Better Buildings®
U.S. DEPARTMENT OF ENERGY

Integrated Lighting Campaign (ILC)

Recognition Opportunities for Participants

February 11, 2021

U.S. DEPARTMENT OF ENERGY

Introductions

Tracy Beeson
Outreach and Data Management
Pacific Northwest National Laboratory

Dr. Kim Trenbath
Technical Team Lead
National Renewable Energy Laboratory

Michael Myer
Technical Team Lead
Pacific Northwest National Laboratory

What Exactly is a Technology Campaign?

A collaborative platform to speed technology adoption

In 2019, participants reported energy savings of more than $250 million from interior lighting improvements, HVAC rooftop unit replacements and retrofits, and the use of energy management systems. – *Better Buildings Solution Center*

Completed campaigns: Smart Energy Analytics, Advanced Rooftop Unit, Interior Lighting Campaign, and Lighting Energy Efficiency in Parking
More info about campaigns available at https://betterbuildingssolutioncenter.energy.gov/alliance/tech-campaigns

Better Buildings Campaigns

Building Envelope Campaign

Website: EC.ORNL.GOV
Email: envelopecampaign@ornl.gov

Integrated Lighting Campaign

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Poll Time!

Which of the following categories most accurately describe your organization?

- ❑ Commercial Real Estate and Hospitality
- ❑ Government
- ❑ Healthcare
- ❑ Higher Education
- ❑ Retail, Food Service, or Grocery

ILC Organizers

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Tyler Cooper

General Services Administration (GSA)

Mechanical Engineer, EIT, Office of Facilities Management

ILC Integrated Lighting Campaign
PROUD ORGANIZER

U.S. DEPARTMENT OF ENERGY

GSA: Largest US Portfolio of Commercial Office Space

8,721

PROPERTIES MANAGED, 377M ft^2

1,574

OWNED, 188M ft^2

$325M

ANNUAL ENERGY COSTS FOR OWNED REAL-ESTATE

"Sensor-based wireless architecture at every light fixture optimizes building systems & operations—lighting, HVAC, asset tracking, space management…"

GPG testbed site:
John C Kluczynski FB, Chicago, IL

At a Glance…

- GSA annual cost for lighting: $36M
- GSA annual cost for HVAC: $105M

- Technology claim:
  - 78% lighting energy savings
  - 25% HVAC savings
  - <8 year payback

GSA design documents P-100 require controls and energy use requirements

Integrated solutions are the next step for some GSA facilities

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Bill Conley

International Facility Management Association (IFMA), National Manager- Facility Services

ILC Integrated Lighting Campaign | PROUD ORGANIZER

U.S. DEPARTMENT OF ENERGY

What IFMA Offers

01

Membership

offering global standards, international reach, recognized worldwide

03

Professional Advancement

through credentialing programs and a range of educational courses

02

Events + Conferences

access to powerful networking and development

04

Knowledge/ Information

cutting edge, specific to FM and built environment professionals

IFMA is the world's largest and most widely recognized international association for facility management professionals

23,368 Members in 112 Countries

IFMA Impact on Built Environment

01

IFMA Members

Manage more than 78 billion square feet of property

02

Purchasing Power

Purchase more than US$526 billion in products and services annually

03

Triple Bottom Line Focus

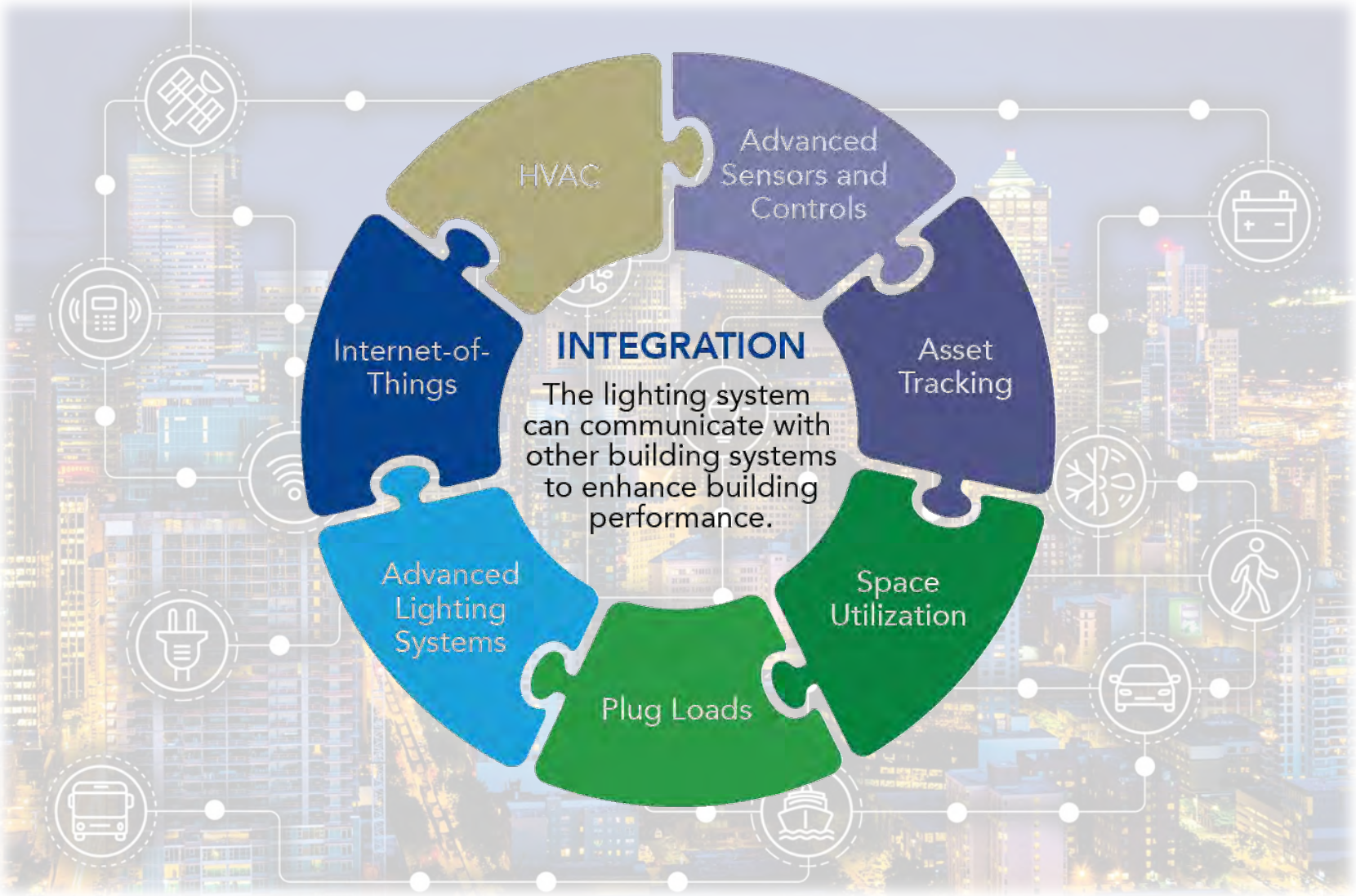
Energy Efficiency
Cost Savings
Indoor Environmental Quality

