



Welcome

Conservation Applied Research & Development (CARD) Webinar

September 29, 2020

Improve your commercial light levels and save on cost

Light Level Analysis in Commercial Buildings: A Minnesota Market Study



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Webinar Basics

Open or close your control panel

Screen

Maximize screen for better view.

Audio options

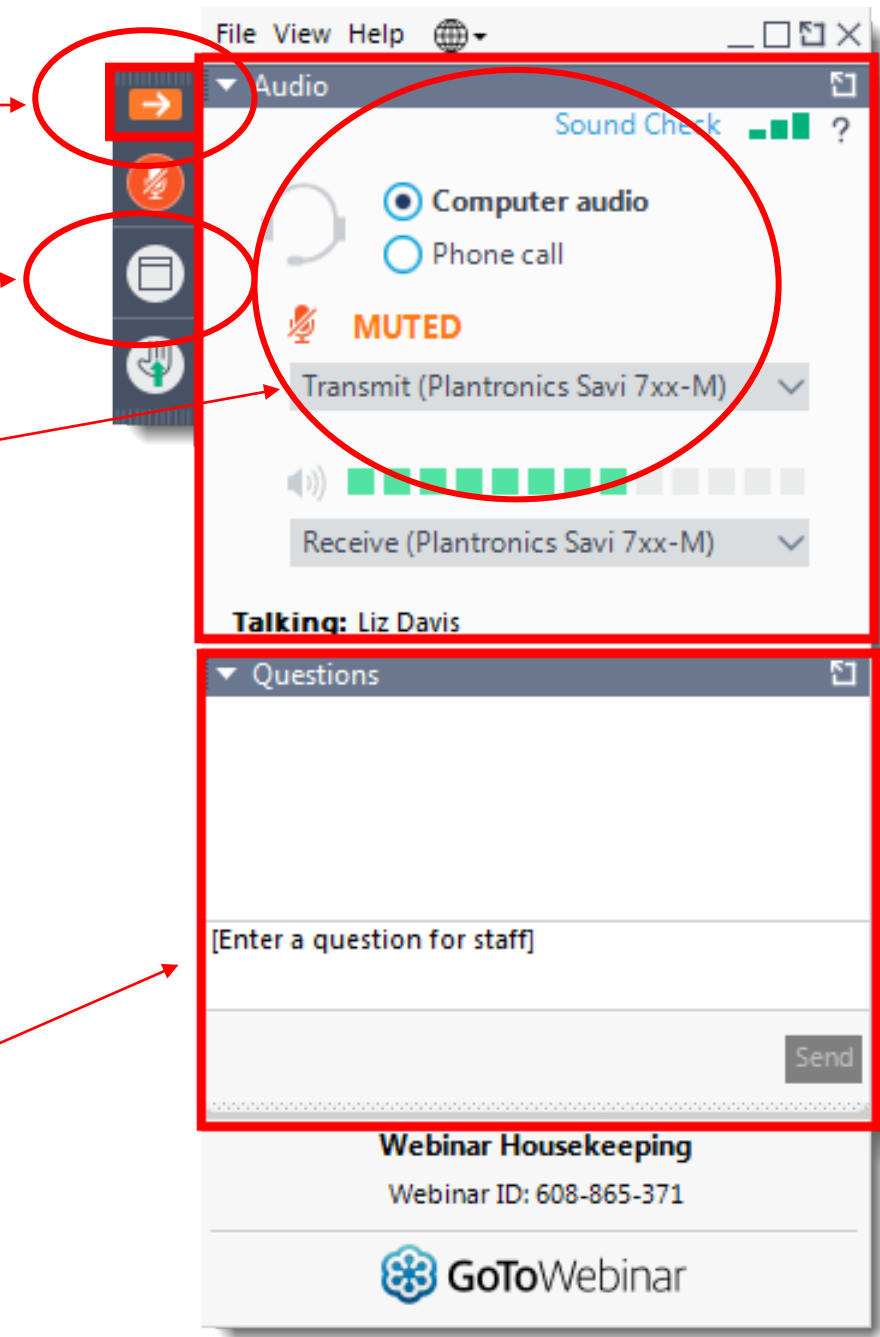
Select either the Computer audio or a Phone call.

