

# LED Street Lighting for Municipalities

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*National Grid*

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*Fall 2016 Regional Local Government Workshop*

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# Welcome

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- Why are we here today?
  - Talk briefly about evolution in street lighting technology and LEDs in particular
  - Introduce National Grid's LED street light offering for municipal customers
  - Discuss how LED technology differs from HPS and how this will affect customers' decision-making
  - Present various options to finance the conversion from HPS to LED



# Agenda

- Welcome
- Background – History of Lighting
- What's the difference? – HPS, Metal Halide, LED
- NYS PSC Streetlight Tariff
- Question /Discussion Session
- Wrap-Up



# History of Lighting

- Technology used to light our streets has evolved continuously for over 160 years
- Each step of the way, proven technologies have given way to new advances, the latest being LEDs
- Each generation of LEDs has brought steady improvement in available options and benefits
- While this is still an emerging technology, utility-grade LED products exist that National Grid is now comfortable offering to our customers



# The Lighting Story

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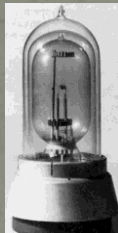
**1879**  
Edison Light  
Bulb



**1901**  
Fluorescent  
Tube

**1919**

Sodium Vapor  
Lamp



**1962**  
First Red  
LED  
(Dr. N. Holonyak)



**~ 1990**  
“High Brightness”  
Red, Orange, Yellow  
& Green LED’s



**1995**  
“High Brightness”  
Green & Blue LED’s



**2000**  
White LED lamps  
Efficacy ~ to Incandescent  
Lamp @ 17lm/W

**2005**  
White LED lamp  
Efficacy ~ Fluorescent  
Lamp 70 lm/W

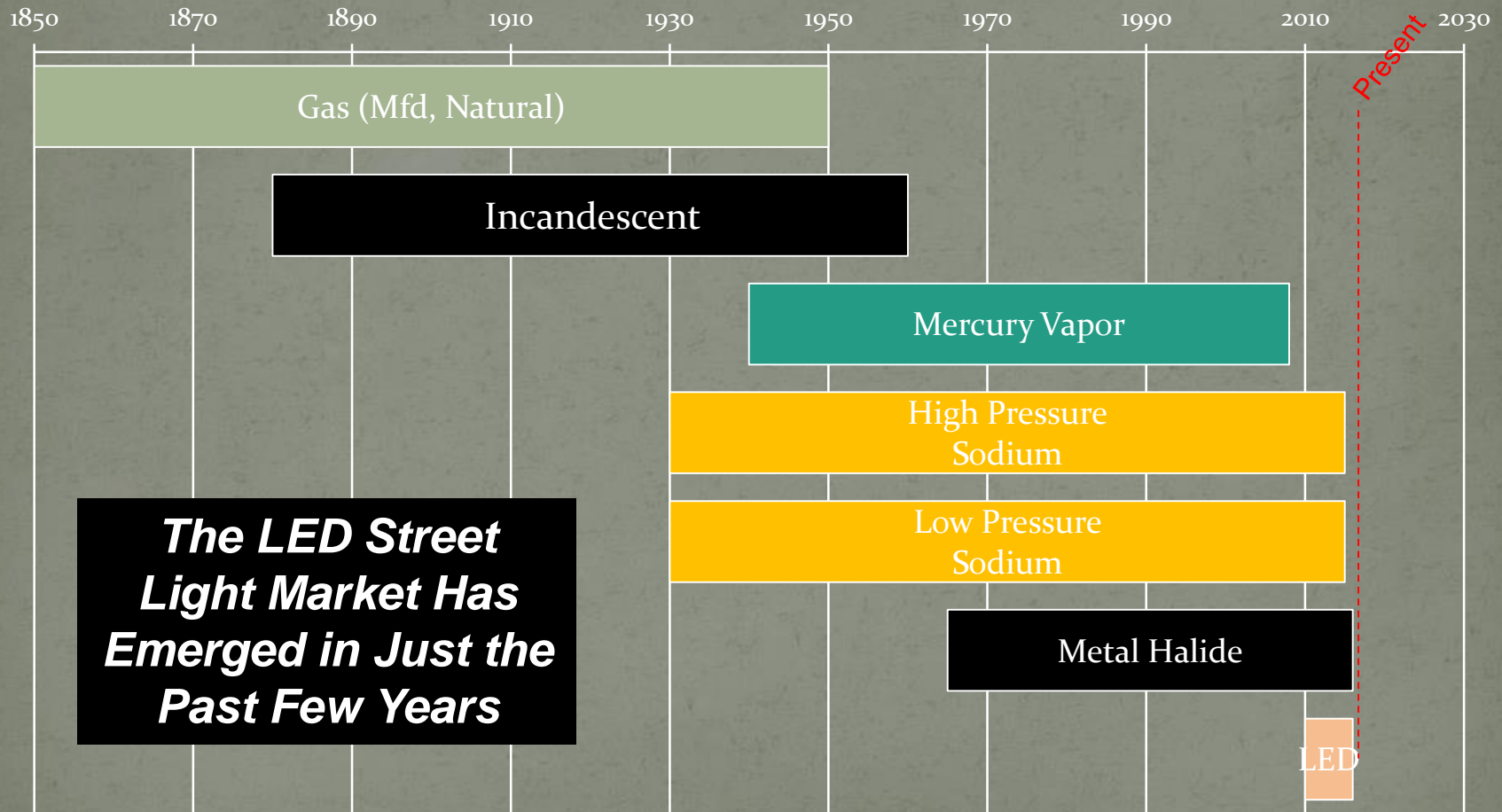


**Production White LED  
Exceeds 150 lm/W**



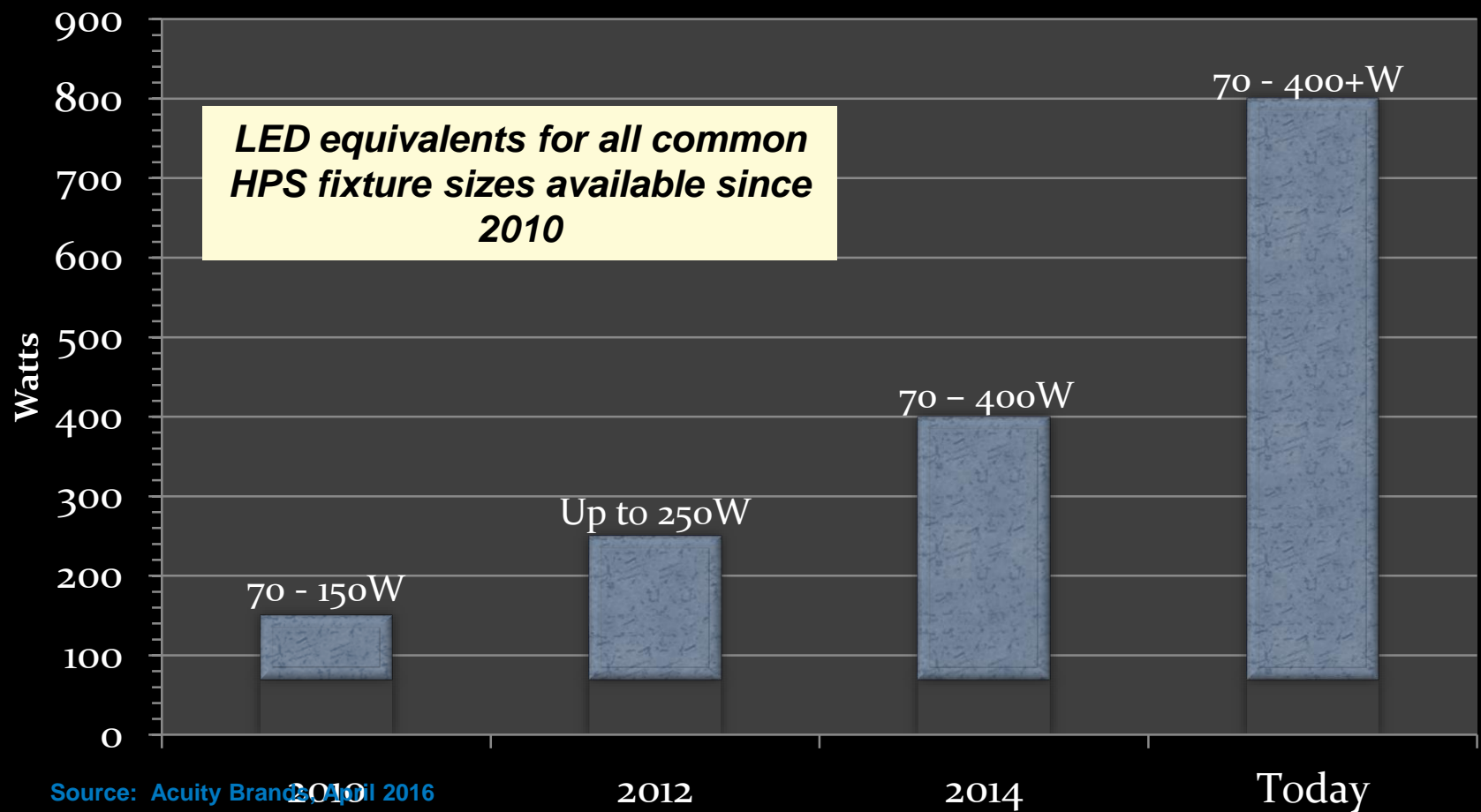
# Evolution of Street Lighting Technology

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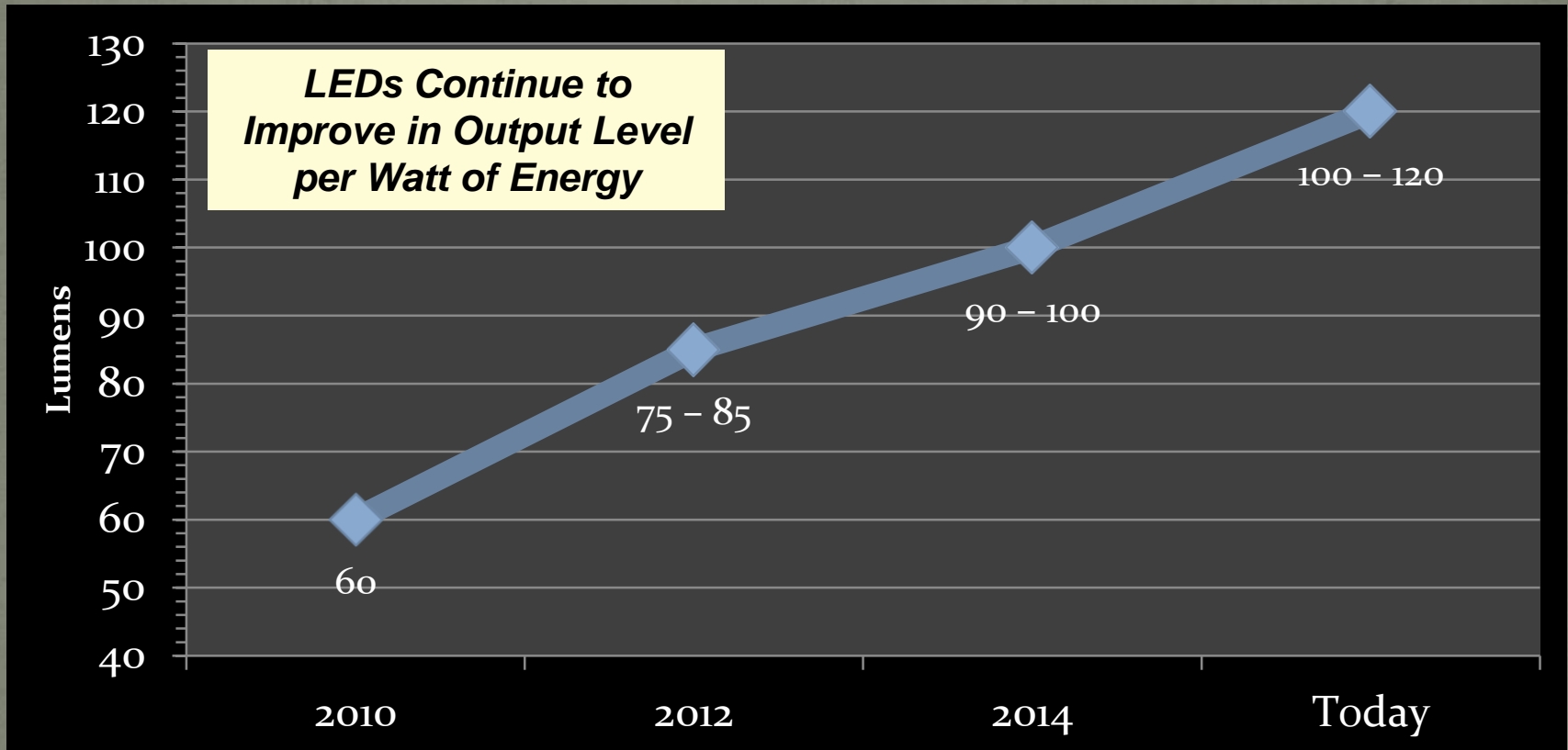
# High Pressure Sodium Equivalency