04

ILC Influence

Provides Resources, Guidance & Technical Advice to IFMA members to achieve their goals through lighting upgrades

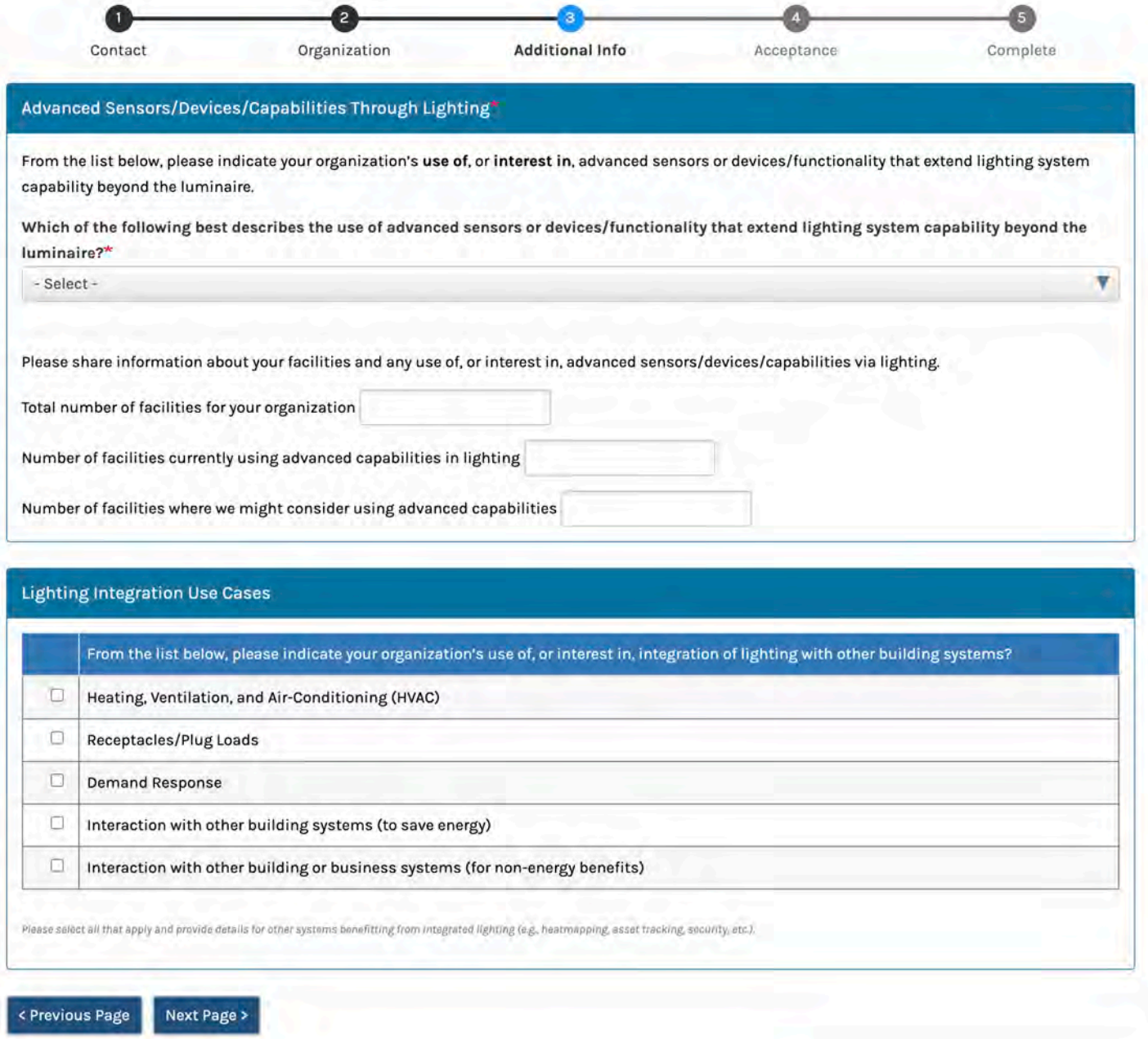
Integrated Lighting Campaign - The Focus



How to Join as a Participant

- Provide contact Information
- Information about your organization

- Tell us about your interests



The Benefits of Joining

Technical Assistance | Information Exchange | Recognition | Resources

- Access to expertise of lighting professionals at Pacific Northwest National Laboratory
  - What use cases might make sense for our project or building?
  - Are the products we are considering capable of meeting the project needs?
- Access to plug-load professionals from National Renewable Energy Laboratory
- We are also here to help you join or submit projects

The Benefits of Joining

Technical Assistance | **Information Exchange** | Recognition | Resources

- Your organization can be listed on our website with a link to your webpage
- Stay up-to-date with our newsletter
- Participate in learning opportunities such as webinars, forums, and other events
- Be on the list to learn of new case studies or research findings to support system integration
- Let us toot your horn!

