COMMERCE DEPARTMENT

Welcome

Conservation Applied Research & Development (CARD) Webinar

April 28, 2022

Energy Savings Potential of Networked Lighting Control

Energy Savings Potential of Networked Lighting Control Systems in Small Business



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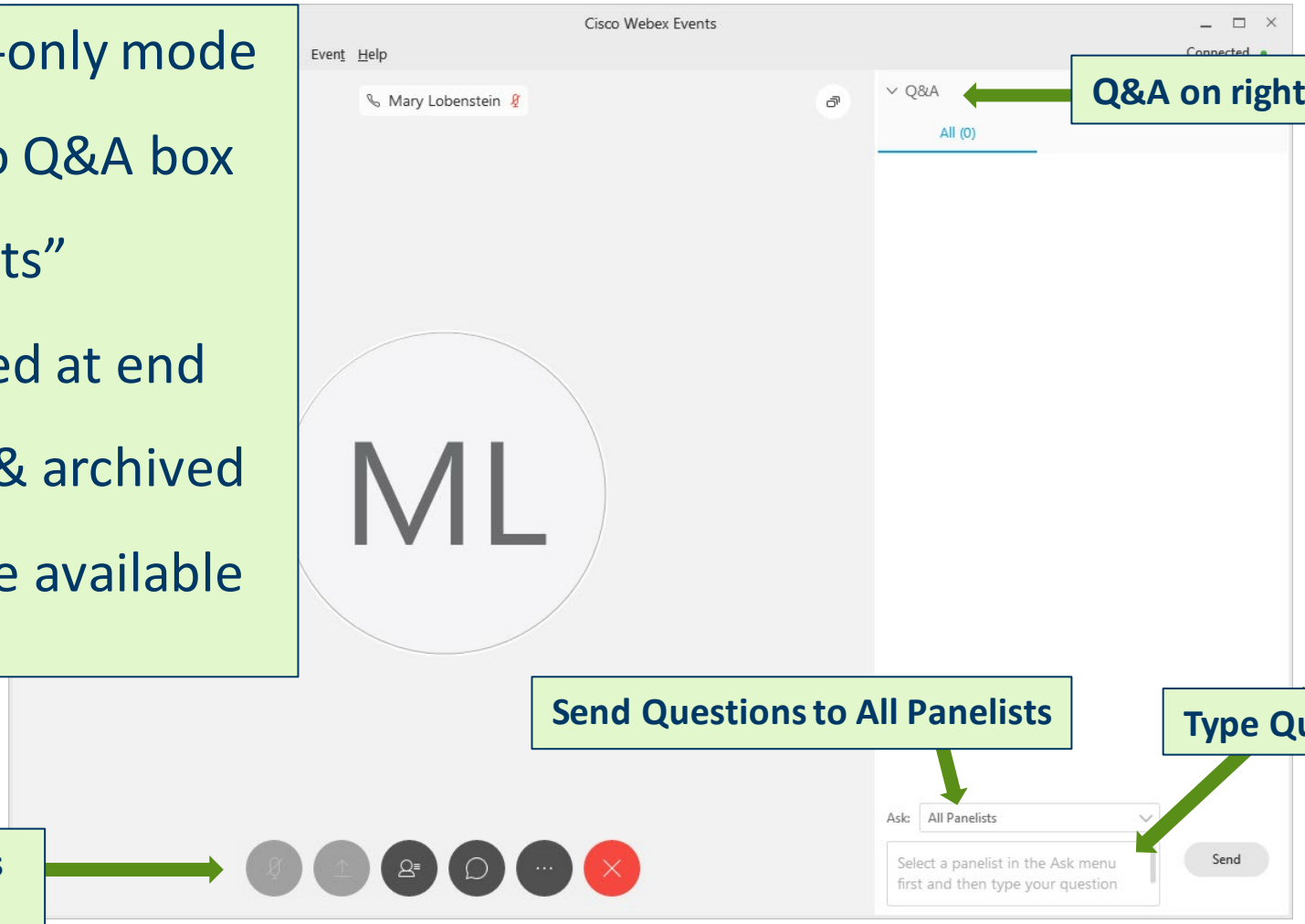
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Webinar Basics

- Attendees in listen-only mode
- Type questions into Q&A box
- Send to “All Panelists”
- Questions addressed at end
- Webinar recorded & archived
- Slide set will also be available



Q&A on right side of WebEx panel

Send Questions to All Panelists

Type Questions in Q&A box

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Minnesota Applied Research & Development Fund

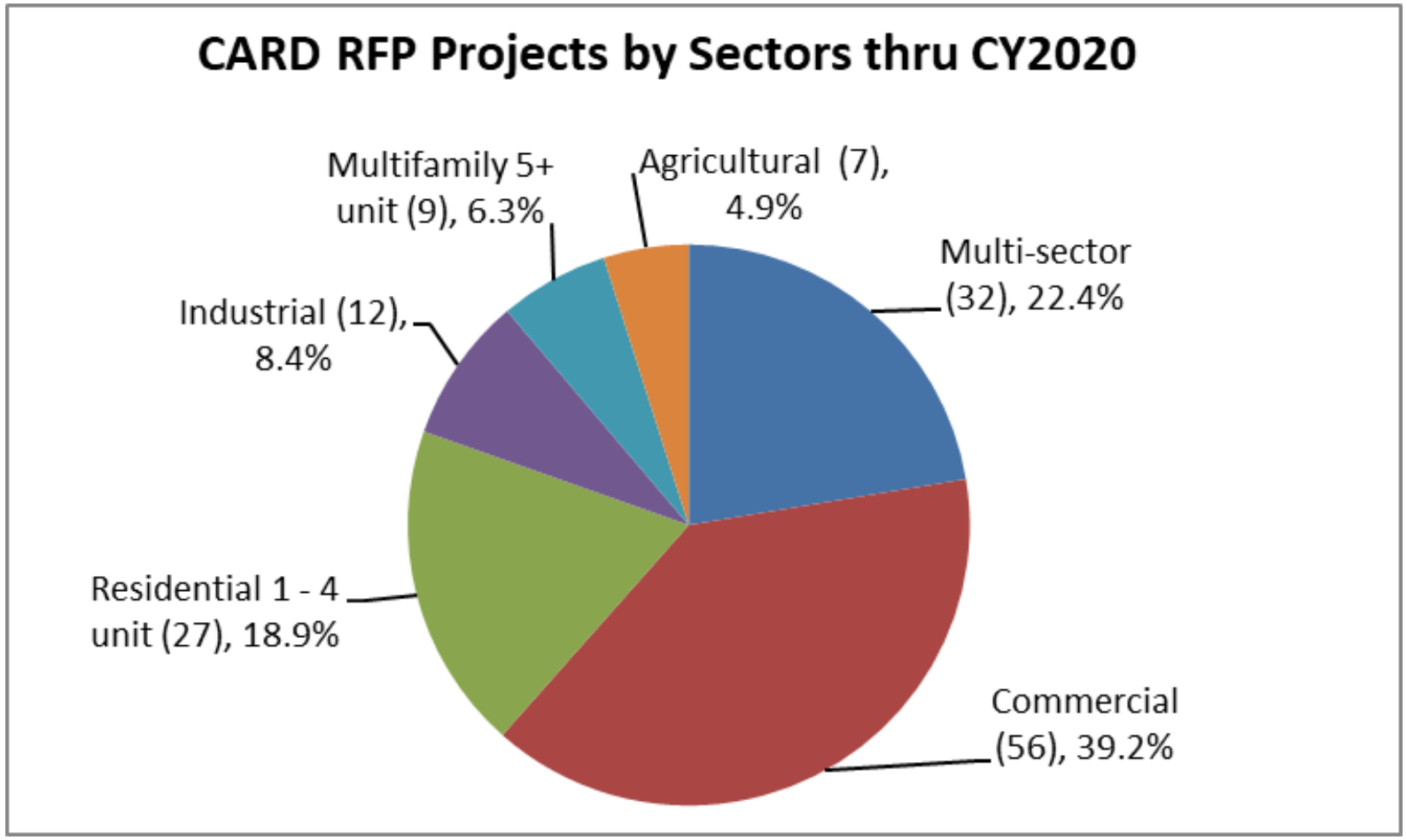
- **Purpose to help Minnesota utilities achieve 1.5% energy savings goal by:**
  - ***Identifying new technologies or strategies to maximize energy savings;***
  - ***Improving effectiveness of energy conservation programs;***
  - ***Documenting CO_2 reductions from energy conservation programs.***

