GRAINGER SHOW 2015

PRODUCTS • SERVICES • RESOURCES

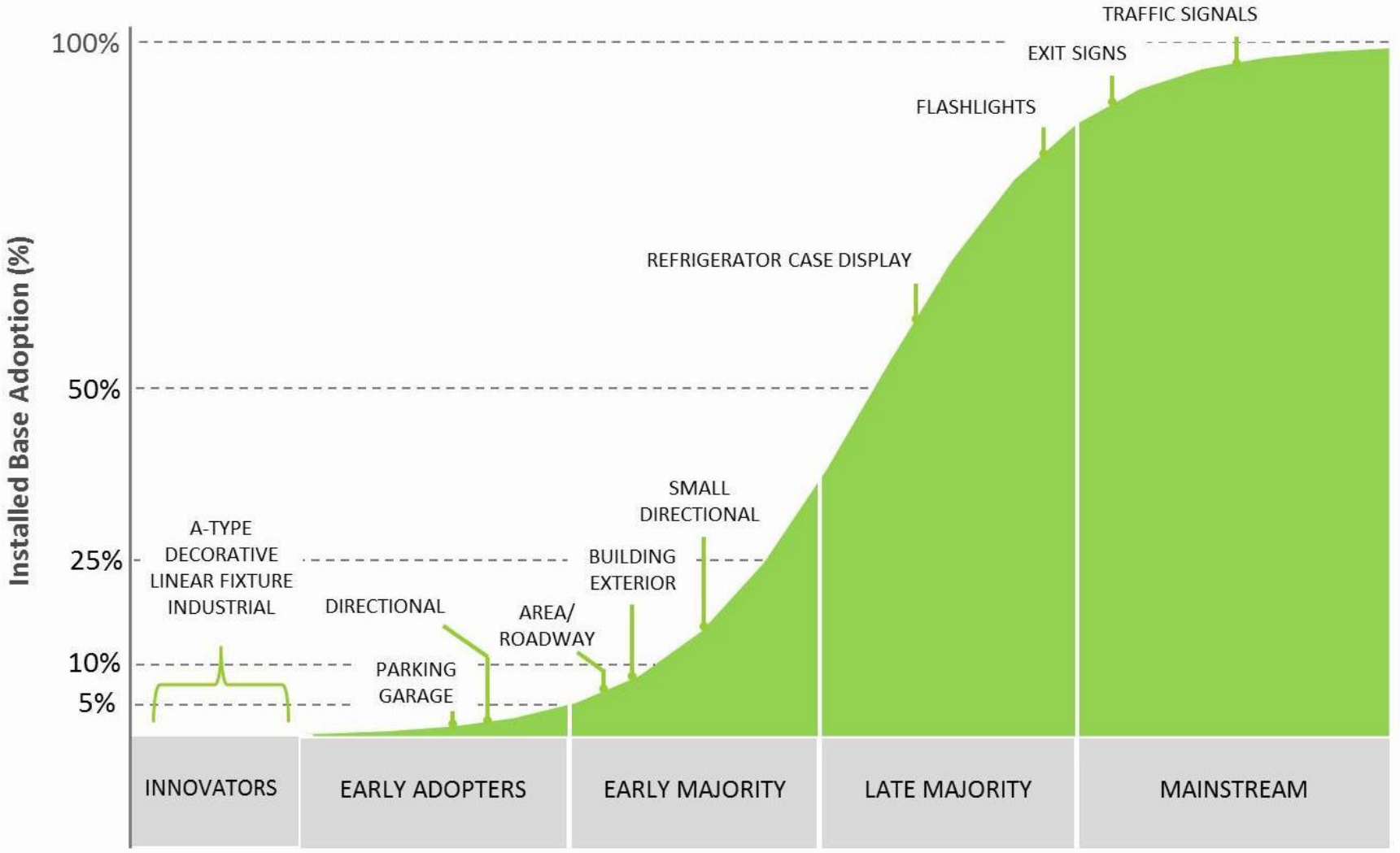
Today's Lighting Products: What You Need to Know

- James Brodrick is the manager of the U.S. Department of Energy Solid-State Lighting program.
- Drawing on extensive technical and market knowledge, Dr. Brodrick has designed a comprehensive DOE national strategy for moving SSL from lab to market. The DOE SSL program has funded more than 200 R&D projects, driving technology innovation and breakthroughs in efficiency and performance.
- On the market side, Dr. Brodrick has implemented a broad-based set of strategies to ensure that DOE R&D investments result in commercial success. These activities are closely coordinated with research progress to ensure appropriate application of SSL products and to avoid buyer dissatisfaction and delay of market development.