The Benefits of Joining

Technical Assistance | Information Exchange | **Recognition** | Resources

- The ILC defines categories for recognition
- Submit your building or portfolio in the applicable category

Interior Lighting Campaign Recognition Event

6/8/2020
Launch

10/14/2020
Submission Open

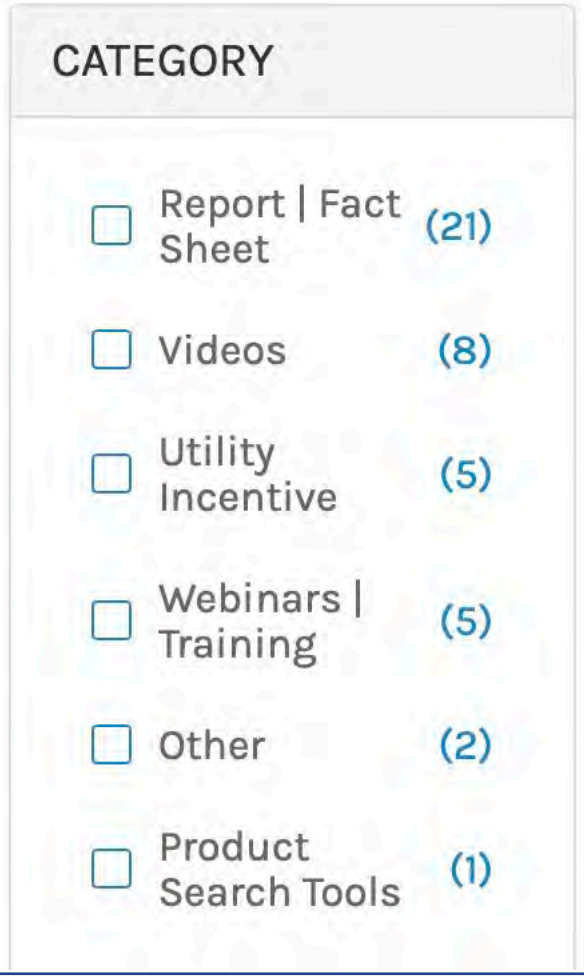
3/15/2021
Submission Closes

6/30/2021
Selection Complete

Fall 2021
2021 Recognition Event at IES annual conference

The Benefits of Joining

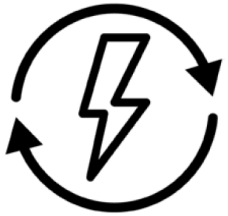
Technical Assistance | Information Exchange | Recognition | **Resources**



- Find national databases and lists for connecting to local utility incentive programs
- Discover research organizations publishing relevant materials
- Learn more about energy savings use cases that can help you maximize your efforts in building systems integration
- Find trainings and webinars that can be leveraged as staff training or continuing education for design professionals
- Watch videos to keep up-to-date on technologies and the work of ILC and our partners

Advanced Lighting Controls: The Possibilities

LIGHTING CONTROL



ENERGY CONSERVATION

SYSTEM PERFORMANCE

REAL ESTATE OPTIMIZATION

PROPERTY SERVICES

WELLBEING

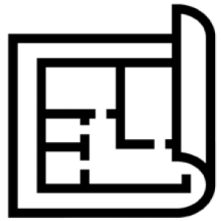
Lighting System Integration: The Possibilities

ASSET TRACKING

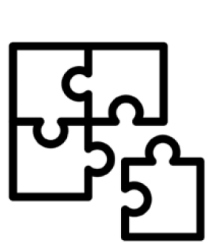
WAYFINDING

FACE-TO-FACE INTERACTON

SAFETY AND SECURITY



FLEXIBLE SPACE UTILIZATION



VIEWER ENGAGEMENT

Time for another Poll…

There are many ways to leverage the lighting system to attain additional benefits! Select all that apply for your organization:

- ❑ System integrations that lead to building energy savings
- ❑ Data acquisition or smart analytics
- ❑ Health and well-being for building participants
- ❑ Location-based services
- ❑ Other

Dr. Kim Trenbath

Plug and Process Loads Overview

National Renewable Energy Laboratory
(NREL)

Plug and Process Loads (PPLs) Technology Research Team

Technical Team Lead:

Dr. Kim Trenbath

National Renewable Energy Laboratory (NREL)