- If you are using your telephone:
 - Select the “Phone call” button
 - Dial in and enter your access code
 - Enter your audio pin and press #

You will be joined into the webinar on mute.

Participation

Type in a question and hit “send” to ask a question.





Minnesota Applied Research & Development Fund

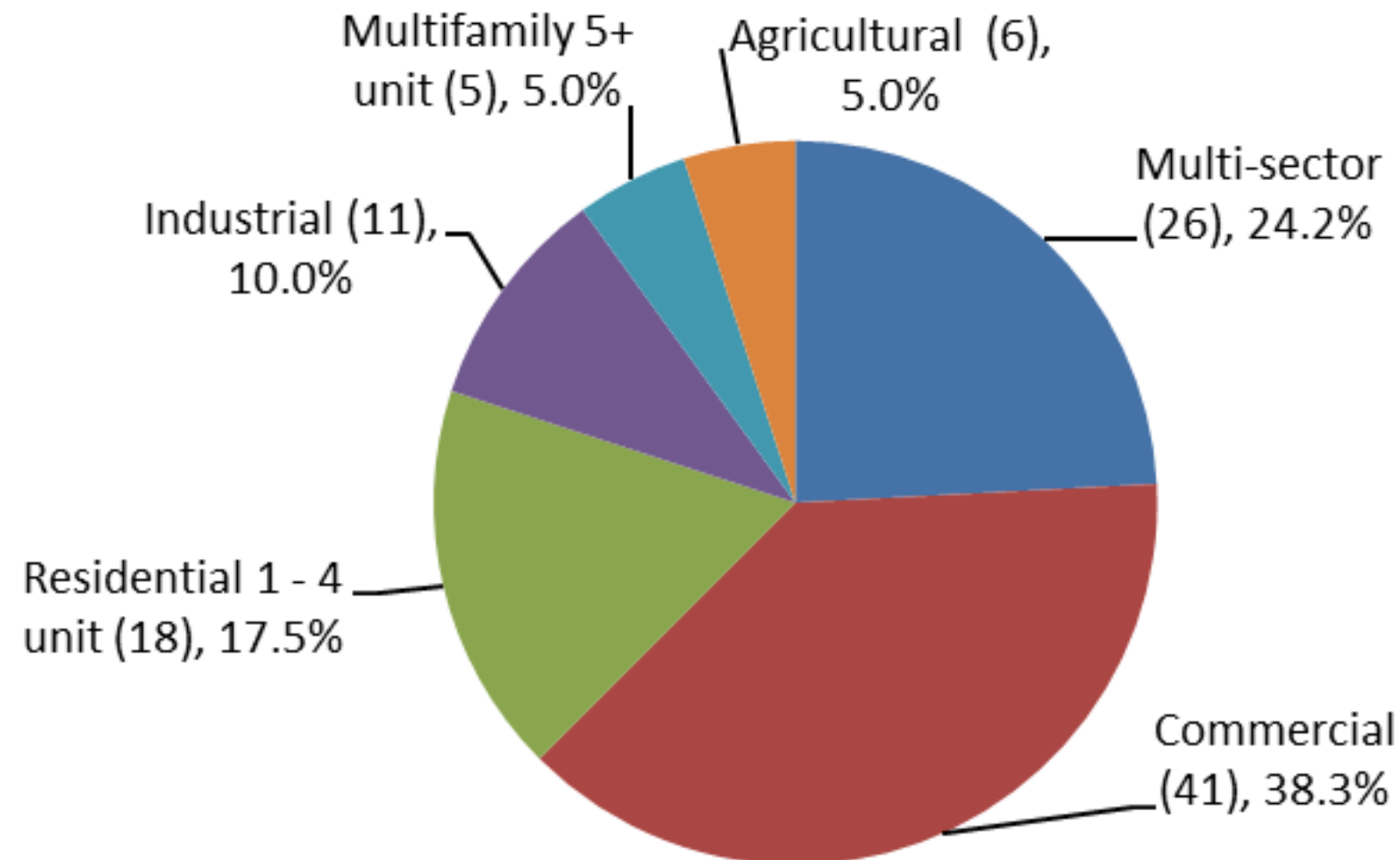
- **Purpose to help Minnesota utilities achieve 1.5% energy savings goal by:**
 - *Identifying new technologies or strategies to maximize energy savings;*
 - *Improving effectiveness of energy conservation programs;*
 - *Documenting CO₂ reductions from energy conservation programs.*

