

Welcome

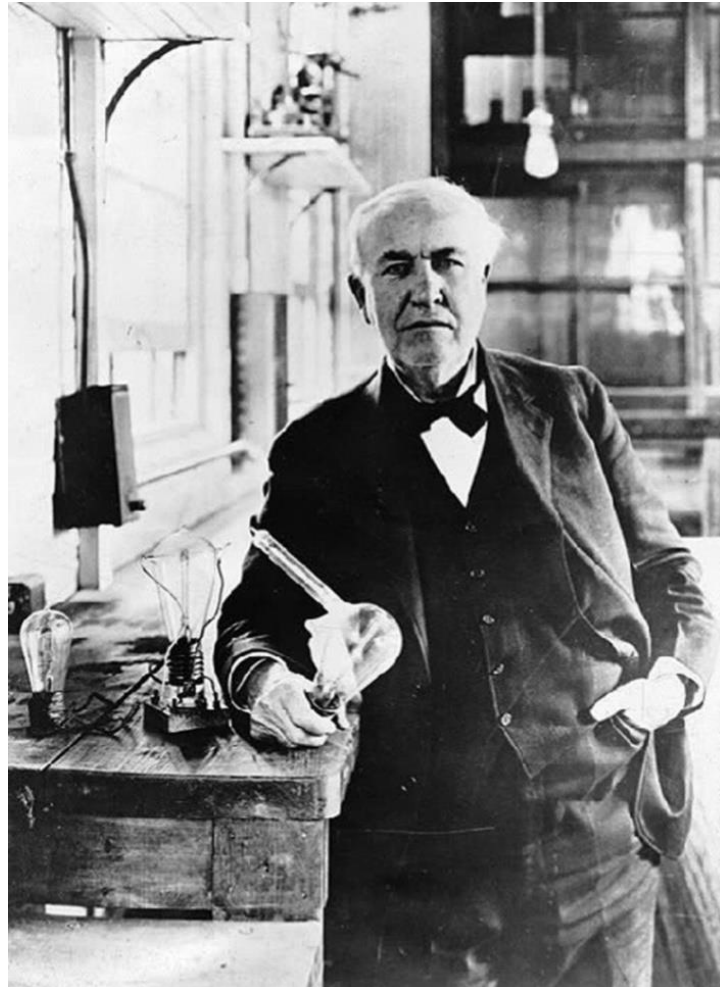
Connected Lighting Systems Workshop

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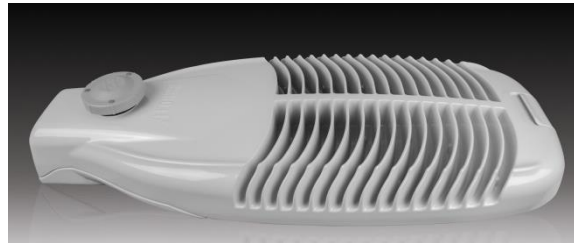
The Evolution of Lighting



