



# Next Generation Lighting

Presented by:

Levin Nock, Contractor, Bonneville Power Administration

John Wilson, Bonneville Power Administration



# Session Agenda

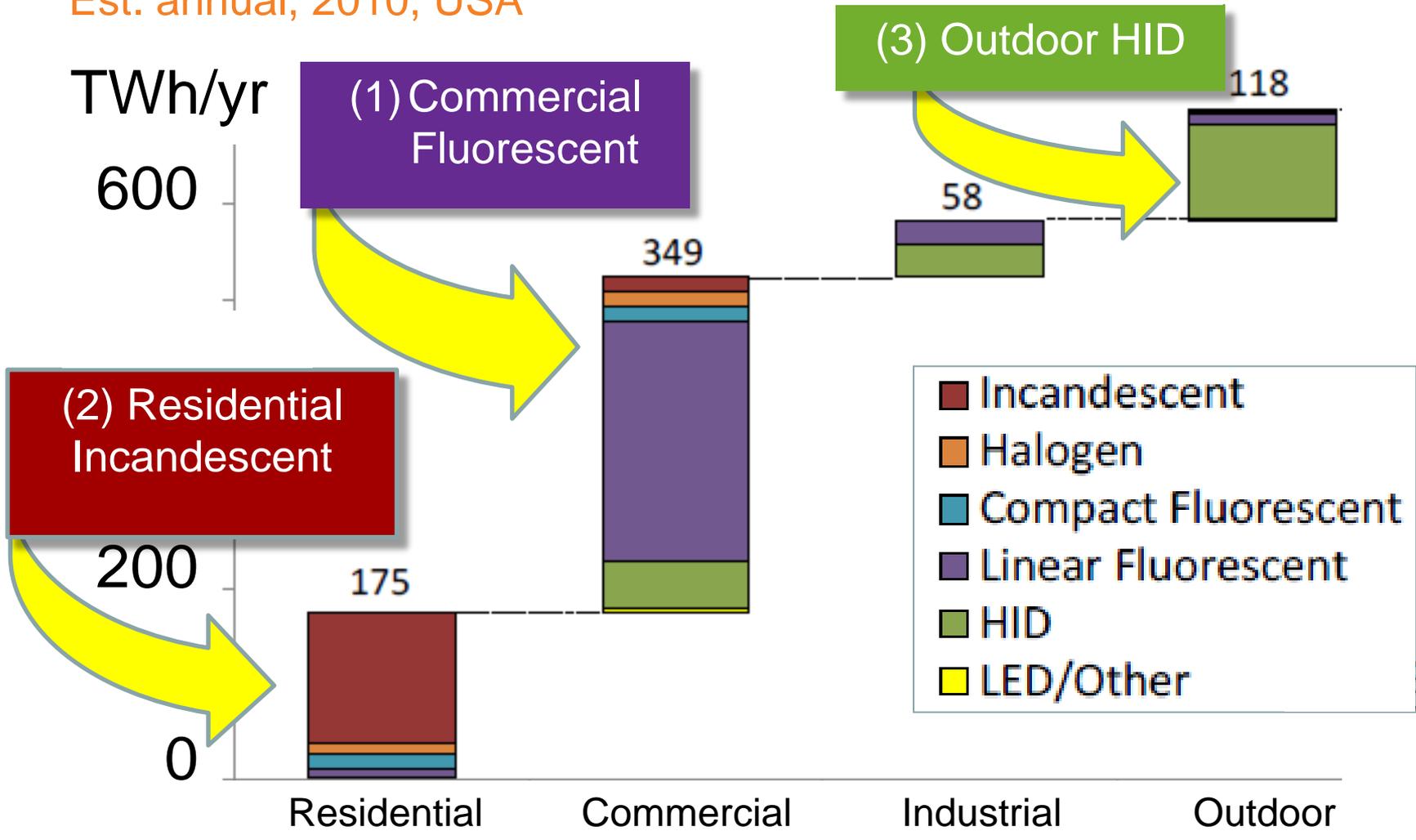
- Next generation lighting is mainly LED
  - Levin Nock, BPA Emerging Technology Group
- BPA is ramping up
  - John Wilson, BPA Programs Group
- Guest Speaker
  - Micah Rose, Lighting Specialist

# Session Take-aways

- LED lights are a disruptive technology.
- We expect a large impact over this decade.
- We are early in the cycle, and ramping up.
- Choosing quality products is essential.