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# Output (Lumens per Watt)

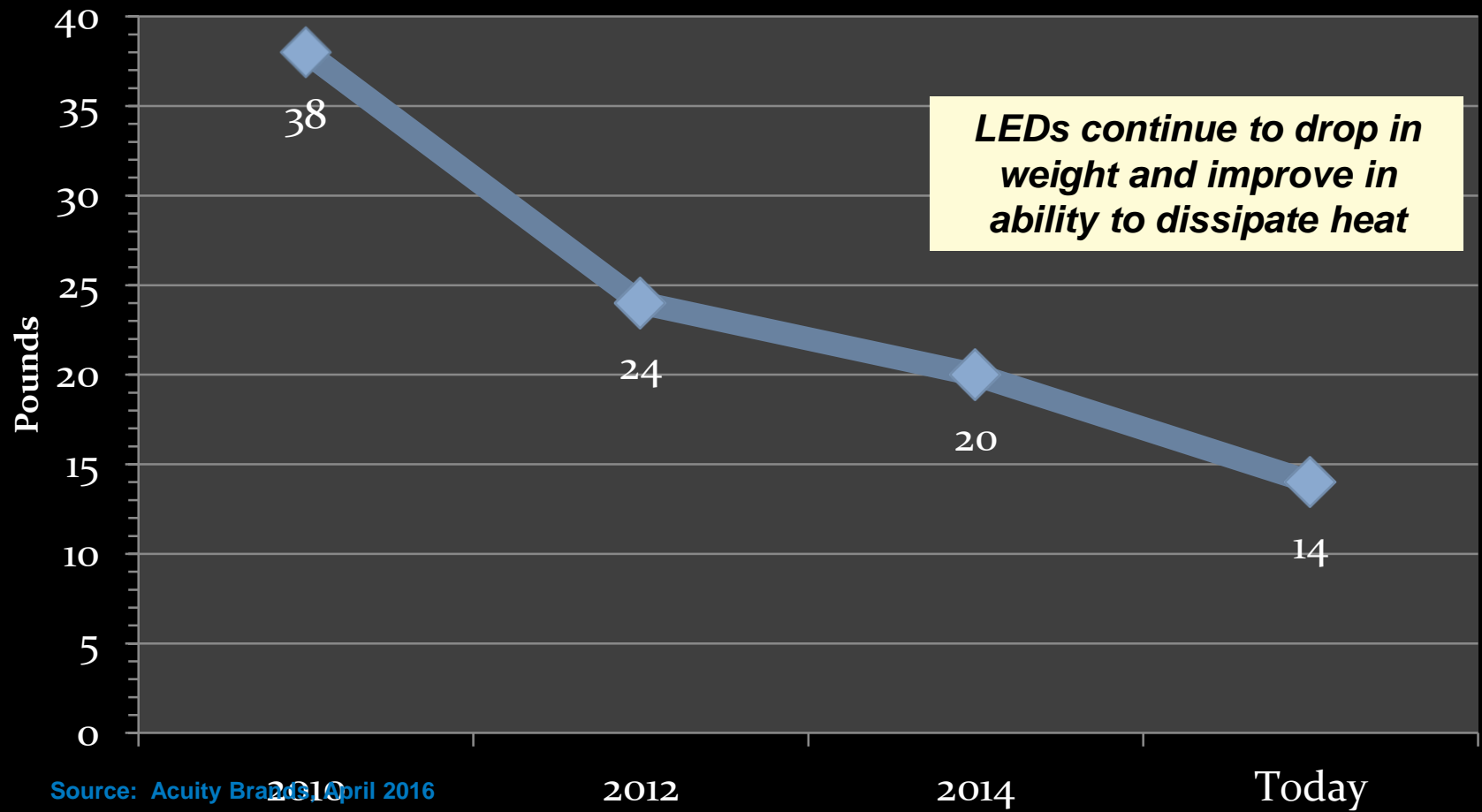
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Source: Acuity Brands, April 2016