Suddenly, LEDs Are Everywhere

Suddenly, LEDs Are Everywhere

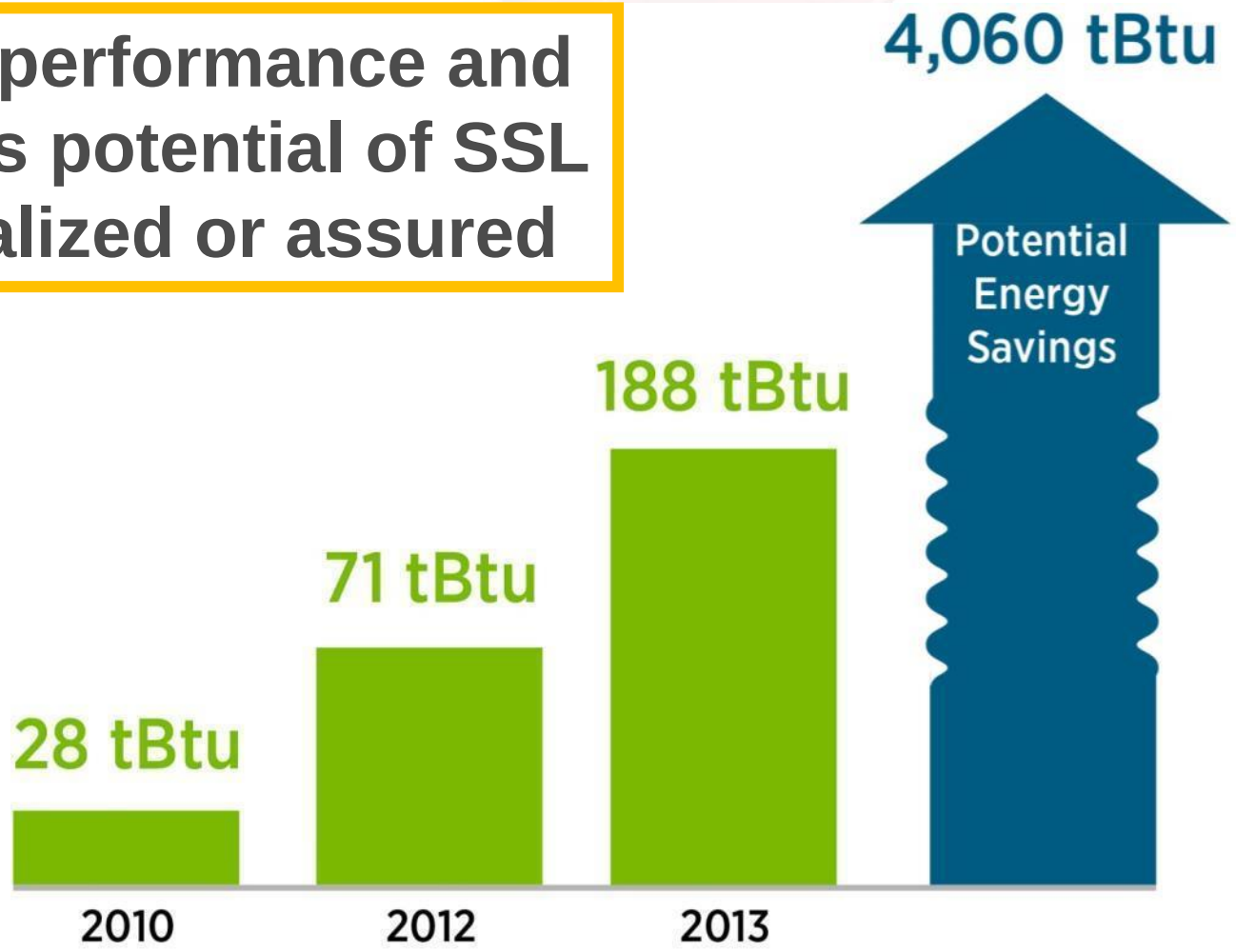
But These Are Still Early Days



Source: Navigant Consulting

Saving Energy Today

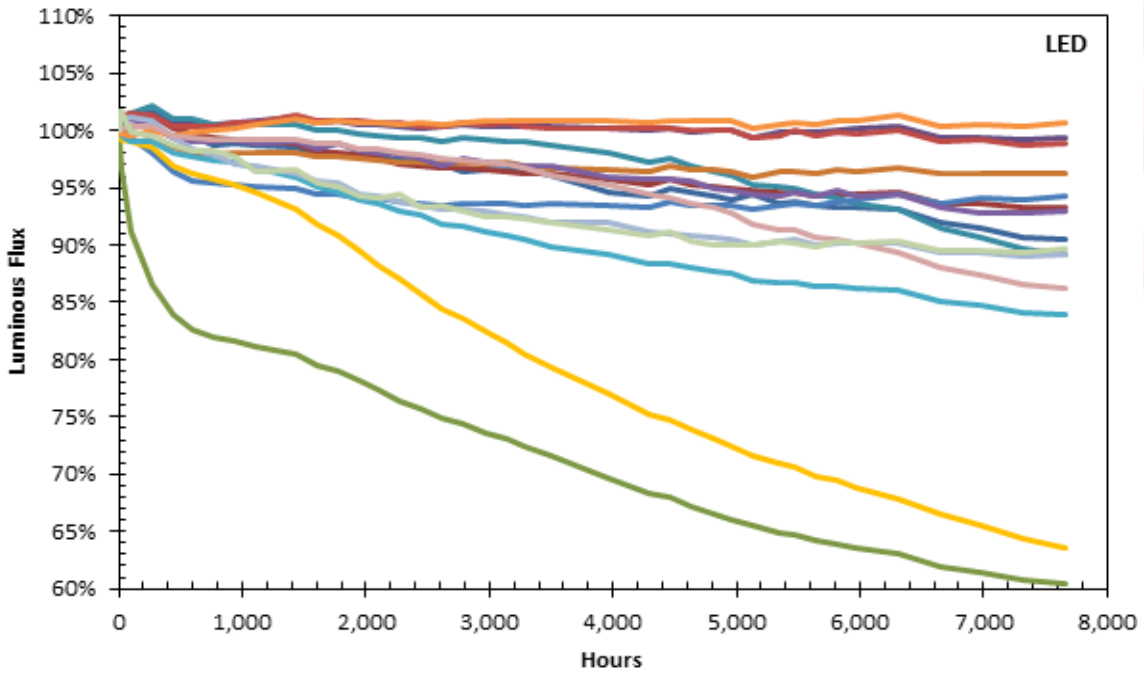
… but the full performance and energy savings potential of SSL is far from realized or assured



Source: Navigant Consulting

Challenges Impacting Market Adoption

