Bringing Emerging Lighting Technologies to the Mass Market:

What are the drivers and how can you be involved?

May 23, 2023 2:00 – 3:00 pm

Yao-Jung Wen

CalNEXT

Chris Wolgamott

neea

Axel Pearson

ILC Integrated Lighting Campaign

lightfair IES IALD IMC

Learning Objectives

- Upon completion, participant will be able to articulate the purpose of emerging technologies programs and their approach to market transformation.
- Upon completion, participant will be able to describe the foci of federal-, regional- and state-level emerging technologies programs.
- Upon completion, participant will be able to identify and recommend technologies and projects suitable for emerging technologies programs.
- Upon completion, participant will be able to utilize the proper channels to participate in the emerging technologies programs.

What is Market Transformation?

"The strategic process of intervening in the market to create lasting change by removing identified barriers and/or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice." – NEEA

A Tale of Two Program Types

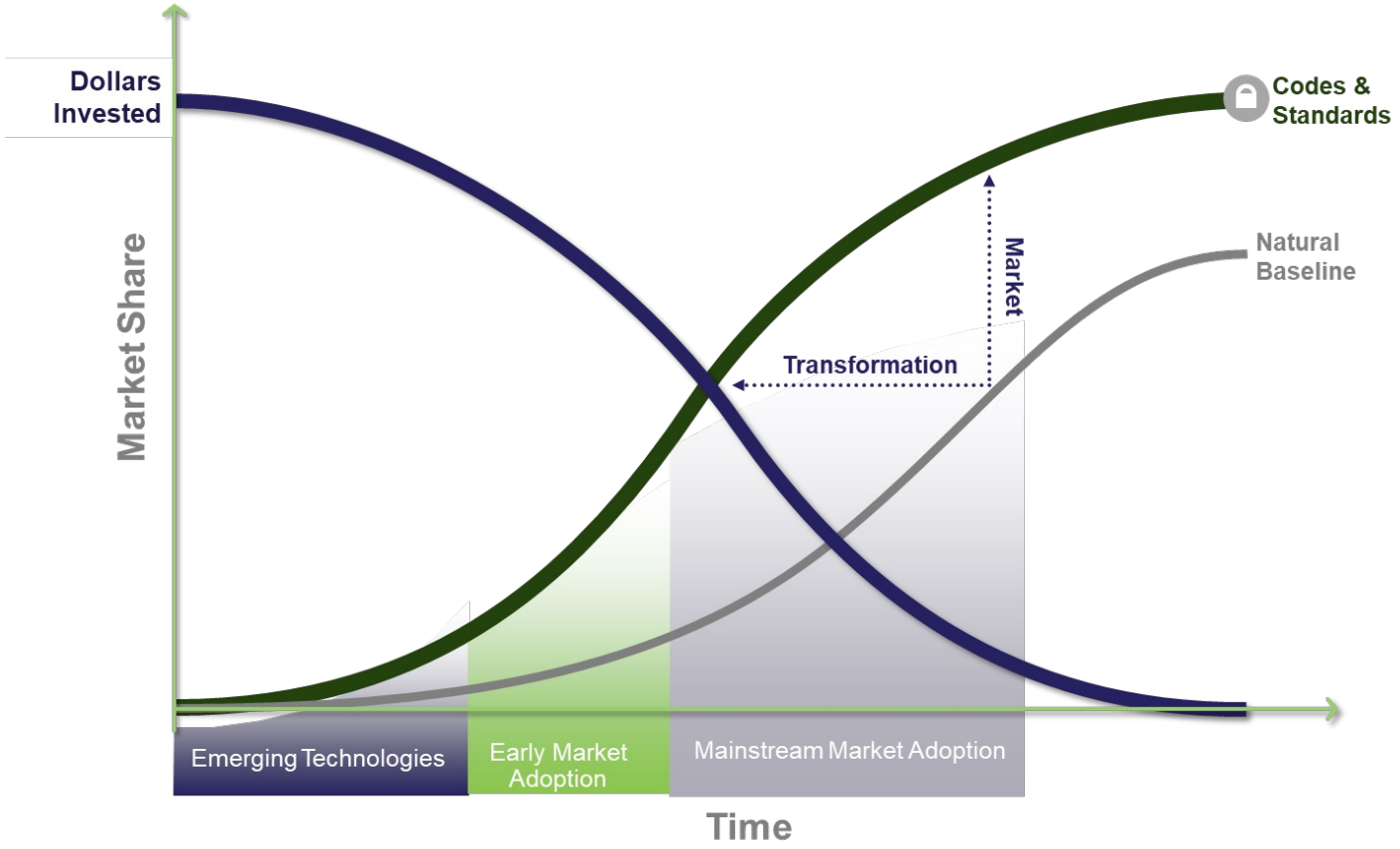
Direct Acquisition	Market Transformation
"Buying kWh savings"	"Influencing market change that results in kWh savings"
Focus on individual end-users; single transactions	Focus on permanent changes to whole markets
Incentives targeted to consumers to buy down cost	Incentives targeted to change supply chain behavior
Assumed direct linkage between actions (incentives) and savings	Actions designed to reduce overall market costs and increase savings including marketing, education and outreach by diffusion into the whole market.
Annual or bi-annual savings targets	Long-term (5 to 10 year) market adoption goals (e.g. 85%)

High-hanging fruit = better targeting, right-sized approach

Smaller, distributed fruit = aggregated, mass collection approach

Why

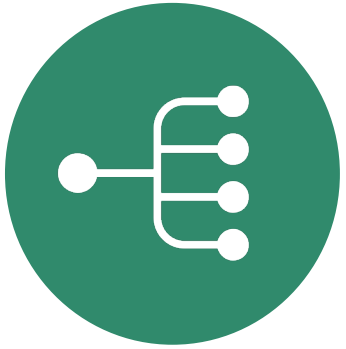
Diffusion of Energy Efficiency Innovation



How do you do it?