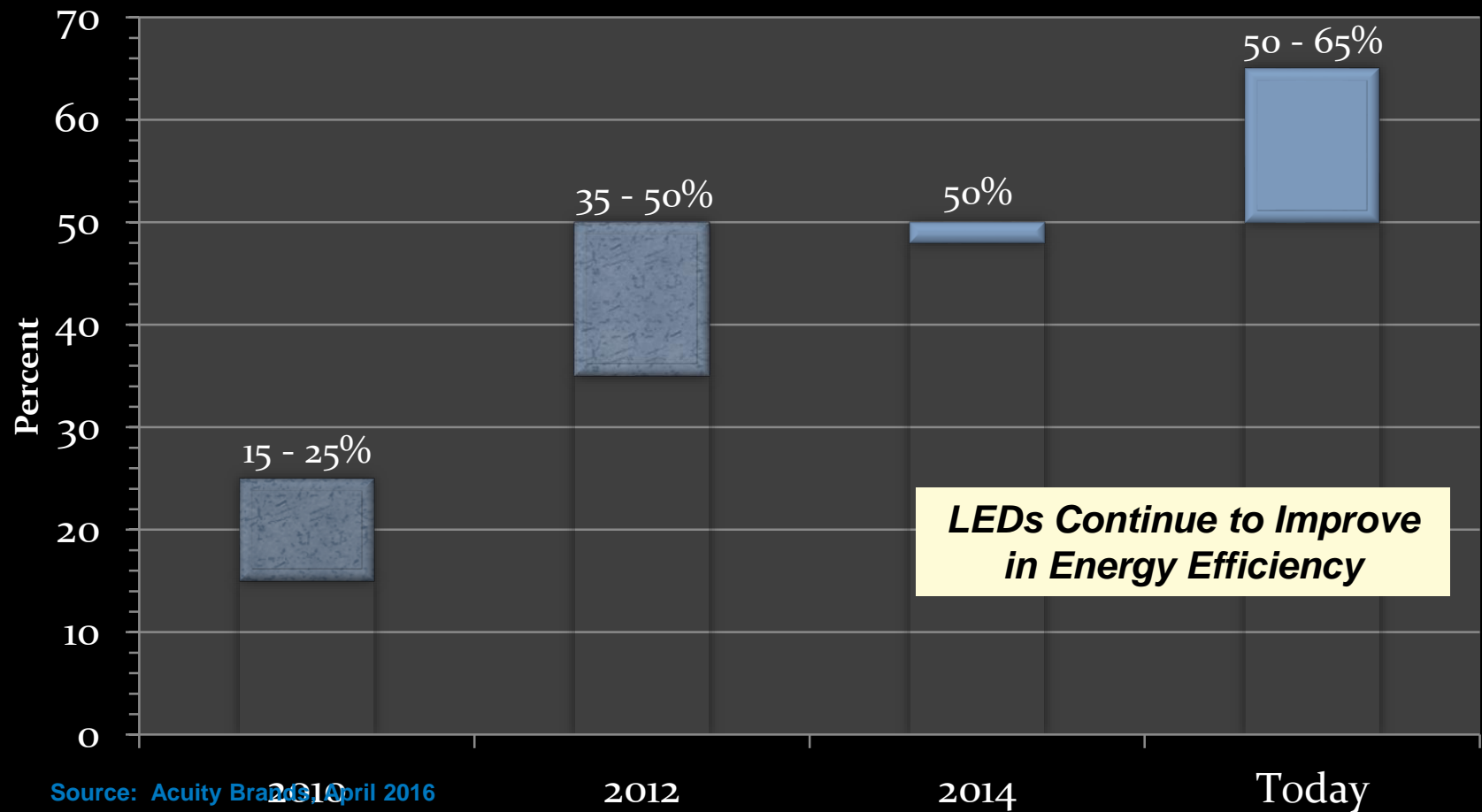


# Unit Weight (lbs.)

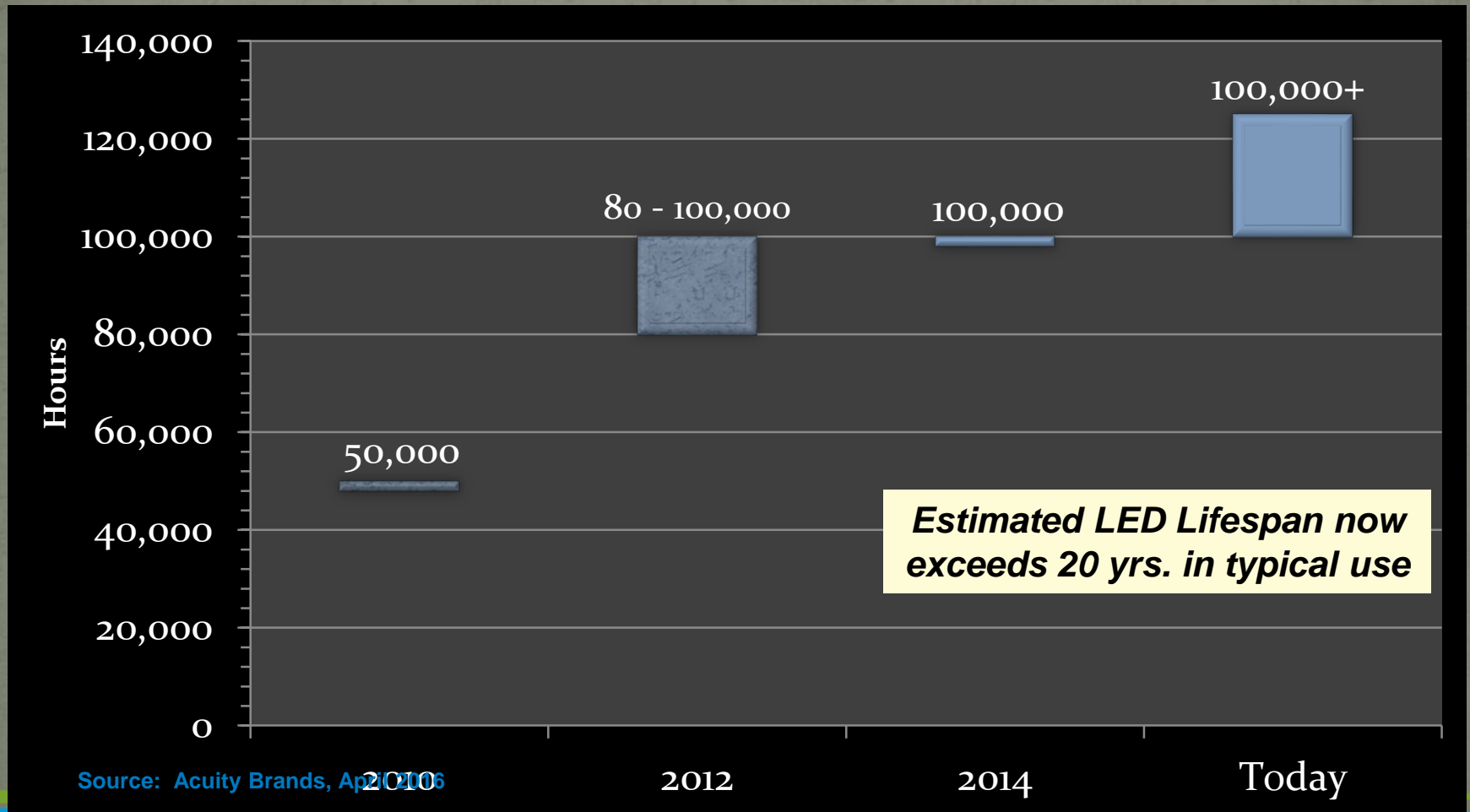


# Efficiency Rating (percent)

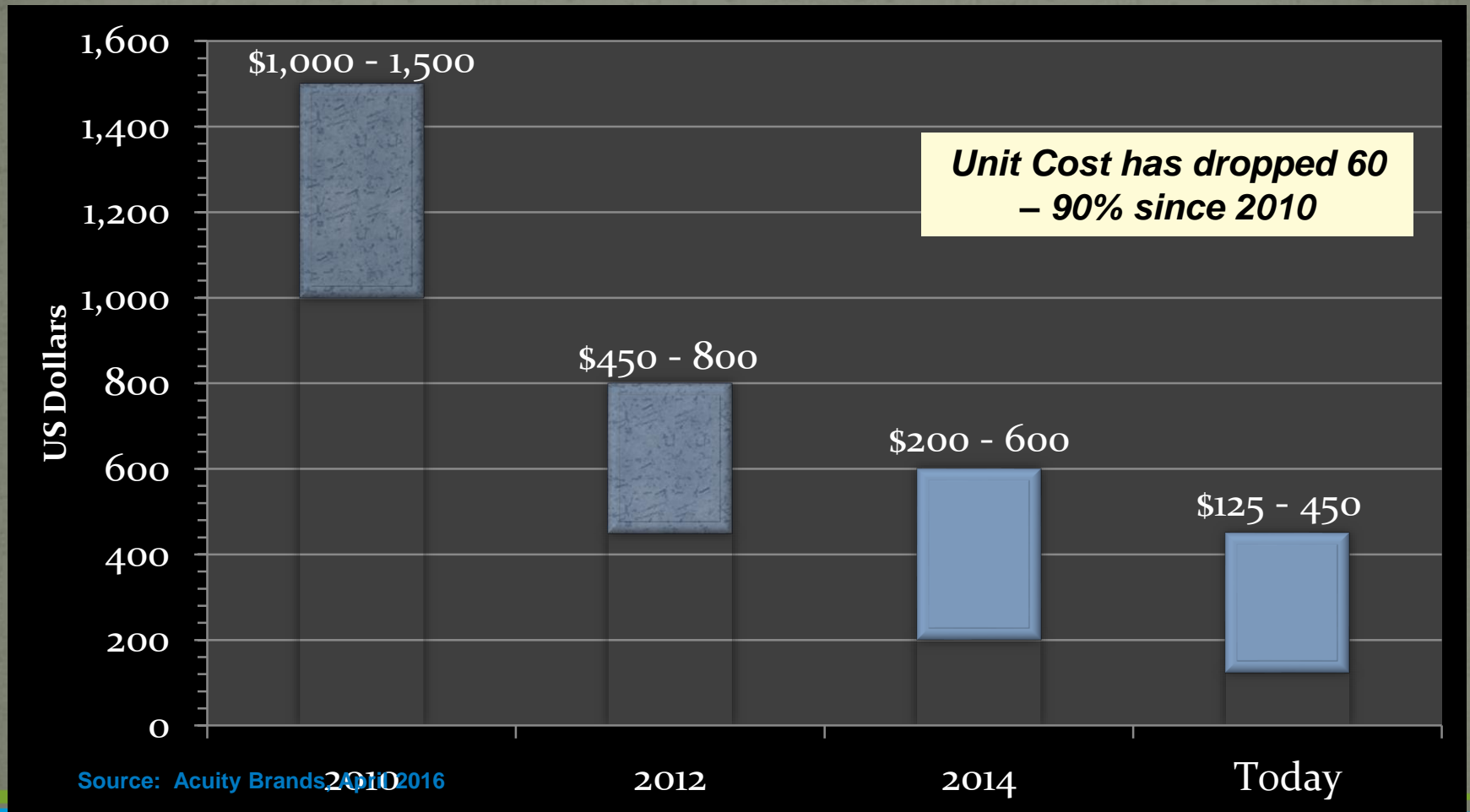
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# Expected Life (hours)



