

WELCOME

National Grid LED Street Light Conversion Webinar

This meeting will start at 8:30am

All participant telephone lines are currently muted, and will be opened for Q&A after the presentations.

Participants may also send in questions using the “chat” feature at any time during the presentations.



nationalgrid

HERE WITH YOU. HERE FOR YOU.

Upstate New York LED Street Lighting Meeting and Webinar

Wednesday June 15, 2016

National Grid

Beacon North

7496 Round Pond Rd

North Syracuse, NY

8:30am – 10:00am



Welcome and Introductions

– M. Littlejohn

nationalgrid

HERE WITH YOU. HERE FOR YOU.

- Objective: 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 HID and how this will affect customers' decision-making
 - Present various options to finance the conversion from HID to LED

Agenda

nationalgrid

HERE WITH YOU. HERE FOR YOU.

Topic	Speaker	Time
Welcome and Introductions	M. Littlejohn	8:30am – 8:35am
Safety Moment	M. Littlejohn	8:35am
Background – How Did We Get Here	M. Littlejohn	8:35am – 8:45am
NYS PSC Streetlight Tariff	J. Walter	8:45am – 9:15am
Payment Options	S. Doty	9:15am – 9:25am
NY Green Bank	A. McCartin	9:25am – 9:30am
Question /Discussion Session	All	9:30am – 9:50am
Wrap-Up	M. Littlejohn	9:50am – 10:00am
Adjourn		10:00am

nationalgrid

HERE WITH YOU. HERE FOR YOU.

Safety Moment: Overview of Public Safety Awareness Program Activities



Recent Natural Gas Industry Events Are Major Drivers

nationalgrid
HERE WITH YOU. HERE FOR YOU.

San Bruno, CA – 2010



Eight dead, 75 homes affected
Poor installation, development
& pressure control issues

Horseheads, NY - 2011



Toddler dead, home destroyed
Failed pipe repair and ineffective
communications

Recent Natural Gas Industry Events Continued

nationalgrid

HERE WITH YOU. HERE FOR YOU.

Harlem, NY - 2014



Eight dead, two buildings destroyed
Ineffective communications, poor
emergency response, & failed fusion joint

A Robust and Interactive Training Environment

nationalgrid

HERE WITH YOU. HERE FOR YOU.

The screenshot shows a web browser window with the URL `firstresponder.ngridsafety.com/index.html`. The page features the National Grid logo and tagline "HERE WITH YOU. HERE FOR YOU." at the top. A navigation menu includes "Home", "Natural gas safety basics", "Natural gas safety training certification", "Electrical safety basics", and "Resources". A large banner titled "Training resources" highlights "First responder safety" with the subtext "Learn to work safely in emergency situations involving electric and natural gas utilities." Below the banner are three sections: "Natural gas safety" with an image of a gas valve, "Electrical safety" with an image of power lines, and "Natural gas safety training certification" with a description of a web-based e-training program. A vertical sidebar on the right contains a numbered list from 1 to 5.

Electrical Safety Training E-Learning Launches 2016

nationalgrid

HERE WITH YOU. HERE FOR YOU.

The screenshot shows a web browser window with the URL "First Responders". The page features the National Grid logo and tagline "HERE WITH YOU. HERE FOR YOU." at the top. Below the logo, there are navigation tabs for "Home", "Natural gas safety basics", "Natural gas safety training certification", "Electrical safety basics", "Electrical safety training certification", and "Resources". The main content area is titled "Training resources" and prominently displays "Electrical safety training certification" over a background image of a power line tower. To the right of this image is a vertical navigation menu with numbers 1 through 6. Below the main heading, there are two columns of content: "Natural gas safety" with an image of gas valves and a descriptive paragraph, and "Electrical safety" with an image of power lines and a descriptive paragraph. On the right side, there is a call-to-action box titled "Register and complete your online training today >" and "Natural gas and electrical safety training certifications" with a brief description and a "Sign in | Register" link.

Increasing Public Awareness – “Leave on for Landlord”

- National Grid provides a service to landlords which allows continuous service while “in-between” tenants.
- This program is referred to as the “Leave-on-for-Landlord”(LOFL).
- The program allows the service to automatically be transferred into the property owner’s name when a tenant moves out.
- This allows the meter to stay on, rather than National Grid contacting the landlord to provide access to the premises, or locking the service until we receive an application for service from the newly arriving tenant.

LED Background: How Did We Get Here

Melanie Littlejohn



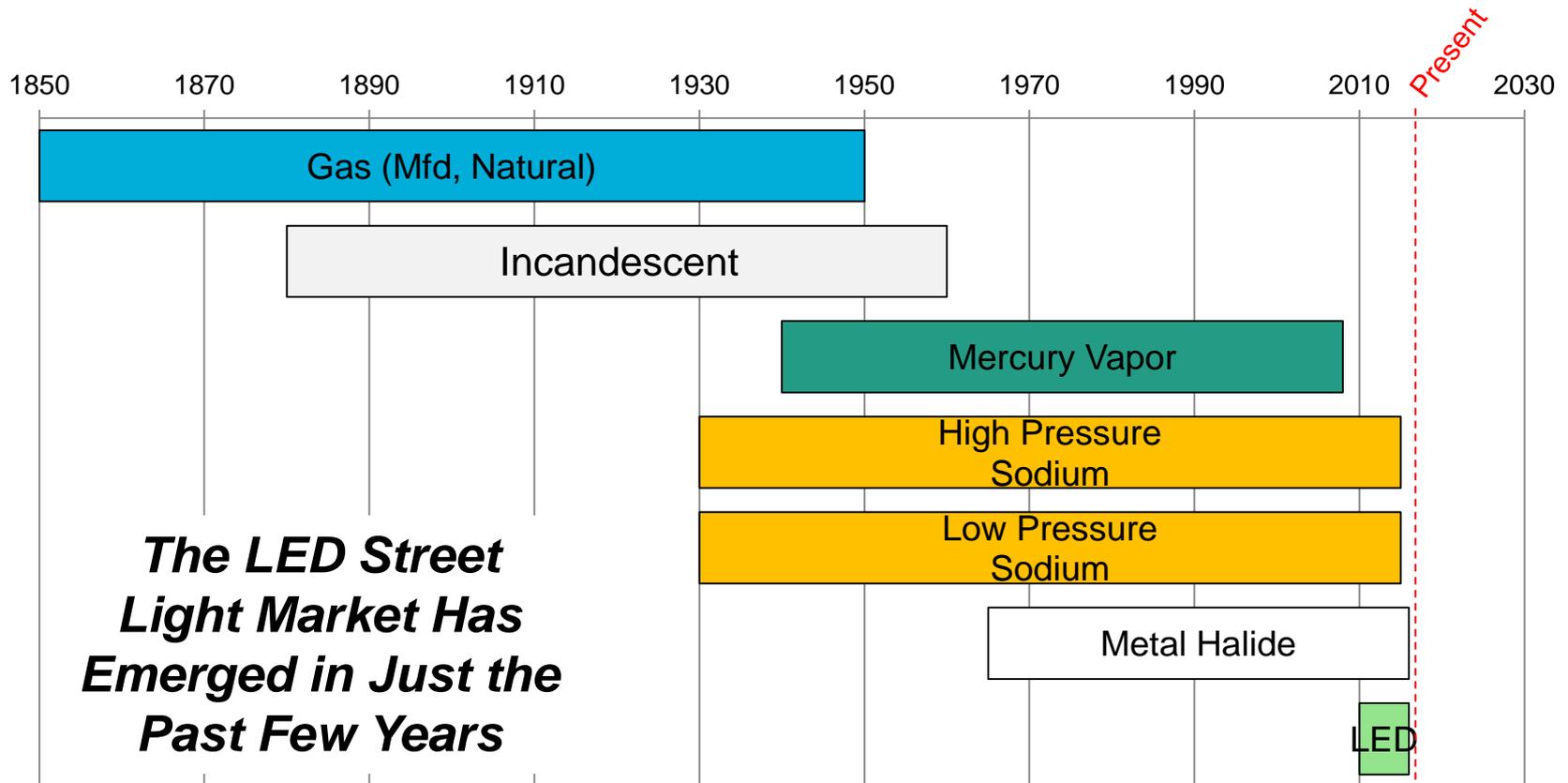
Background: How Did We Get Here – M. Littlejohn