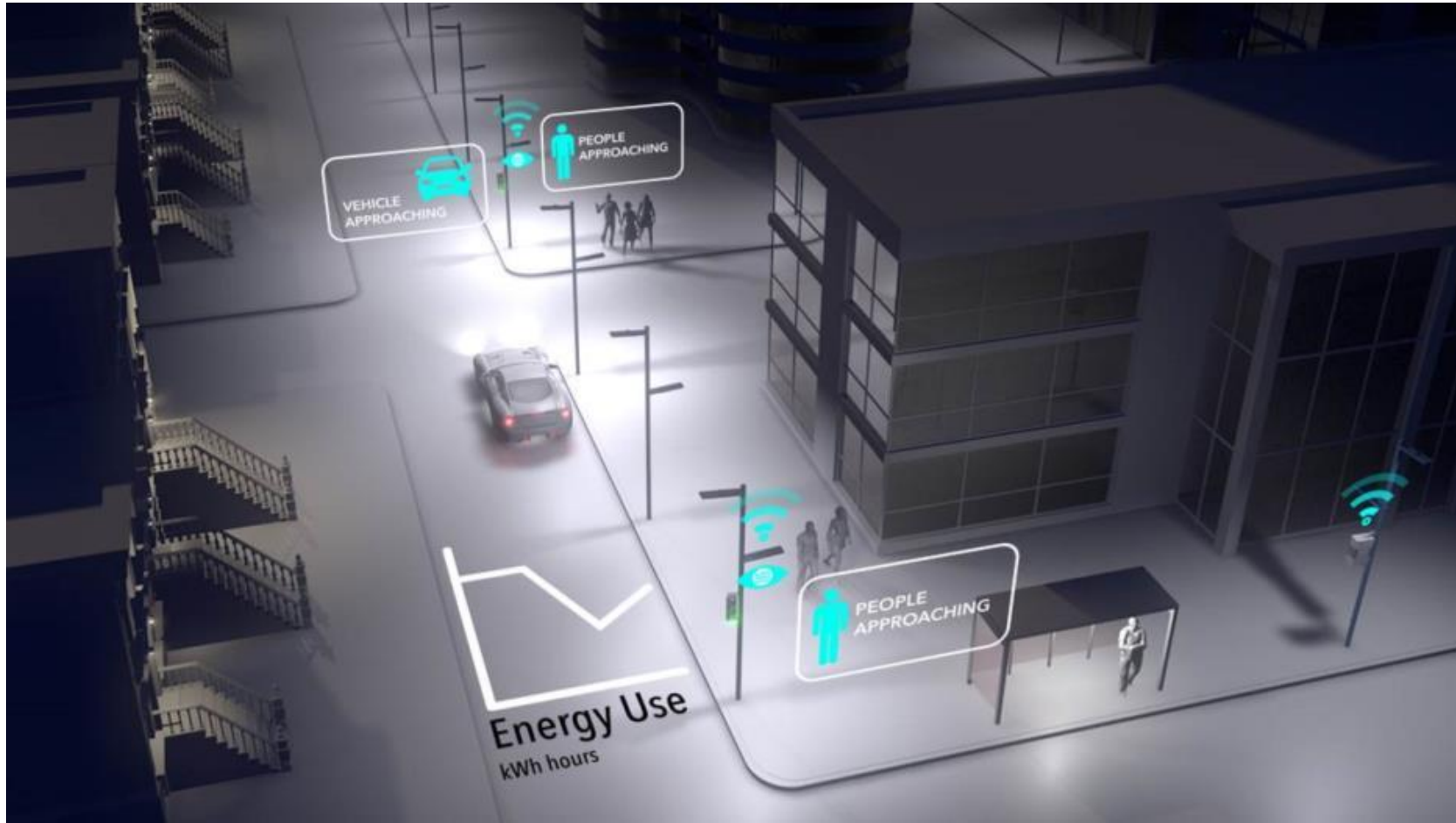
...used to move pretty slowly!

Then Came Solid-State Lighting

Disruptive technology
transforms lighting industry



The Second Lighting Revolution



Moving even faster...

Promising even greater disruption...

How Will This Shift Fundamentally Change Lighting?



What Is Driving Connected Lighting?

Solid-state lighting

Significant technology trends driving performance improvements and cost reductions

Emergence of cloud storage, computing, analytics

Focus on systems and data



What Is Driving DOE's Connected Lighting Strategy?

- Potential for deeper energy savings, plus value-added functions and improved lighting service
- Key barriers:
 - Lack of interoperability, common protocols
 - Lack of accurate test and measurement methodology for energy reporting
 - Exaggerated or over-simplified claims
- DOE's role: Convene, facilitate, conduct targeted R&D for focused needs

In a Nutshell

- ✓ Big players
- ✓ High stakes, large \$\$
- ✓ Much uncertainty
- ✓ High potential for market dislocation

Sound familiar?

Key Elements of DOE's Connected Lighting Strategy

- Build internal capabilities, expertise
- Collaborate with other stakeholders
- Align with synergistic industry efforts
- Ongoing dialogue with stakeholder groups
 - Standards development organizations, e.g., American National Standards Institute (ANSI)
 - Industry consortia, e.g., Open Connectivity Foundation (OCF)
 - System integrators
- Disseminate, recalibrate at Connected Lighting Systems Workshop



DOE Connected Lighting Test Bed Infrastructure



Two movable ceiling grids, with suspended ceiling tiles, AC outlets, wired Ethernet jacks, wireless access points



Mounting struts and AC outlets capable of wall-mounting and powering more than 20 connected streetlights