Steps to Implementation

Step Zero:
Market Characterization & Baseline



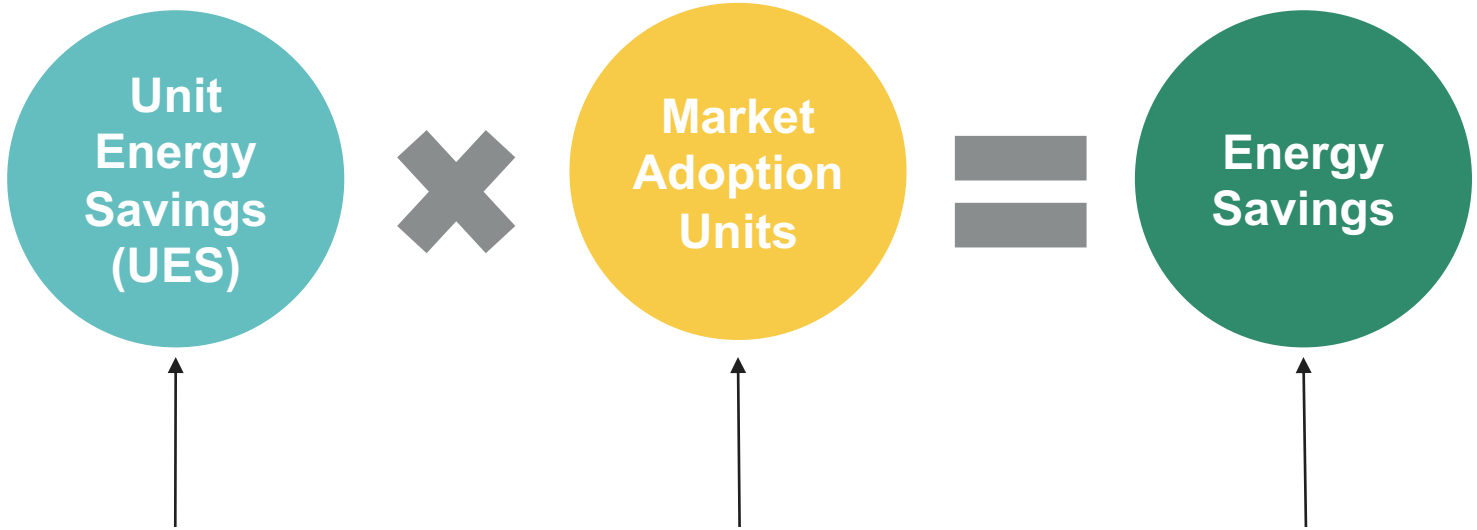
Step One:
Barriers & Opportunities

Step Two:
Design Interventions/ Establish Metrics

Step Three:
Implementation & Adaptive Management

Market Transformation Life Cycle

Energy Savings Calculation Components



Agenda

Three Different Market Transformation Programs

- CalNEXT (State Level)
- NEEA (Regional Level)
- DOE (National Level)
- Q&A

CalNEXT: California Statewide Electric Emerging Technologies Program

Market transformation effort at the state level

What is CalNEXT?

- A path for emerging technologies to be supported by utilities for mass adoption
- No more “pilot to death” or “forever demonstrations”
- Lighting experts and technical advisors to make sure we are not just chasing efficacies and ignoring everything else

Program Objectives

- **Communicate** program priorities to stakeholder community.
- **Scan, Prioritize, Evaluate** commercially available, emerging, or underutilized technologies and their applications to support increased adoption in the IOU EE portfolios.
- **Broadcast** results to inform stakeholders, support technology transfer, and advance industry understanding to support large-scale commercial adoption.
- **Advance** California's decarbonization, equity, and grid priorities by incorporating them into research priorities.
- **Execute** emerging technology research projects that support the IOU energy efficiency portfolios.

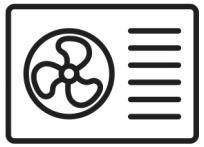
Program Objectives

- **Communicate** program priorities to stakeholder community.
- **Scan, Prioritize, Evaluate** commercially available, emerging, or underutilized technologies and their applications to support increased adoption in the IOU EE portfolios.
- **Broadcast** results to inform stakeholders, support technology transfer, and advance industry understanding to support large-scale commercial adoption.
- **Advance** California's decarbonization, equity, and grid priorities by incorporating them into research priorities.
- **Execute** emerging technology research projects that support the IOU energy efficiency portfolios.

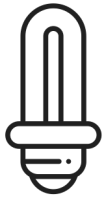
Technology Priority Maps (TPMs)

CalNEXT

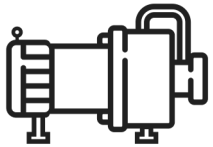
Appliances & Plug Loads



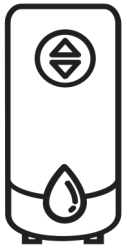
HVAC



Lighting



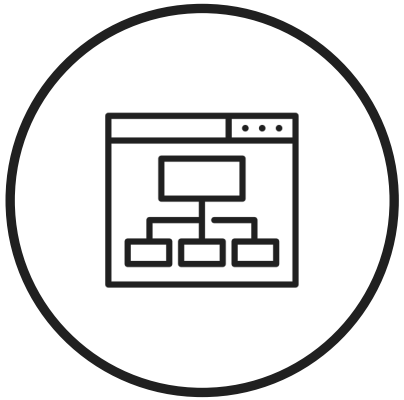
Process Loads



Water Heating

Whole Buildings

What are the TPMs?



High-Level Framework

Explains the CalNEXT program priorities with annual updates, sorted into six technology categories

Communications Tool

Defines what research topics CalNEXT emphasizes on

Screening Metric

Project scoring based on alignment with TPMs

TPM Components

Technology Category	*i.e. Lighting*
Technology Family	*Functional grouping of program roles, opportunities, and barriers*
Technology Subgroup	*Example technologies (non-exhaustive)*
Definition	*Narrative to provide additional clarity on the Technology Family scope*
Opportunities	*Description of the potential impacts and research areas*
Barriers	*Description of key barriers and potential research areas*
CalNEXT Priority	*Degree of emphasis on the Technology Family*
CalNEXT Role	*Level of support (funding) for the Technology Family*

Example Technology Family

Technology Category	Lighting
Technology Family	**Connectivity, Controls, and Integration**
Technology Subgroup	• Integrated lighting control systems • Advanced daylighting controls • Lighting energy management systems • BMS Integration
Definition	Sensors, communication systems, and control algorithms that reduce energy consumption in lighting and other building systems, provide data for other purposes, or enhance occupant comfort and wellness.
CalNEXT Priority	High
CalNEXT Role	Lead

Opportunities and barriers narratives and other Technology Families: https://calnext.com/resources/lighting/

Lighting Technology Priority Map (TPM)

CalNEXT

Technology Families

2020

- Integrated controls
- Advanced lamps
- Centralized DC power conversion systems
- Daylighting
- Signage

2022 (First Year of CalNEXT)

- Connectivity, controls, and integration
- Advanced electric light sources
- DC lighting
- Signage
- Horticultural lighting

2023 (Under Development)

- Connectivity, controls, and integration
- Advanced electric light sources
- DC lighting
- Signage
- Horticultural lighting
- Advanced exterior lighting

Program Objectives

CalNEXT

- **Communicate** program priorities to stakeholder community.
- **Scan, Prioritize, Evaluate** commercially available, emerging, or underutilized technologies and their applications to support increased adoption in the IOU EE portfolios.
- **Broadcast** results to inform stakeholders, support technology transfer, and advance industry understanding to support large-scale commercial adoption.
- **Advance** California's decarbonization, equity, and grid priorities by incorporating them into research priorities.
- **Execute** emerging technology research projects that support the IOU energy efficiency portfolios.

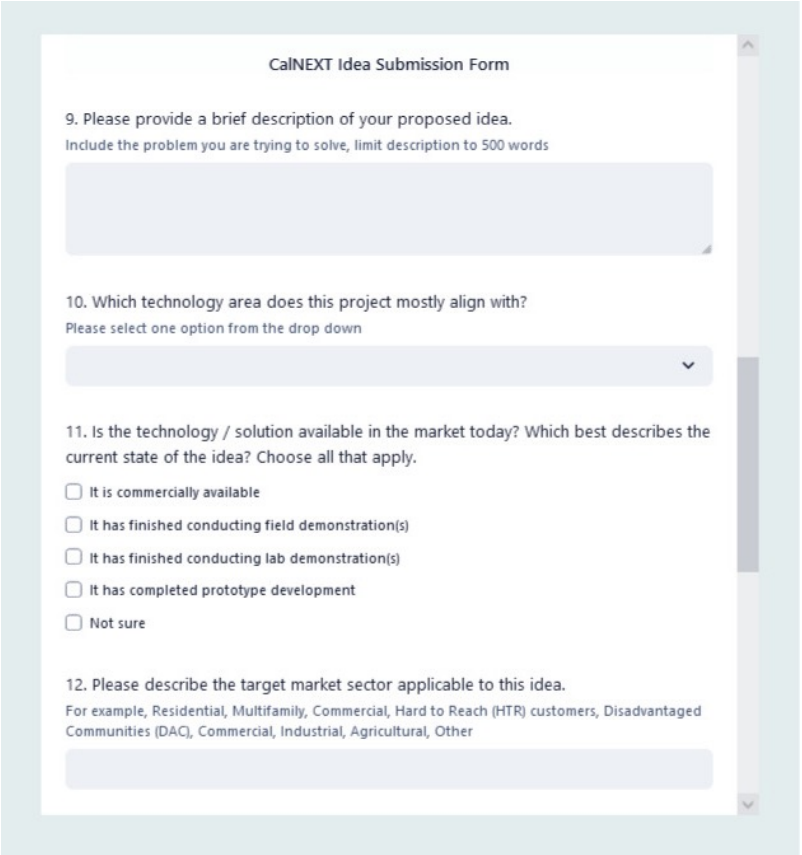
What is the CalNEXT Process?

