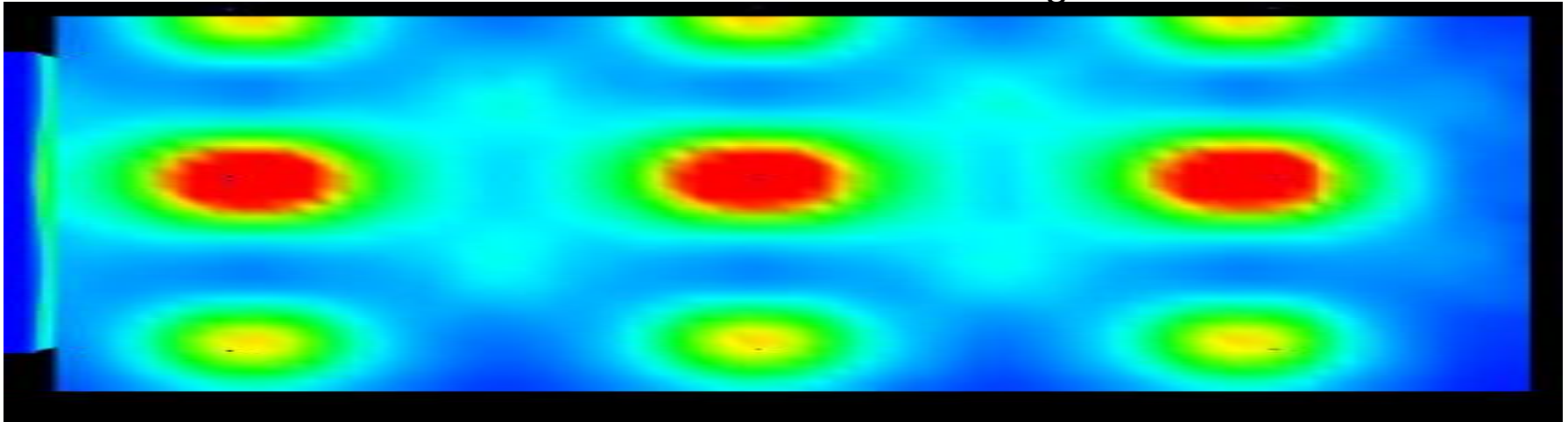
**-Improved Lighting**

**-Almost a 70% energy  
savings.**

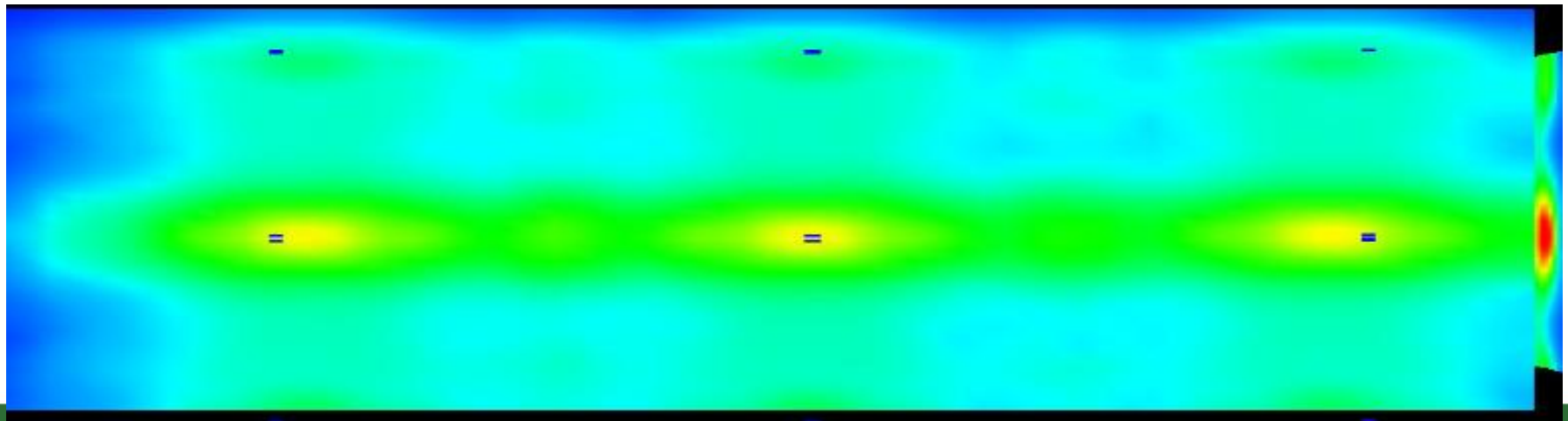
**-Led Fixtures will last 5  
times as long as the  
existing Metal Halides.**