# Electricity Consumption by Lighting Type

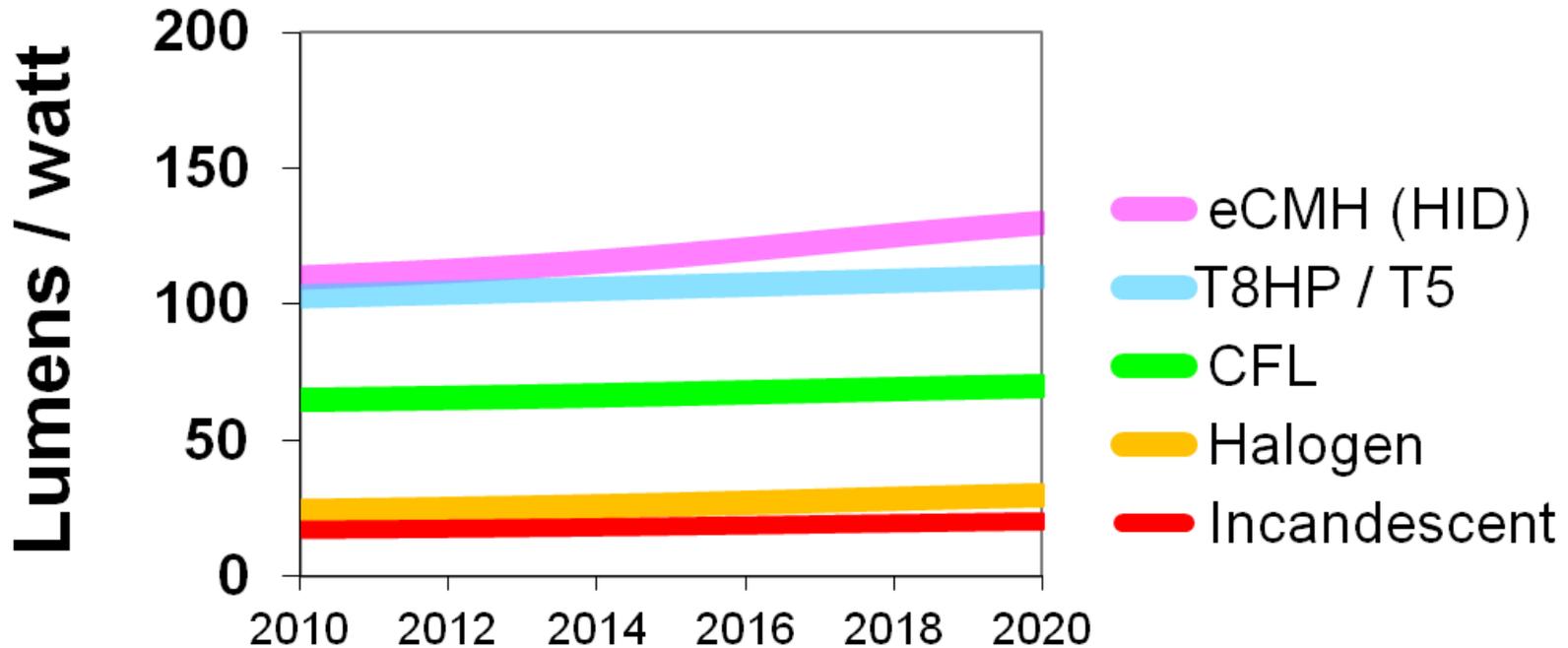
Est. annual, 2010, USA



Adapted from Fig ES-1, p.13, "2010 U.S. Lighting Market Characterization" (1/2012), DOE EERE/Navigant