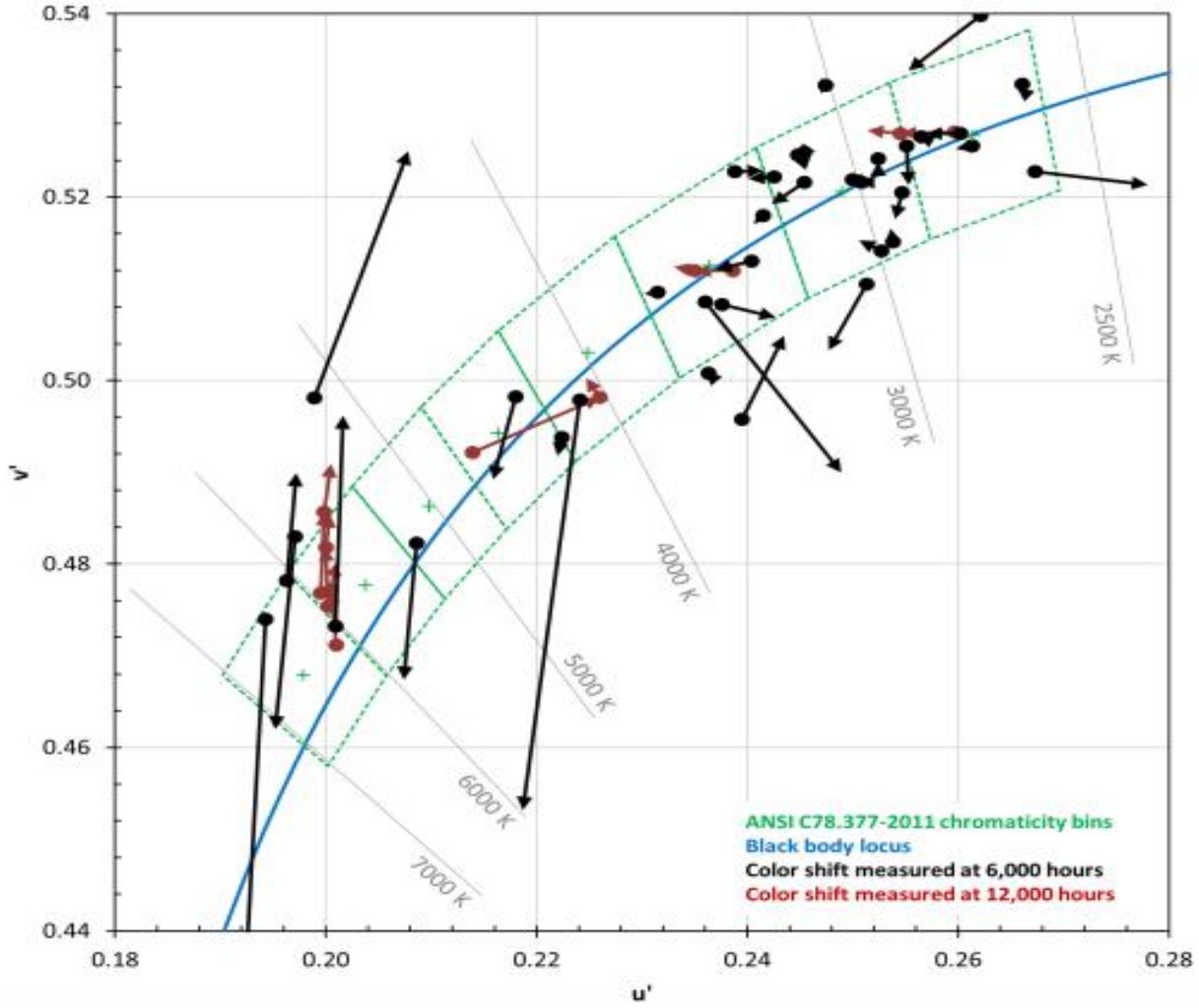
- LED lighting is fundamentally different from traditional lighting technologies
- Technological challenges with today's products: lumen maintenance, color stability, flicker, dimming performance, and more



Recent lumen maintenance testing of various LED lamps from major retailers shows two performing very poorly (one of these from a major manufacturer).