Minnesota Statutes §216B.241, Subd. 1e

- **Utility may reach its energy savings goal**
  - **Directly through its Conservation Improvement Program (CIP)**
  - **Indirectly through energy codes, appliance standards, behavior, and other market transformation programs**

State Capitol Image: Courtesy Minnesota Department of Administration

CARD RFP Spending by Sector thru FY2020



RFP Summary

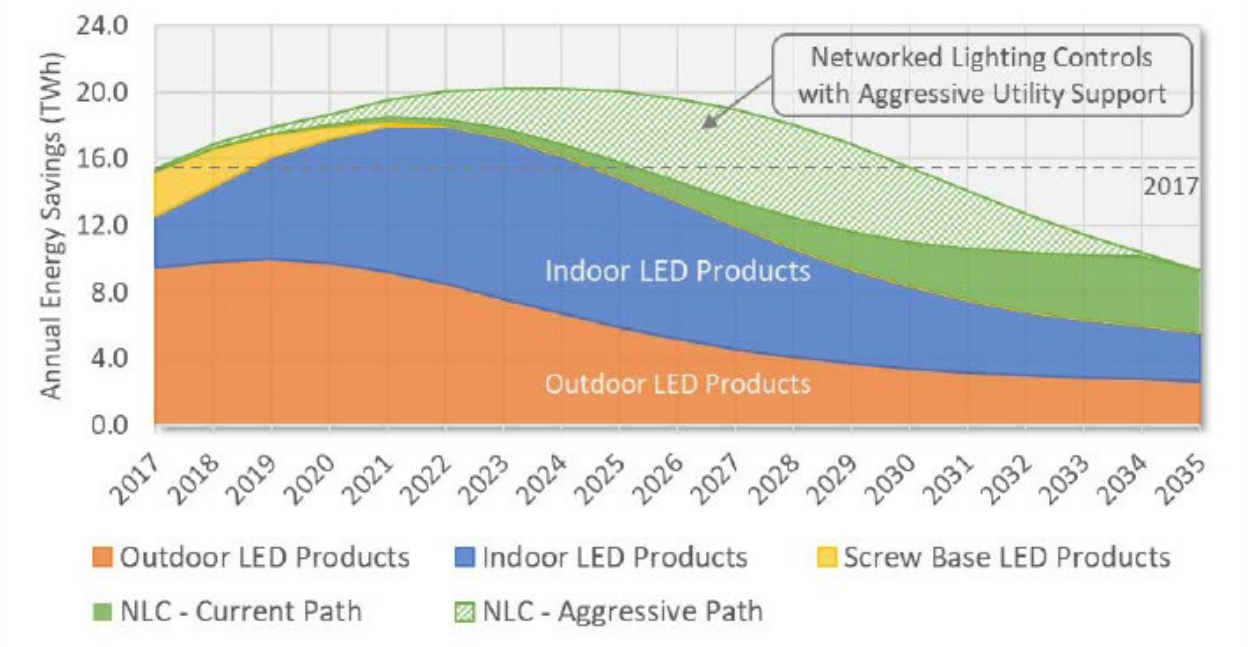
- 12 Funding Cycles
- 513 proposals
- 143 projects funded
- $31.2 million in research

Networked Lighting Controls in Small Business

- Technology
- Research project
  - Educational seminars
  - Case studies
  - Discussion and recommendations

Networked Lighting Controls

Networked lighting controls (NLC) is an emerging Internet of Things technology that offers deep energy savings potential for commercial lighting.



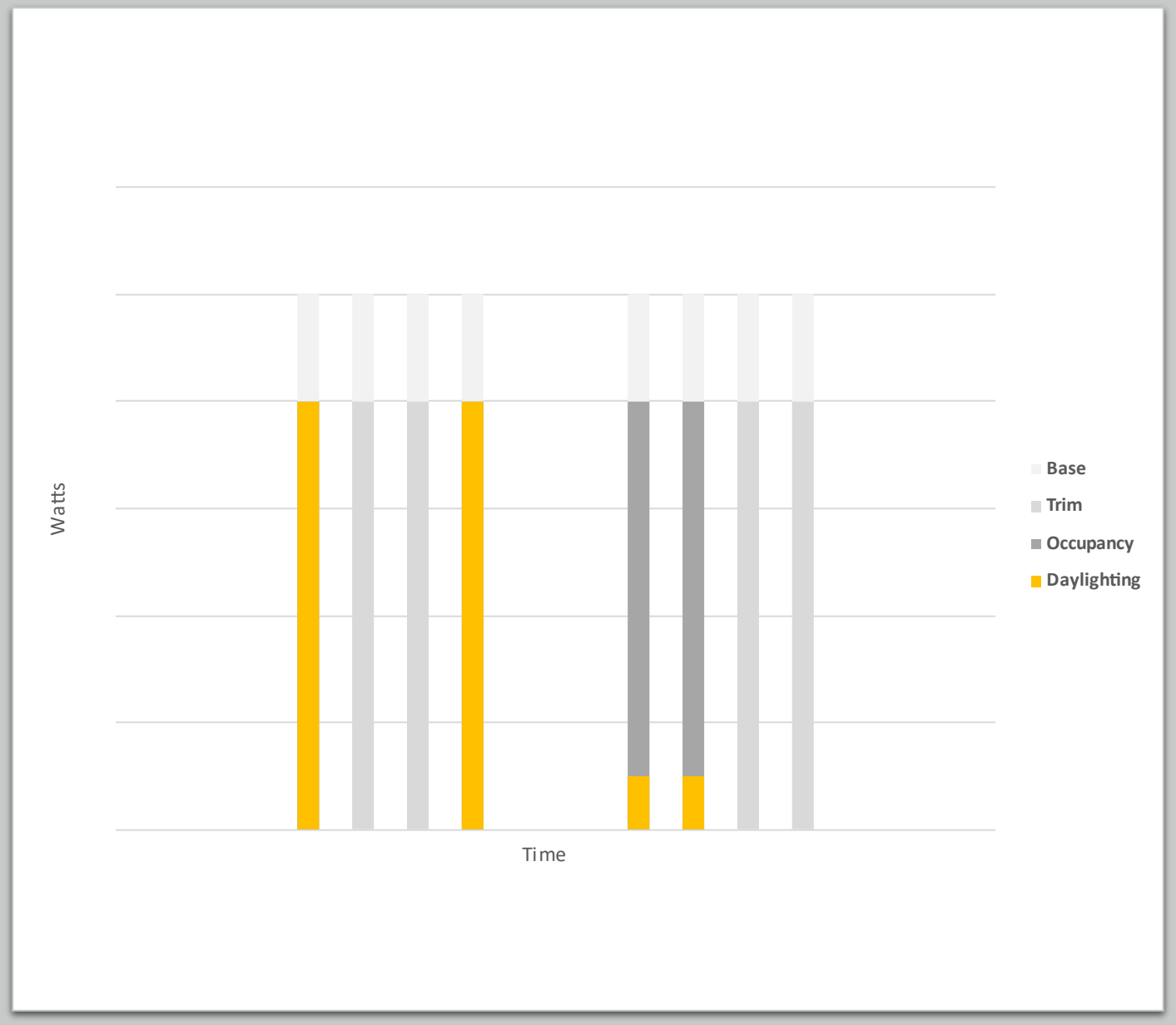
Source: DLC, *Energy Savings Potential of DLC Commercial Lighting and Networked Lighting Controls*, July 2018.