1000 watt Metal Halide Existing Fixtures



309 watt LED



# Solar Lighting



## Grid Connected Light Installation

| Grid Connect       | Count | Cost    | Extended         |
|--------------------|-------|---------|------------------|
| Lights & Poles     | 59    | \$1,050 | \$61,950         |
| Installation       | 59    | \$800   | \$42,400         |
| Trenching (feet)   | 5580  | \$40    | \$223,200        |
| Transformer & Base | 2     | \$8,000 | \$16,000         |
| Disconnect(s)      | 4     | \$900   | \$3,600          |
| <b>Total:</b>      |       |         | <b>\$347,150</b> |

## Solar Light Installation

| Grid Connect   | Count | Cost    | Extended         |
|----------------|-------|---------|------------------|
| Lights & Poles | 76    | \$3,100 | \$235,600        |
| Installation   | 88    | \$1,000 | \$88,000         |
| <b>Total:</b>  |       |         | <b>\$323,600</b> |

# Energy Codes

- The State of Iowa is governed by two energy codes:
- ASHRAE 90.1-2007, Section 9
- IECC 2009
- Both are more or less equal and set maximum power densities for every type of Building and/or particular Space
- Both went into effect on January 1, 2010

## 9.4.1.3 Exterior Lighting Control

- Lighting for all exterior applications not exempted in Section 9.1 shall have automatic controls capable of turning off exterior lighting when sufficient daylight is available or when the lighting is not required during nighttime hours.

## 9.4.1.3 Exterior Lighting Control (con't)

- Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photosensor. All time switches shall be capable of retaining programming and the time setting during loss of power for a period of at least ten hours.
- **Exception:** Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.

## 9.4.4 Exterior Building Grounds Lighting

- All exterior building grounds luminaires that operate at greater than 100 W shall contain lamps having a minimum efficacy of 60 lm/W unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under Section 9.1.1 or 9.4.5.

## 9.4.5 Exterior Building Lighting Power

The total exterior lighting power allowance for all exterior building applications is the sum of the individual lighting power densities permitted in Table 9.4.5 for these applications plus an additional unrestricted allowance of 5% of that sum. Trade-offs are allowed only among exterior lighting applications listed in the Table 9.4.5 “Tradable Surfaces” section.

**Exceptions: Lighting used for the following exterior applications**  
is exempt when equipped with a control device  
independent of the control of the nonexempt lighting:

- Specialized signal, directional, and marker lighting associated with transportation.
- Advertising signage or directional signage.
- Lighting integral to *equipment or instrumentation* and installed by its *manufacturer*.
- Lighting for theatrical purposes, including performance, stage, film production, and video production.
- Lighting for athletic playing areas.
- Temporary lighting.
- Lighting for industrial production, material handling, transportation sites, and associated storage areas.
- Theme elements in theme/amusement parks.
- Lighting used to highlight features of public monuments and registered *historic landmark structures or buildings*.