# Present Generation Lighting

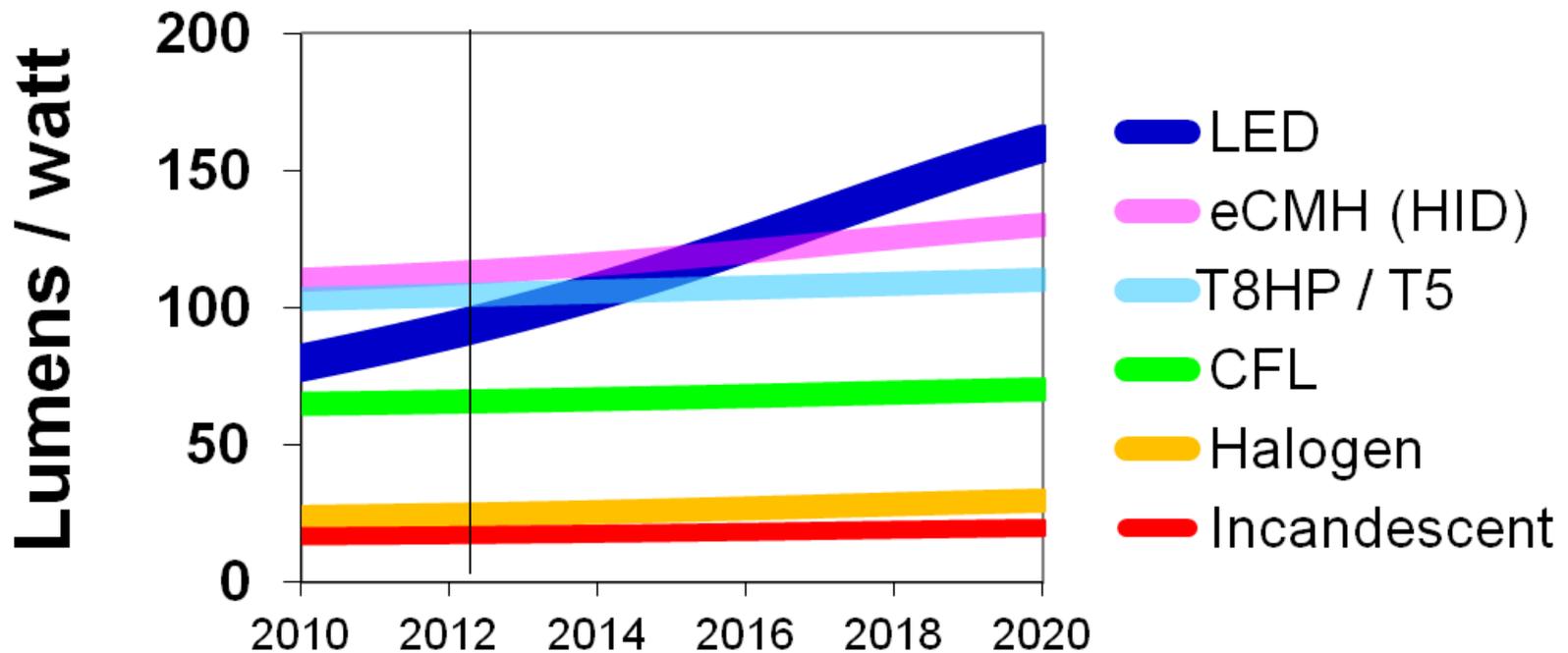
Efficacy of Good Examples of Each Technology



Adapted from Philips lighting presentation 2007, & Fig 3.4 “SSL R&D: Multi-Year Program Plan”, 3/2010 DOE