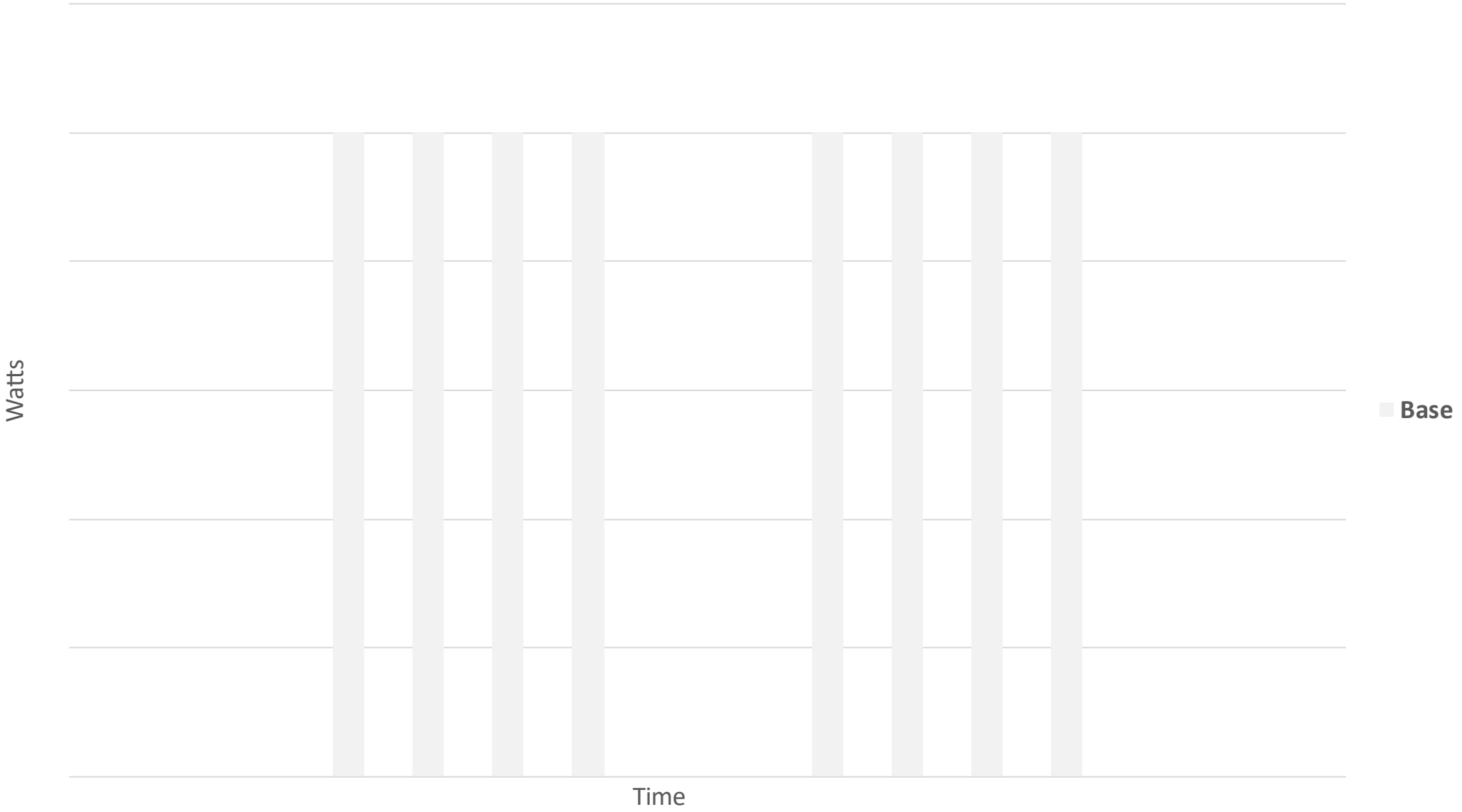
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Layered Control Strategies

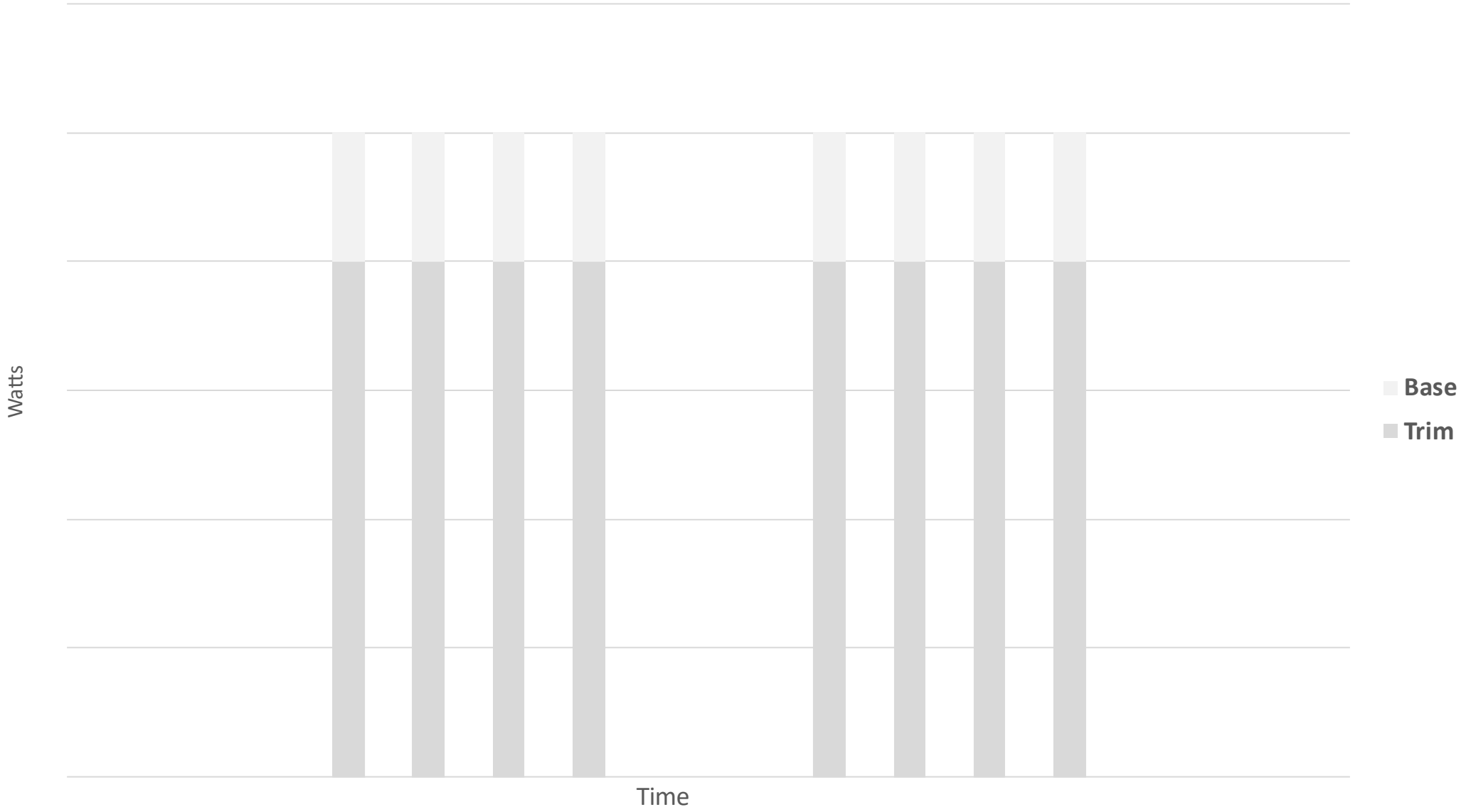
- NLC systems enable energy saving strategies to be layered in the same space including occupancy sensing, daylight harvesting, scheduling, and task tuning.