Submit an Idea

Submit a Project

Idea Submission

Submit at CalNEXT.com → Team Reviews → Provide Feedback → Help with Project



CalNEXT Idea Submission Form

9. Please provide a brief description of your proposed idea.
Include the problem you are trying to solve, limit description to 500 words

10. Which technology area does this project mostly align with?
Please select one option from the drop down

11. Is the technology / solution available in the market today? Which best describes the current state of the idea? Choose all that apply.

- ☐ It is commercially available
- ☐ It has finished conducting field demonstration(s)
- ☐ It has finished conducting lab demonstration(s)
- ☐ It has completed prototype development
- ☐ Not sure

12. Please describe the target market sector applicable to this idea.
For example, Residential, Multifamily, Commercial, Hard to Reach (HTR) customers, Disadvantaged Communities (DAC), Commercial, Industrial, Agricultural, Other

Project Submission

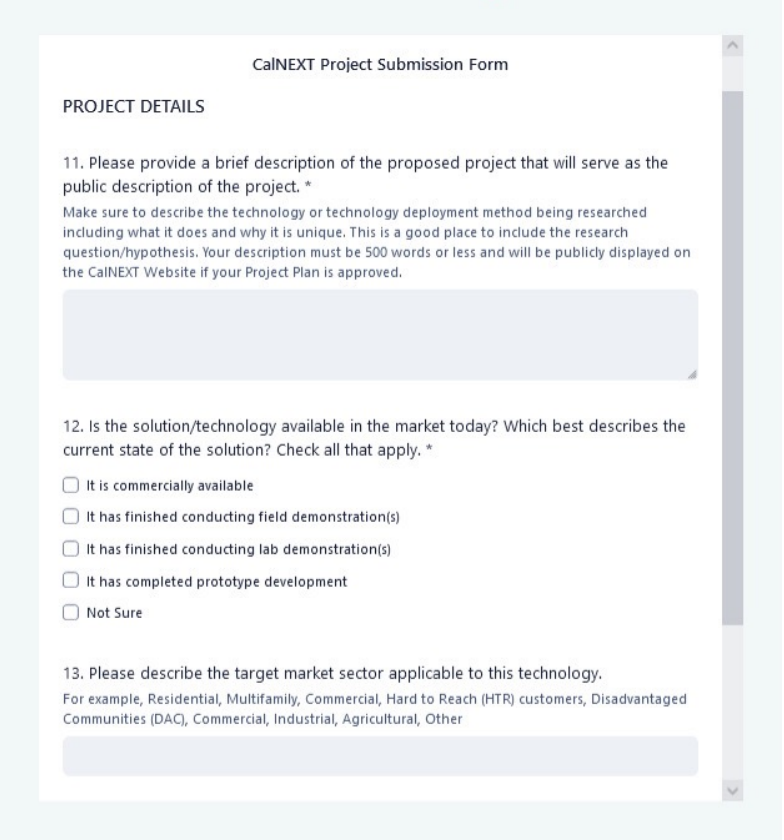
CalNEXT

Program Alignment
- TPM priority
- Technology transfer & EE portfolio alignment

Benefits
- Utility company benefits
- Disadvantaged and hard-to-reach community benefits

Quality of Idea
- Scope & project clarity
- Market strategy
- Innovation
- Project readiness

Timeline & Cost
- Duration
- Budget



CalNEXT Project Submission Form

PROJECT DETAILS

11. Please provide a brief description of the proposed project that will serve as the public description of the project. *

Make sure to describe the technology or technology deployment method being researched including what it does and why it is unique. This is a good place to include the research question/hypothesis. Your description must be 500 words or less and will be publicly displayed on the CalNEXT Website if your Project Plan is approved.

12. Is the solution/technology available in the market today? Which best describes the current state of the solution? Check all that apply. *

- [ ] It is commercially available
- [ ] It has finished conducting field demonstration(s)
- [ ] It has finished conducting lab demonstration(s)
- [ ] It has completed prototype development
- [ ] Not Sure

13. Please describe the target market sector applicable to this technology.

For example, Residential, Multifamily, Commercial, Hard to Reach (HTR) customers, Disadvantaged Communities (DAC), Commercial, Industrial, Agricultural, Other

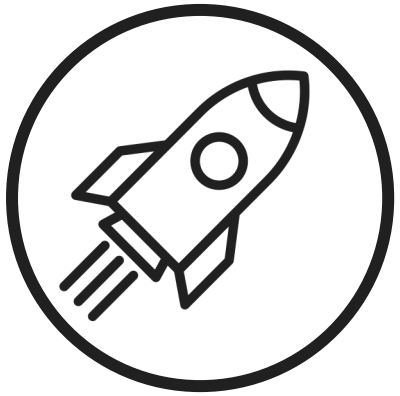
Utility Energy Efficiency Portfolios

CalNEXT

Workpaper Development

Program Integration

Codes & Standards Readiness

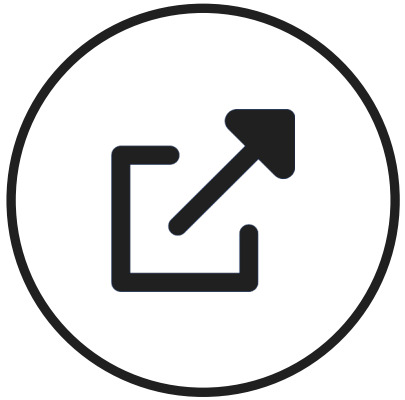


Market Transformation

Project Types

Technology Development Research

Focus on addressing market barriers or developing the commercial capability of ***early-stage technologies***.



Technology Support Research

Focus on addressing market barriers or developing the commercial capability of ***market-ready technologies***.

CalNEXT Project Goals

- 170 projects over program lifetime
- 40 projects selected for 2023
- 35 projects completed in 2023
- Maximize impact and technology transfer
- Balanced project portfolio across all six technology categories

2023 Targets			
Target Description	**Technology Development Research**	**Technology Support Research**	**Total**
New Contracted Projects	8	32	40
Completed Projects	8	27	35

Opportunities for Lighting Projects

Recent Projects

Pre-CalNEXT Emerging Technologies Projects	Agriculture Lighting Applications	2018-2023
	Smart Street Light Poles Demonstration	2018-2023
	Indoor Horticulture Field Lighting BCD/CP&S Demonstration	2020-2023
	Demonstrate Smart Exterior Solid-State Lighting in Low-Income or Disadvantaged Communities	2020-2024
	Controlled Environment Horticulture (CEH) Field Study: Adaptive Daylighting Controls	2020-2022
CalNEXT Projects	Greenhouse Lighting Controls	2022-2023

- Plenty of opportunities for project funding.

NEEA: Northwest Energy Efficiency Alliance

Market transformation effort at a regional level

lightfair IES | IALD IMC

What is NEEA?

