LED and Adaptive Lighting
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Today's Presentation

- Provide updates on LED street lighting technology and standards
- Example specifications reviewed
- Retrofit process discussed
- Adaptive controls also discussed

LED's

Fact

- Technology has evolved at a rapid pace
- Optical systems vary widely.
- High potential and suppliers have invested heavily
- Adaptive controls easy to integrate
- Barriers to market adoption

Unproven

- Long term field proven performance

Optical Systems

- High efficiency
- Effective optical distribution – leads to improved uniformity
- Great cut-off
- Varying optical designs

Design

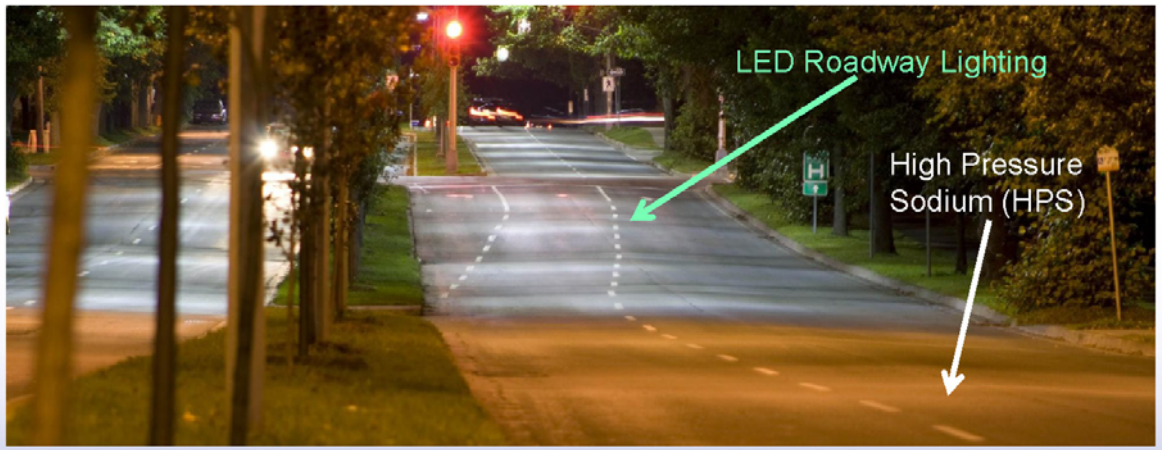
- Sidewalk lighting levels
- Pole heights (lower)

Nova Scotia LED Pilot Results

An energy savings of *53%* will be gained from retrofitting the 1100 existing cobra head luminaires with LED luminaires.

If additional research funding is available, it is recommended the long term results of this pilot be measured and the results published.

Halifax, Nova Scotia (Robie St) - 55% Energy Savings



196 Watts
HPS - 150W Bulb

88 Watts
Satellite™ 96 LED-280mA

References and Information

- Smart Street Lighting Summit – San Jose (Ref)
- VTTI - Studies
- Illuminating Engineering Society of North America
- CSA C653 Luminaire Performance (UPD) - Updates coming to include LED's
- NEMA Target Efficacy Rating
- TAC Energy Efficiency Guide – Ready by 2013
- US DOE – Caliper and Gateway Programs
- US DOE – Model Specs -
- Lightsaver's - www.lightsavers.ca

Recent DMD Studies / Research

- TAC Roadway Lighting Design Guide (national publication)
- TAC Light Level Reduction and Energy Efficiency Guide (national publication)
- US Federal Highway Lighting Handbook (national publication)
- Edmonton – Green standards / energy reduction
- Edmonton LED Retrofit (8,000 lights so far – 90,000 upcoming)
- Lethbridge – LED Retrofit (20,000 lights over 5 years)
- New Brunswick Power – LED Retrofit (80,000 lights so far)
- Nova Scotia LED retrofit (1,600 lights)
- Hamilton Study – Energy efficiency
- Nova Scotia (UNSM) – Energy efficiency review
- LED specs –Edmonton, Fort St John, Coquitlam, Surrey, Thunder Bay, Lethbridge, New Brunswick, Nova Scotia, Hamilton, Medicine Hat, Port Moody, etc.
- Surrey – LED pilots and review and field measurements
- BC Hydro – 15+ adaptive lighting studies
- Coquitlam LED pilot
- Nova Scotia LED pilot
- NRCAN Adaptive Lighting pilots (20 all across Canada)
- Prince George Adaptive Lighting Pilot (500 lights)
- BCH Adaptive Lighting Deployment Guide
- Surrey Adaptive Lighting product review

LightSavers Canada

LightSavers Canada is a national market consortium that aims to step up the adoption of LED lighting and smart adaptive controls in certain general illumination applications.