[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**

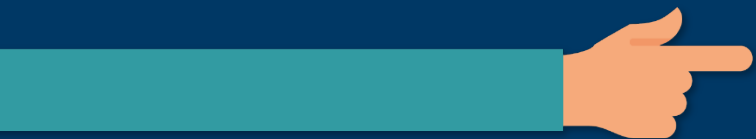
CARD RFP Spending by Sector thru FY2019

CARD RFP Projects by Sectors thru FY2019



RFP Summary

- 10 Funding Cycles
- 472 proposals
- 121 projects funded
- \$27.4 million in research



THANK YOU TO OUR SPONSOR



Conservation Applied Research and Development (CARD) Program

Background and objective

Methodology

Results

Conclusions and recommendations

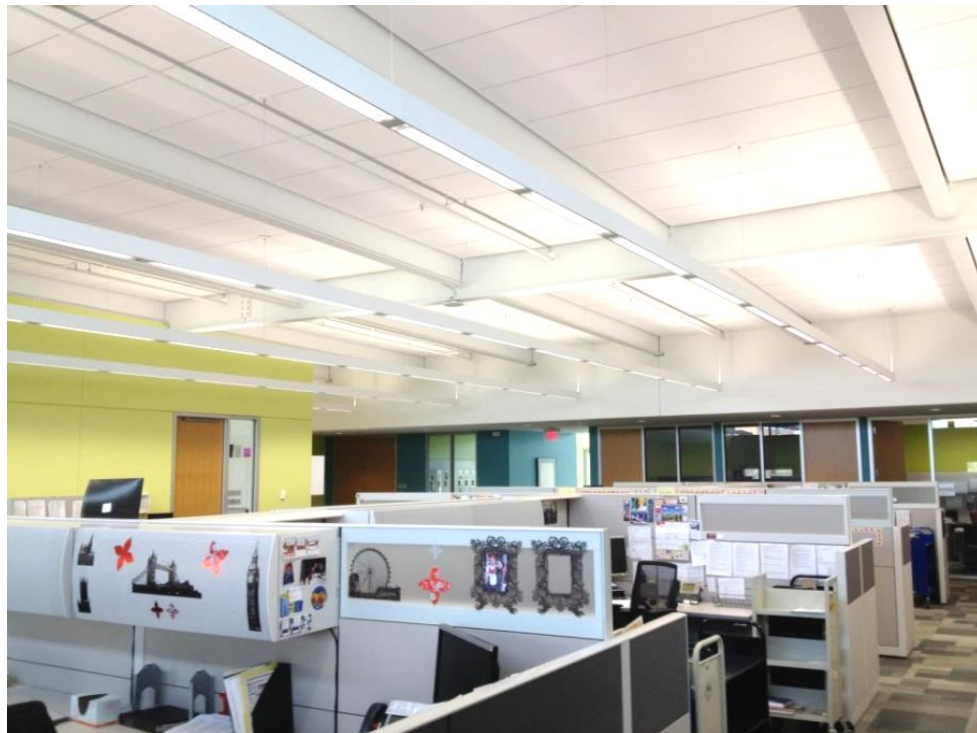


Background and Objective

Background: The Opportunity

Dimming lights in commercial spaces so that the average light level is appropriate for the specific activities being performed