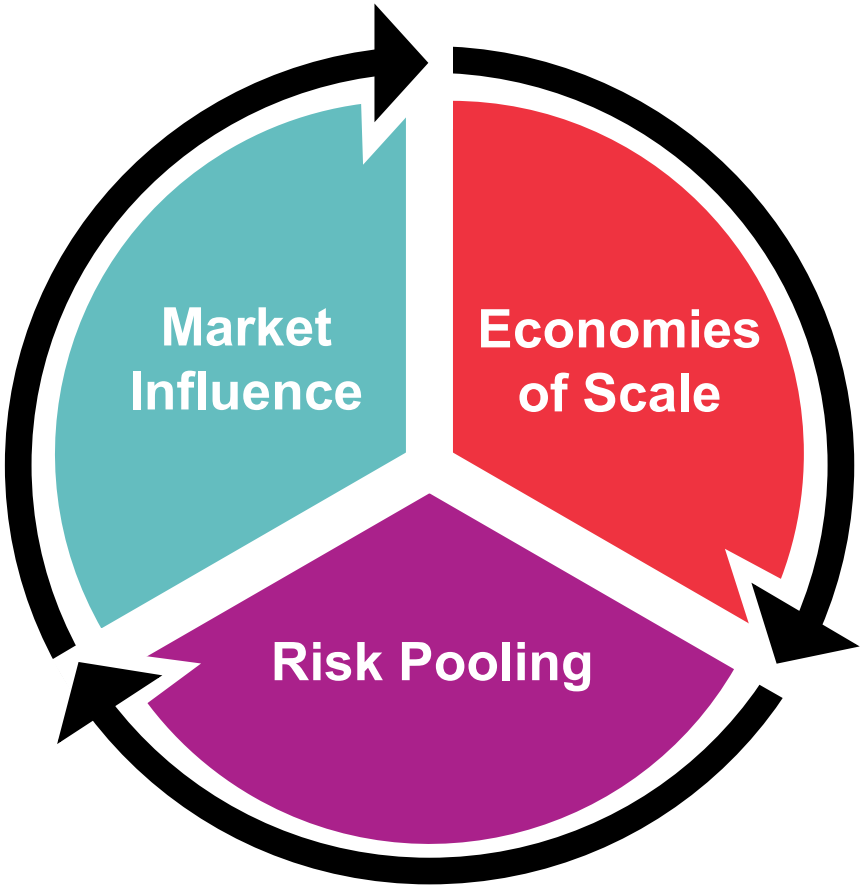
An alliance of utilities and energy efficiency organizations

Purpose of the Alliance

Pool resources and share risks to transform the market for energy efficiency to the benefit of consumers in the Northwest

Why an Alliance?

NEEA



What Does NEEA Do?

NEEA

Emerging Technologies

Portfolio Execution

Codes & Standards

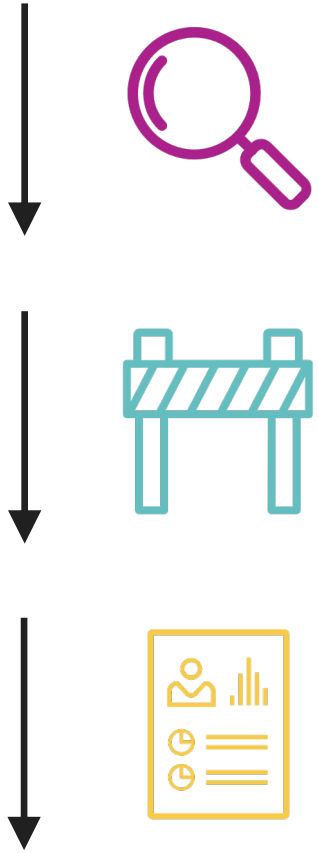
Convene and Collaborate

Market Intelligence

NEEA Market Transformation

NEEA

The strategic process of intervening in a market to create lasting change.