- Technology used to light streets has evolved continuously for over 160 years
- Each step of the way, proven technologies have given way to new advances, driving customers to ask, “Should I adopt the new technology or maintain the existing one?”
- LED is the latest technology and each iteration 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

Evolution of Street Lighting Technology

nationalgrid

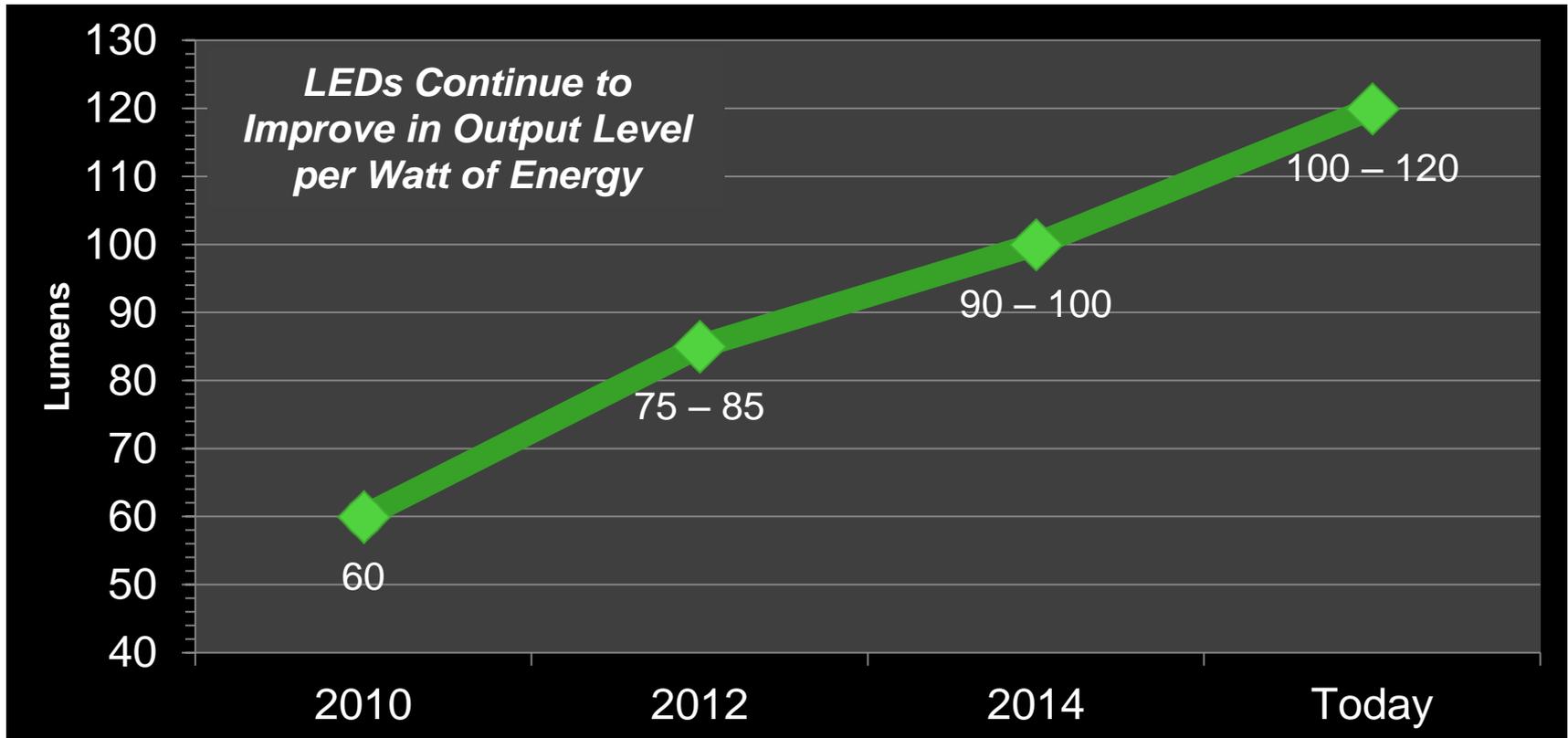
HERE WITH YOU. HERE FOR YOU.



LED Output (Lumens per Watt)

nationalgrid

HERE WITH YOU. HERE FOR YOU.