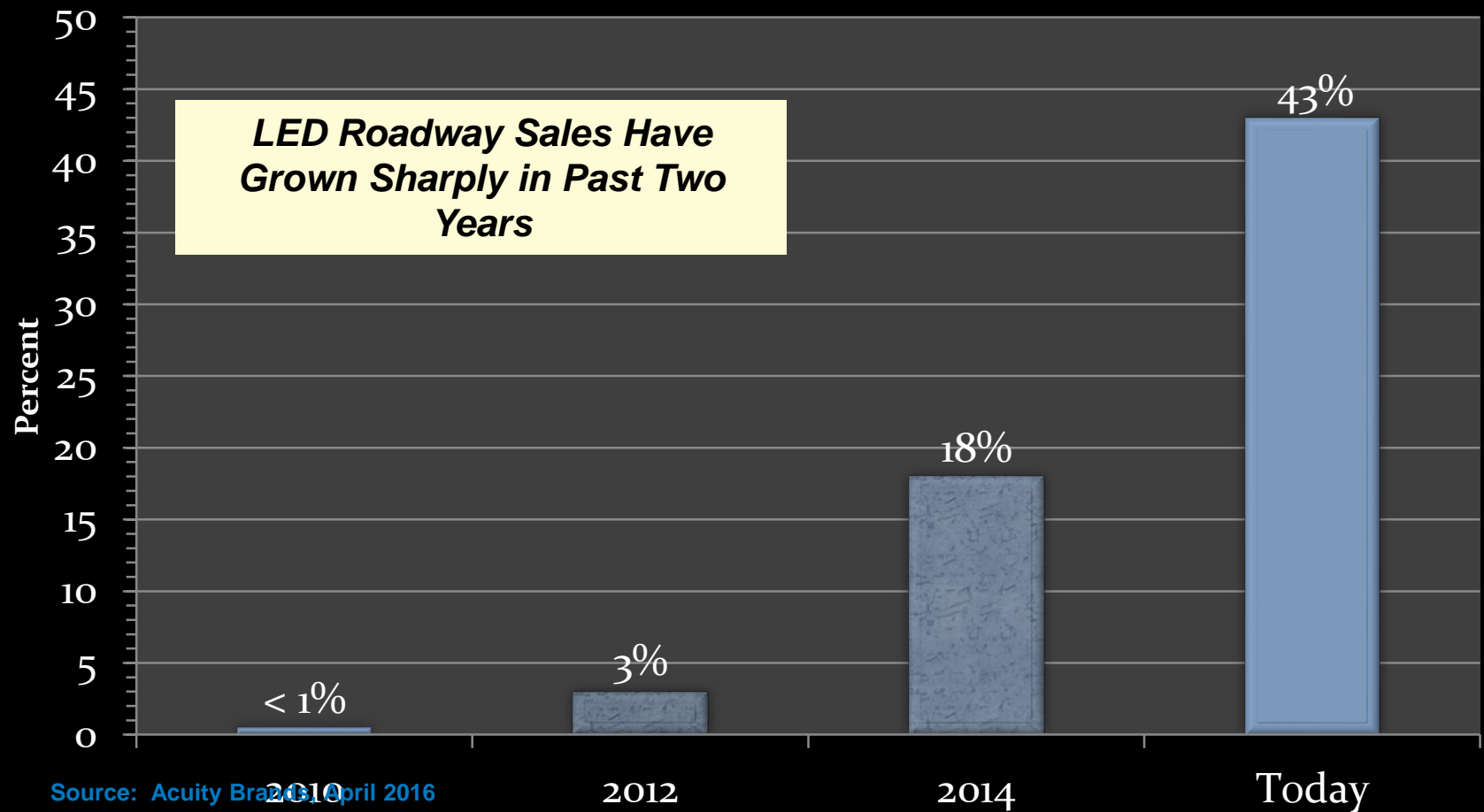
# Unit Cost (dollars)





# Roadway Street Light Sales (Percent)

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# LED Characteristics

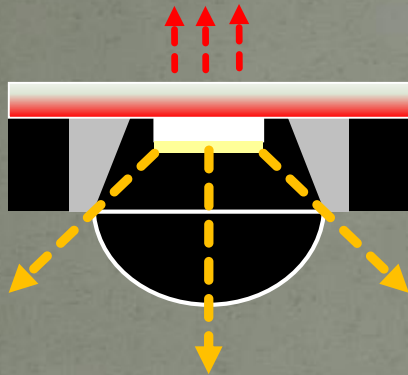
- Energy Efficient
- Long Life – Expected 10-15+ years
- Reduced Maintenance
- White Light Color - Improved Nighttime Visibility
  - Increased Sense of Safety and Security
- Directional Light Distribution
  - Dark Sky Friendly
- Instant On
- Dimmable
- Vibration Resistant
- Environmentally friendly