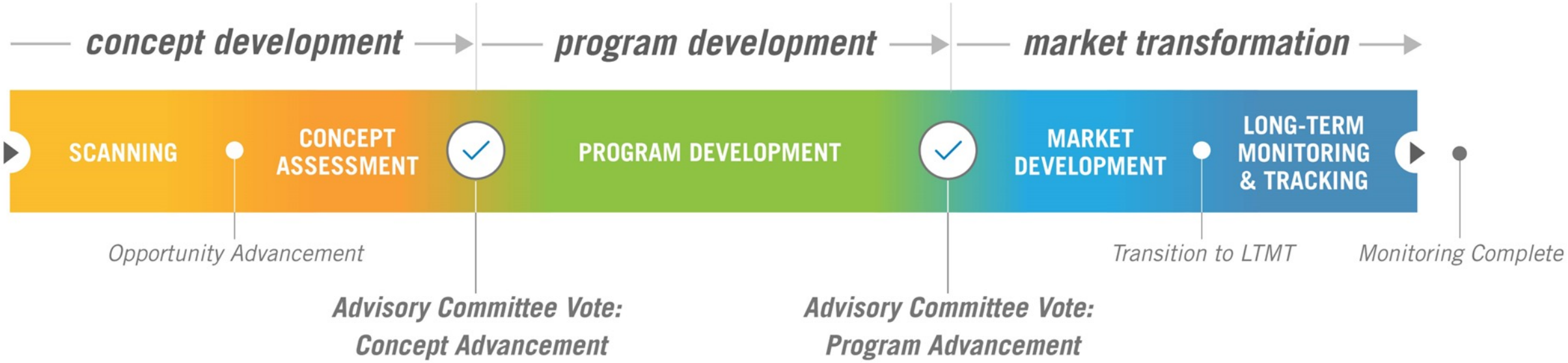


Identify barriers / opportunities

Intervene to remove or leverage

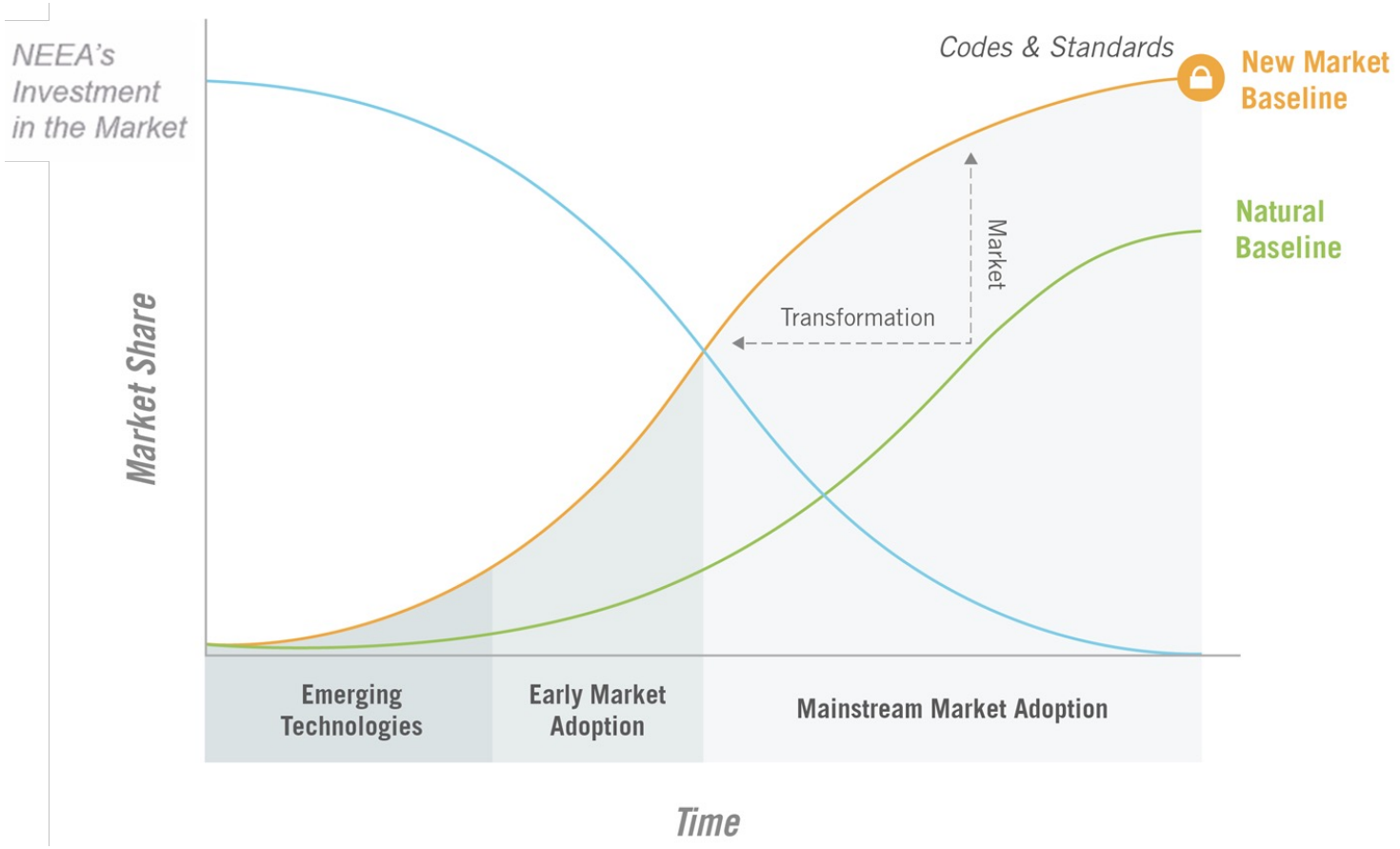
Track and evaluate market progress

NEEA Initiative Life Cycle



NEEA's MT Adoption Curve

NEEA



Who NEEA Works With

NEEA

Manufacturers

AcuityBrands.

