



COMPARING LIGHT TECHNOLOGIES

Comparing Light Technologies
LED vs. Induction & HPS Lamp
WHAT YOU NEED TO KNOW

WHITE PAPER

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THE PROS AND CONS IN DETAIL

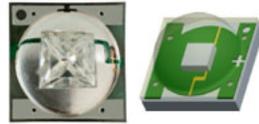
A Look at How LED Compares with “Traditional” Lamp Technology



Induction Lamp:

Pros:

- » Rated life 60,000 hours L-50 (to 70% lumens, limited by ballast life)
- » CRI=+80
- » CCT= 3000K
- » Luminous flux: 8,000 lm (100 hour), 5,600 lm (60,000 Hours)
- » Luminous Efficacy: 80 lm/w (100 hour).
- » Highly Efficient and Energy Saving
- » Instant starting, no cold-start
- » No flickering
- » Perform well under extreme cold conditions
- » Bright, white light (CRI ≥ 80)
- » Improved visibility and security
- » No glare and light pollution
- » Green Light Source
- » Startup Speed Rapid (2 seconds)
- » Maintenance cost low



LED Lamp:

Pros:

- » Long life span 100,000+ Watt hours L-70
- » Very high energy conversion efficiency up to 135 Lumens/watt new generation LEDs, Relume products produce Luminous Efficacy: 80-90 lm/w installed inside the fixture with optimal heat sink.
- » CRI (Color Rendering Index) of 60-96
- » CCT (Correlated Color Temperature) available from 2000K to 10,000K
- » Minimal lumen depreciation (decline light output with age) compared to other lamp types as filament evaporation and depletion is absent
- » “Instant-on” and hot re-strike, unlike Sodium vapors and Metal Halides
- » Ability to focus exact luminous area
- » Focus area and color design help eliminate light pollution
- » No toxic materials used in manufacturing



High-pressure sodium

Pros:

- » Very inexpensive
- » Excellent efficacy
- » Good optical control
- » Good rated lifetime

LED Lamp: (cont.)

Pros:

- » Solid State construction, no moving parts, very rugged
- » Environmentally friendly, uses less energy (76% less than current lamps)
- » Environmentally friendly, can be disposed of in landfills.
- » Startup Speed Rapid (2 seconds)
- » Maintenance cost very low

THE PROS AND CONS IN DETAIL

A Look at How LED Compares with “Traditional” Lamp Technology

Induction Lamp:

Cons:

- » Relatively inexpensive
- » Efficacy compromised by trapped light
- » Power supply life rated for 65000 hour less than the lamp rated life. Recommended to replace the lamp and power supply at the same time.
- » Optical Issues: Induction lamps are really fluorescent lamps without electrodes with poor optical control.
- » Light is produced at the surface of the phosphor – a large highly diffuse source.
- » Difficult to properly direct and manage light with reasonably sized optics – yielding a low lumen utilization coefficient for the luminaire.
- » Very large in size compare to LED retrofit units.
- » Mercury hazard severity: Induction lamps contains mercury amalgam in the lamp making it safer but when the lamp heat up and reaches its ideal operating pressure , the mercury fully vaporized to form plasma. When the lamp cools off (turned off) the mercury condenses on the inner walls of the lamp.

LED Lamp:

Cons:

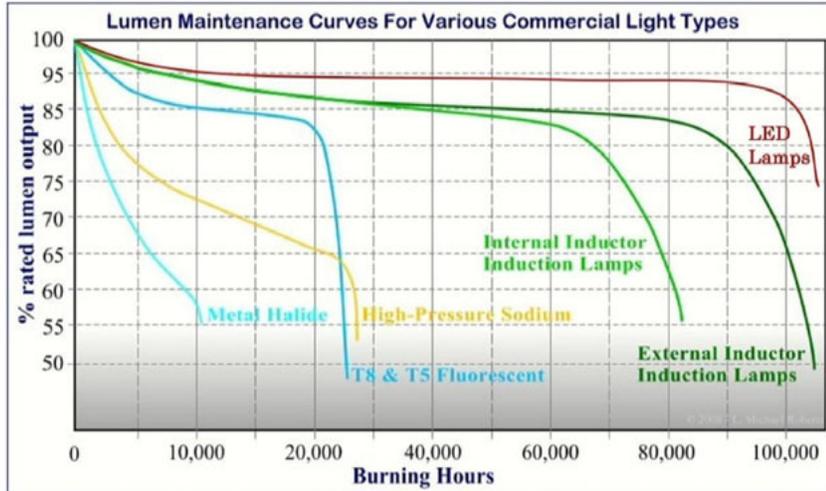
- » Relatively expensive

High-pressure sodium

Cons:

- » Poor color rendition
- » Apparent potential for Little improvement
- » Working life, Short (5,000 hours)
- » Power Consumption very high
- » Startup Speed Quite Slow (Over 10 minutes)
- » Color Temperature Quite Low (Yellow Or Amber)
- » Maintenance cost high

Lumens Maintenance Curves For Various Commercial Light Types



- » The Lumen Maintenance curve depicts the actual lifetime of the Visually Effective Lumens (light) as compared to other lighting scenarios. The LED and induction lamp outlasts the competition whether it is HID (MH or HPS) or the newer T5 & T8 anywhere from 3-5 times longer.

Visual Uniformity Comparison

- » The following photos were taken on the same evening, on the same street (Willamette Bluff in g Portland, OR), with the same camera settings. All luminaires are new and mounted on identical new poles, spaced for optimal performance given the road contours. (Visual test conducted and performed by US Department of Energy efficiency and renewal energy.)

INDUCTION



max (lux)	11.2
min (lux)	0.5
avg (lux)	3.02
avg:min	6.04
Watts	79
PF	0.98
CCT	2759

~9.4 lm/W
in drivelaness

LED



max (lux)	27
min (lux)	6.3
avg (lux)	11.56
avg:min	1.83
Watts	110
PF	0.99
CCT	6667

~25.8 lm/W
in drivelaness

Visual Uniformity Comparison (cont.)

HIGH PRESSURE SODIUM



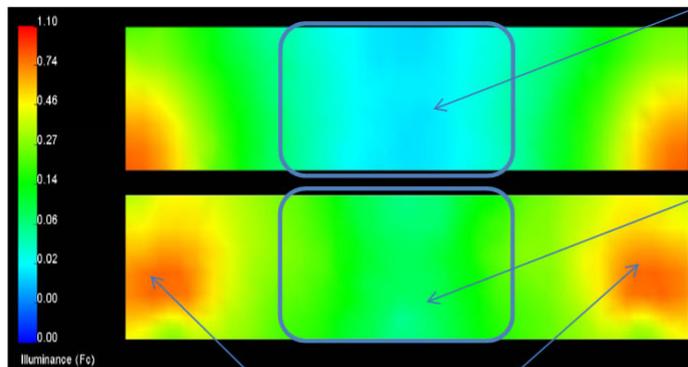
max (lux)	24.1
min (lux)	2.6
avg (lux)	9.96
avg:min	3.83
Watts	115
PF	0.93
CCT	2097

~21.2 lm/W
in drivelanes

Modeled Uniformity Comparison

Equal Wattage

Type III induction (above) vs. LED (below)*



None uniform light distribution, need to add one pole in the middle

Uniform light distribution, no need to add one pole in the middle

*Not the same products installed on Willamette Bluff shown in the preceding photos.

Light Poles

ABOUT THE AUTHOR - RELUME TECHNOLOGIES

Relume Technologies is a Michigan-based manufacturer of highly efficient, environmentally friendly, and cost effective LED lighting products and control systems with sales outlets in the U.S., Canada, Mexico, the Caribbean, Europe and the Middle East. Relume products are used in municipal lighting, commercial signage, outdoor advertising, transportation, and US military applications. Relume Technologies is a founding member of the Michigan Solid State Lighting Association, and supports the organization's mission of ensuring that Michigan is a global leader in solid-state lighting, research & development, and manufacturing. It was recently recognized as one of Michigan's 50 Companies to Watch by the Edward Lowe Foundation. Relume's LED outdoor lights use 40 percent less electricity than conventional streetlights and last up to six times longer. The substantial savings in reduced energy and maintenance costs results in an average payback on investment of less than four years.