# Next Generation Lighting

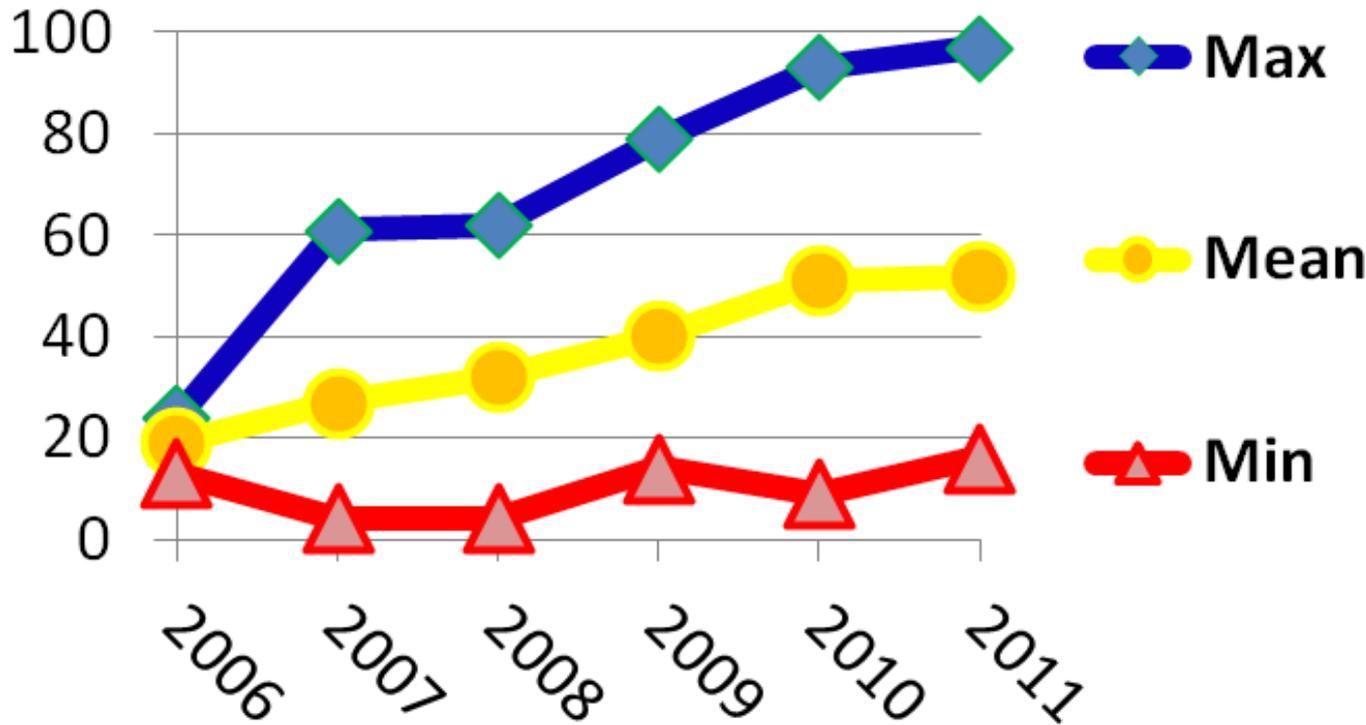
Efficacy of Good Examples of Each Technology



Adapted from Philips lighting presentation 2007, & Fig 3.4 "SSL R&D: Multi-Year Program Plan", 3/2010 DOE