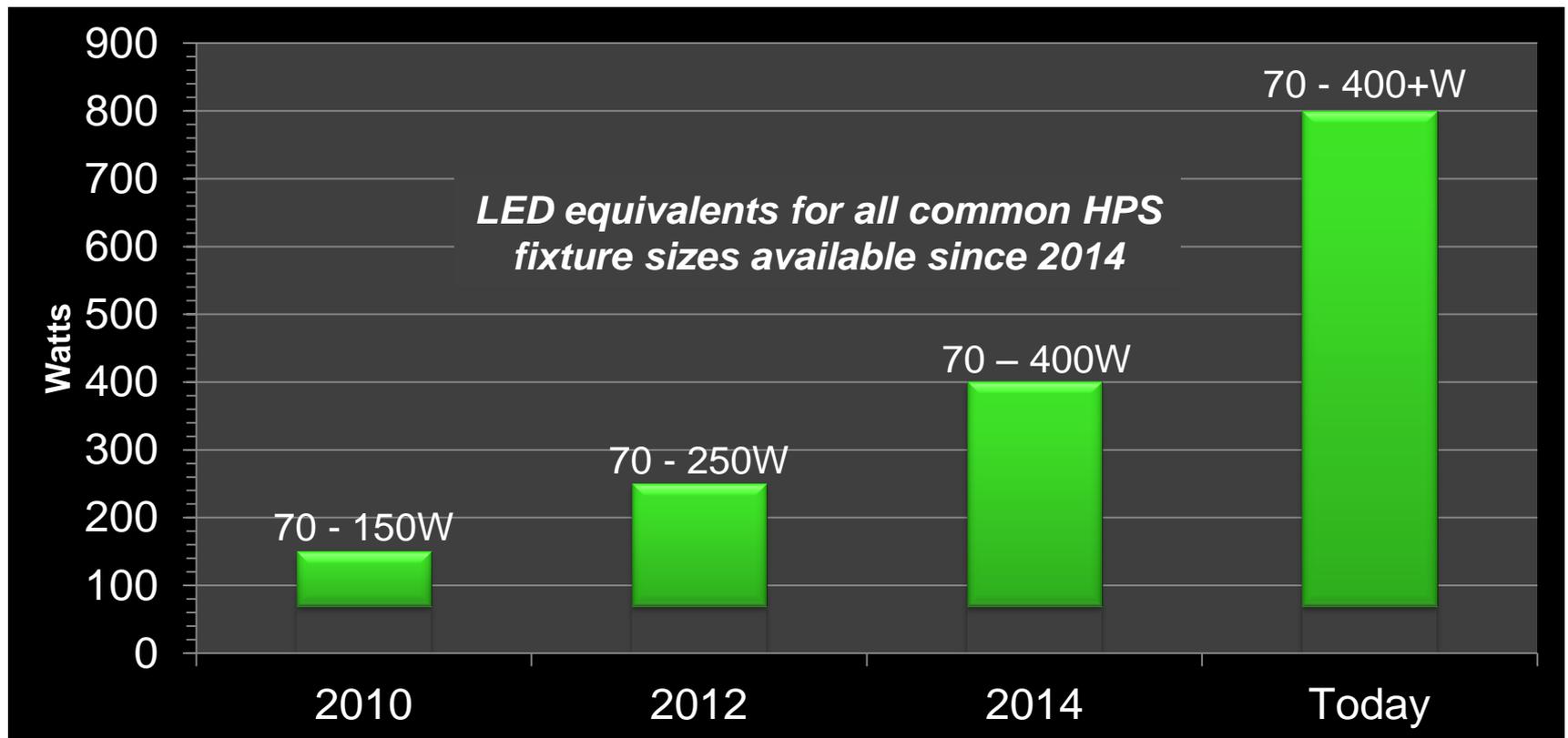


Source: Acuity Brands, April 2016

HPS Equivalency of LED

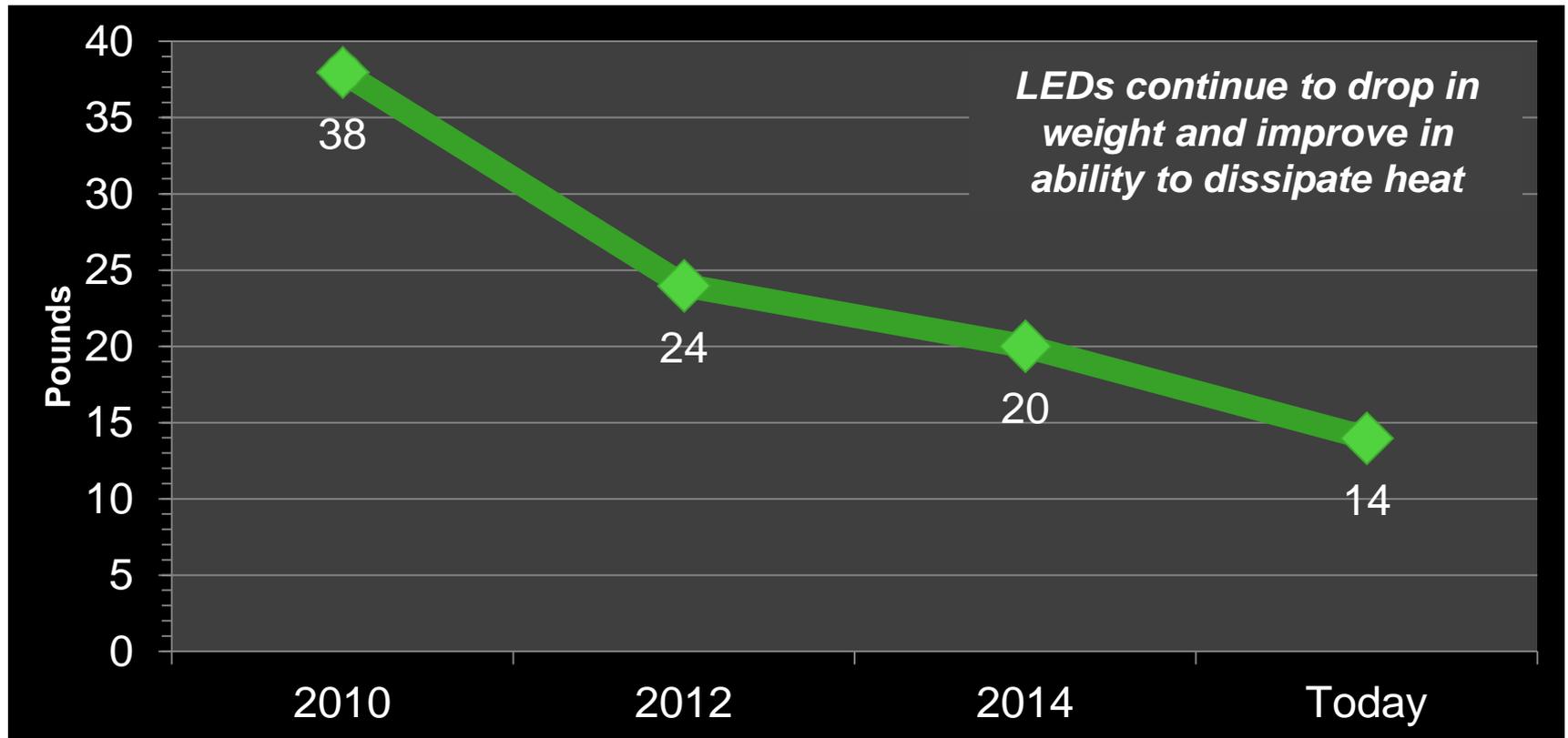
nationalgrid

HERE WITH YOU. HERE FOR YOU.



Source: Acuity Brands, April 2016

LED Unit Weight (lbs.)