- When combined with modern LED lighting, light output can be optimized through individual control and automated daylight sensing.

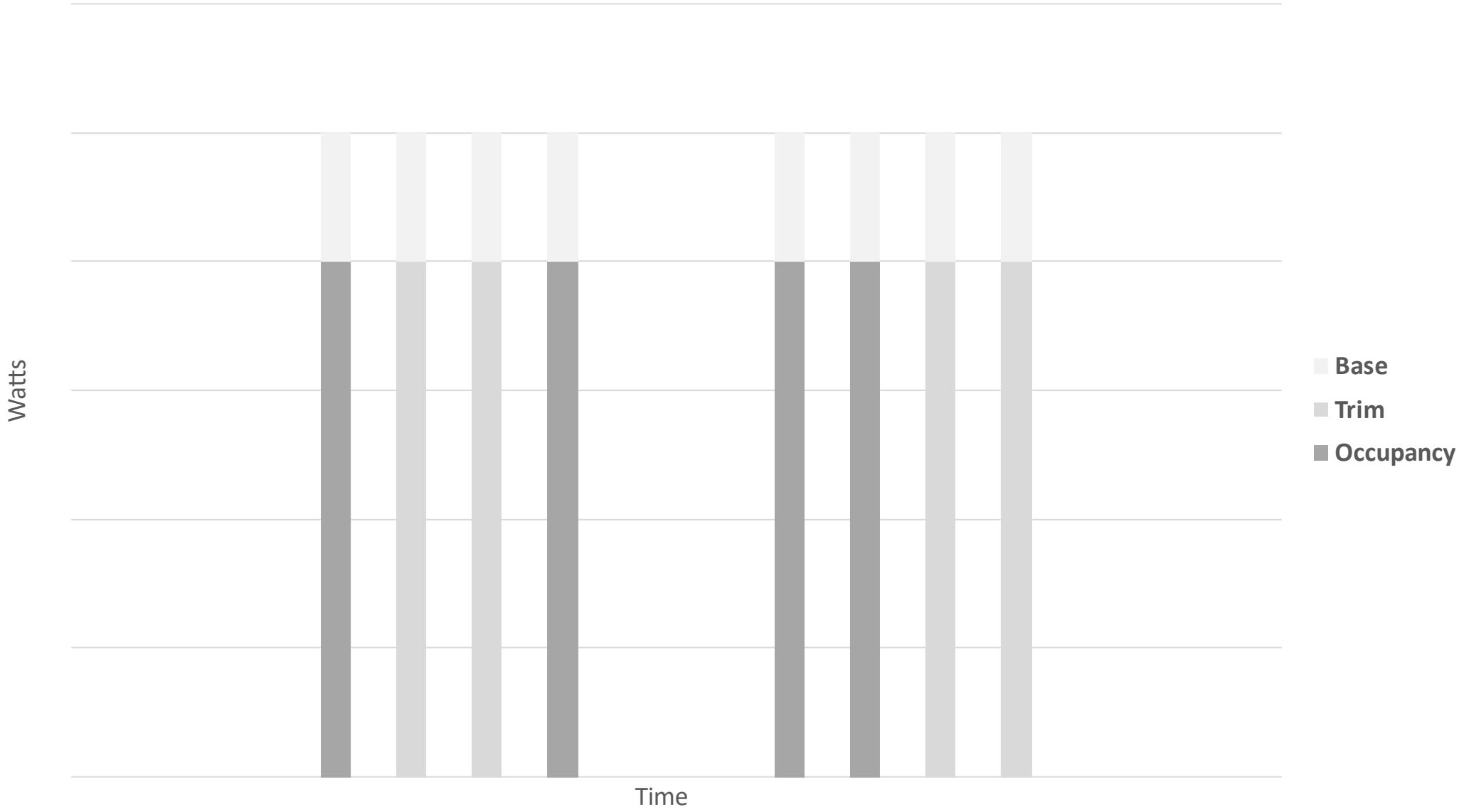




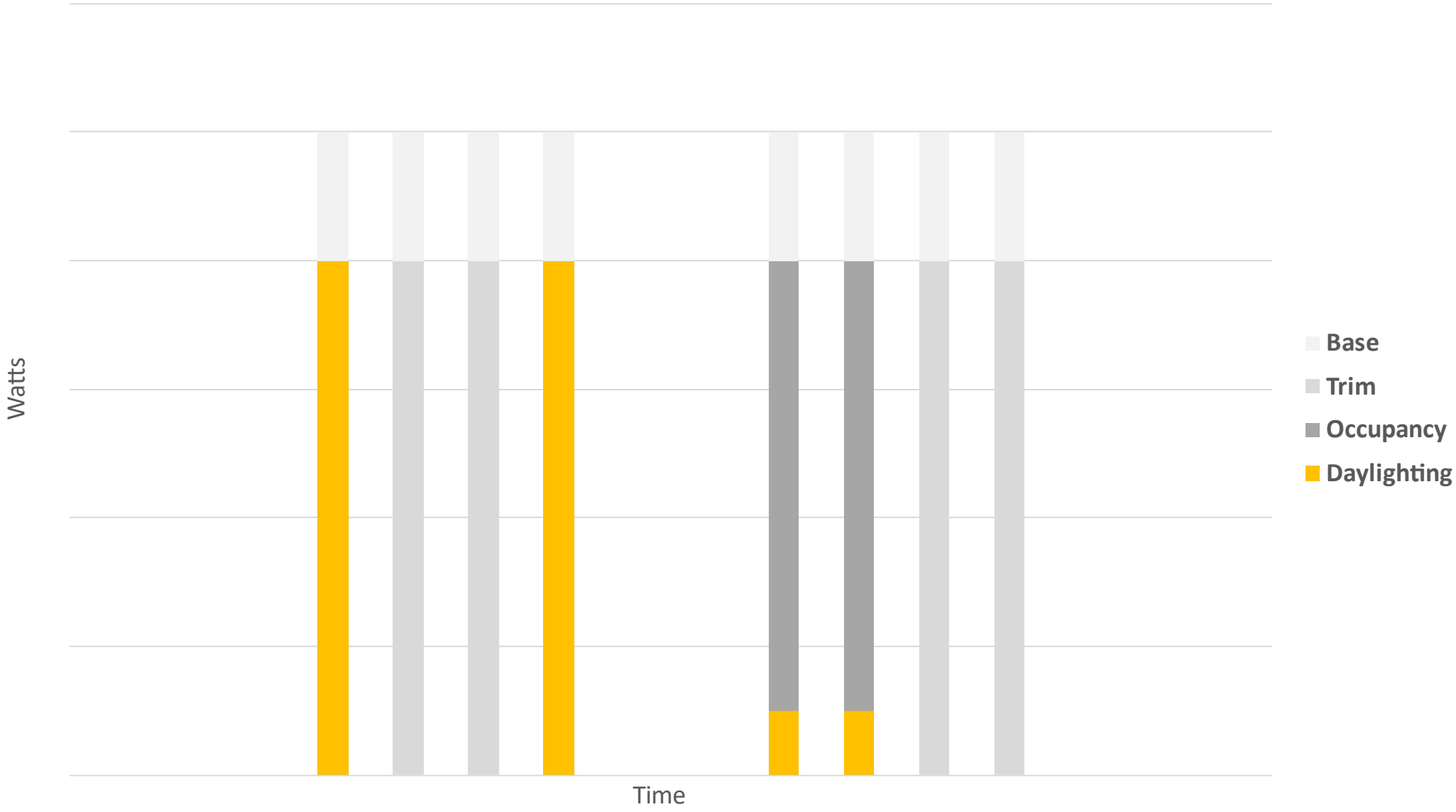
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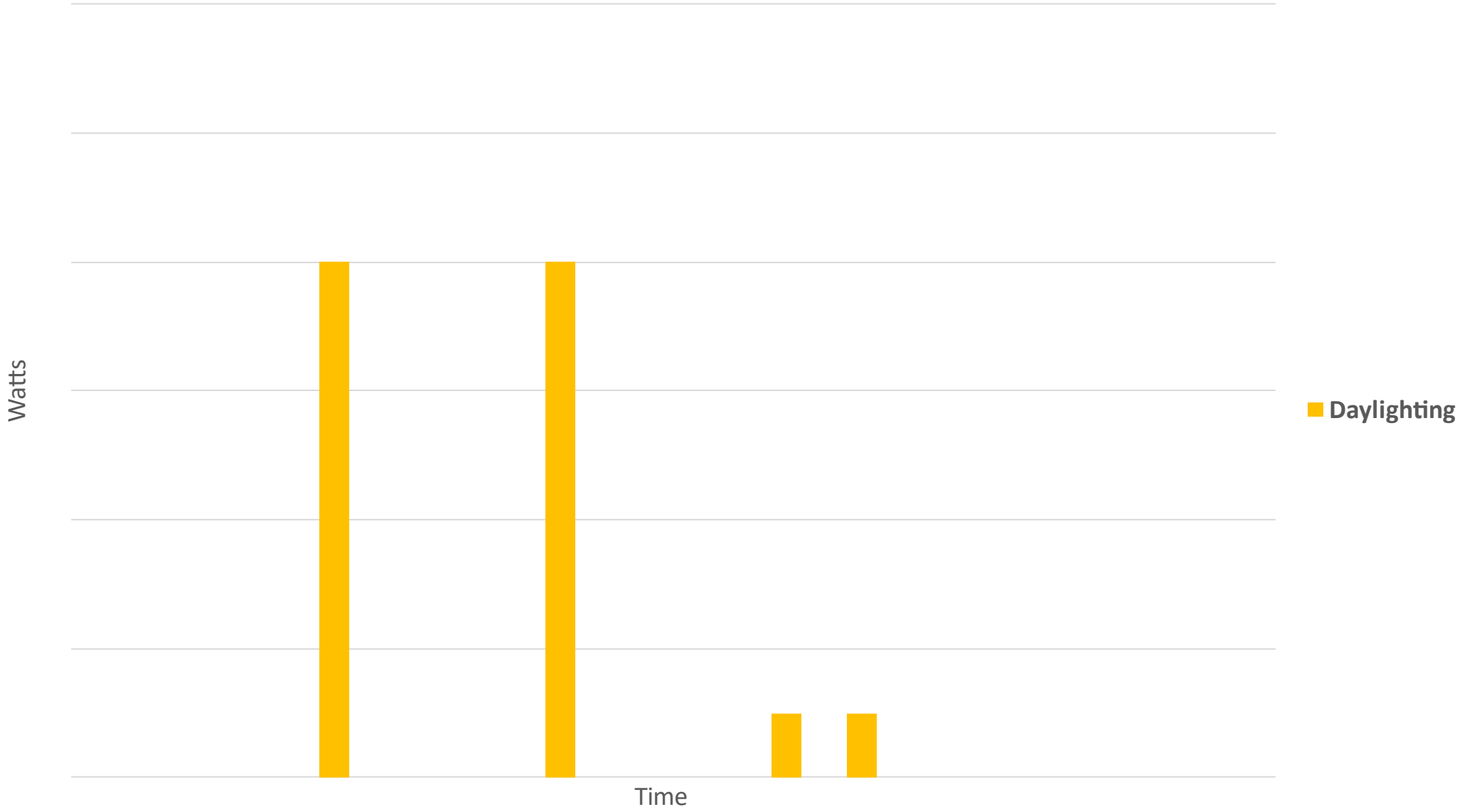
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Watts
Time
Daylighting

Technology overview

What are Networked Lighting Controls? Digital networks of control devices – sensors, network interfaces, and controllers that affect changes in luminaires.



Source: Lutron

- Components are individually addressable.
- May be triggered automatically, (i.e. occupancy sensing) or manually, such as through a wall mounted switch.
- Digital communication network may be wireless, wired or a hybrid system.

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DesignLights Consortium (DLC) Technical Requirements, Version NLC5

- A NLC system must have the following capabilities at a minimum to qualify for DLC certification:

Must have:

- Networking of luminaries and devices
- Occupancy sensing
- Daylight Harvesting / Photocell control
- High-End trim
- Zoning
- Individual Addressability
- Continuous dimming
- Cybersecurity
- Energy Monitoring



Design Lights Consortium

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Extended Capabilities

- **Demand response** – can be set up to automatically dim when signal is sent by the utility.
- **Asset Tracking** – RF sensor technology in luminaries can sense RFID tags and track objects in real time (use for inventory, forklifts, portable medical equipment etc.).
- **Indoor positioning** – Luminaries with Wi-Fi or Bluetooth capabilities used to track smartphones carried by people as they move throughout the building
- **Heat maps** – Infrared sensors integrated in luminaries can track occupants over time, creating heat maps that indicate if building spaces are under- or over- utilized so organizations can reconfigure their spaces accordingly.
- **Security** - Outdoor security lighting can layer motion sensing on top of dimming schedule to switch luminaries to full brightness to deter vandalism/theft.
- **Fault detection** - capable of self-diagnostic testing and reporting of emergency lighting fixtures, enabling facility management to proactively address faulty equipment.