Kim.Trenbath@nrel.gov

Phone (office): (303) 275-3710

Amy LeBar
NREL

Robin Tuttle
NREL

Kristi Maisha
NREL Intern

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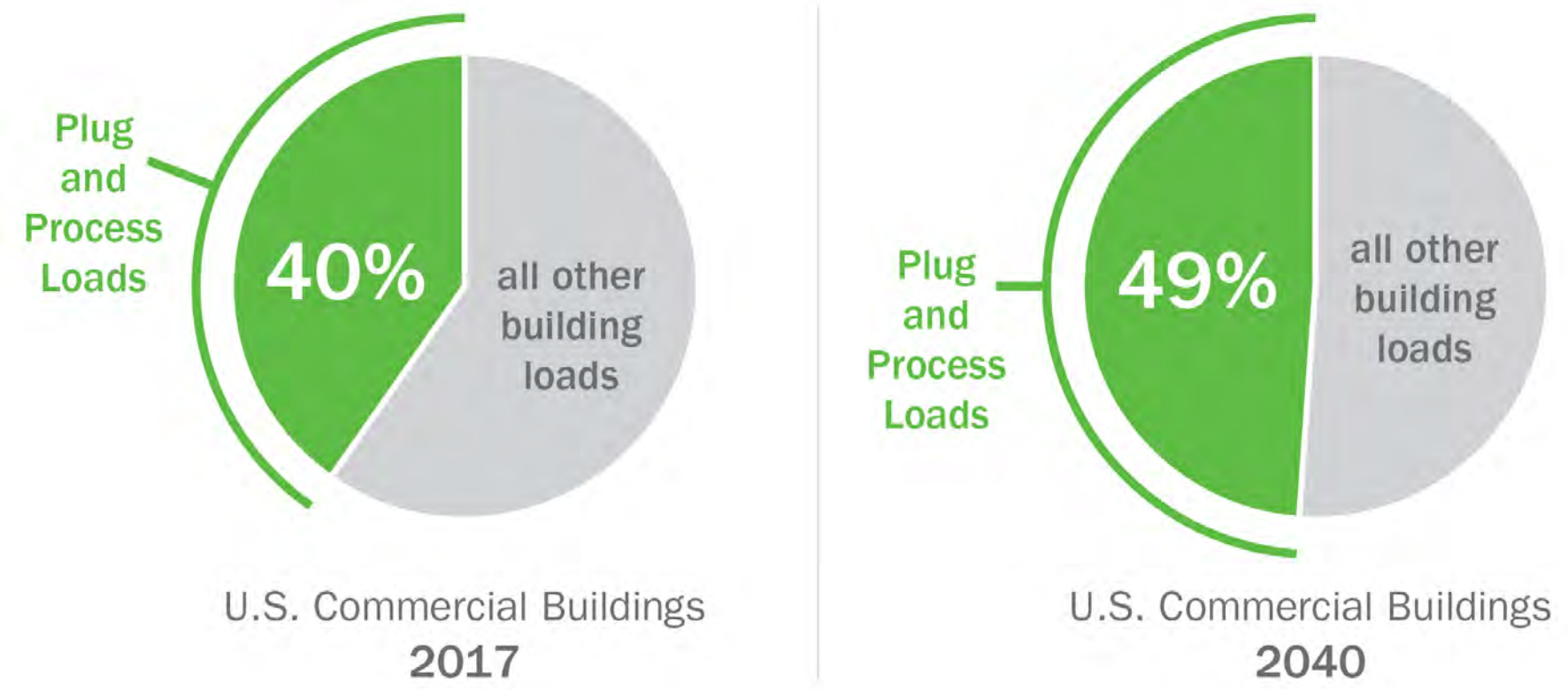
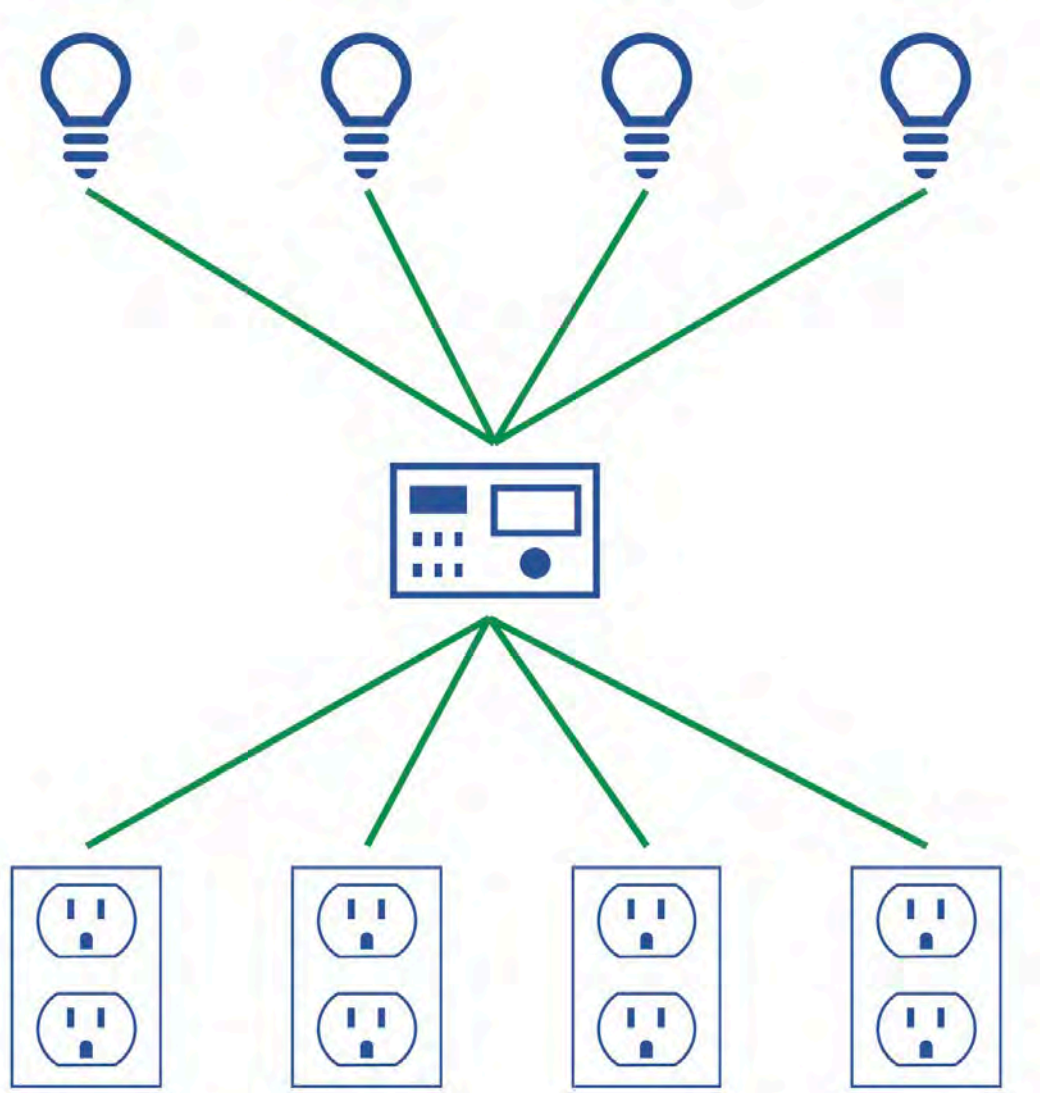
Plug Loads Are….

40% of whole-building energy



Data source: EIA's *Annual Energy Outlook 2018* (EIA 2018)

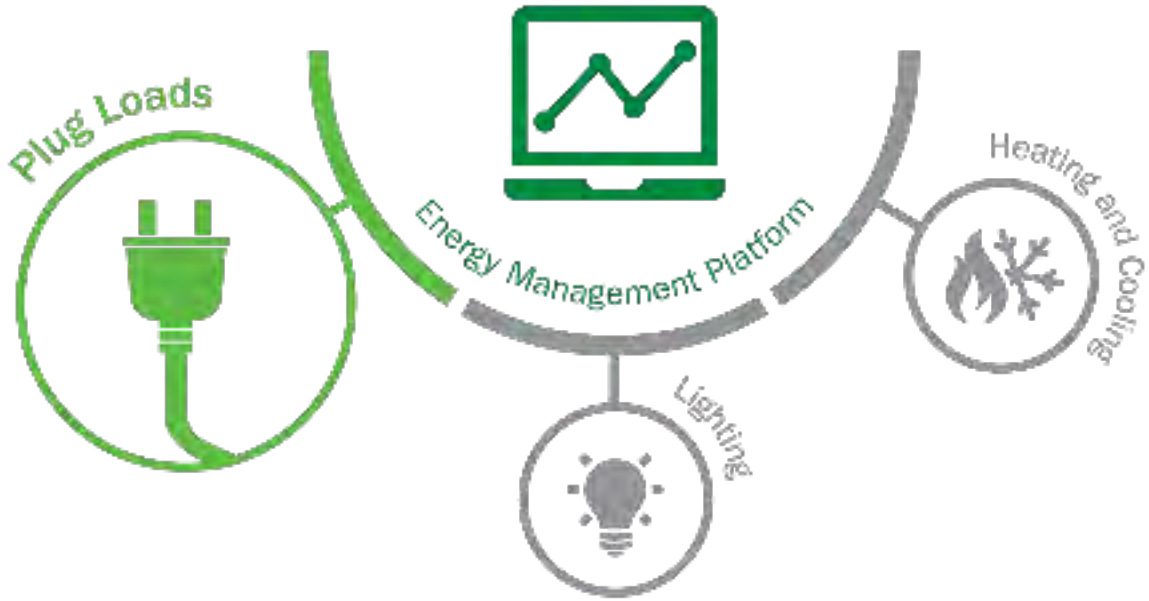
Integrating lighting and plug loads



Publication

Integrating Smart PPL Controls into EMIS Platforms – A Landscaping Study

- Technical Report
- Rois Langner & Kim Trenbath
- June 2019



Strategy: Education and Awareness

Designate a PPL champion

Choose someone who understands PPL systems and can work with all teams to implement system controls.