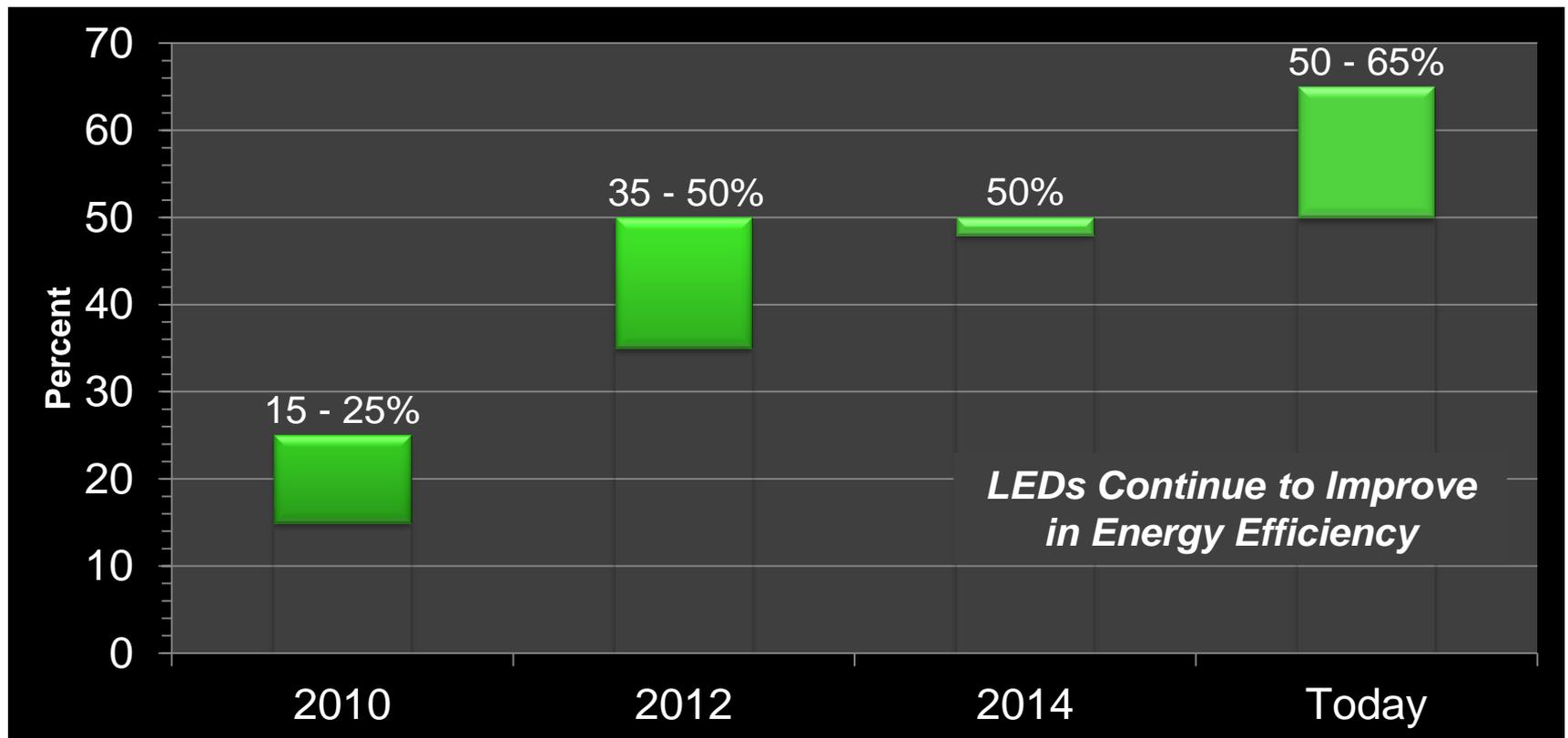


Source: Acuity Brands, April 2016

LED Efficiency Rating (percent)

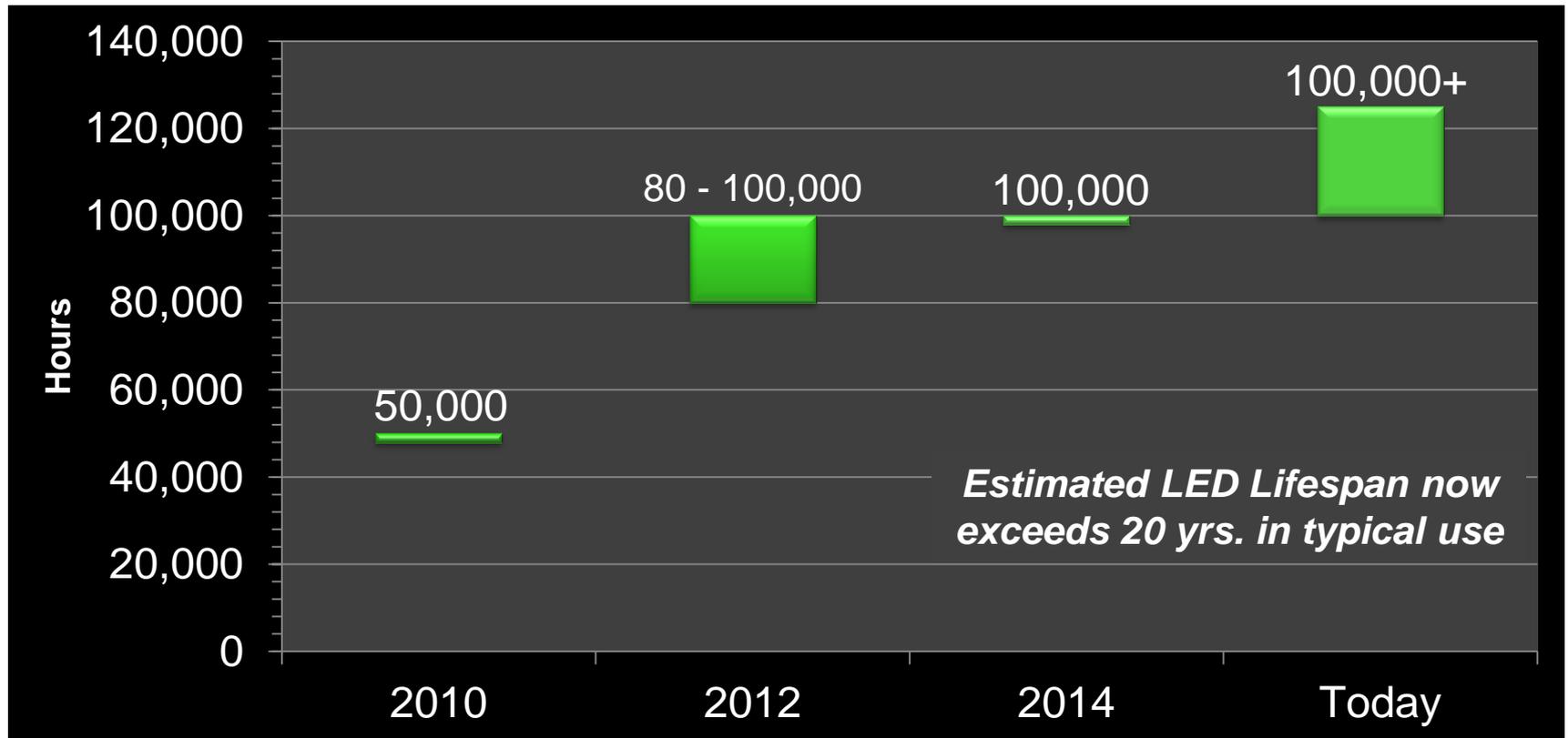
nationalgrid

HERE WITH YOU. HERE FOR YOU.