Learn more…
http://energy.gov/eere/ssl/retail-replacement-lamps

Challenges Impacting Market Adoption



Color stability: While many LED products maintain chromaticity over time, some experience color shift

CALiPER testing of various LED lamps shows color shift at 6,000 and 12,000 hours

Learn more…

Color Maintenance of LEDs in Laboratory and Field Applications

http://energy.gov/eere/ssl/gateway-demonstration-special-reports

Challenges Impacting Market Adoption

Dimming: Performance depends on characteristics of the LED sources (drivers) and dimmer, plus number and type of light sources on the dimmer

Compatibility issues can cause pop-on, drop-out, audible noise, premature failure

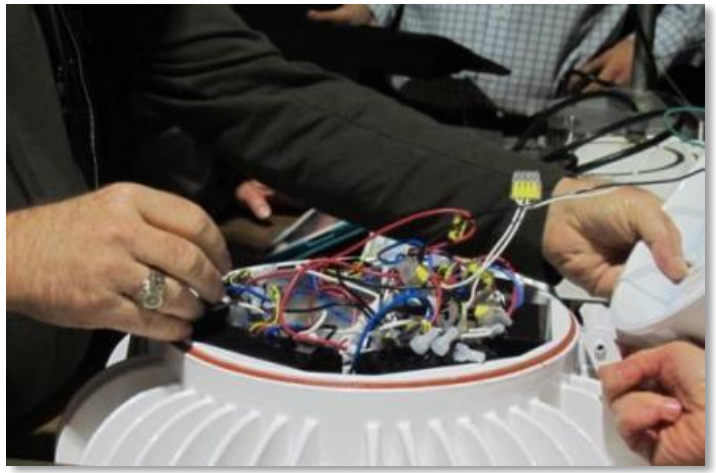
Learn more…

Dimming LEDs with Phase-Cut Dimmers:
The Specifier's Process for Maximizing Success

http://energy.gov/eere/ssl/gateway-demonstration-special-reports

LED Lighting Is Far From Plug and Play

- Limitations of existing infrastructure present challenges related to compatibility, interoperability, interchangeability
- Controls offer added energy savings, but only work properly if specified, installed, and commissioned correctly
- New form factors, control approaches emerging



Navigating the Noise

- DOE testing and field studies provide unbiased information and analysis on product performance
- Product lists provide verified performance data
- Design competitions drive innovation, draw attention to well-designed products
- Website offers valuable resources and tools: **www.ssl.energy.gov**

CALiPER

www.energy.gov/eere/ssl/caliper-testing

Next Generation LUMINAIRES

www.ngldc.org

LED lighting facts® A Program of the U.S. DOE

www.lightingfacts.com

GATEWAY Demonstrations

www.energy.gov/eere/ssl/gateway-demonstrations

Here at Grainger: Ask the Experts at Booth 1317

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Sales. Pitch. Free.

DOE Sessions, Mon/Tues/Wed

- It's 2015 — Should All Your Sockets Be Filled with LEDs?
- The Lowdown on Downlights
- NGL — A Guide to the Best and the Brightest in LED Fixtures
- LED Solutions for the Dark Hours
- Just the Facts, Ma'am: Getting the Most Out of LED Lighting Facts and Other LED Product Data
- Totally Tubular: How Can I Upgrade My Old Troffers with LED?

Today's LED Products

Dimming LEDs at the Burden Museum

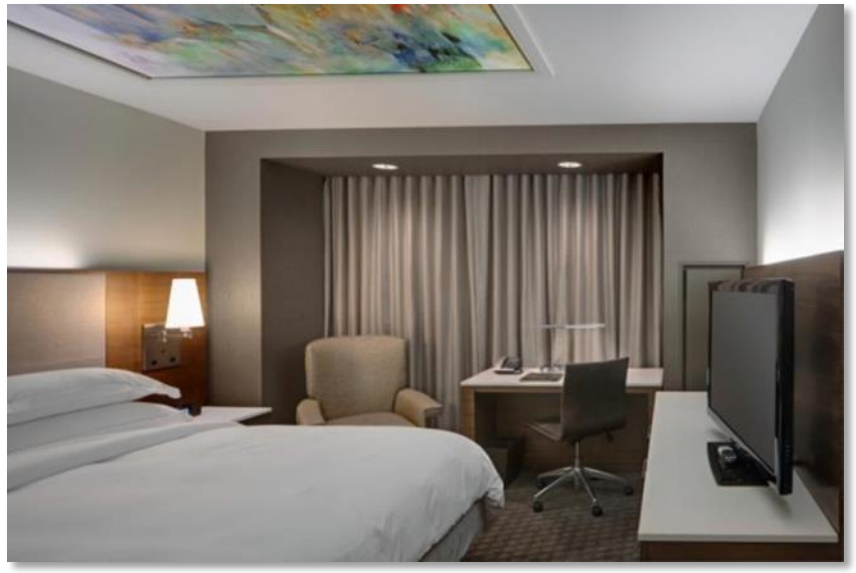
- DOE report provides step-by-step guidance on dimming LED lighting products with phase-cut dimmers
- Also highlights challenges caused by rapid product evolution
- Delay between design and installation (18 months) meant that some products were discontinued, others were upgraded
- Changes to specifications impacted dimming compatibility