LightSavers Canada will assist municipal and provincial governments, public institutions, and private companies that own or manage lighting assets to learn from each other about LED and smart control performance, procurement, and financing.

Technical Specifications and Standards

- ANSI C78.377-2008, Specifications for the Chromaticity of Solid-State Lighting Products - Specifies recommended chromaticity (color) ranges for white LEDs with various correlated color temperatures (CCTs).

- IES G-2, Guideline for the Application of General Illumination ("White") Light-Emitting Diode (LED) Technologies - Provides lighting and design professionals with a general understanding of LED technology as it pertains to interior and exterior illumination, as well as useful design and application guidance for effective use of LEDs.

- IES LM-79-2008, Approved Method for the Electrical and Photometric Testing of Solid-State Lighting Devices - Specifies a standard test method for measuring the photometric properties of SSL devices, allowing calculation of luminaire efficacy.

- IES LM-80-2008, Approved Method for Measuring Lumen Depreciation of LED Light Sources - Specifies a standard method for measuring the lumen depreciation of LEDs, allowing calculation of LED lifetime. Electronic copies may be purchased online through the IES store.

- IES TM-21-2011, Projecting Long Term Lumen Maintenance of LED Light Sources - Specifies a recommended method for projecting the lumen maintenance of LED light sources based on LM-80 collected data.

Technical Specifications and Standards

- IES LM-82-2012, Approved Method for the Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature - Provides a method for measuring the lumen degradation of light engine products at various temperatures in support of manufacturers determining LED luminaire reliability and lifetime characteristics.

- NEMA SSL-1, 2010, Electronic Drivers for LED Devices, Arrays, or Systems - Provides specifications for and operating characteristics of non-integral electronic drivers (power supplies) for LED devices, arrays, or systems intended for general lighting applications.

- NEMA SSL 3-2011, High-Power White LED Binning for General Illumination - Provides a consistent format for categorizing (binning) color varieties of LEDs during their production and integration into lighting products.

- UL 8750, Safety Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products - Specifies the minimum safety requirements for SSL components, including LEDs and LED arrays, power supplies, and control circuitry.

Standards in Development

- CIE TC1-69, Color Quality Scale
- IES LM-XX1, Approved Method for the Measurements of High Power LEDs
- IES-TM-XX3, Method for Measuring Lumen Maintenance of LED Lamps, Light Engines, and Luminaires
- IES TM-26, Method for Estimating the Rated Life of an LED Product
- ANSLG/ANSI C82.XX1, LED Drivers Reliability

TAC Light Level Efficiency and Power Reduction Guide (Draft)

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LED Considerations

Cost - Better quality LED street lights can be over *$1,000* whereas a typical cobra head luminaire is typically around $200. Some of lower wattage LED's now around $400.00 - 500.00. *Consider ROI over payback*

Light Loss Factor – A factor which is applied to all lighting to compensate for lamp depreciation over time. Lighting levels are based on end of lamp life. As LED's can last for 20+ years this is key factor.

Standardization - LED roadway luminaires are relatively new to the market. Specifications under development. *Will review example specs*

Lack of Proven Long Term Performance - As LED roadway luminaires are new to the industry, long term performance has not been field proven.
This can be overcome with longer warranty period and MTBF analysis.