Institutionalize PPL reduction practices

Formalize and incorporate PPL energy-saving tactics into building policies (see guide for examples).

Establish the business case for PPL reduction

Utilize available resources to demonstrate the potential energy and financial savings from PPL reduction.

Educate employees on the benefits

Educate employees on the benefits of PPL reduction to realize improvements and prevent misuse.

Access at:

https://www.nrel.gov/docs/fy20osti/76994.pdf

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Other Control Strategies

Automatic Receptacle Controls

Smart Outlets

Advanced Power Strips

Visit Our Website for PPL Resources

https://betterbuildingssolutioncenter.energy.gov/alliance/technology-solution/plug-process-loads

- Recorded webinars
- Utility incentives
- Fact sheets (i.e. plug load disaggregation)
- Case studies
- *NEW* Guides for assessing and reducing plug loads

Upcoming Webinar

- **Title:** Beyond Energy Efficiency: How Your Device Usage Patterns Affect Energy Consumption
- **Date/Time:** March 17, 2021; 1:00pm ET
- **Description:** How people use plug load devices can strongly affect their energy consumption. Learn what factors are most important for certain types of devices, and how to reduce inefficiencies.
- **Registration link:** https://attendee.gotowebinar.com/register/3183241606160939022

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Website and Contact

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PPL Team Email:

PPL@NREL.gov

BBA website:

https://betterbuildingsinitiative.energy.gov/alliance/technology-solution/plug-process-loads

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Michael Myer

Case Studies on Lighting Integration

Pacific Northwest National Laboratory (PNNL)

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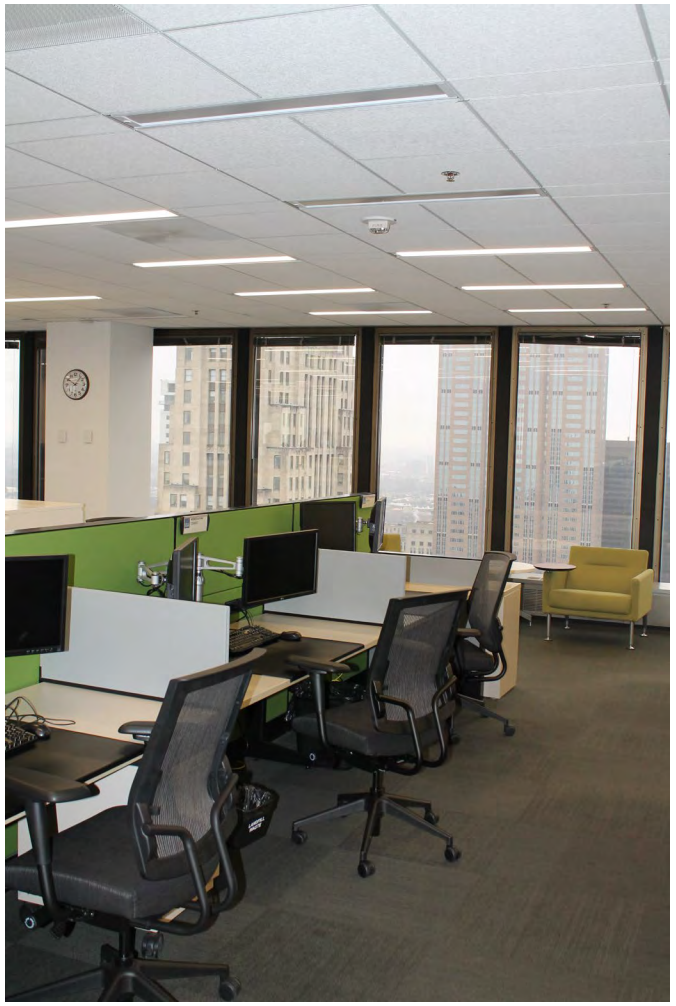
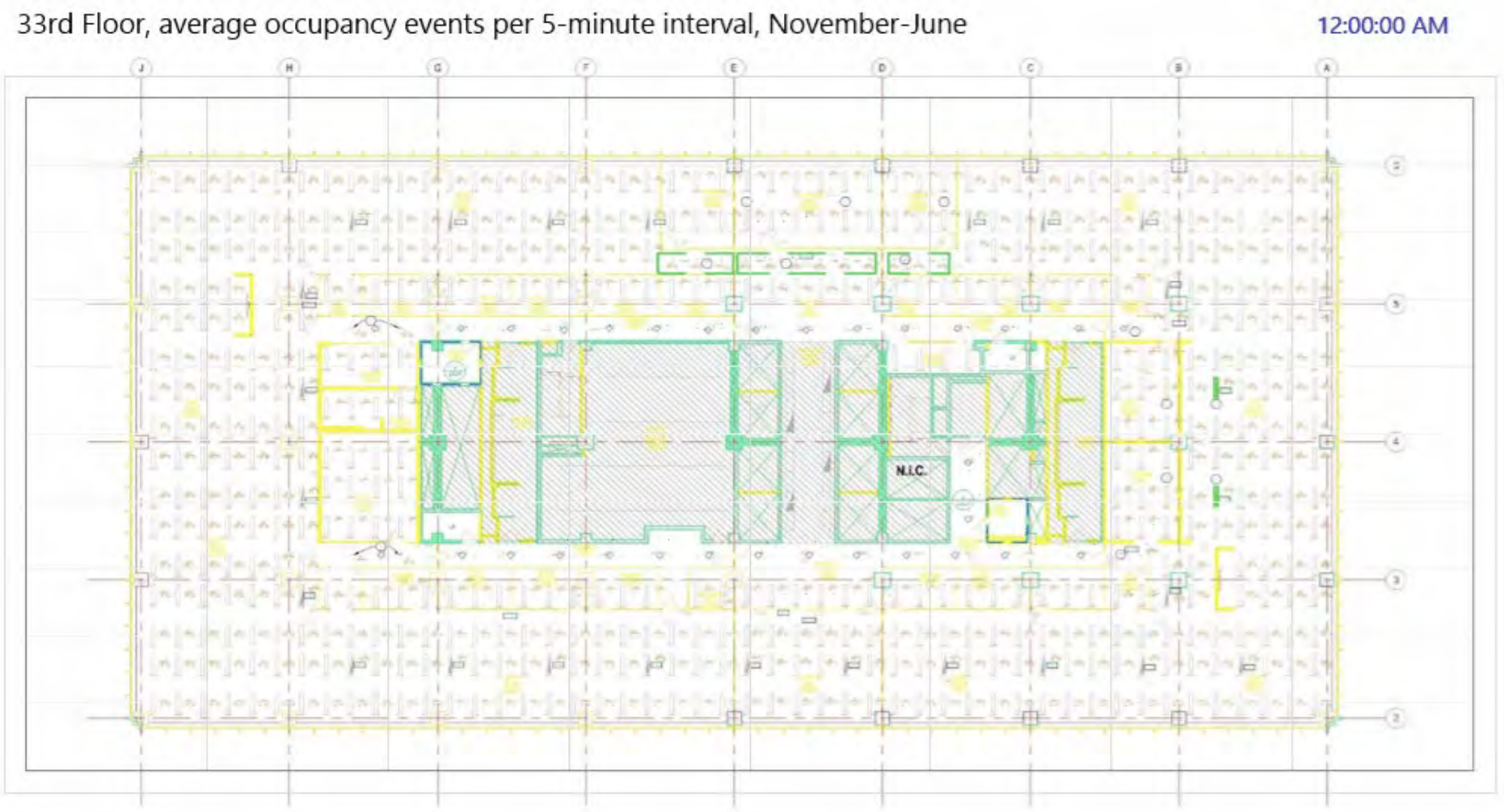
GSA JCK Building – LED Lighting, Controls, HVAC Integration, IoT