Energy Reporting Studies

Streetlight energy reporting accuracy study

- Collaboration with National Grid, TESCO, Georgia Power

nationalgrid



THE EASTERN SPECIALTY COMPANY

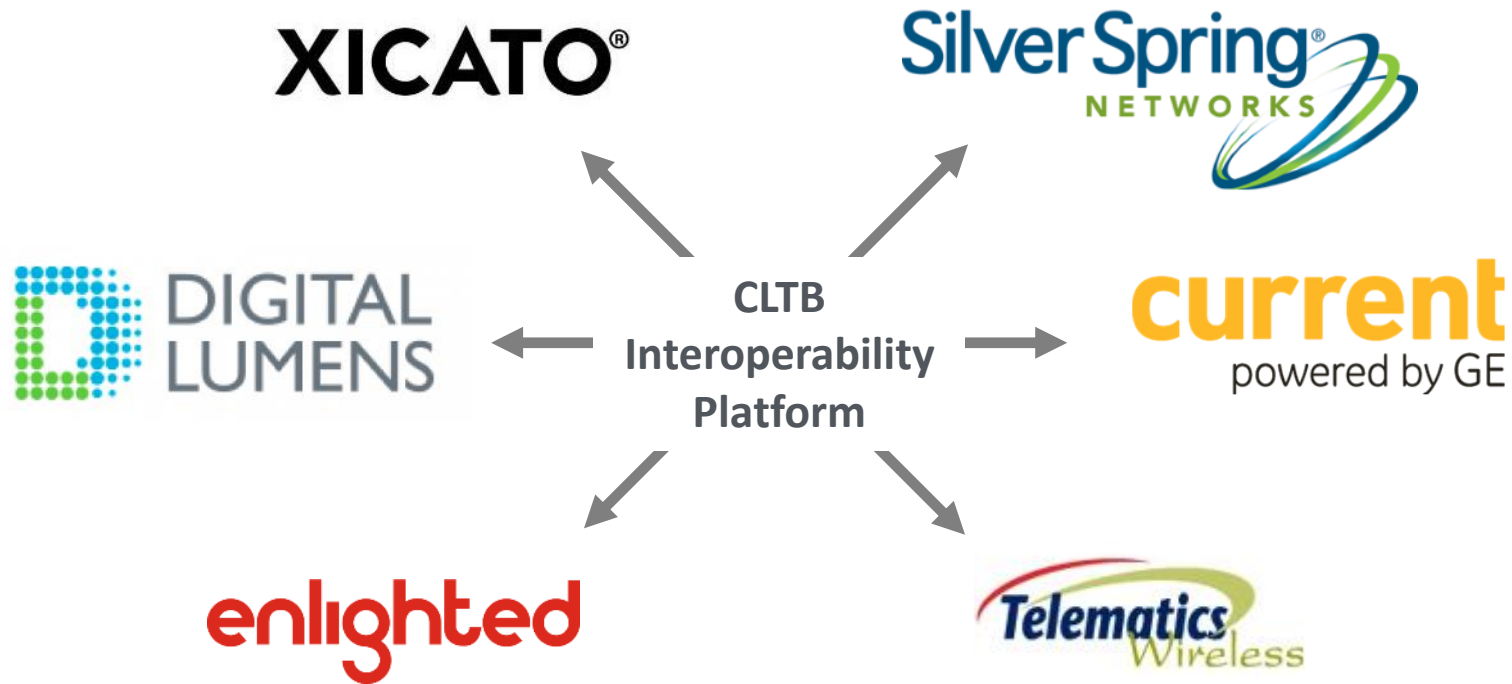


A SOUTHERN COMPANY

Power over Ethernet studies

- **Part 1:** Background on PoE technologies and architectures, existing standards and specs
- **Related study:** Testing to quantify energy losses in PoE cabling, verify usefulness of emerging industry recommended practices

Interoperability Studies



Part 1: Integration and evaluation of indoor and outdoor systems via APIs

Part 2: Improved testing and characterization methodology

Many Efforts Focused on Interoperability

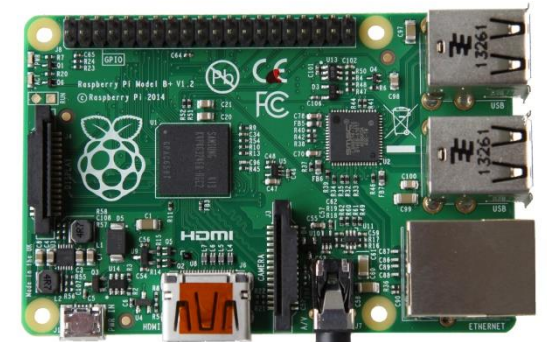


Cybersecurity Vulnerability Test Method

- Two cybersecurity testing systems installed
- V0 test method complete
- Further test method development in partnership with UL and others
- Planned testing will be done in collaboration with other Industrial Internet Consortium (IIC) Security Claims Evaluation Testbed members



SoCe CPPS-Gate 40
Cybersecurity Gateway



Raspberry Pi Hardware running
Kali Linux Software

Next Generation Lighting Systems Competition



- Sponsored by DOE, IES, IALD
- 2017 focus: Connected Lighting Systems
- Permanent installations at Parsons School of Design in NYC