Educational Seminars

December 2019



Educational seminars were held in Bemidji and Rochester, MN in December 2019.

Agendas:

- Technology overview by RAB Lighting
- Q&A
- Discussion of training needs and incentive structures
- Hands on learning opportunity

Attendees:

- Utilities
- End-use customers
- Distributors
- Consultants
- No contractors ☹

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Key Takeaways from Seminars

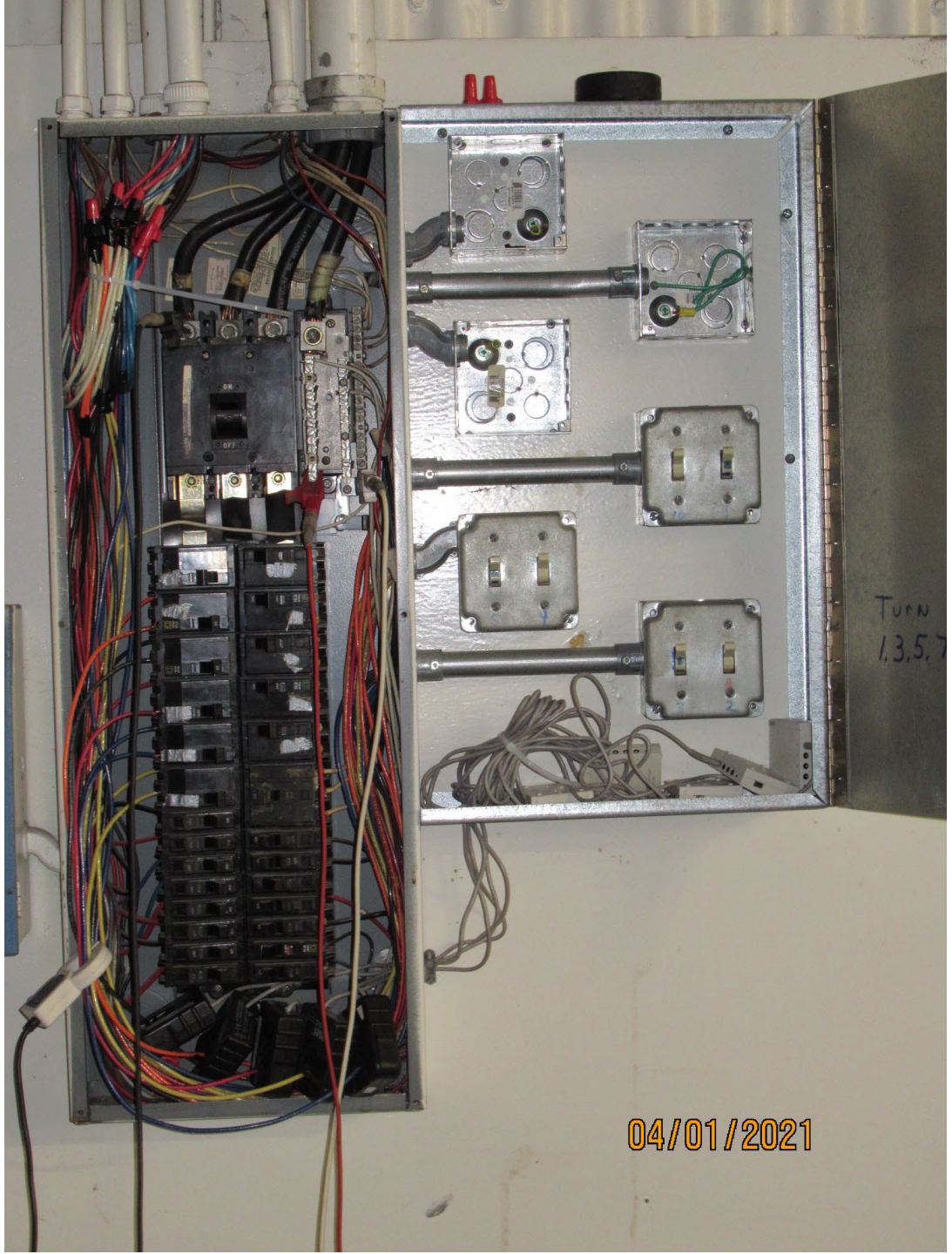
- NLC technology is evolving to enable better integration with building control systems
- Cybersecurity risks mitigated by compliance with latest DLC requirements
- Non-energy benefits are often most important to customers
- Energy monitoring capability can enable savings verification and performance-based incentives to encourage persistence
- Prescriptive incentives needed to help move projects
- More training opportunities are needed*

*No contractors in attendance.

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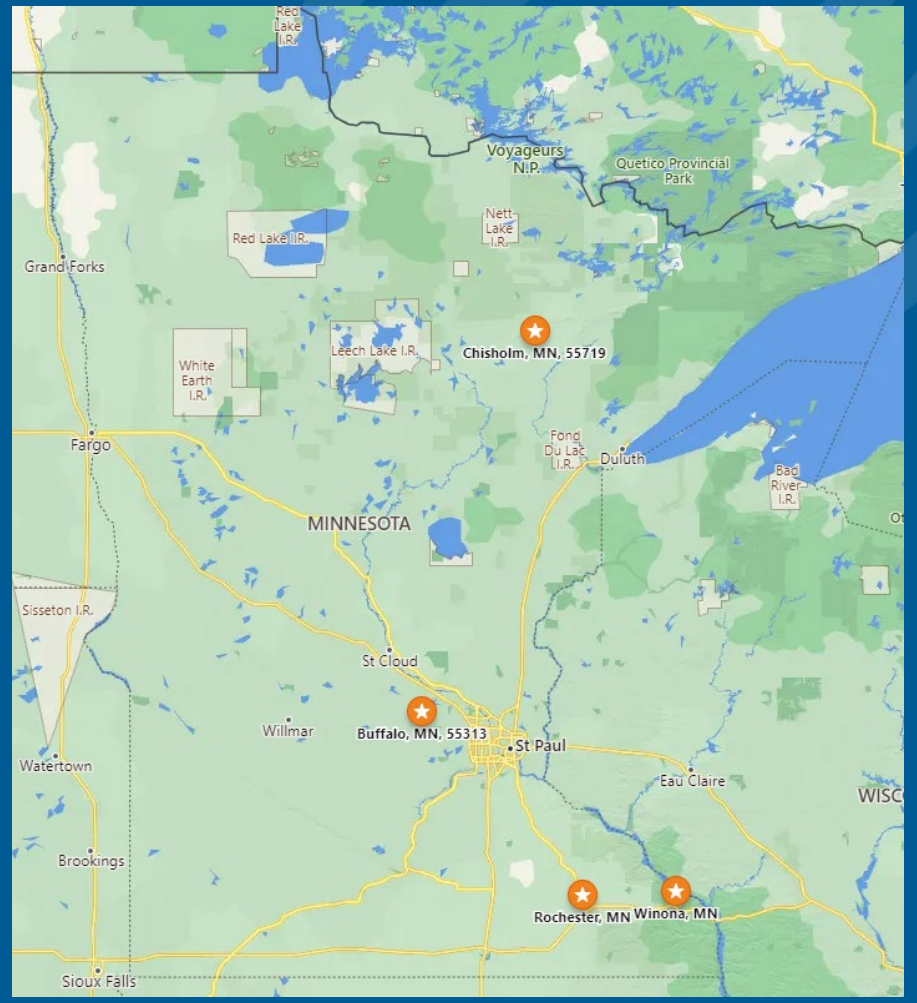
Case Studies

- Case studies of NLC deployment in small businesses
- Goals:
  - Measure energy savings
  - Gauge ease of commissioning
  - Survey customer satisfaction
- Methodology:
  - Submetering
  - Structured interviews



Sites

No.	Site	Location (MN)	Square Feet	Building Type
1	Haley Comfort Systems	Rochester	73,000	Retail
2	Miller Ingenuity	Winona	70,000	Manufacturing
3	Chisholm City Sports Arena	Chisholm	36,000	Sports Arena
4	McDonald's	Buffalo	6,500	Dining: Cafeteria/Fast Food



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Site 1: Retail

- T8 & T12 fluorescent to LED
- NLC system-controlled circuits in front sales area along with “light clouds” showcasing lighting products.
- Cx performed by Lutron manufacturer’s representative.
- Motivation: reduce energy usage and costs.