Learn more…

Dimming LEDs with Phase-Cut Dimmers: The Specifier's Process for Maximizing Success

http://energy.gov/eere/ssl/gateway-demonstration-special-reports

The Lowdown on Downlights at the Hilton Columbus



- DOE evaluation of LED downlights in guest rooms
- Requirements: Dimming and occupancy control system
- Results: 50% energy savings
- Additional benefits: Instant on, long life, low maintenance

Learn more…

LED Recessed Downlights: Columbus, Ohio

http://energy.gov/eere/ssl/gateway-demonstration-indoor-projects

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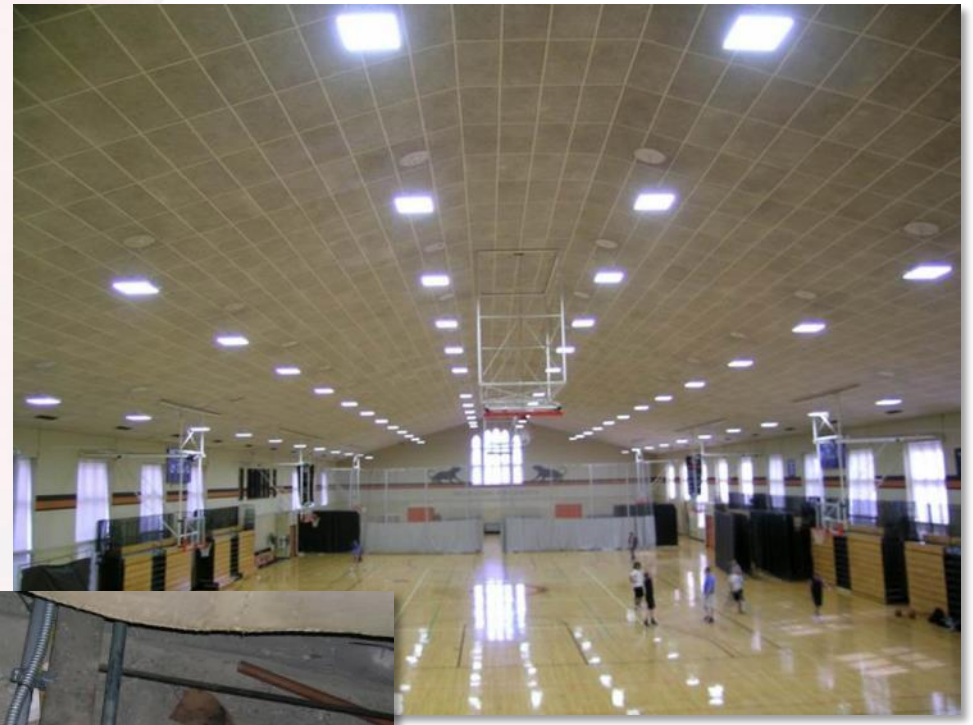
The Lowdown on Downlights

LEDs Go Ivy League at Princeton University

- LED conversion projects part of larger effort to reduce carbon footprint to 1990 levels by 2020
- Installations to date: Walkway, parking garage, parking lot, offices, dance studio, gymnasium, laboratory
- Dillon Gym (2012): LED conversion included option for dimming by zones
- Interoperability of fixtures and controls was challenging; custom interface was required



LEDs Go Ivy League at Princeton University

- Icahn Lab (2014): First building-wide LED retrofit of cove lights and troffers

Learn more…

LD+A Magazine Article:
http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/august2014_gatewayprojects.pdf

Full report coming soon

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Totally Tubular:
How Can I Upgrade My Old Troffers with LED?