COOPER Lighting Solutions

signify

avi-on Simple Bluetooth® Controls

enlighted A Siemens Company

Retailers

BEST BUY

THE HOME DEPOT

TARGET

nationwide marketing group

COSTCO WHOLESALE

National Orgs

ENERGY STAR

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

U.S. GREEN BUILDING COUNCIL LEED USGBC

CEE Working Together, Advancing Efficiency

DLC

ACEEE

Other

Northwest Power and Conservation Council

SEEA SOUTHEAST ENERGY EFFICIENCY ALLIANCE

SWEEP SOUTHWEST ENERGY EFFICIENCY PROJECT

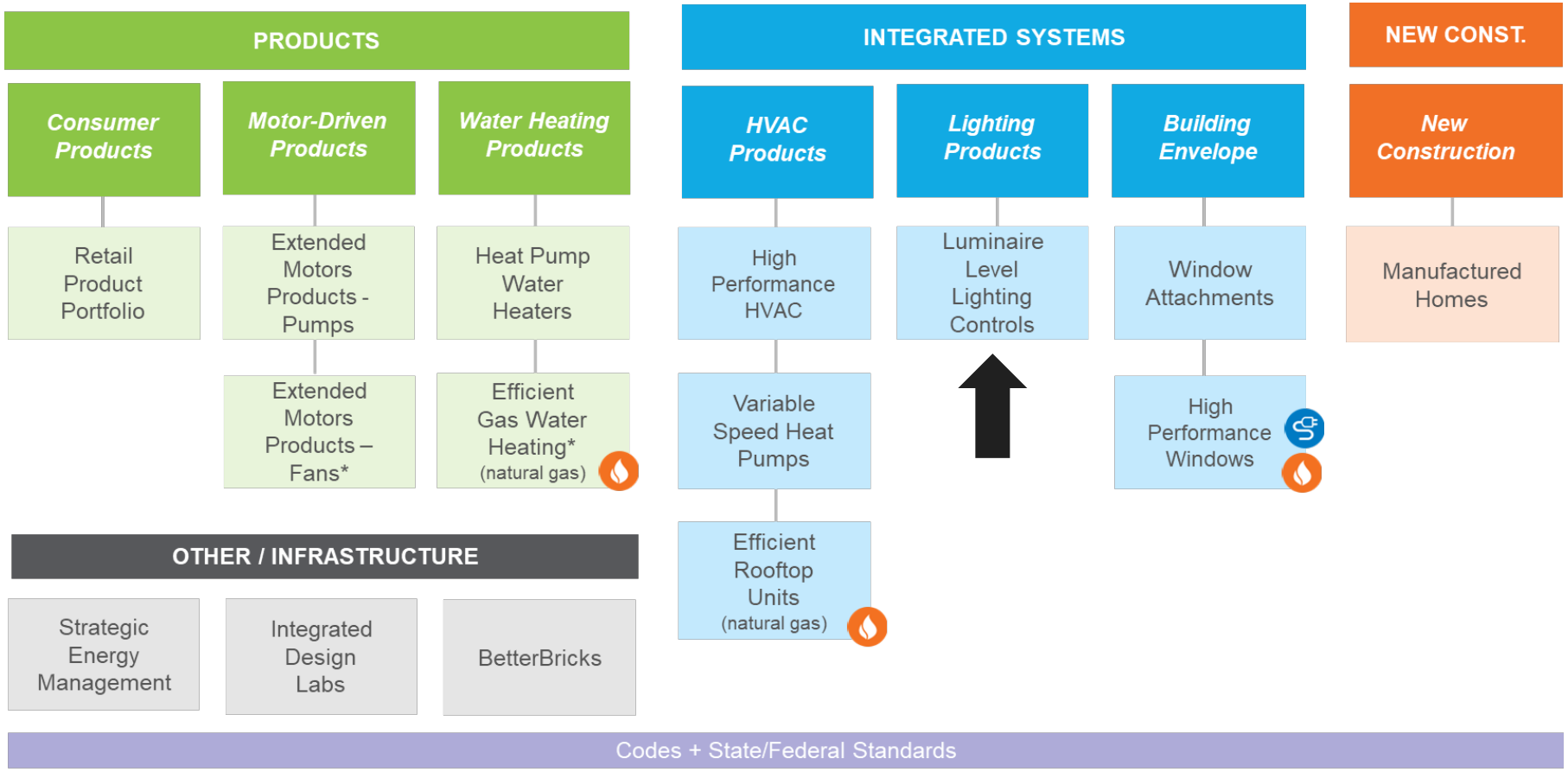
MEEA MIDWEST ENERGY EFFICIENCY ALLIANCE

NW Energy Coalition for a clean and affordable energy future

lightfair® IES | IALD IMC

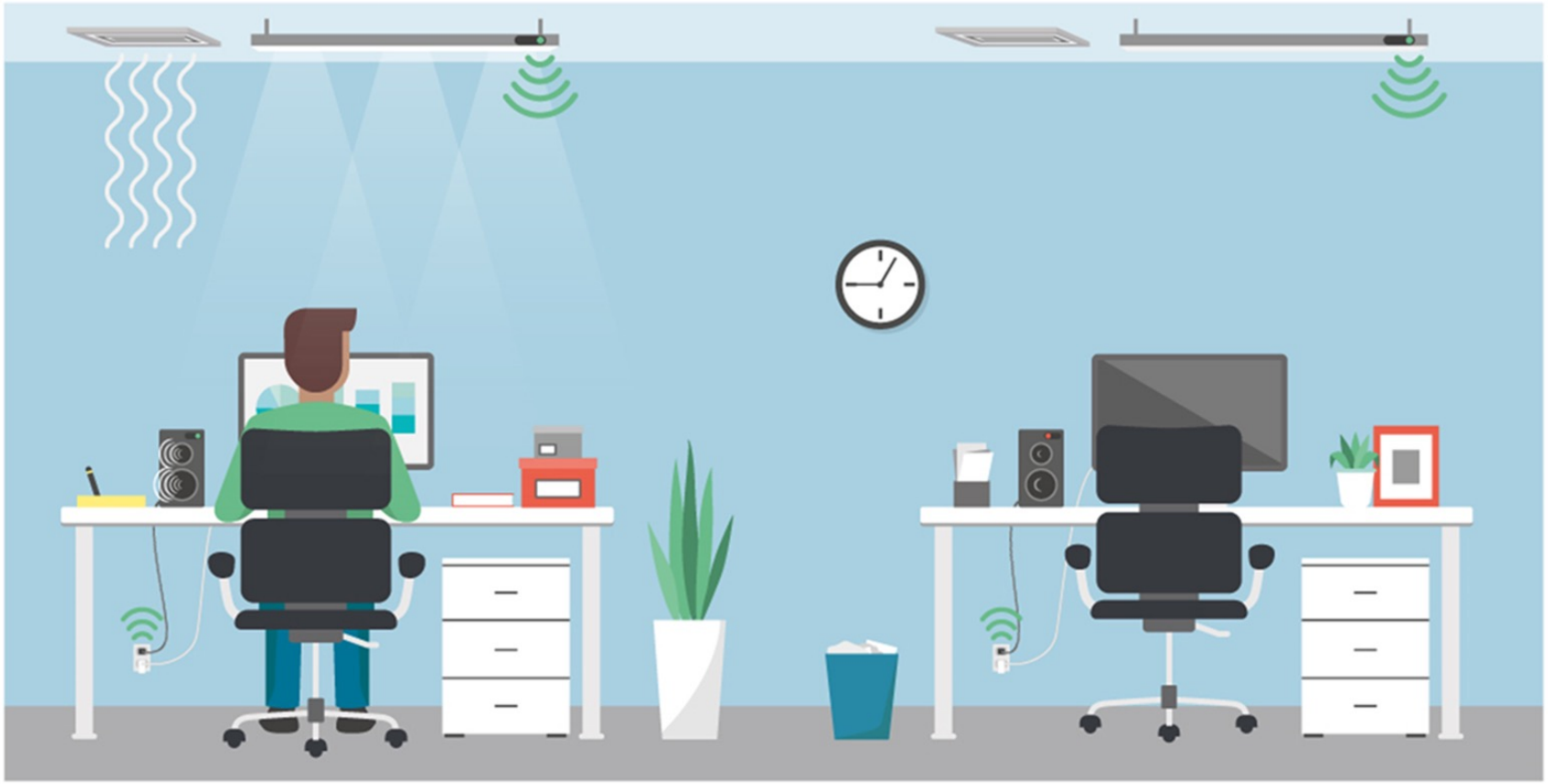
NEEA Product Group Structure

NEEA



Luminaire Level Lighting Controls (LLLC)

NEEA



Three Tiers for Network Lighting Control Types

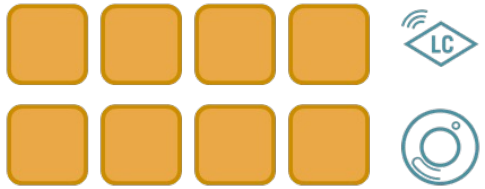
NEEA

Tier 0

Non-LLLC NLC

Not Individually Addressable

1 sensor : many fixtures



1 load controller : many fixtures

Tier 1

Non-LLLC NLC

Individually Addressable

1 sensor : many fixtures

1 load controller : 1 fixture

Tier 2

NLC with LLLC

Not Individually Addressable

1 sensor : 1 fixture

1 load controller : 1 fixture

Sensor

Load controller in hub or luminaire

LLLC Timeline

NEEA

DOE's Integrated Lighting Campaign

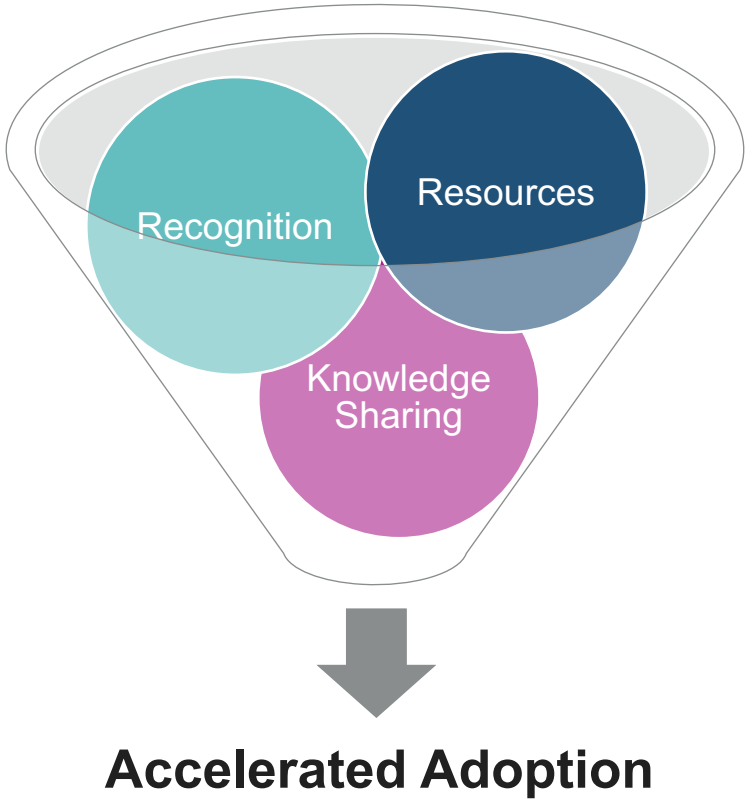
Market transformation effort at the national (federal) level

lightfair IES IALD IMC

What is a Technology Campaign?