Energy Savings Results:

Space Type	Description	Existing controls	NLC Strategies	Fixtures Savings %	Controls Savings, % of New Fixtures
Retail	Light Clouds	N/A	Schedule, Trim	N/A	49%
Retail, Open Office	Front Sales Area	N/A	Schedule, Trim, Occupancy	N/A	29%
Wtd-Ave					**48%**

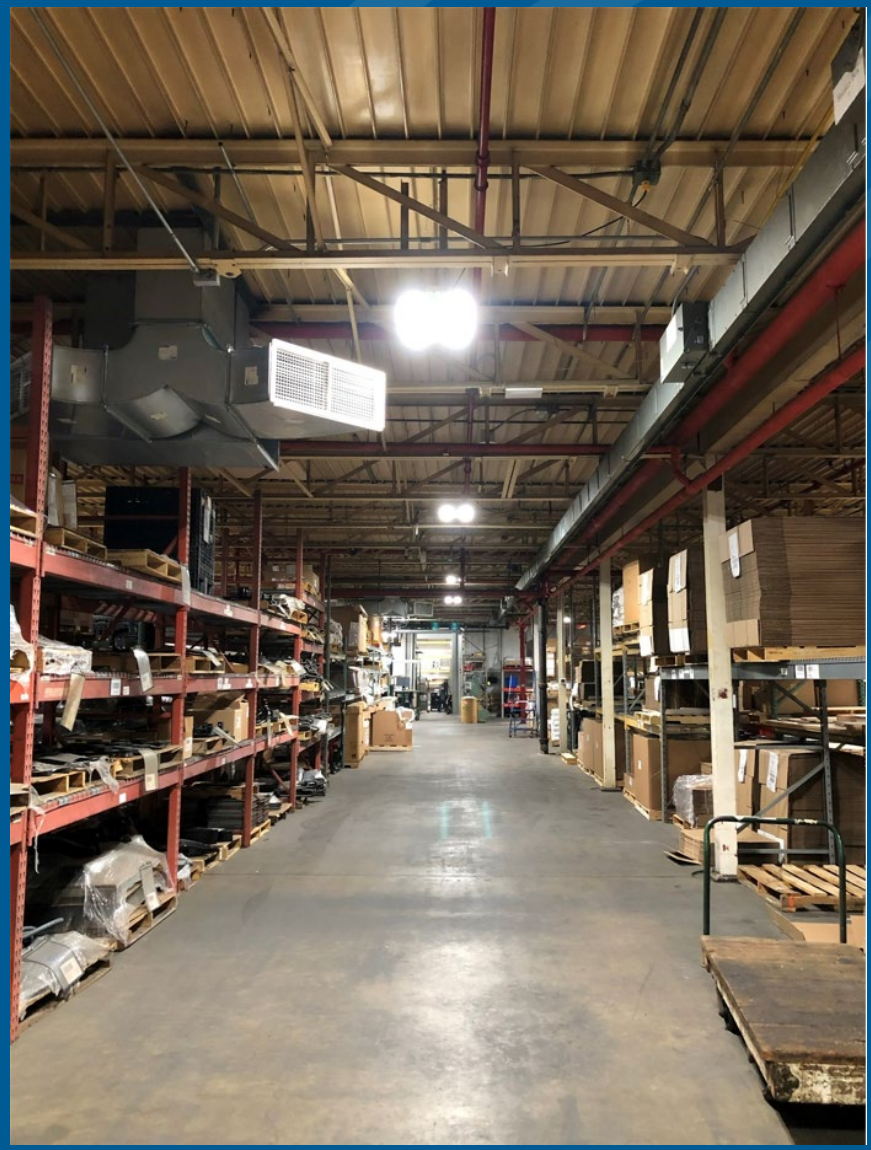
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Site 2: Manufacturing

- T8 fluorescent high bay fixtures to LED.
- Cx performed by Lutron manufacturer's representative.
- Motivation: grew out of lighting sales process. Drawn to scheduling and occupancy sensing benefits.

Energy Savings Results:

Space Type	Description	Existing controls	NLC Strategies	Fixtures Savings %	Controls Savings, % of New Fixtures
Manufacturing	Proprietary Process Room	Manual	Schedule, trim	54%	8%
Warehouse	Main Plant Aisle	Manual	Trim, occupancy	30%	29%
Warehouse	Shipping & Receiving	Daylighting	Trim, occupancy, daylight	35%	33%
Manufacturing	Press Room	Manual	Trim, occupancy	48%	35%
Wtd-Ave				**43%**	**24%**



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Site 3: Sports Arena

- T5 high bay lighting to LED.
- Wireless wall controller to enable manual dimming and preprogrammed scenes, 100% output for games, 50% for practice and general skating.
- Plagued by faulty and incompatible parts
- Motivation: Energy savings potential and incentive offers.



Energy Savings Results:

Space Type	Description	Existing controls	NLC Strategies	Fixtures Savings %	Controls Savings, % of New Fixtures
Playing Area	Ice sheet and spectator seating	Manual	Manual Scene Selection	65%	11%

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Site 4: Fast Food

- Replacement of fluorescent downlight fixtures with LED fixtures.
- Renovation of play area to offices, conference room
- Motivation: desire to manage energy costs, “go digital” wherever possible

Energy Savings Results:

Space Type	Description	Existing controls	NLC Strategies	Fixtures Savings %	Controls Savings, % of New Fixtures
Dining	Dining Area	Manual	Schedule	76%	0%
Dining	Cash Registers	Manual	Schedule, trim	54%	19%
Closed Office	New Office Space	N/A	Schedule, occupancy, daylight	75%	43%
Wtd-Ave				**73%**	**18%**



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Findings-Energy Savings

Site No.	Building Type	Existing Controls	NLC Strategies	Fixture Savings %	Control Savings % of New Fixtures
1	Retail	N/A	Schedule, Trim, Occupancy	N/A	48%
2	Manufacturing	Daylighting, Manual	Schedule, Trim, Occupancy, Daylight	43%	24%
3	Sports Arena	Manual	Manual Scene Selection	65%	11%
4	Dining: Fast Food	Manual	Schedule, Trim, Occupancy, Daylight	73%	18%

Takeaways:

- Control savings are small relative to fixture savings
- Occupancy sensing produced highest savings (with exception of light cloud)
- Savings are highly dependent on site conditions

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Savings Compared to TRM

Site No.	Building Type	TRM[1] Savings %	Case Study Control Savings %
1	Retail	44%	48%
2	Manufacturing	30%	24%
3	Sports Arena	23%	11%
4	Dining: Fast Food	47%	18%

[1]Minnesota TRM version 3.2

- TRM comparison reinforces the highly site-specific nature of control savings

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Motivations for Choosing NLC

What factors were most important for choosing NLC?