# Some LED's Are Improving Fast, But Not All of Them

Initial Lumens/watt



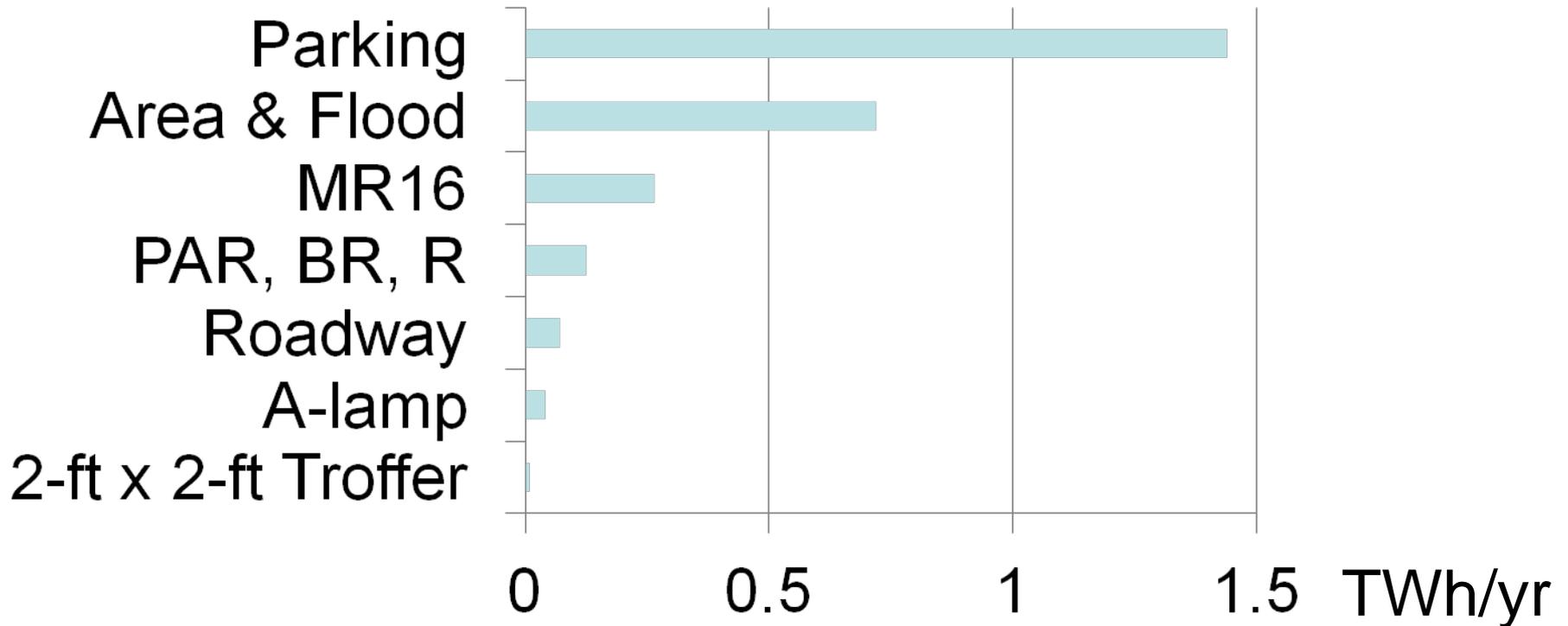
Most efficient  
**100 lm/w**

Least efficient  
**20 lm/w**

Source: LED lighting tested each year by US DOE EERE Caliper Tests

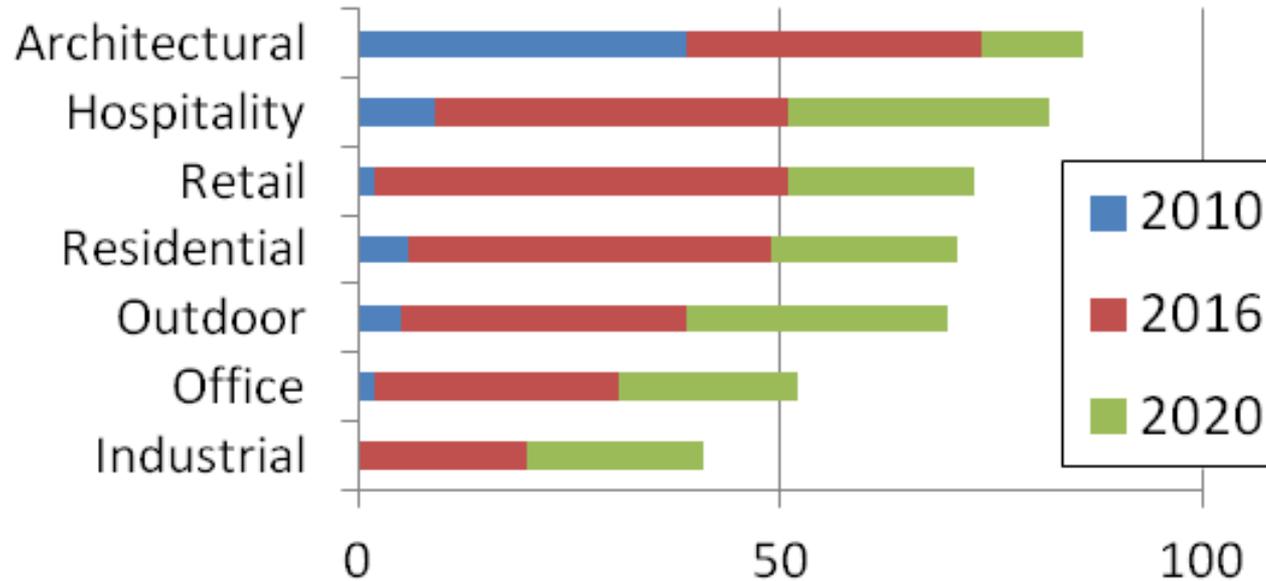
# LED Electricity Savings by Application

## Annual in 2010 in USA, Site Energy



Source: *Energy Savings Estimates of Light Emitting Diodes in Niche Lighting Applications*. Prepared by Navigant Consulting, Inc. for the Department of Energy. Washington D.C. January 2011.

# The Predicted LED Takeover



LED share of the annual lighting market value in each sector, as a percentage of the total market value in that sector

Total general lighting market: light source market for replacement & new fixture installation, w/o controls

Cumulative chart: 2010=blue, 2016=blue + red, 2020=blue + red + green

Source: McKinsey, Global Lighting Market Model, & Global Lighting Professionals and Consumer Survey.