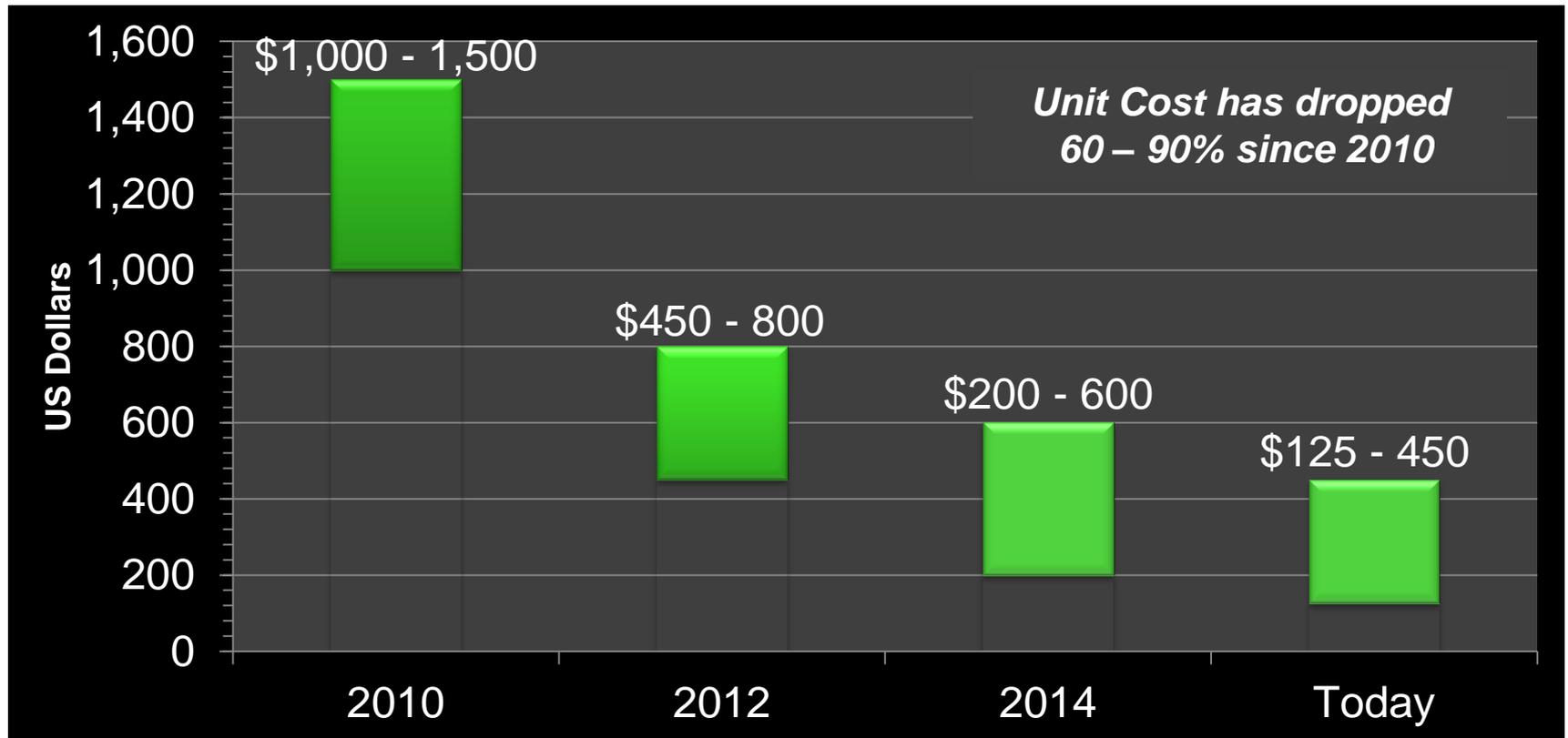
Source: Acuity Brands, April 2016

LED Expected Life (hours)



Source: Acuity Brands, April 2016

LED Unit Cost (dollars)

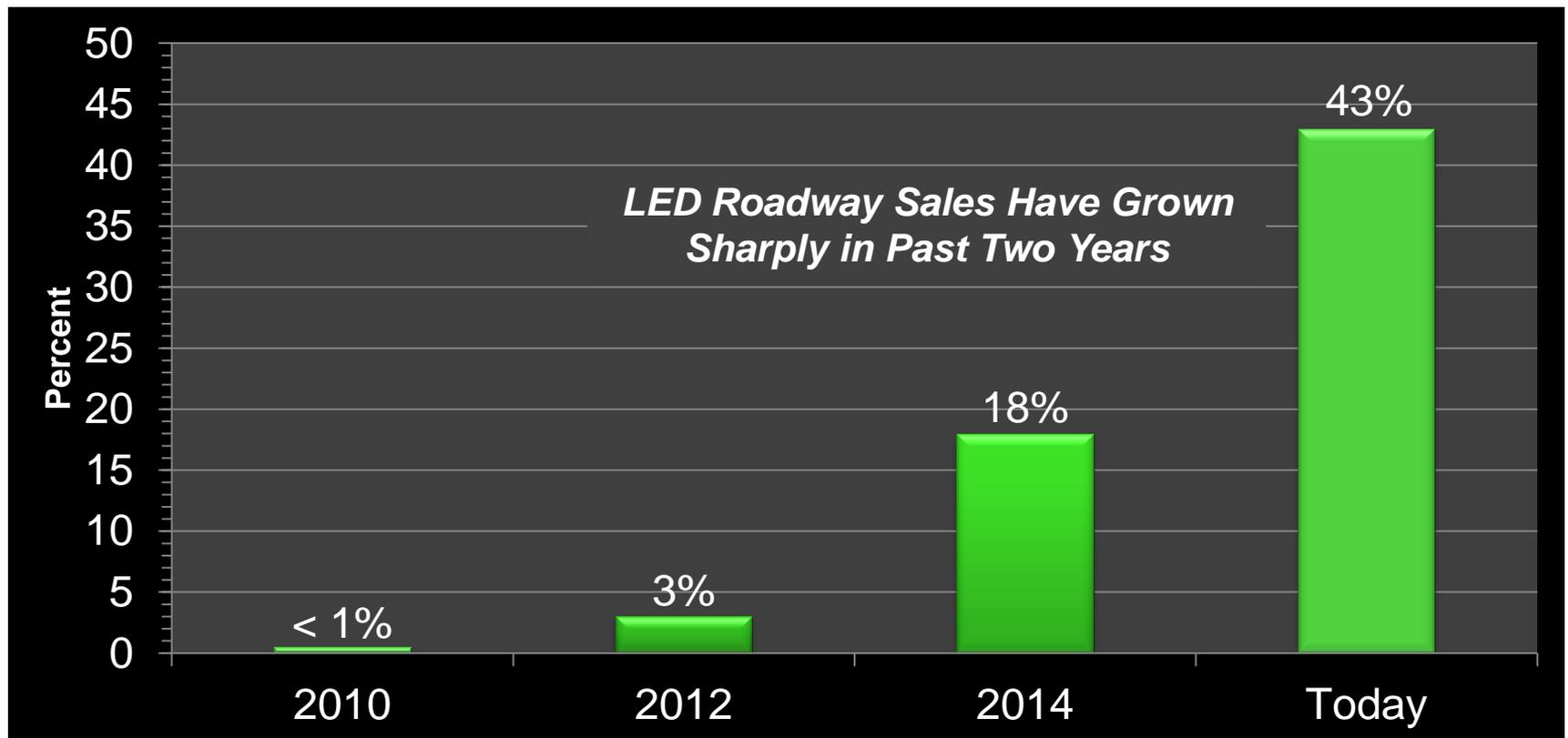


Source: Acuity Brands, April 2016

LED Roadway Street Light Sales (Percent)

nationalgrid

HERE WITH YOU. HERE FOR YOU.



Source: Acuity Brands, April 2016

National Grid's LED Offering for NMPC Municipal Customers

nationalgrid

HERE WITH YOU. HERE FOR YOU.

- 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

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

- **LED Technology & Lighting Characteristics**

John Walter



LED Characteristics

nationalgrid

HERE WITH YOU. HERE FOR YOU.

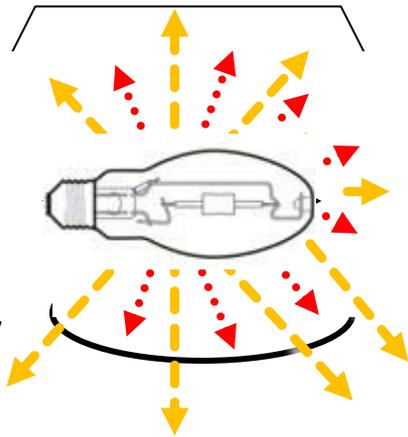
- Energy Efficient
- Directional Light Distribution
 - Uniformity
- White Light Color
 - Improved Nighttime Visibility
 - Increased Sense of Safety and Security
- Long Life
 - Expected 10-20 years
- Reduced Maintenance
- Operational Issues
 - Instant On
 - Dimmable
 - Vibration Resistant
 - Failure modes
- Environmentally friendly
 - RoHS Compliant
 - Dark Sky Friendly
- Human Factors