Site No.	Building Type	Energy Savings	Lighting Quality	Incentives	Remote Monitoring	Easily Re-configure Settings
1	Retail	✓				
2	Manufacturing	✓		✓		
3	Sports Arena	✓		✓		
4	Dining: Fast Food	✓			✓	

- Participants valued energy savings from a “peace of mind” perspective
- Ancillary benefit: reconfigure fixture groups and relocate switches

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Commissioning Process

It (Mostly) Went Well…

Site No.	Approximate Commissioning Time	Commissioning Agent	Simple and Straightforward?
1	2 visits/ 1 hour, 3 hours	Manufacturer's Representative	Yes
2	2 visits/ 1 hour, 10 hours	Manufacturer's Representative	Yes
3	> 9 days	Manufacturer	No
4	1 visit/4 hours	Manufacturer's Representative	Yes

- At all sites, commissioning was completed by an experienced technician working for the manufacturer or a manufacturer's representative
- Went smoothly, none indicated that the process was burdensome (**notable exception Site 3*).
- Installed using customers input, incorporated customer training in the process so customers could make future adjustments themselves.

**Problems at site 3 were result of communication and compatibility issues between the controller and luminaries. Serves as an example of challenges that can occasionally occur with connected technology.*

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Discussion

- Control savings are small relative to fixture savings.
  - Majority of savings came from fixture upgrades.
  - Suggests NLC should be installed as part of an overall lighting upgrade whenever possible.
  - NLC on standalone basis may be harder to justify.
- Control savings are highly dependent on site conditions.
  - Occupancy sensing produced highest relative savings (with one exception)
  - Difference in findings from TRM and other sources reinforces site-specific nature of lighting control savings.

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Recommendations

- Minnesota utilities are well-positioned to aid in the transition to advanced control technologies though their strong relationships with customers and trade allies.
- Promotion starts with **education**.
  - Many customers and contractors are not familiar with NLC.
  - Control companies offer their own training programs, but utilities can partner or offer parallel training and education efforts to reach more people.
  - NLC is increasingly part of advanced building controls that drive deeper savings
- **Incentives** help to seal the deal.
- We strongly recommend that utilities offer prescriptive incentives for NLC.
  - Properly designed prescriptive incentive allows trade allies to easily calculate and include the qualifying incentive amount in proposals.
  - Custom incentives require trade ally to complete and submit facility specific information to the utility, which then requires an engineering review.

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Questions?

Energy Savings Potential of Networked Lighting Control



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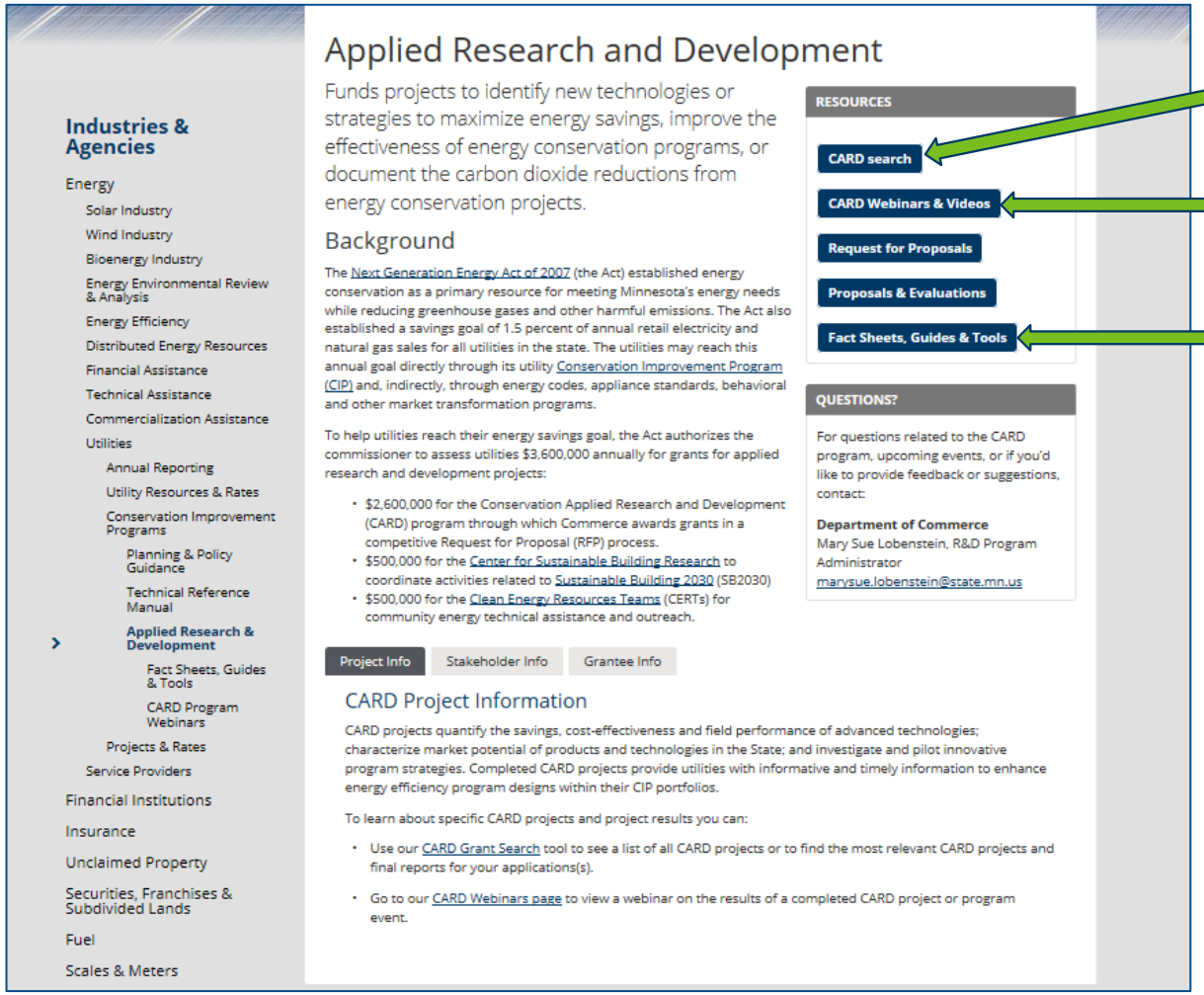
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Send us your questions using the Q&A panel

CARD Project Resources



For **Reports** use **CARD Search** Quick Link

For **Webinars** use **CARD Webinars & Videos** Quick Link

For **Other** research documents use **CARD Fact Sheets, Guidelines & Tools** Quick Link

Webinar Recording & Final Report available in couple months

R&D Web Page (https://mn.gov/commerce/industries/energy/utilities/cip/applied-research-development/)

Thanks for Participating!

Upcoming CARD Webinars:

- **June 8, 2022:** Slipstream - Opportunities for CIP to Support Tribal Food Sovereignty
- **July 13, 2022**: Citizens Utility Board of MN - Analysis of New or Modified Energy Efficiency Programs to Increase Energy Savings of Underserved Populations

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