# Directionality

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LED

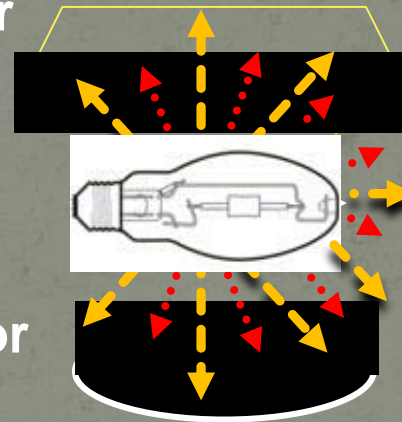


UNIDIRECTIONAL

Conventional Lighting

Reflector

Refractor  
Lens



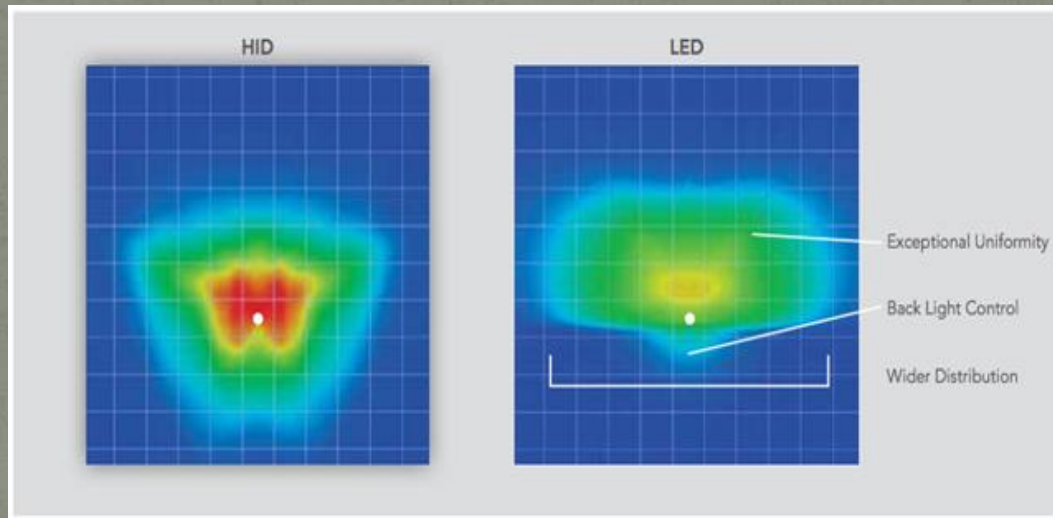
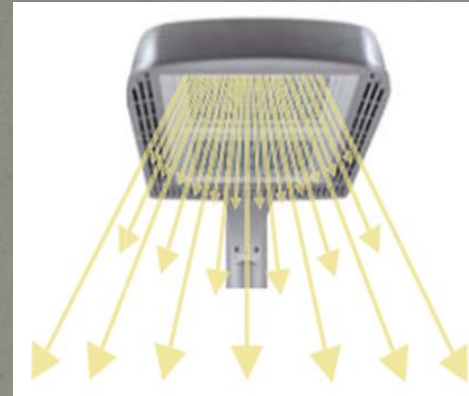
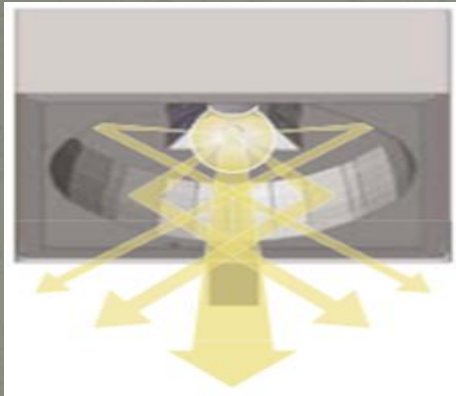
Light    ● ● ● ● ●  
Heat    ● ● ● ● ●

OMNIDIRECTIONAL



# Directionality

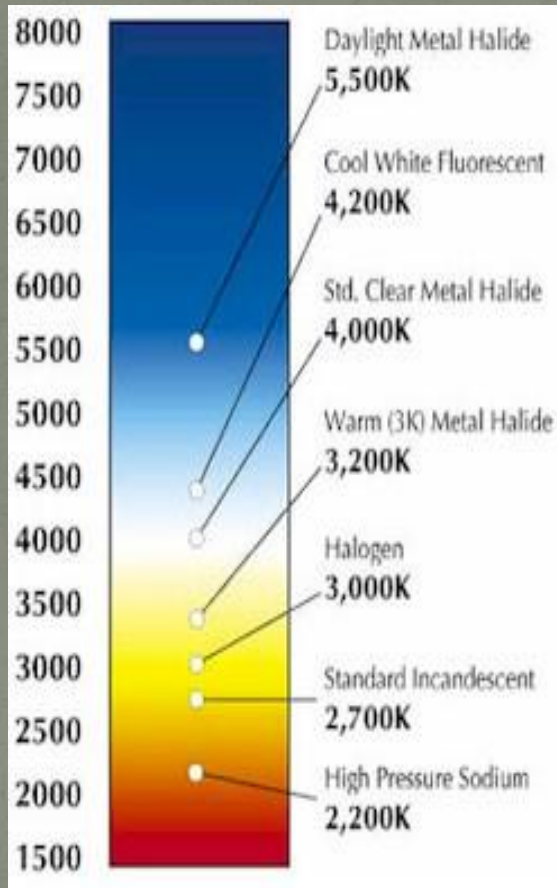
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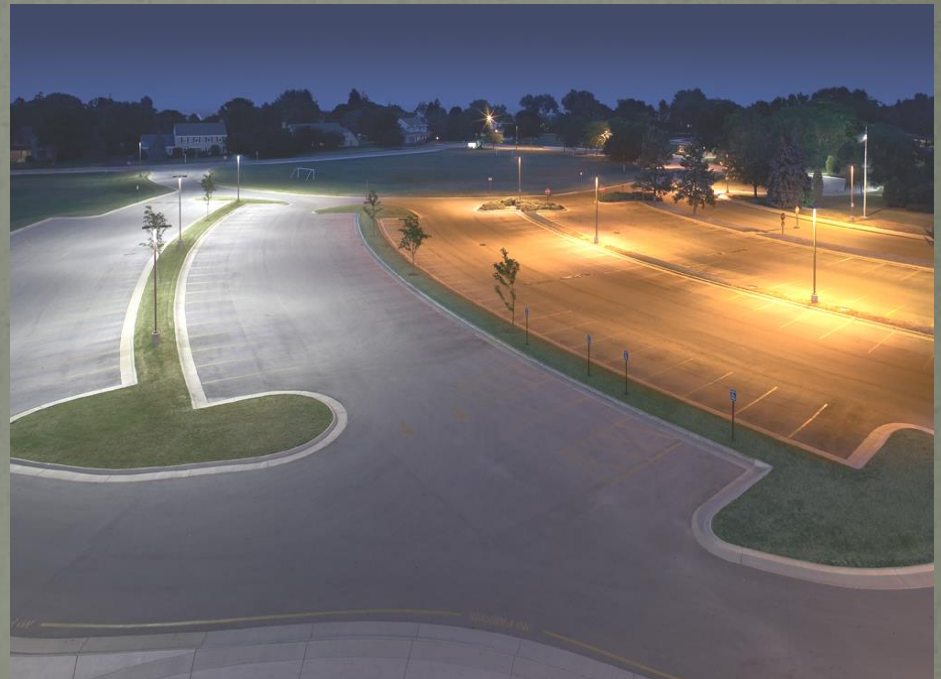
# Color