# Benefits to Consumers

(from LED products of high quality)

- Long lifetime (25,000 to 100,000 hours)
- Energy savings
- Good color rendering
- Good dimming
- Potential for new designs & applications
- Works well in cold temperatures
- No mercury, no hazardous materials

# Issues with LED Lighting

- Prices are high
- Quality varies widely
  - Lifetime, efficacy, dimming, etc
- Swapping isn't simple
- Some products will be obsolete within a year, but may last 10+ years
- The phrase “equivalent wattage” is vague
- Some products fade but never die



# Addressing LED Issues

## ■ Qualified product lists



lighting design lab

DESIGNLIGHTS  
CONSORTIUM



## ■ Consumer education

- A good warranty
- Lumens from Lighting Facts™ label

Lighting Facts™	
LED Product	
Light Output (Lumens)	840
Watts	9
Lumens per Watt (Efficacy)	93
Color Accuracy Color Rendering Index (CRI)	87
Light Color Correlated Color Temperature (CCT)	3100 (Warm White)
Warm White	Bright White
2600K	3200K
4500K	6500K
<small>Visit <a href="http://www.lighting-facts.com">www.lighting-facts.com</a> for the Label Reference Guide.</small>	
<small>All results are according to IESNA LM-79-2000: Approved Method for the Electrical and Photometric Testing of Solid-State Lighting.</small>	
<small>Brand X, 18756CH15642896RQ11234HG</small>	

## ■ Niche-specific incentives

- Where LED matches or beats the best practice for energy savings
- Where high quality products are available
- Where BCR > 1