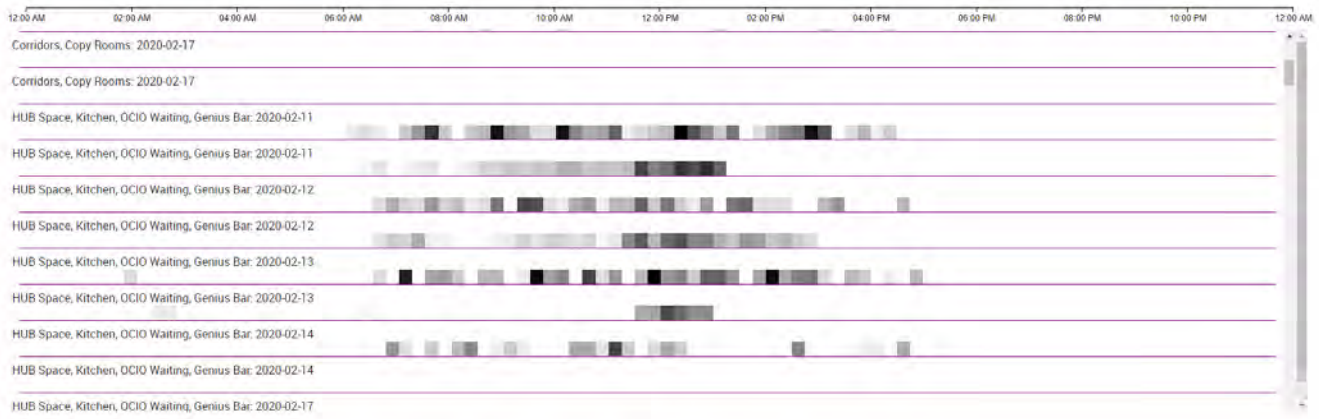


- 63% savings for LED lighting and controls
- HVAC integration attempted, but not successful – more of a building issue and less of a technology issue
- IoT system with workplace analytics
- GSA found the IoT system to be more valuable than the LED lighting and controls

Lighting Control Data & IoT Applications

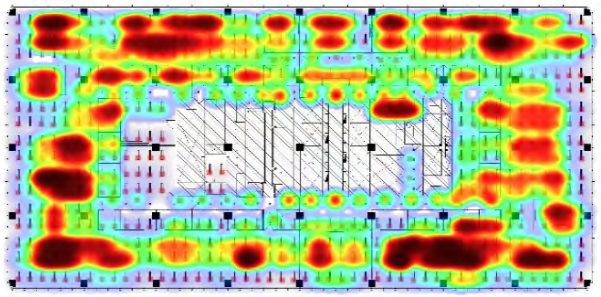


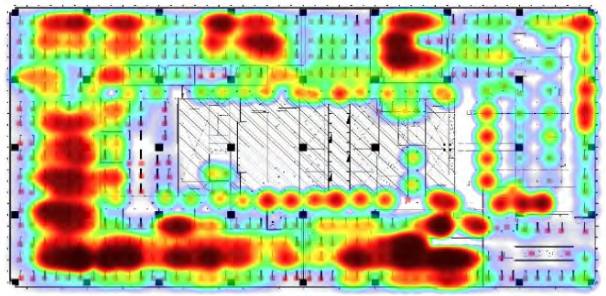
Sample IoT Applications Considered



Space Utilization

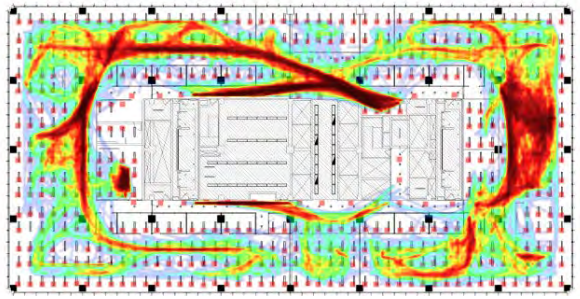
- Time of day across the top
- Each row is a different room / zone
- Darker color indicates more usage





Space Optimization

- “Heat map” of data
- Dark red = high occupancy
- Green or purple = low occupancy