Key Product Elements

Reliability - MTBF
Quality
Durability
Functionality
Warranty

Key Product Elements.pdf

Specifications

Example LED Spec.pdf

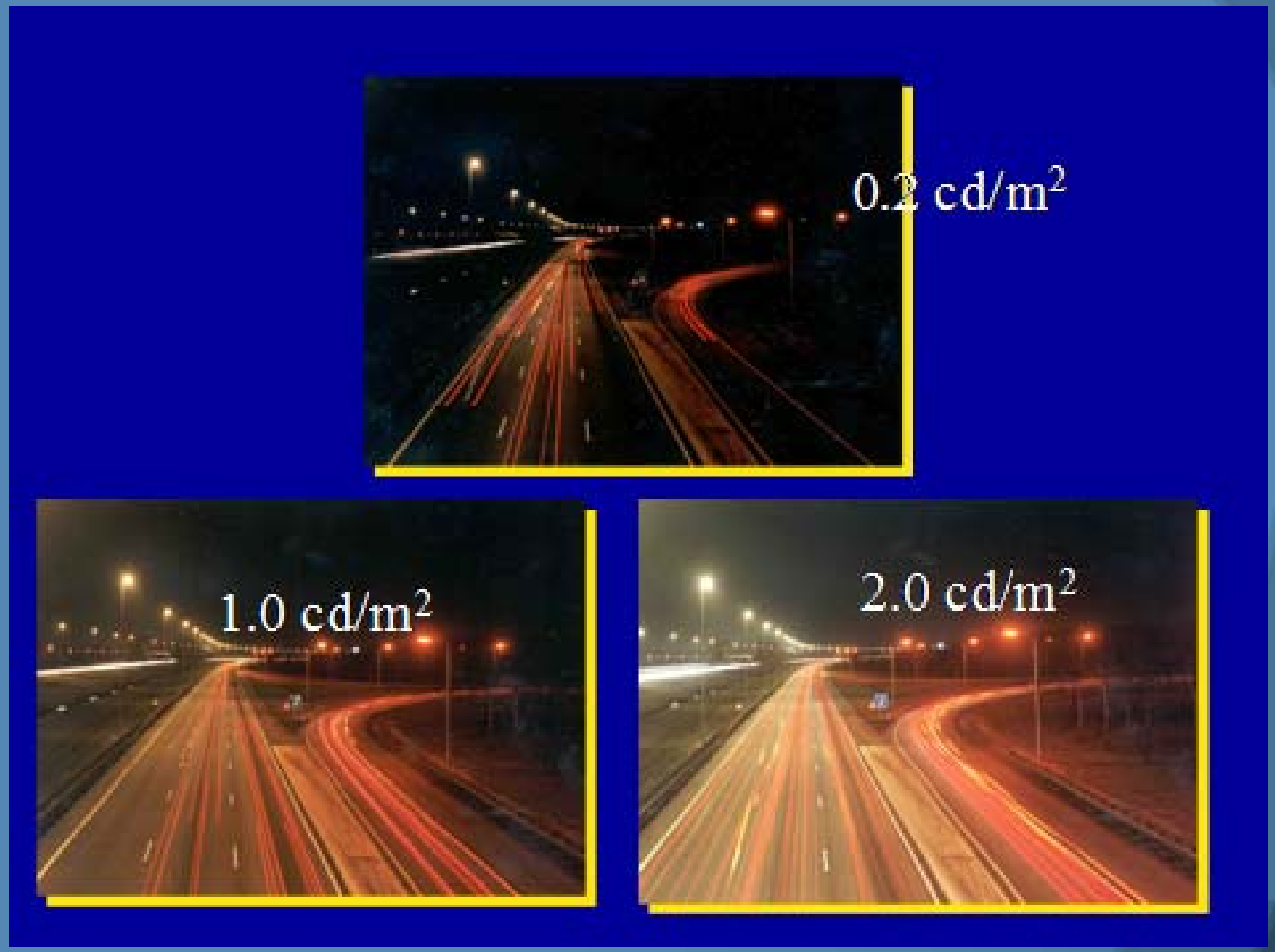
Adaptive Lighting

"The ability to vary lighting levels to suit activity levels."

Becoming accepted practice in many published documents

Bill in US Congress mandating adaptive controls for all new outdoor luminaires by 2013. Not law yet however…

Adaptive Lighting Example



Potential Benefits/Issues?

- Reduced Energy Consumption – Studies show 20% to 30% on average for most Cities while still meeting required light levels
- Obtrusive Light Reduction – Less light off site while people are sleeping
- Power Consumption Monitoring – Can be used to validate costs
- Streamlined Asset Management – Benefits maintenance
- Legal issues ?? VTTI exploring –

Retrofit and Deployment

Feasibility

Item	LED Lighting	Adaptive Lighting
Power savings	50%	25%
Maintenance Savings	50%	0%

Undertake Inventory
Inventory.pdf

Cost Benefit
Simple Return on Investment (ROI) = gain – cost /cost x100
Gain – estimated energy and maintenance savings over life of luminaire (say 20 years)
Cost – Supply and install cost luminaires
ROI - Expressed as a %. Better than payback

Retrofit and Deployment

- Specifications
- Procurement
- Test and Commission
- Monitor and review
- Public and Communications Program

Product Procurement

Performance (30 points)

Information requested in the technical specifications will be reviewed and rated. Review will include:

Review data submitted for correctness.

Comparison of UPD ratings. Best accepted UPD should score the highest points.

Ability to meeting light level, uniformity, and veiling luminance lighting requirements.

Rate features and options provided.

-

Product Procurement

Quality and Longevity (40 points)

Information requested in the technical specifications will be reviewed and rated. Review will include:

A review of data submitted for correctness.

Review Mean Time Between Failure (MTBF) results, as this a critical element.

Review of testing data and reports for compliance.

Product review. Actual luminaire submitted should be reviewed.

Product Procurement

Cost (30 points)

Can be scored based on a relative pricing formula.

If a supplier bids $12,000.00 and that is the lowest bid price, that proponent receives 30 points 100% of the possible points for that category(12,000/12,000 = 100%).

A proponent who bids $24,000.00 receives 50% of the possible points for that category ($12,000/$24,000 = 50%), and a proponent who bids $24,000.00 receives a score of 15 possible points (50% of 30 points) for that category.

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Questions and Answers