# Technical Advisory Group (TAG)

- 2012 LED Lighting TAG is in progress

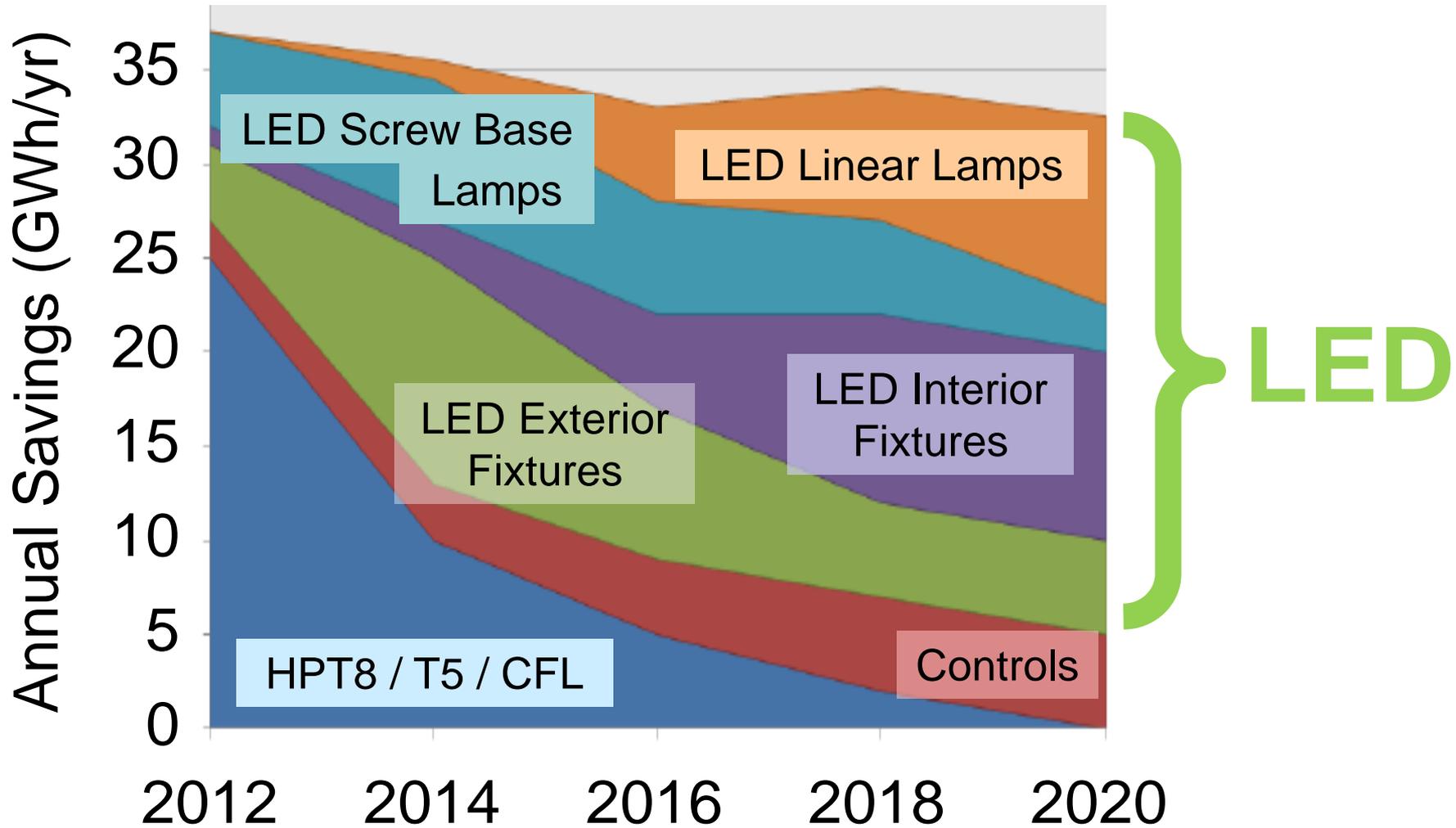


US DOE EERE

## Focus areas

- Area and Parking Lot Lighting
- Outdoor Wall Packs
- Street Lighting
- Linear Commercial Office Lighting

## Efficiency Vermont C&I Lighting Program Energy Savings Forecast



Source: adapted from "Efficiency Vermont Perspective: C&I Lighting Program Results & Plans", 2012

# Conclusion

- LED lighting is a disruptive technology
- We expect a large impact over this decade
- We are early in the cycle
- By 2020, 50% of lighting in the US will be LED

# BPA is Ramping Up with cautious optimism...

## A Programs Perspective on Implementing Solid State Lighting

Presented by:

John Wilson, C&I Lighting Program Straw Boss  
BPA Energy Efficiency

# Overview of Programs Perspective

- BPA's Program History with LEDs
- Current Approach to LED Program Offerings
- Benchmarking LED performance going forward
- Future of LEDs in C&I Lighting Program



# BPA Appetite for LEDs

BPA has been slow to adopt to LEDs for many good reasons

Over the past 5 years...

- Vast Majority of LED products under performed
- Vast Majority of LED products over priced
- Product life is suspect
- BPA had an abundance of low cost savings it could achieve
- Low power costs in the PNW is a natural market barrier to LEDs gaining traction



# BPA Appetite for LEDs

- Learning from Past Mistakes
  - T8 Electronic Ballasts in the early 90's
  - CFL's throughout the 90's
  - Both examples delayed market penetration and would act as a market barrier for years to come



# Current Outlook on LEDs

- Programs ranks LED products into 3 tiers:
  - Varsity
  - Junior Varsity
  - Freshman Team



# How BPA Groups LEDs

## – Varsity Squad

- Already in BPA Lighting Calculator
- Proven cost effective
- Plenty of data available (more is always better)
- Incentives offered through BPA shift the market

- Screw in Reflectors
- Down Lights
- LED Traffic Signals
- LED Exit Signs



# How BPA Groups LEDs

## – Junior Varsity

- Already in BPA Lighting Calculator
- Available data lacking / BPA needs more data
- Incentives typically pretty minimal / not shifting market

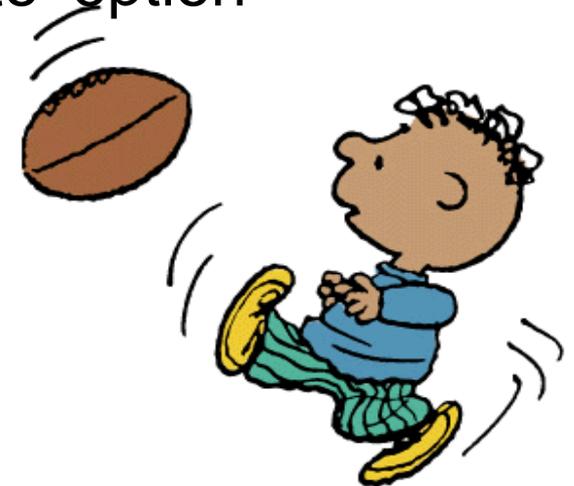
- Troffer fixtures
- Canopy fixtures
- Wall packs
- Parking garage
- Yard / Area lights



# How BPA Groups LEDs

## – Freshman Team

- Not in BPA Lighting Program / Calculator
- All available indicators point to not cost effective
  - Always could use more data
- System efficacy much less than ‘go to’ option
  - Street Lights
  - High Bay Lights
  - Highway Lights
  - Flood Fixtures