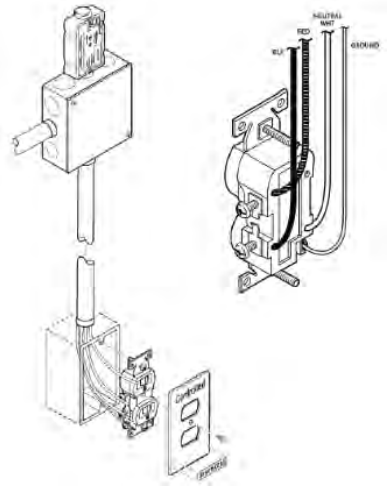
Real-Time Location System RTLS

- NOT actually tested, RF tag on badge
- Can tag assets, geofence an area
- Could be used for COVID contact tracing

Tinker Air Force Base Lighting + Plug (Dept. of Defense / ESTCP project)

Project Details

- 5,000 ft^2 portion of office space
- 15 Initial / 14 actually working controlled receptacles
- ≈ $160 material per receptacle
- $550 labor per receptacle
- Labor involved rewiring of receptacle, mounting controller in outlet, and configuring



Tinker Air Force Base Lighting + Plug (Dept. of Defense / ESTCP project

Cost Effective Criteria

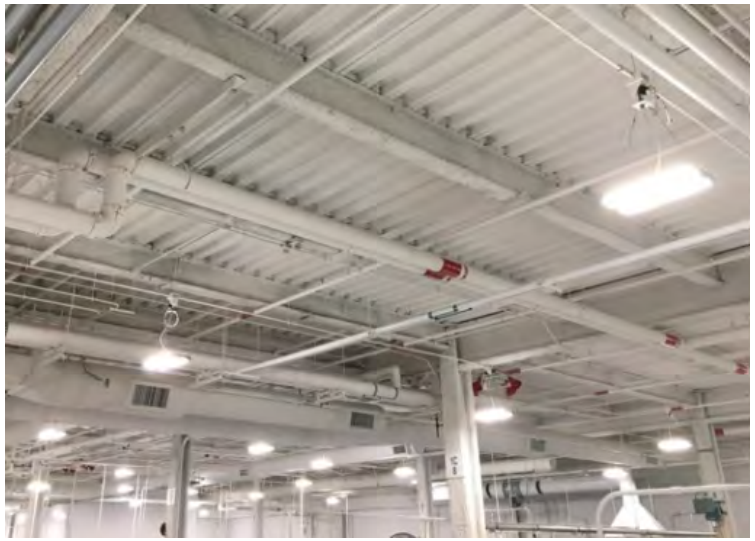
This application not cost effective

- 14 controlled receptacles saved 25 kWh over a year
- At national electricity rate, saves $2.58 / year
- Materials: 14 @ $160 = $2,240
    - Material simple payback greater than 100 years
- Labor: 14 @ $550 = $7,700
    - Labor simple payback greater than 100 years

Lessons Learned

- Saved 38% energy of controlled receptacles
- However, receptacles were controlling low power devices
    - 38% of low power loads (which translates to low energy) cannot easily be monetized
- More active load management necessary
    - Uncontrolled receptacle loads increased during study
- Firmware issues delayed the project
- Would a color reinforce the controlled receptacle better?

Tinker Air Force Base Lighting + HVAC (Dept. of Defense / ESTCP project)



HVAC Zones	Occupancy Control Days (Demo Project Control Setting)	Non-Control Days (Baseline Control Setting)
Occupied	Normal	Normal
Vacant	Occupancy Time Delay: 30 Min Vacant: Setback 2 degrees	Normal

Project Details

- Savings
  - 30% | 21,000 ft^2 high bay space
  - 13% | 5,000 ft^2 office space
  - 26% area-weighted average

- Site: Easy install – mounted the HVAC control hardware in the cabinet next to the MFR appliance & ran cables to the HVAC equipment.
- Delay 1 – Some non-project related equipment issues discovered
- Delay 2 – Over congested BACnet network, configuration, and overloaded server

Cost Effective Criteria

Application very cost effective

- Materials: $3,278
- Labor: not separated from lighting, but estimated to be about $8,000
- Saving $7,400 / year
- Payback about 1.6 years

Tinker Air Force Base Lighting + HVAC (Dept. of Defense / ESTCP project)

Lighting	Plug Loads Controls	HVAC Integration
		
69% Savings	38% Savings	26% Savings
18.7-year simple payback	But costs outweighed savings and lighting + plugs ***INCREASED*** *payback* 20.7-year simple payback	HVAC was operational change and little equipment → high savings to initial cost 10.3-year simple payback

Recognition Opportunities for Participants

Advanced Use of Sensors and Controls for Lighting

- Beyond typical basic occupancy, daylighting, dimming, and scheduling approaches

- Particular interest in projects enabling deeper operational savings in lighting applications and/or that create enhanced user/occupant experience

Recognition Opportunities for Participants

Integrated Controls for Plug Loads and Lighting Systems

- Novel integration of lighting and plug load control systems with a focus on energy savings

Integrated Controls for HVAC and Lighting Systems

- Innovative approaches to save energy by managing lighting and HVAC loads together when spaces are not in use

Other Integrated Systems and Lighting

- Other ways in which lighting is integrating with other building and business systems
- Some examples: grid/storage, photovoltaics, automated shades, asset tracking, security, etc.

Final Poll:

Have you completed any projects that leverages advanced lighting controls or system integration to attain larger org. goals?

- ❑ Yes! We have a project to submit
- ❑ We are working on something now
- ❑ We are considering some work and we would like more info
- ❑ We find building controls integration to be prohibitive

California State University Dominguez Hills

About the school

- Established in 1960
- Over 17,000 students
- 346 acres in south bay region of Los Angeles

About the project

- In 2013, lighting retrofits began
- In 2015 tied upgraded space to the HVAC system
- In 2020, building upgrade completed
- Moving forward: new capabilities, more buildings, and deep savings!