Directionality

Conventional Lighting

Reflector

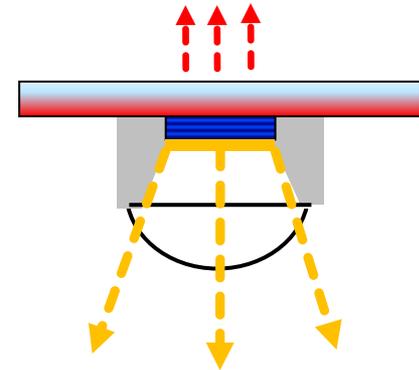


Refractor
Lens



OMNIDIRECTIONAL

LED



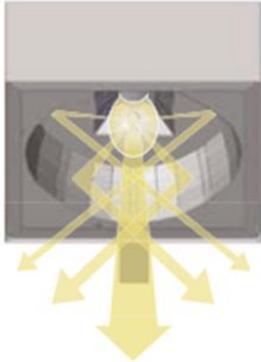
UNIDIRECTIONAL



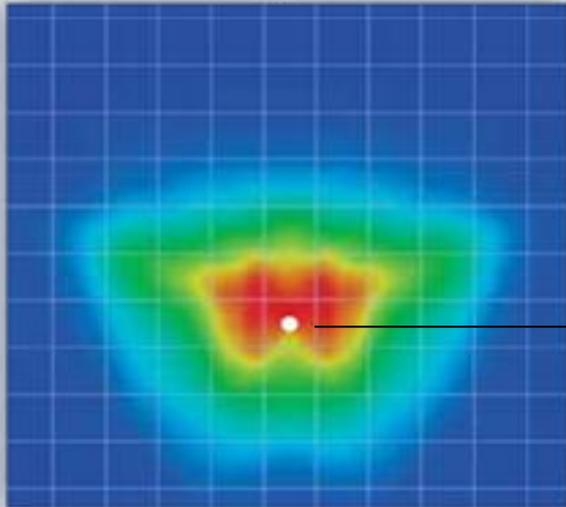
Directionality

nationalgrid

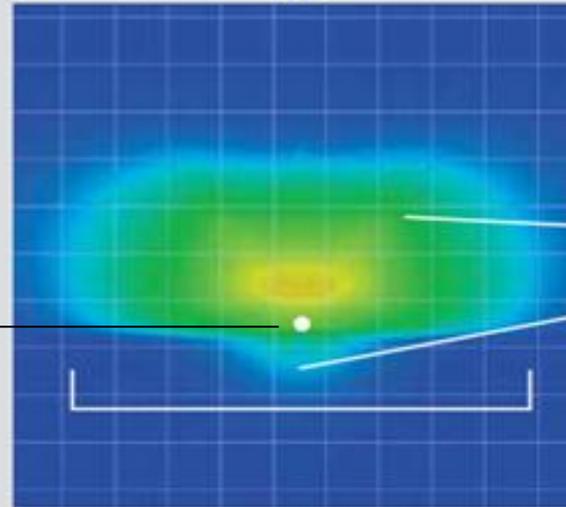
HERE WITH YOU. HERE FOR YOU.



HID



LED



Exceptional Uniformity

Back Light Control

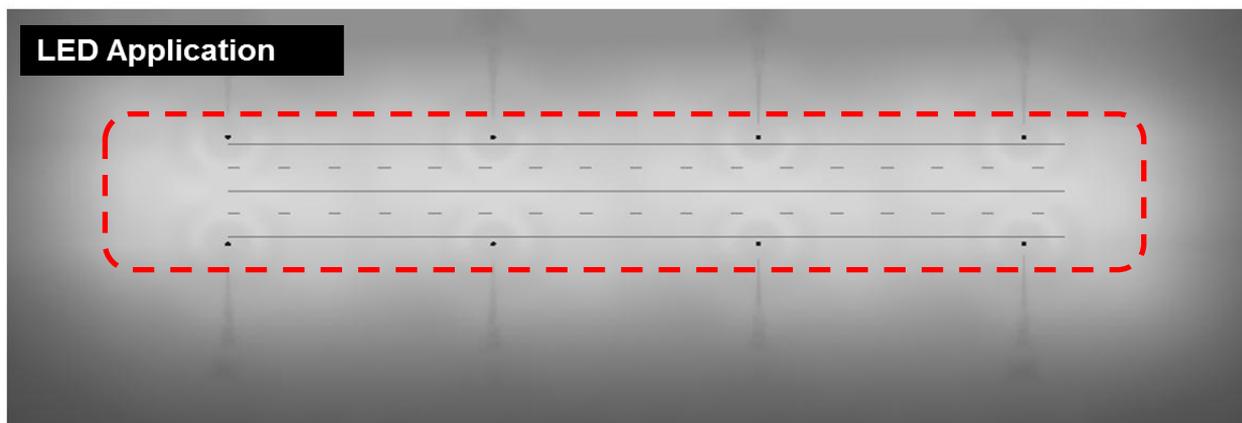
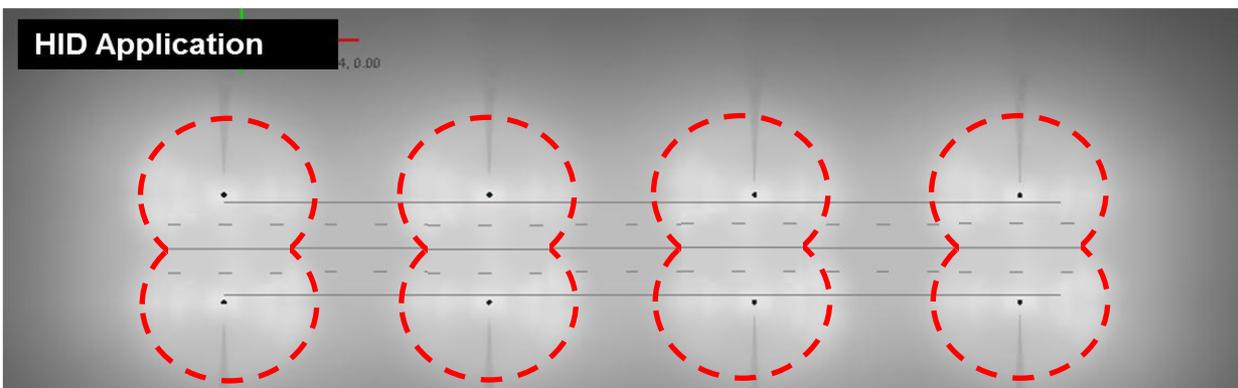
Wider Distribution



Uniformity: HID vs LED

nationalgrid

HERE WITH YOU. HERE FOR YOU.