# How this has played out in Programs

- C&I Lighting Program currently has limited LED offerings
  - Limited by application
  - Limited by available wattages
- BPA often weighted incentives for ‘more reliable’ technology
  - Electronic (and even pulse start) metal halide
  - Fluorescent (CFL & Linear)
- Many LED’s that offer greater savings potential, subsequently receive lower incentives

# The Times they are a Changin'

- As LED products increase in performance and decrease in price BPA will add more measures with increased incentives.
- Currently Lighting Team is specifically targeting
  - LED wall packs
  - LED area lights
  - LED troffers
  - LED parking lot lights
  - LED canopy lights
- Focus will be on LED applications < 150 watts
- Expect changes in Fall 2012 release of lighting calc 3.0

# Program Requirements

- Program Requirements help weed out poor performing products
  - They also complicate program offerings
  - No shortage for things BPA could spec for
  
- Minimum Requirement for Efficacy
  - Screw in Reflectors must be  $> 40$  Lumens / Watt
  - LED Troffer Fixtures must be  $> 90$  Lumens / Watt
  
- Minimum Requirement for Wattage Drop
  - Screw in reflectors must be  $< 25\%$  of baseline
  - Parking Lot & Wall Packs must be  $< 50\%$  of baseline

# Benchmarking LED Performance

- Efficacy Index
  - Compares Adjusted Design Lumens for
    - Best common practice for EE technology
    - Proposed LED technology
  
- Confidence Index
  - BPA collects data for every LED application
  - BPA takes the good with the bad...

# Why we Sometimes Say No...

## EXAMPLE:

- Standard T8 replaced with LED Tube
  - 31 watts to 21 watts (33% wattage reduction)
- 20,000 Rated Hours & Operates 24/7
- **2.2 year measure life**
- Installed cost \$120
- Savings supports \$10 / fixture incentive
- **16 Year Payback**

# Calculating Incentives for New Measures

- Typical requirement for non-standard lighting approvals is BC Ratio  $> 1$
- For LED products we often allow BC ratio to drop below 1
- LED products that have been LM-79 testing and meet program requirements will be incented at \$0.15 / kWh\*
- Expect expanded LED offerings for FY-13

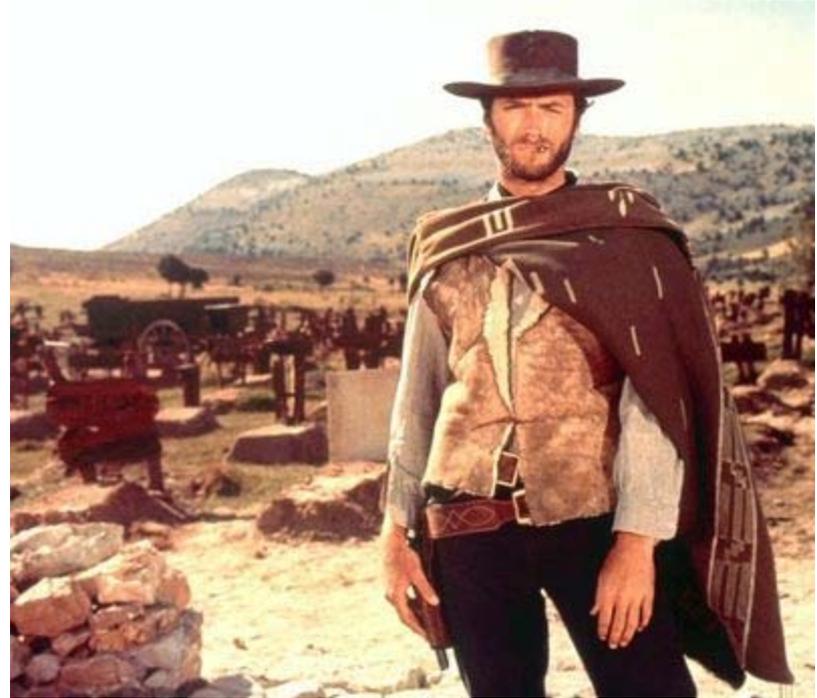
# Working Together

- The effort to keep lousy LEDs off the market is going to take BPA and utilities working in partnership with the trade allies community
- Don't just drink the LED Kool Aide!
- Ask the right questions
- If the product makes sense, BPA will incentivize it



# Real World Application

- The Good
- The Bad
- The Ugly



# Contact

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