Walmart Pioneers Use of LED in Retail

- Early pioneer in LED lighting systems: Signage (2003), freezer case lighting (2005), parking lots (2008), spotlights (2009), downlights (2009), sales floor (2011)
- Rigorous concept, test, pilot, assessment, and rollout process
- Must achieve sustainability goals with ROI
- Partnered with DOE on development of specifications for parking lot

Learn more…
https://www4.eere.energy.gov/alliance/activities/specifications

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LED Solutions for the Dark Hours

Walmart Pioneers Use of LED in Retail

- First all-LED store in South Euclid, OH (2013)

LED Lighting Facts® Offers Buyer Guidance

- More than 1,900 partners include manufacturers, retailers/distributors, lighting professionals, energy efficiency sponsors, and testing labs
- Searchable database includes verified performance data for more than 23,000 products
- Since 2009, Grainger has required new and existing suppliers to list products with the DOE LED Lighting Facts program

LED lighting facts®
A Program of the U.S. DOE

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Just the Facts, Ma'am
Getting the Most Out of LED Lighting Facts and Other LED Product Data

Next Generation Luminaires™ Competition

- Sponsored by DOE, IES, IALD
- Spotlight on top products that employ the latest advances
- Rigorous requirements and judging
- Helps sift through massive volume of commercial LED products
- Winning products listed on **www.ngldc.org**

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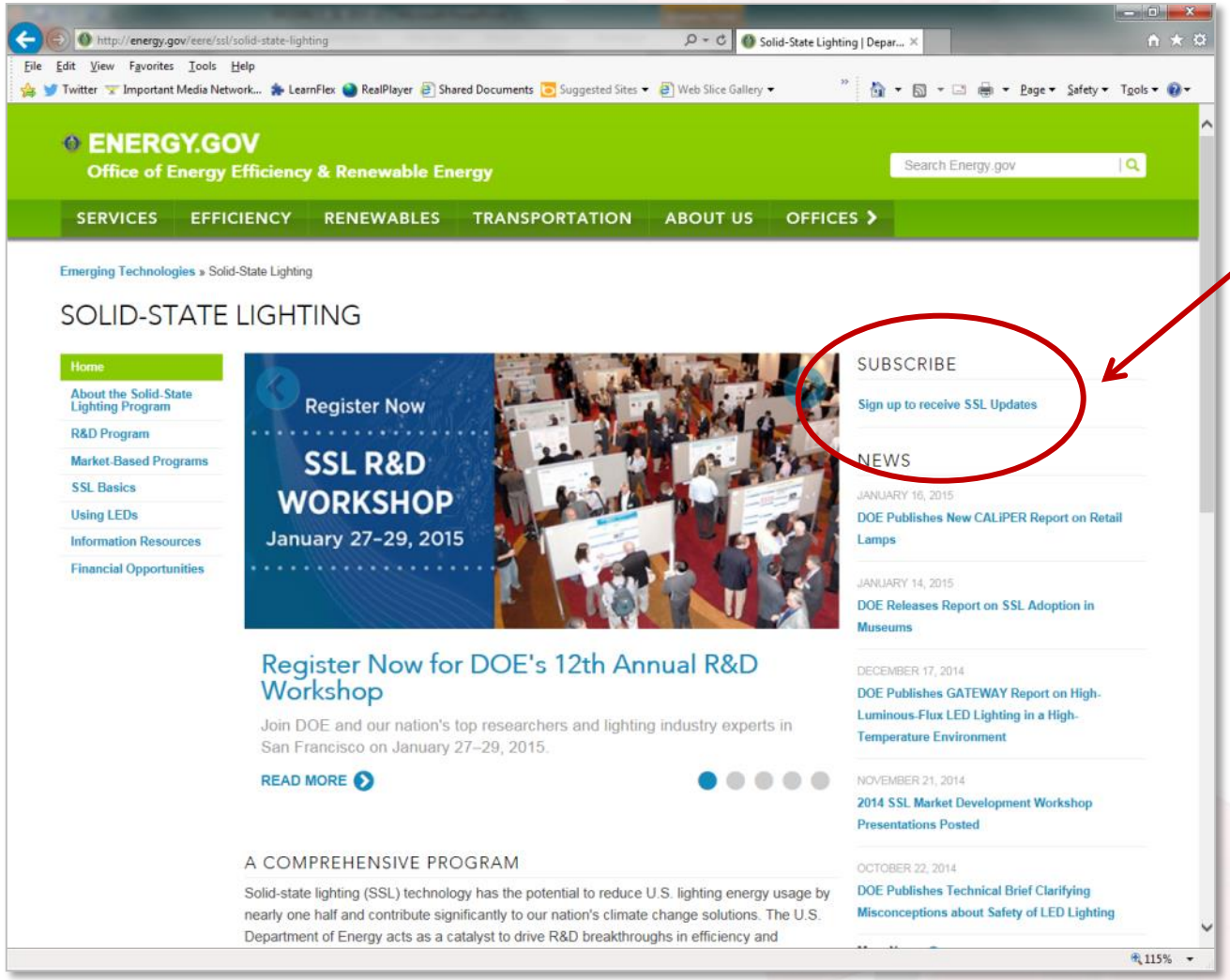
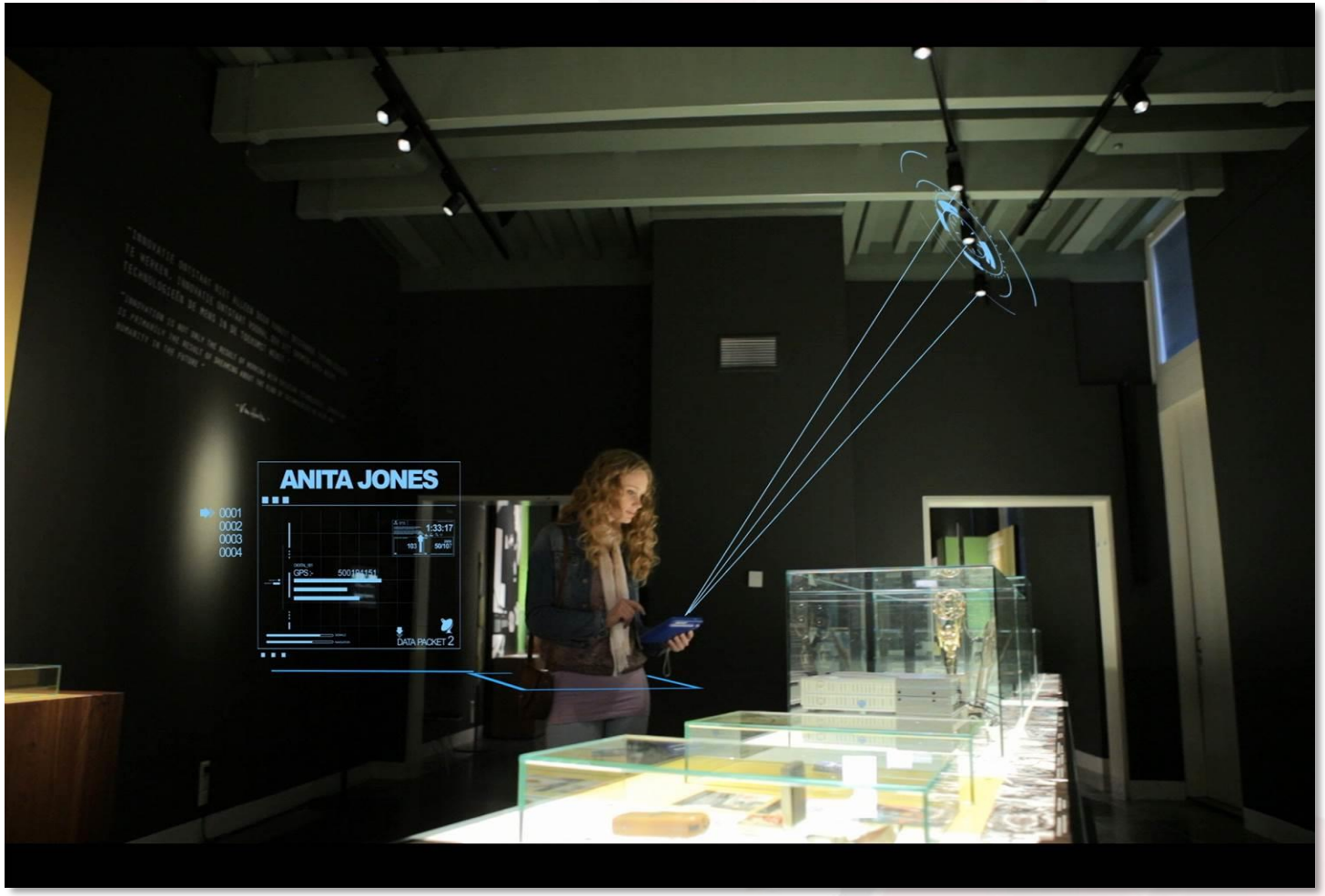
NGL — A Guide to the Best and Brightest in LED Fixtures