Uniformity: HID vs LED

nationalgrid

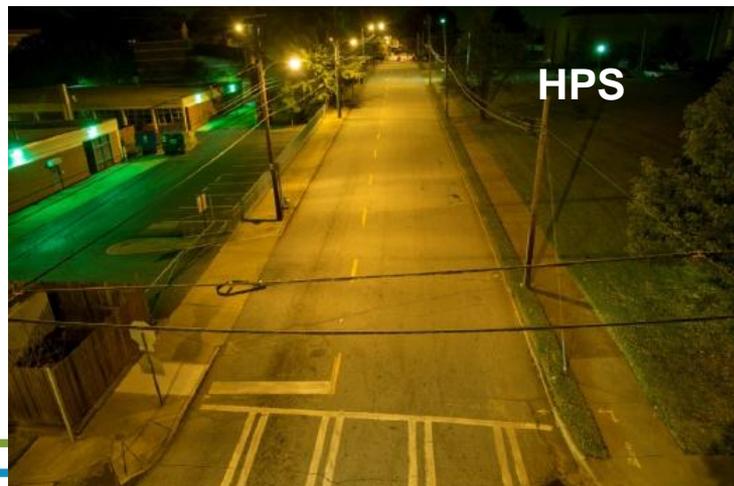
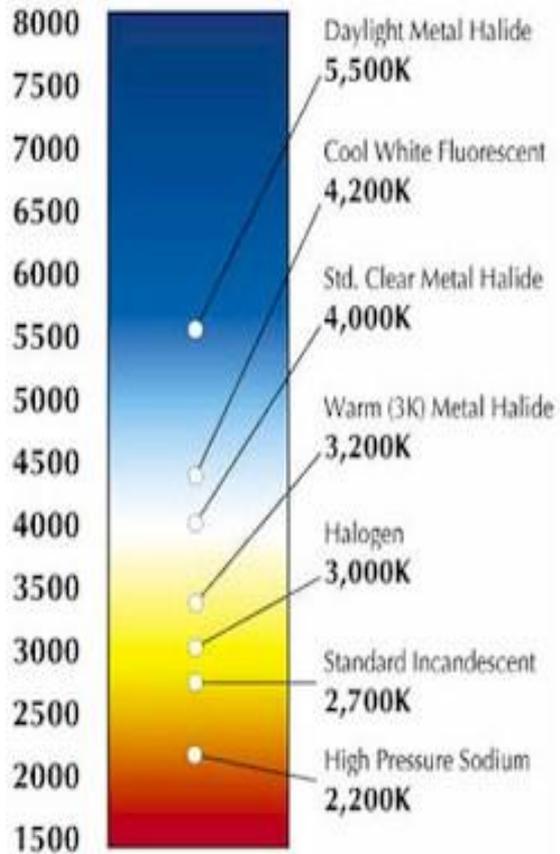
HERE WITH YOU. HERE FOR YOU.



Color

nationalgrid

HERE WITH YOU. HERE FOR YOU.



Color Rendition

LED



HPS



Operational Issues

nationalgrid

HERE WITH YOU. HERE FOR YOU.

- Long Life:
 - LED Chip: 50,000 Hrs (12yrs) - 100,000 Hrs (24yrs)
 - IES LM70 (Failure) = 70% Initial Lumen Output
 - Driver: 50,000 Hrs
 - Long Life Photocontrol: 50,000-100,000 Hrs



Operational Issues

nationalgrid

HERE WITH YOU. HERE FOR YOU.

- Maintenance:
 - No Lamp Replacement
 - Alignment / Electrical Connections
 - Dirt Depreciation
 - Disposable - No LED or Driver Replacement



Operational Issues



Driver / Circuit
Board Failure



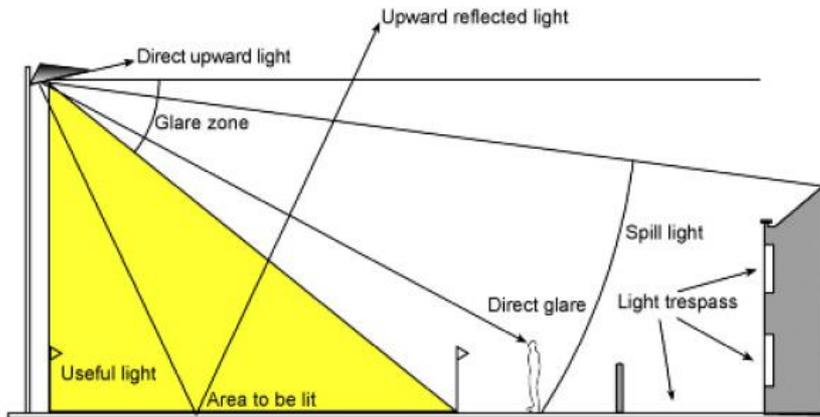
Color Shift
(Poor Thermal Design)

OTHER CONSIDERATIONS

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

Environmental – Dark Sky Issues

■ Light Pollution (Skyglow)



Environmental – Dark Sky Issues

- Light Trespass



Environmental – Dark Sky Issues

- Glare: 3 Levels (Annoyance, Discomfort, Disability)

- Annoyance Glare



Environmental – Dark Sky Issues

- Discomfort Glare:
 - Driver Glare Zone = $[75^{\circ}-90^{\circ}]$
 - Pedestrian Glare Zone = $[0^{\circ}-75^{\circ}]$



Environmental – Dark Sky Issues

- Disability Glare:



Environmental – Dark Sky Issues

- Glare Solution Option



■ Health

■ Circadian Rhythm Effects

- Melatonin Suppression – Sleep disorders

- Epidemiological studies – Cancer Risks

- Blue Light Therapy – Skin Cancer Treatment

■ Wildlife

- Impact on Animal Habitat & Evolution

- Sea Turtles, Migratory Birds, Nocturnal Animals

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

- **LED Tariff and Procedural Overview**

John Walter



LED Offering Parameters

nationalgrid

HERE WITH YOU. HERE FOR YOU.

Focused specifically on:

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



LED Offering Parameters

nationalgrid

HERE WITH YOU. HERE FOR YOU.

- Permanent Discontinuance (Termination of Existing Luminaire)
 - One for One Replacement
 - Average Net Book Value by Tax Area
 - No Removal Costs
 - No System Reconfiguration Costs
- Relocation
 - Permanent Discontinuance costs apply
 - New installation is at no cost to customer.



Wattage & Lumen Comparison

HID - LED

nationalgrid

HERE WITH YOU. HERE FOR YOU.

Existing HID Nominal Wattage	HID Lamp Source Lumens	HPS Roadway Luminaire Delivered Lumens	LED System Wattage	LED Roadway Delivered Lumens
70	6,300	~4,221	30	~2,700
100	9,500	~6,365	30	~2,700
100	9,500	~6,365	60	~5,000
150	16,000	~10,720	60	~5,000
175	12,000	~8,040	60	~5,000
250	28,500	~19,095	140	~13,000
400	50,000	~33,500	250	~25,000

Illumination Comparison

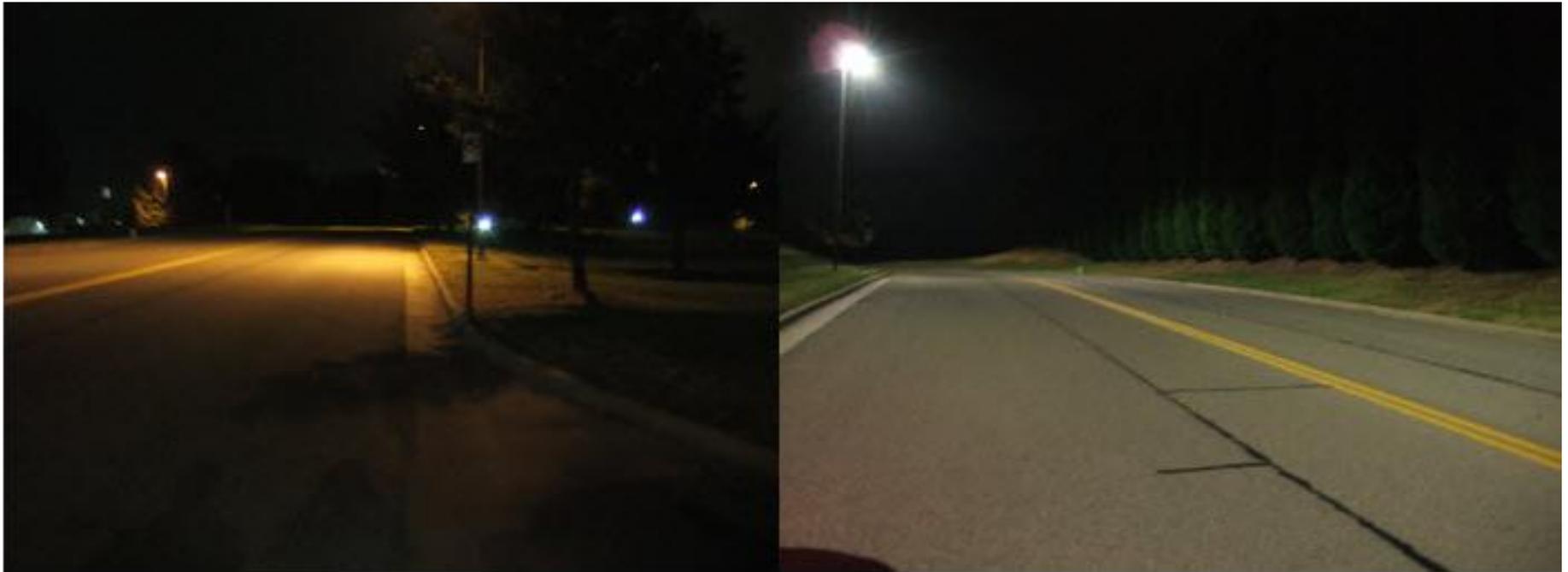
HID - LED

nationalgrid

HERE WITH YOU. HERE FOR YOU.