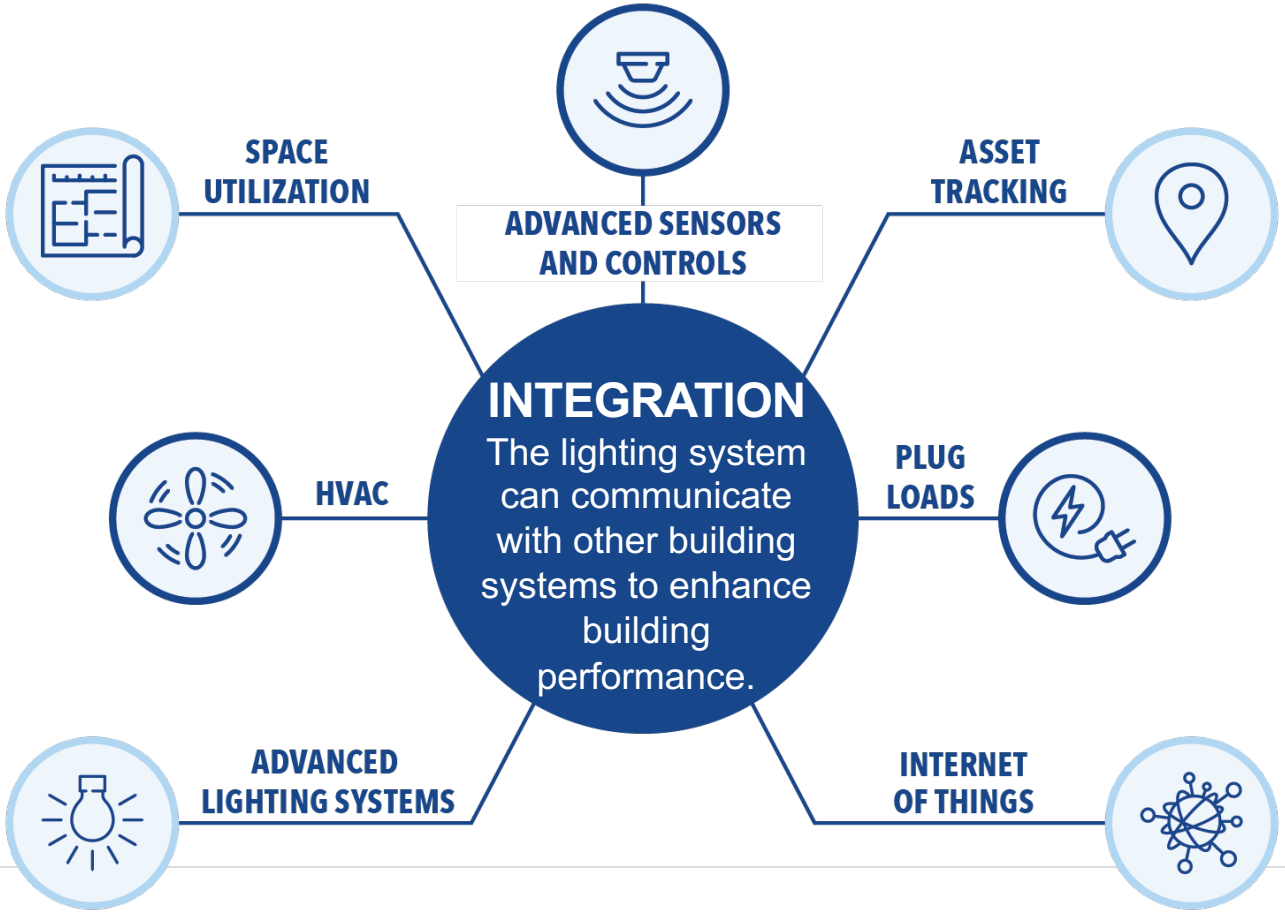
A collaborative platform to speed technology adoption

- The Campaign targets building owners and managers who are open to adopting advanced and novel approaches to improve building performance
- Demonstrate and recognize real-world savings and benefits
- Provide resources that make it easier for buyers to consider new or underutilized solutions
- Celebrate success!



Overview – Integrated Lighting Campaign

ILC recognizes innovative lighting projects and organizations that push the envelope in terms of integration, energy savings, novel capabilities, and non-energy benefits



Campaign Partners

Organizers

Industry Orgs, DOE, GSA

- Provide direction, guidance, and support
- Confirm recognitions
- Meet bi-weekly with ILC team

Supporters

Energy Efficiency Organizations, Utilities, Manufacturers

- Promote ILC in their organizations and networks
- Provide products and services to Participants

Participants

Building owners and facility managers

- Adopt the technology
- Get recognized
- Work with ILC to promote their recognition

ILC Network

Building a strong network of partners is key to success of the Campaign

- **ILC Organizers** provide guidance and strategy. Primary outreach and deployment arm
- **Participants and Supporters** are a group of diverse stakeholders. Extends ILC's reach by sharing success and drawing on many experts throughout different sectors

7 ILC Organizers

Better Buildings U.S. Department of Energy
IES Illuminating Engineering Society
LCA Lighting Controls Association
NALMCO
GSA
IFMA International Facility Management Association — Empowering Facility Professionals Worldwide
DLC Energy · Quality · Controllability

185 Participants and Supporters

neea
YAMAHA
PSE Puget Sound Energy
Vertical Harvest
Seed Capital
Home Innovation Research Labs
Columbia Vagelos College of Physicians and Surgeons
the link space that inspires
MRA Group a Stuardi company
The University of Vermont Agriculture & Life Sciences
McWong
HOLT Public Schools Innovate • Educate • Inspire
Resource Innovation Institute
Missouri Slope Tailored Care, Inspired Living.
AGC Washington Chapter Building the Landscape of Washington
Chicago Smart Lighting Program
GABUS Automotive Group Locally Owned. Community Focused.
North Bakersfield Toyota
California Energy Alliance
Energy Solutions
Evergreen Consulting Group Experience. Energy. Efficiency.
nep
avi-on Simple · Bluetooth · Home

lightfair IES IALD IMC

Knowledge Sharing

Better Buildings

Healthcare Campus Recognized for Innovative Use of Lighting Sensors and Controls

CASE STUDY: BRYAN HEALTH

About the Project

Bryan Health is a locally owned, nonprofit healthcare organization serving patients in Nebraska, as well as parts of Kansas, Iowa, South Dakota, and other states in the region. When a scheduled remodel neared, Bryan Health saw an opportunity to upgrade lighting throughout its East and West Campus locations in Nebraska and replace all their fluorescent luminaires with energy-efficient LEDs. A new, modern lighting system held the promise of significantly reducing energy consumption, lowering operating costs, and streamlining maintenance. But what else could it do? It turns out, quite a lot.

Mike Wiruth, master electrician at Bryan Health, explored lighting applications and integration strategies with internal stakeholders that could also support physician productivity and contribute to patient wellness and healing.

Project Goals

- **PERSONALIZATION.** Give office personnel and medical health providers ability to set their own task lighting scenes. Lighting control is particularly important for radiologists when taking x-rays and reviewing scans.
- **DIMMABILITY.** Lighting fixtures needed to be dimmable to benefit from daylight harvesting but also to reduce brightness of the LED lights to reduce glare.
- **EFFICIENCY.** They needed a lighting system that could streamline and automate certain tasks, reduce unnecessary energy consumption, and lower utility bills. As an added bonus, their utility, Lincoln Electric System, offered Bryan Health a rebate for each fluorescent lamp removed and a separate rebate to cover a percentage of labor costs for installing new controls.
- **CENTRALIZATION.** They also wanted to manage it all from an easy-to-use, cloud-based, centralized lighting system with advanced data visualization.

Bryan Medical Center in Lincoln, NE

PROJECT QUICK FACTS

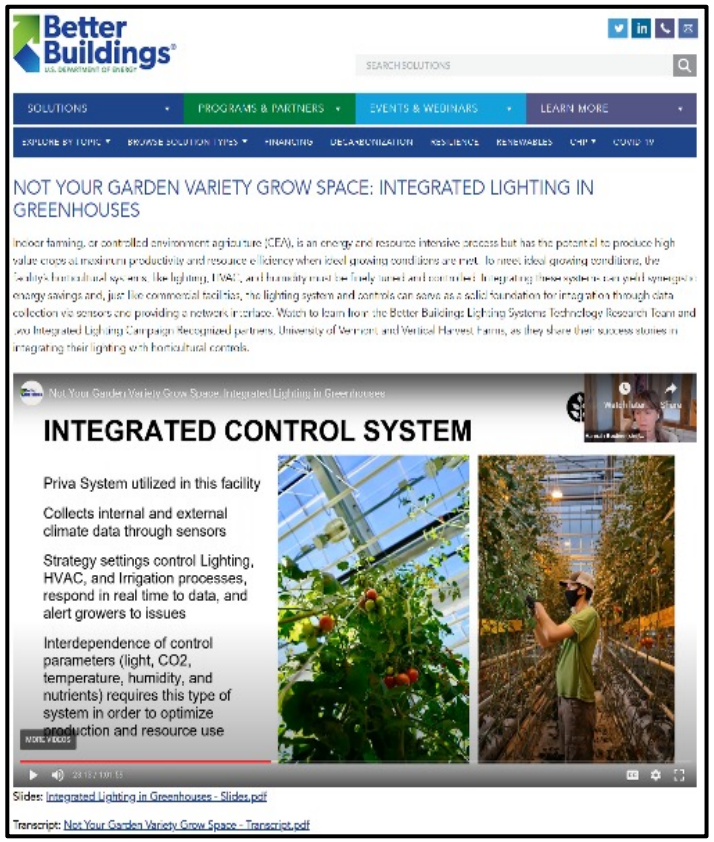
- Bryan Health owns three million square feet of building space in Lincoln, Nebraska, which includes two acute care facilities and many outpatient clinics.
- Bryan Health partnered with lighting integration firm AES Design to purchase the fixtures and the lighting management system.
- Architectural firm Davis Design was contracted to specify future work to meet new campus standards and develop as-built documentation for all ongoing work.