## TABLE 9.4.5 Lighting Power Densities for Building Exteriors - Tradable Surfaces

- **Uncovered parking areas**
- Parking lots and drives **0.15 W/ft<sup>2</sup>**
- **Building grounds**
- Walkways less than 10 ft wide **1.0 W/linear foot**
- Walkways 10 ft wide or greater, Plaza Areas, Special Feature Areas **0.2 W/ft<sup>2</sup>**
- Stairways **1.0 W/ft<sup>2</sup>**
- **Building entrances and exits**
- Main entries **30 W/linear foot of door width**
- Other doors **20 W/linear foot of door width**
- **Canopies and overhangs**
- Canopies (free standing and attached and overhangs) **1.25 W/ft<sup>2</sup>**
- **Outdoor sales**
- Open areas (including vehicle sales lots) **0.5 W/ft<sup>2</sup>**
- Street frontage for vehicle sales lots in addition to “open area” allowance **20 W/linear foot**

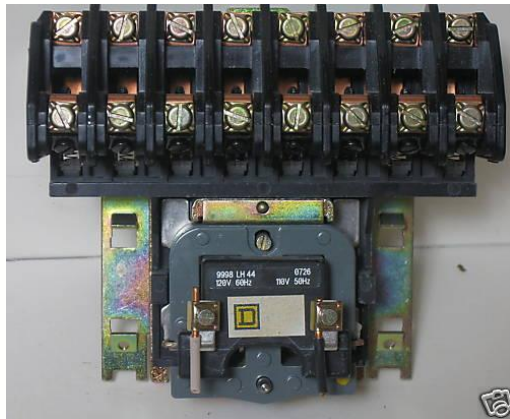
## TABLE 9.4.5 Lighting Power Densities for Building Exteriors – Non-tradable Surfaces

- **Building facades** - **0.2 W/ft<sup>2</sup>** for each illuminated wall or surface or **5.0 W/linear foot** for each illuminated wall or surface length
- **Automated teller machines and night depositories** - **270W per location** plus **90W** per additional ATM per location
- **Entrances and gatehouse inspection stations at guarded facilities** - **1.25 W/ft<sup>2</sup>** of **uncovered area** (covered areas are included in the “Canopies and Overhangs” section of “Tradable Surfaces”)
- **Loading areas for law enforcement, fire, ambulance, and other emergency service vehicles** - **0.5 W/ft<sup>2</sup>** of **uncovered area** (covered areas are included in the “Canopies and Overhangs” section of “Tradable Surfaces”)
- **Drive-through windows at fast food restaurants** - **400W** per drive-through
- **Parking near 24-hour retail entrances** - **800W** per main entry

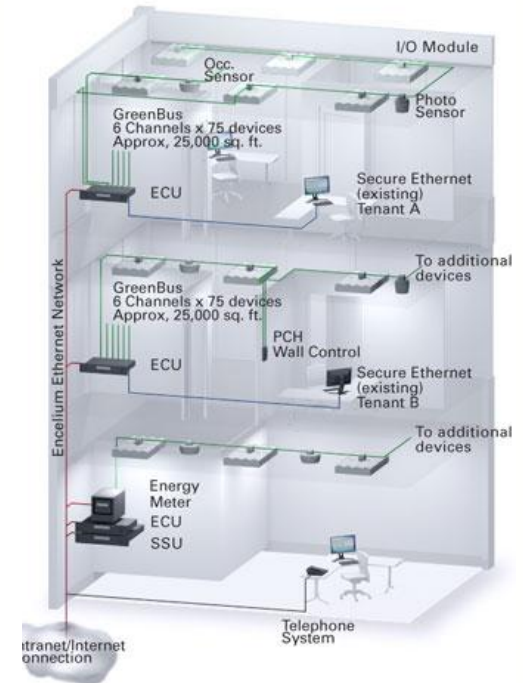
# Lighting Controls

Outdoor Spaces

# Conventional Controls



# Efficient/Programmable and Precise Controls – Hardwired Versions



# Wireless Versions



## **Questions to ask when designing a system:**

- Number of circuits to be controlled?
- Circuit ampacity?
- Circuit voltage?
- Method of control:
  - Occupancy Sensor
  - Daylight Harvesting
  - Scheduling

## Questions to Ask (continued)

- Remote Monitoring?
- If so, internet service available?
- Does daylight harvesting make sense?
- Is bi-level switching required?

## Questions?

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