Competition 1 Entrants

RAB Lighting

Nextek Power Systems

Cree

Eaton

Lumenwerx

Selux Corporation

Crestron Electronics

Organic Response



Installation

Installed and configured by qualified electrical contractors



Performance Evaluation

By lighting practitioners, facilities professionals, utility personnel



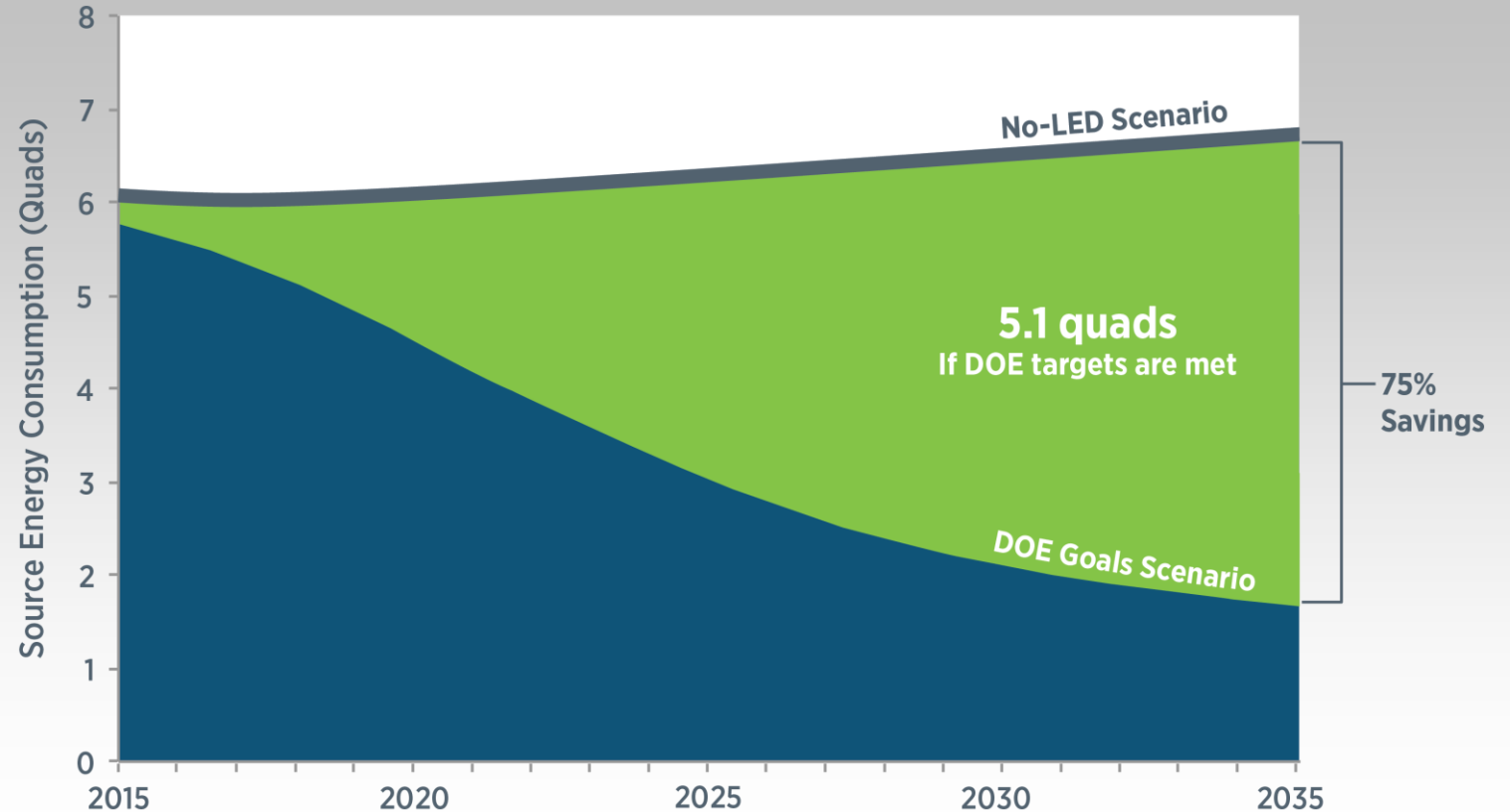
Ongoing Evaluation

By Parsons students and faculty, as well as manufacturer entrants

Why It Matters!

TURNING **DOWN** LIGHTING ENERGY USE

U.S. energy savings attributable to LED lighting will reach 5.1 quads by 2035. Energy use for lighting in 2035 will be **75% lower** than it would have been if LEDs had not entered the market.



Breaking It Down

BREAKING
DOWN
5.1 QUADS
OF **SAVINGS**

CONTROLS
Connected lighting and energy management systems, along with traditional controls, will be essential in realizing the forecast across all sectors. Savings from controls will be enormous for LED luminaires in commercial and outdoor settings.