Tons of Resources @ www.ssl.energy.gov



Tomorrow's LED Lighting Systems

Tomorrow's Lighting Systems



Susanne Seitinger, Philips Color Kinetics, 2014 SSL Market Development Workshop

Tomorrow's Lighting Systems

Dan Ryan, ByteLight, 2015 SSL R&D Workshop

Tomorrow's Lighting Systems

Andreas Wojtysiak, OSRAM, 2015 SSL R&D Workshop

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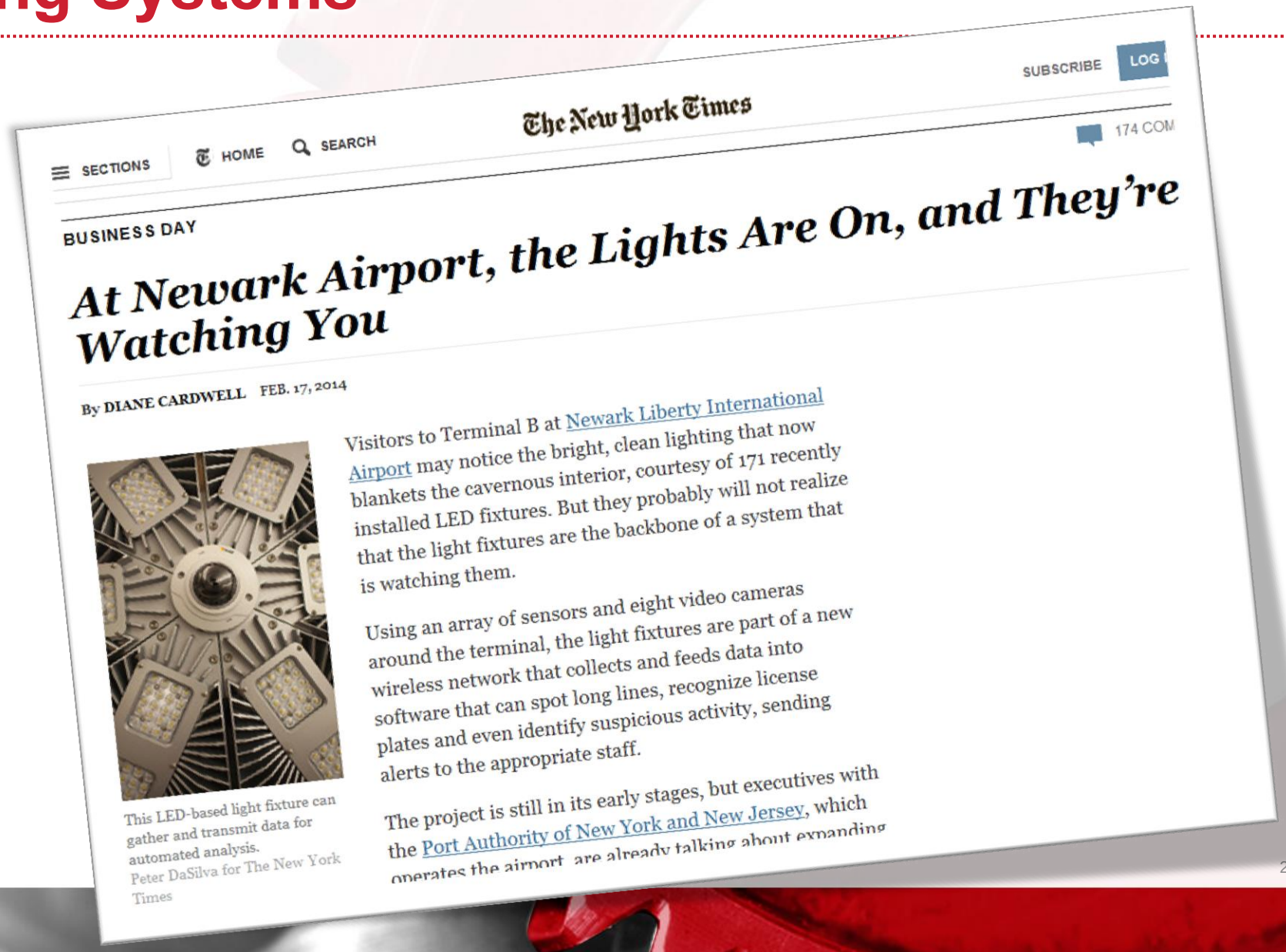
Robert Spivock, GE, 2015 SSL R&D Workshop

Tomorrow's Lighting Systems

Andrea Wilkerson, Pacific Northwest National Laboratory, 2014 SSL Market Development Workshop

Tomorrow's Lighting Systems

- Increased sophistication of future lighting systems will present further challenges
- Controls, color tuning, other smart features
- What future research is needed to support value-added features?



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BUSINESS DAY

At Newark Airport, the Lights Are On, and They're Watching You

By DIANE CARDWELL FEB. 17, 2014

This LED-based light fixture can gather and transmit data for automated analysis. Peter DaSilva for The New York Times

Visitors to Terminal B at Newark Liberty International Airport may notice the bright, clean lighting that now blankets the cavernous interior, courtesy of 171 recently installed LED fixtures. But they probably will not realize that the light fixtures are the backbone of a system that is watching them.

Using an array of sensors and eight video cameras around the terminal, the light fixtures are part of a new wireless network that collects and feeds data into software that can spot long lines, recognize license plates and even identify suspicious activity, sending alerts to the appropriate staff.

The project is still in its early stages, but executives with the Port Authority of New York and New Jersey, which operates the airport, are already talking about expanding

Evolving Focus Areas for DOE R&D

- Expanded focus on lighting systems research
- Expanded focus on controls research and education, technical support for standards and industry consortiums
- Expanded focus on fostering collaboration to accelerate OLED technology advances

Philips project to develop innovative LED lighting system for patient rooms

2014: First OLED products recognized by Next Generation Luminaires competition

Fasten Your Seat Belts

- The new lighting landscape is going to look vastly different
- Value-added features will accelerate market adoption
- Increased sophistication of future lighting systems will present further challenges
- New form factors, new players, new questions
- Rely on DOE resources to help you navigate the noise

Stay Tuned

Register for SSL UPDATES:
www.ssl.energy.gov

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www.lightingfacts.com

CALiPER

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