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# HPS – LED Comparison

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# Operational Issues

- Useful Life:
  - LED Chip – 50,000 (12yrs) -100,000 Hrs. (24yrs)
    - IES LM70 (Failure) = 70% Initial Lumen Output
  - Driver – 50,000 Hrs.
  - Long Life Photocontrol – 50,000-100,000 Hrs.
- Maintenance:
  - Alignment / Electrical Connections
  - Dirt Depreciation
  - No LED or Driver Replacement



# Operational Issues



**Driver / Circuit Board Failure**



**Color Shift**

## OTHER CONSIDERATIONS

- Driver / Circuitry Failure
- Flicker
- Surge Protection Failure
- Color Shift
- Heat Sink Bond Failure
- Manufacturer Defect





# LED Challenges

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- Human Perception
- Uniformity
- Adaptability
- Visibility
- Environmental



# Environmental – Dark Sky Issues

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- Light Trespass



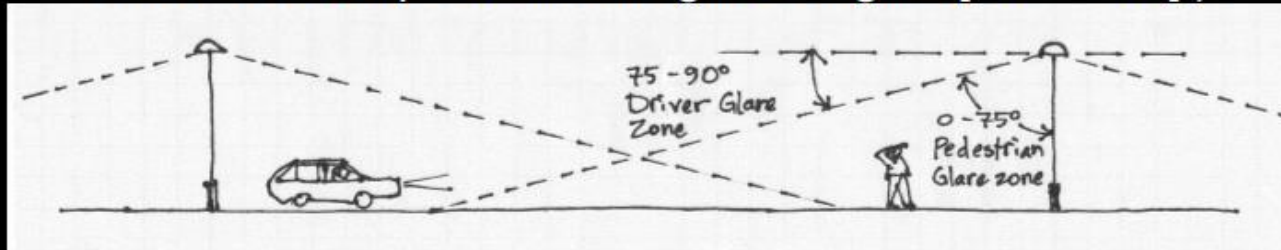
# Environmental – Dark Sky Issues

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- Glare (Annoyance, Discomfort, Disability)

- Discomfort glare (Driver's glare angles [ $\approx 75^\circ - 90^\circ$ ] are different from pedestrian's glare angles [ $\approx 0^\circ - 75^\circ$ ])



- Disabling glare that **scatters light** and affects adaptation

Annoyance Glare





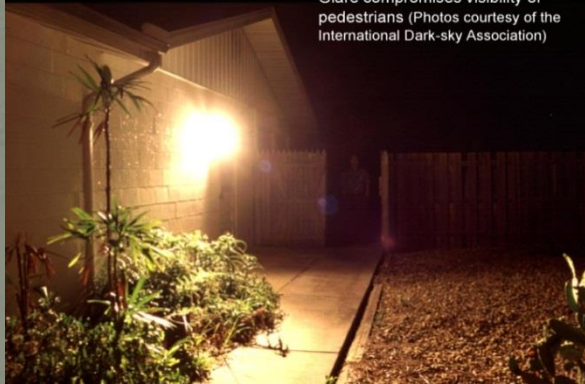
# Environmental – Dark Sky Issues

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- Glare - Discomfort



Glare compromises visibility of pedestrians (Photos courtesy of the International Dark-sky Association)





# Environmental – Dark Sky Issues

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- Glare - Disability



# National Grid's LED Street Light Offering for Niagara Mohawk Municipal Customers

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# National Grid's LED Offering for NiMo Municipal Customers



- National Grid has been actively monitoring products offered by LED manufacturers since 2010
- Watched as the industry has confronted issues common to all emerging markets and are pleased with the current state of LED product offerings
- Collaborated with NYS PSC in developing our LED offering, which was filed in October 2015, and approved in May 2016



# NY State Public Service Commission Tariff No. 2

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- PSC 214 – Service Classification No. 2
  - Company-owned, Company-maintained, Full Service Street Lighting
  - Roadway (Cobra head) Luminaires Only
  - Dusk-to-Dawn and Continuous Operation Only





# Municipal LED Choices\*

- Option 1 – National Grid (Company) Owned LED
  - Removal of existing Company Owned HID to be replaced by Company Owned LED (NYSPSC No.214 SC-2 May 2016)
- Option 2 – Customer Owned LED
  - Customer to purchase Company Owned Street lighting System (NYSPSC No.214 SC-2 Nov. 2016)

\* Cobra head Configuration Only

# Option 1 – National Grid Owned LED Lighting

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- Formal request for existing Roadway average NBV by authorized representative on letterhead or municipal email domain address.
- First come, first served application based on dated Authorization of Additional Facilities request for conversion and/or new LED roadway luminaires
  - Specifying street light locations,
  - Replacement LED luminaire types
  - Prepayment of Permanent Discontinuance value.



# National Grid Owned Luminaire Cost Comparison

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Reserved for Table 1



# Light Output Comparison

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Reserved for Table 2





# HID/LED National Grid Owned - Cost Comparison

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Reserved for Table 3



# Option 2 – Customer Owned LED Lighting (cobra head only)

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- Formal request for of existing Roadway Lighting by authorized representative on letterhead or municipal email domain address.
- Greater of either 10% or 100 lights of the existing system
- Company shall provide the customer with a proposed price (Opt 2) within 90 days
- In addition, Customer will receive a cost from National Grid to convert to LED, maintain and own (Opt 1).

# Roanoke Virginia Project

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## Don't forget performance

400W HPS – 470 input watts    140W Autobahn ATB2



## Seeing is believing

# Conclusion

- Many aspects to consider regarding a well operating street lighting system such as the design, product, safety and maintenance.
- DO YOUR HOMEWORK

Presenter : Paul Gister