400w HPS (470w)

140w LED



Annual Luminaire Charge HID - LED (per unit)

Annual Luminaire Charge, (per unit)

Light Source	Wattage						
	70	100	100	150	175	250	400
HPS/MV/MH	70	100	100	150	175	250	400
LED	30	30	60	60	60	140	250
Luminaire Type							
Roadway (HID)	\$53.65	\$53.65	\$53.65	\$54.81	\$54.81	\$63.01	\$63.01
Roadway (LED)	\$83.83	\$83.83	\$88.52	\$88.52	\$88.52	\$110.09	\$119.16

Annual Cost/Benefit Comparison HID - LED

nationalgrid

HERE WITH YOU. HERE FOR YOU.

HID - LED Annual Cost/Benefit Comparison

Luminaire Properties				Annual Charges				Annual Benefit/(Cost)		
Luminaire Type / Wattage	Luminaire Billable Wattage	Delivered Lumens	Annual kWh	Facility Charge	Distribution Charge (\$0.08575)	Commodity Charge (Estimate \$0.02750)	Total Charges	Facility Charge	Volu-metric Charge	Total Benefit
LED Roadway A - 30W	30	2700	129	\$83.83	\$11.06	\$3.55	\$98.44			
HPS Roadway - 70W	86	4221	359	\$61.64	\$30.78	\$9.87	\$102.30	(\$22.19)	\$26.05	\$3.86
HPS Roadway - 100W	118	6365	492	\$61.64	\$42.19	\$13.53	\$117.36	(\$22.19)	\$41.11	\$18.92
LED Roadway B - 60W	60	5000	254	\$88.52	\$21.78	\$6.99	\$117.29			
HPS Roadway - 100W	118	6365	492	\$61.64	\$42.19	\$13.53	\$117.36	(\$26.88)	\$26.95	\$0.07
HPS Roadway - 150W	173	10720	721	\$62.80	\$61.83	\$19.83	\$144.45	(\$25.72)	\$52.89	\$27.17
MH Roadway - 175W	207	8040	863	\$62.80	\$74.00	\$23.73	\$160.53	(\$25.72)	\$68.97	\$43.25
LED Roadway C - 140W	140	13000	588	\$110.09	\$50.42	\$16.17	\$176.68			
HPS Roadway - 250W	304	19095	1268	\$71.18	\$108.73	\$34.87	\$214.78	(\$38.91)	\$77.01	\$38.10
LED Roadway D - 275W	275	25000	1151	\$119.16	\$98.70	\$31.65	\$249.51			
HPS Roadway - 400W	470	33500	1960	\$71.18	\$168.07	\$53.90	\$293.15	(\$47.98)	\$91.62	\$43.64

Conversion Process Overview

nationalgrid

HERE WITH YOU. HERE FOR YOU.

- Formal inquiry for existing Roadway average net book value (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.



Conversion Process Overview

nationalgrid

HERE WITH YOU. HERE FOR YOU.

- Company will install/replace up to 20% of its inventory of in-service Roadway luminaires with LED Roadway luminaires in an annual period
- The customer must commit to a conversion of no less than 20%, or a minimum of 100, of its Company-Owned Roadway luminaires per bill account in an annual period.



Improved Roadway Lighting

nationalgrid

HERE WITH YOU. HERE FOR YOU.

- Enhanced Driver/Pedestrian Safety & Security
- Energy & Operational Cost Savings
- Reduced Environmental Impacts
- Better Nighttime Vision
- Accurate Color Rendition



Available Financing Options

Steve Doty



Qualifying & Payment options

nationalgrid

HERE WITH YOU. HERE FOR YOU.

- Customer is required to pay the cost of the facility's undepreciated book value of targeted replacement fixtures and any system reconfiguration costs
- Options available to Customer to assist with upfront payment:
 - Secured funding by Municipality
 - Surcharge
 - NY Green Bank





NY Green Bank

Financing Opportunities for National Grid's LED Streetlight Conversion Program

Amy McCartin, Vice President | June 15, 2016



Introducing NY Green Bank

nationalgrid

HERE WITH YOU. HERE FOR YOU.

Achieving these ambitious climate goals will require tremendous growth in the clean energy marketplace, which will in turn require significant financing from both public and private resources

**\$1B state sponsored
specialized financial entity**

Investing in New York-based
clean energy projects

Mobilize private capital

To reduce costs of clean
energy projects by increasing
capital availability and market
liquidity

**Accelerate New York's
transition to a clean
energy economy**

Enabling more clean energy
projects to get done more
quickly

NY Green Bank Performance to Date

Stimulating New Clean Energy Proposals in the State

Over \$1.3 billion in investment proposals, representing total proposed investment exceeding \$4.7 billion

Strong Active Pipeline

Active pipeline is ~\$500.0 million

Portfolio Driving Material Clean Energy Investments Across NY

Investments support total clean energy project cost of \$518.3 million, overall portfolio of \$96.0 million

Mobilizing Private Capital

NYGB's current portfolio represents expected leverage ratio of ~5:1 in private sector dollars

Revenue Growth Paving the Way to Self-Sufficiency

Over \$2.9 million in revenues generated

Contributing to REV and the CES

Estimated lifetime greenhouse gas reductions up to 2.9 million metric tons, equivalent to removing over 37,000 cars for 17 years



Potential Financing Structure for LED Conversions

nationalgrid

HERE WITH YOU. HERE FOR YOU.

This is a utility-owned option where the utility owns the new LED fixture

- NY Green Bank can provide municipalities capital to pay down the unamortized book value of old fixtures on National Grid's books
- Under the new tariff, the monthly usage payments for LED lights will be less than before the conversion
- Municipalities repay NY Green Bank through a shared savings agreement

Example

$80\% \times \$25 = \20 paid to NY Green Bank per year

$\$100 / \$20 = 5$ year repayment period

After year 5, municipality retains 100% of savings (\$25 per year)

Assumptions	
Net book value of old fixture	\$100
Annual savings per LED fixture	\$25
Annual % savings retained by municipality	20%
Annual % savings paid to NY Green Bank	80%

Contact Us

nationalgrid

HERE WITH YOU. HERE FOR YOU.

**NY Green Bank
1359 Broadway, 19th Floor
New York, NY 10018
Tel: (212) 379-6260
info@greenbank.ny.gov
www.greenbank.ny.gov**



Questions from:

**Beacon North
Webinar Chat
Open Telephone Lines**



nationalgrid

HERE WITH YOU. HERE FOR YOU.

Wrap Up

M. Littlejohn