KEY STRATEGIES AND OUTCOMES

- Bryan Health employed the following **advanced lighting strategies**:
  - Lighting management system
  - Occupancy sensors
  - Task tuning levels and preset lighting scenes
  - Remote-controlled switches
- Advanced lighting and integration strategies led to the following positive **outcomes** for Bryan Health:
  - improved energy efficiency
  - better diagnostics
  - fewer support calls
  - shorter response times
  - increased individual comfort
  - remote control
  - reduced lighting energy use by 57%.

Learn more at betterbuildingssolutioncenter.energy.gov/

ENERGY



Better Buildings

SEARCH SOLUTIONS

SOLUTIONS | PROGRAMS & PARTNERS | EVENTS & WEBINARS | LEARN MORE

EXPLORE BY TOPIC | BROWSE SOLUTION TYPES | FINANCING | DECARBONIZATION | RESILIENCE | RENEWABLES | CHIPS | COVID-19

NOT YOUR GARDEN VARIETY GROW SPACE: INTEGRATED LIGHTING IN GREENHOUSES

Indoor farming, or controlled environment agriculture (CEA), is an energy and resource intensive process but has the potential to produce high value crops at maximum productivity and resource efficiency when ideal growing conditions are met. To meet ideal growing conditions, the facility's horticultural specific, like lighting, HVAC, and humidity must be finely tuned and controlled. Integrating these systems can yield synergistic energy savings and, just like commercial facilities, the lighting system and controls can serve as a solid foundation for integration through data collection via sensors and providing a network interface. Watch to learn from the Better Buildings Lighting Systems Technology Research Team and two Integrated Lighting Campaign Recognized partners, University of Vermont and Vertical Harvest Farms, as they share their success stories in integrating their lighting with horticultural controls.

Not Your Garden Variety Grow Space: Integrated Lighting in Greenhouses

Watch later | Share

INTEGRATED CONTROL SYSTEM

Priva System utilized in this facility

Collects internal and external climate data through sensors

Strategy settings control Lighting, HVAC, and Irrigation processes, respond in real time to data, and alert growers to issues

Interdependence of control parameters (light, CO_2, temperature, humidity, and nutrients) requires this type of system in order to optimize production and resource use

MORE VIDEOS

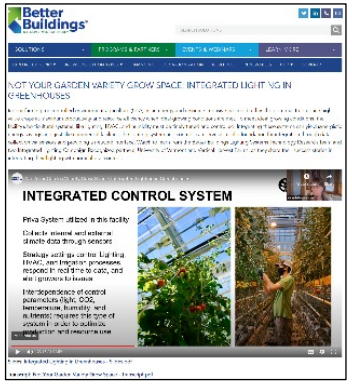
Slides: Integrated Lighting in Greenhouses - Slides.pdf

Transcript: Not Your Garden Variety Grow Space - Transcript.pdf

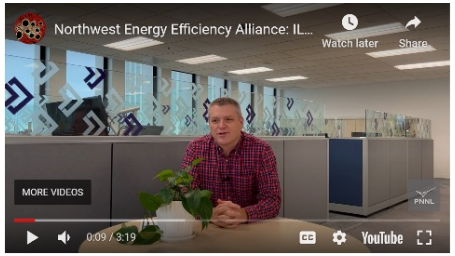
Building a body of knowledge around advanced and integrated lighting serves as a valuable resource to other stakeholders that this technology is reliable, saves energy, reduces cost, and improves occupant experience

The Body of Knowledge

ILC



10+ Webinars



2 Participant Videos

8 Case Studies

2 Journal Publications

6 Infographics

lightfair IES IALD IMC

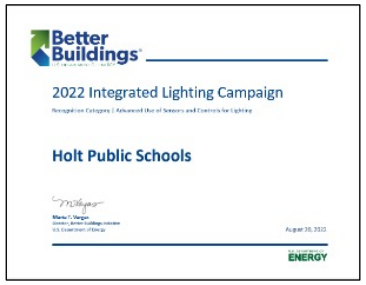
Technical Resources

The ILC offers resources ranging from fact sheets and case studies to recorded webinars and utility incentives

- These resources help facility owners and managers overcome barriers to adoption, like lack of education, complexity, and funding

Recognition

Group photo from the 2022 ILC Recognition Event, held at IES Annual Conference, in New Orleans, LA on August 20, 2022.



ILC
Integrated Lighting Campaign
RECOGNIZED PARTICIPANT

Recognition highlights and promotes early adopters as industry leaders. Sharing their stories lets other stakeholders know this technology saves energy, reduces costs, and improves buildings.

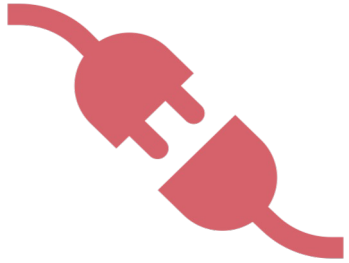
Recognition Promotion

Infographics highlight key features, metrics and successes

Videos spotlight the participants and lets them tell the story

Recognition Categories

Advanced Use of Sensors and Controls for Lighting



Integrated Controls for Plug Loads and Lighting Systems

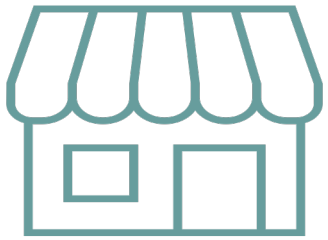
Integrated Controls for HVAC and Lighting Systems

Other Integrated Systems and Lighting

Integrated Lighting and Horticultural Controls

Innovative Maintenance, Operation, and Financing Service Models

Recognition Categories



Advanced Lighting Solutions for Small Buildings (<50,000 ft^2)

Germicidal Ultraviolet (GUV) Systems for Energy Savings and Improved Indoor Air Quality

Sustainability in Lighting

Energy Justice, Diversity, Equity, and Inclusion in Advanced Lighting

Join the Campaign!

How can you get **involved**?

- Join as a Supporter
- Promote ILC through social media, emails, newsletters, etc.
- Identify projects and encourage others to join
- Help ILC Participants submit for recognition

What are the **benefits**?

- DOE exposure though social media, emails, newsletters
- Appear in case studies and promotion
- Featured in industry media
- Recognition opportunity
- Use of ILC Supporter logo

ILC Integrated Lighting Campaign | PROUD SUPPORTER

Q&A

Contact Us and Get Involved!

Yao-Jung Wen
Energy Solutions / CalNEXT
ywen@energy-solution.com

Chris Wolgamott
Northwest Energy Efficiency Alliance
cwolgamott@neea.org

Axel Pearson
Pacific Northwest National Lab
axel.pearson@pnnl.gov

lightfair IES | IALD IMC

Please remember to complete the course evaluations.
Thank you.

lightfair IES IALD IMC