CSUDH

ILC Integrated Lighting Campaign PROUD PARTICIPANT

integratedlightingcampaign.energy.gov

ENERGY.GOV
Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Integrated Lighting Campaign

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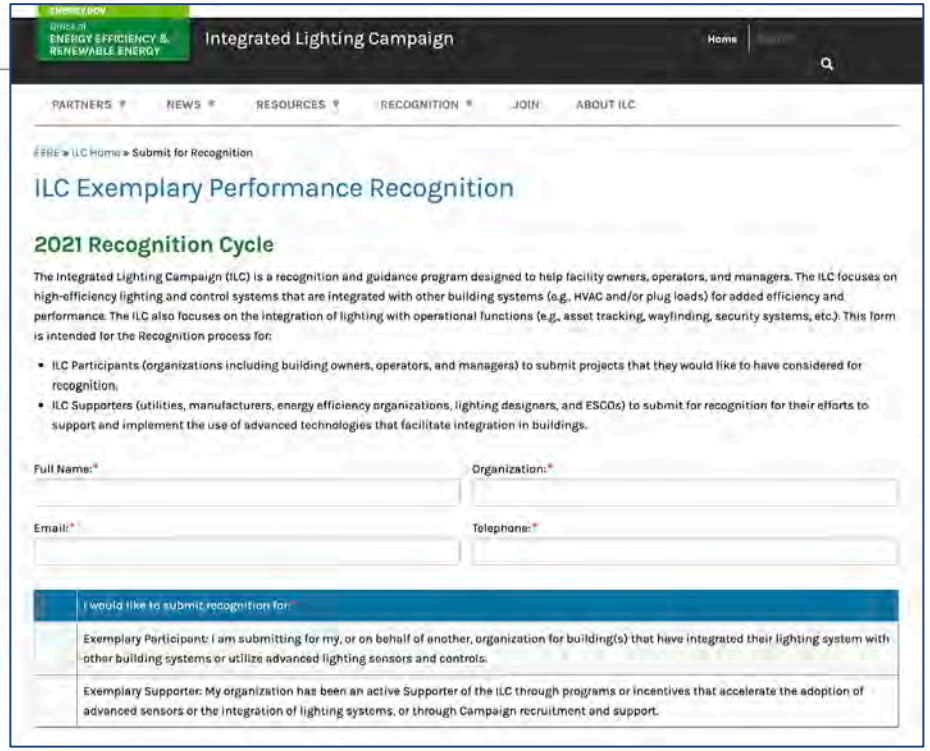
EERE » ILC Home

Submit for Recognition Now!

Each year the Integrated Lighting Campaign will confer recognition for exemplary projects submitted by Participants, and for programs, incentives, and/or support to the ILC by

READ MORE



Partners

Participants

Organizations—including building owners, operators, and managers—have access to resources and technical assistance.

Learn More

Supporters

Supporting partners include utilities, manufacturers, energy-efficiency organizations, lighting designers, and energy service companies (ESCOs).

Learn More

Submission Process

Full Name:* Kenny Seeton

Organization:* California State University Dominguez Hills (CSUDH)

Email:* kseeton@csudh.edu

Telephone:* 3102432206

	I would like to submit recognition for:*
◉	Exemplary Participant: I am submitting for my, or on behalf of another, organization for building(s) that have integrated their lighting system with other building systems or utilize advanced lighting sensors and controls.
○	Exemplary Supporter: My organization has been an active Supporter of the ILC through programs or incentives that accelerate the adoption of advanced sensors or the integration of lighting systems, or through Campaign recruitment and support.

Building Information

Buildings being submitted: ◉ Single Building ○ Building Portfolio

Building or Portfolio Name:* James L Welch Hall

Building Location(s): Carson, CA

Approximate total building area being submitted for recognition (if known): 179222 ft²

Lighting Sensors/Controls Categories

☐ **Advanced Use of Sensors and Controls for Lighting:**

The Campaign is interested in how sensors and controls are enabling deeper energy savings in lighting applications, improving building operations, and creating enhanced user/occupant experiences. This category seeks to recognize uses of sensors and controls that go beyond basic occupancy, daylighting, dimming, and scheduling approaches.

Integrated Categories

☐ **Integrated Controls for Plug Loads and Lighting Systems:**

This category seeks to recognize integration of lighting and plug load meter and control systems, with a focus on energy savings. For example, lighting control signals can often be used to control plug load devices that are plugged into controlled outlets or panels. Similarly, energy signals from plug load devices could help inform lighting controls.

☐ **Integrated Controls for HVAC and Lighting Systems:**

This category seeks to recognize innovative approaches the integration of HVAC and lighting systems. For example, lighting controls that are integrated with HVAC systems can indicate when a space is vacant to modify air flow or temperature set points during periods when spaces are un-occupied.

☐ **Other Integrated Systems:**

This category recognizes new, novel uses of integrating the lighting to provide features other than simply lighting a space. Some examples include; grid services, external shading systems integrating with electric lighting, using sensors in the lighting to provide data about space utilization or asset tracking, or other unique features.

Lighting Sensors/Controls Categories

☑ Advanced Use of Sensors and Controls for Lighting:

The Campaign is interested in how sensors and controls are enabling deeper energy savings in lighting applications, improving building operations, and creating enhanced user/occupant experiences. This category seeks to recognize uses of sensors and controls that go beyond basic occupancy, daylighting, dimming, and scheduling approaches.

Project Description (narrative):

Provide a written narrative about how your lighting system sensors and controls are going beyond the norm; the novel capabilities they provide, and the resulting outcomes (e.g., incremental savings, improved business operations, occupant satisfaction, etc.). Sites will be evaluated on the novelty of the approaches and the benefits/outcomes. Please note any building automation system or energy management information system platform used to integrate controls and include additional information deemed informative, including summary data quantifying energy benefits, business operation benefits, or occupant satisfaction (e.g., from formal or informal surveys).

This project uses advanced sensors that with occupancy, photo-sensing, temperature sensor, kW logging, and Bluetooth. Every luminaire was hardwired to the retrofit kit from the previous lighting upgrade which reduced installation costs by not requiring access above the dropped ceiling. With the increased number of sensors the time-delay for turning luminaires off was decreased, which prevented false-offs while are occupants present. Luminaire-dedicated sensors also facilitate individual controllability of the luminaires, which allowed each user to select light levels comfortable for them. The average set-point based on occupant preference was 40% of full light output.

Measured/Perceived Benefits (narrative):

Our conservative estimated kWh savings were calculated at 556,000 kWh, or 34% of the baseline annual lighting and fan energy consumption. This approach also saved 2,985,918 kBTU, or 27% of the heating and cooling energy use.

An informal survey of building occupants showed that people love the light levels, because they have control of it.

More questions?

Tracy Beeson

Phone: (509) 375-3852
tracy.beeson@pnnl.gov

… or IntegratedLighting@PNNL.GOV