Too Bright

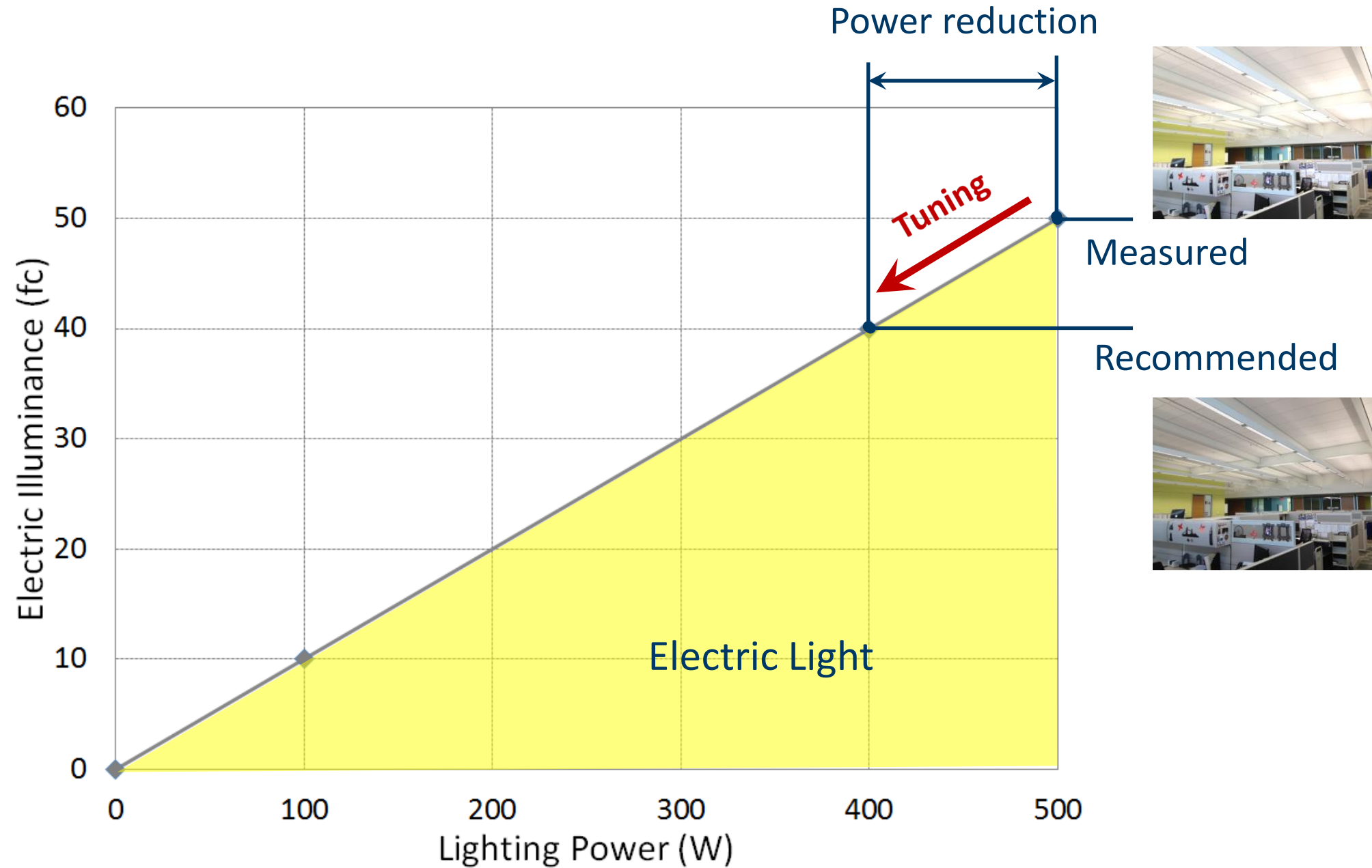


Tuning

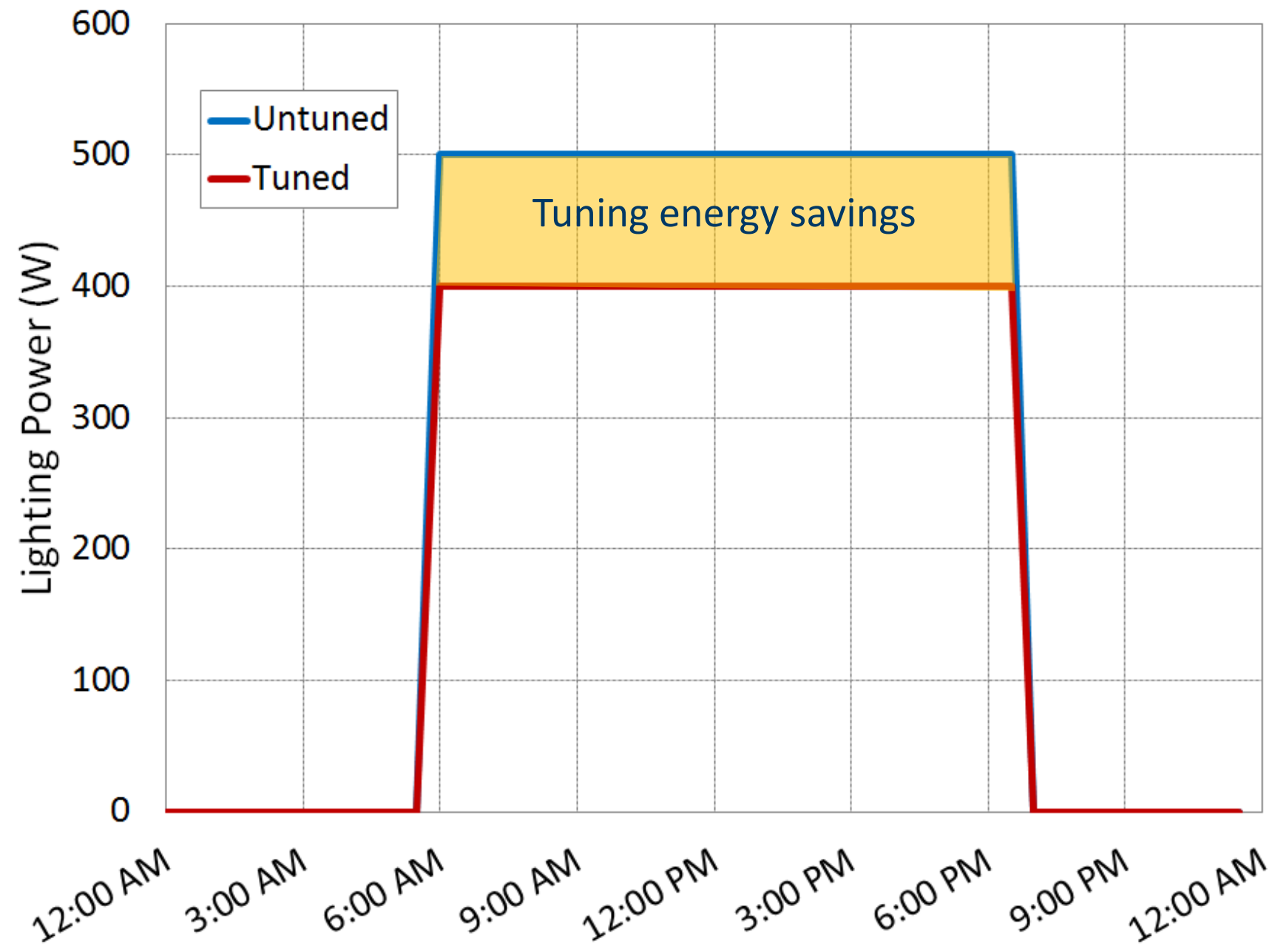
Just Right



Background: The Opportunity



Background: The Opportunity





Objective: Objectives

- 1) Characterize LED light levels in Minnesota commercial buildings.
- 2) Develop program recommendations for optimizing light levels.



Methodology



Methodology: Project Steps

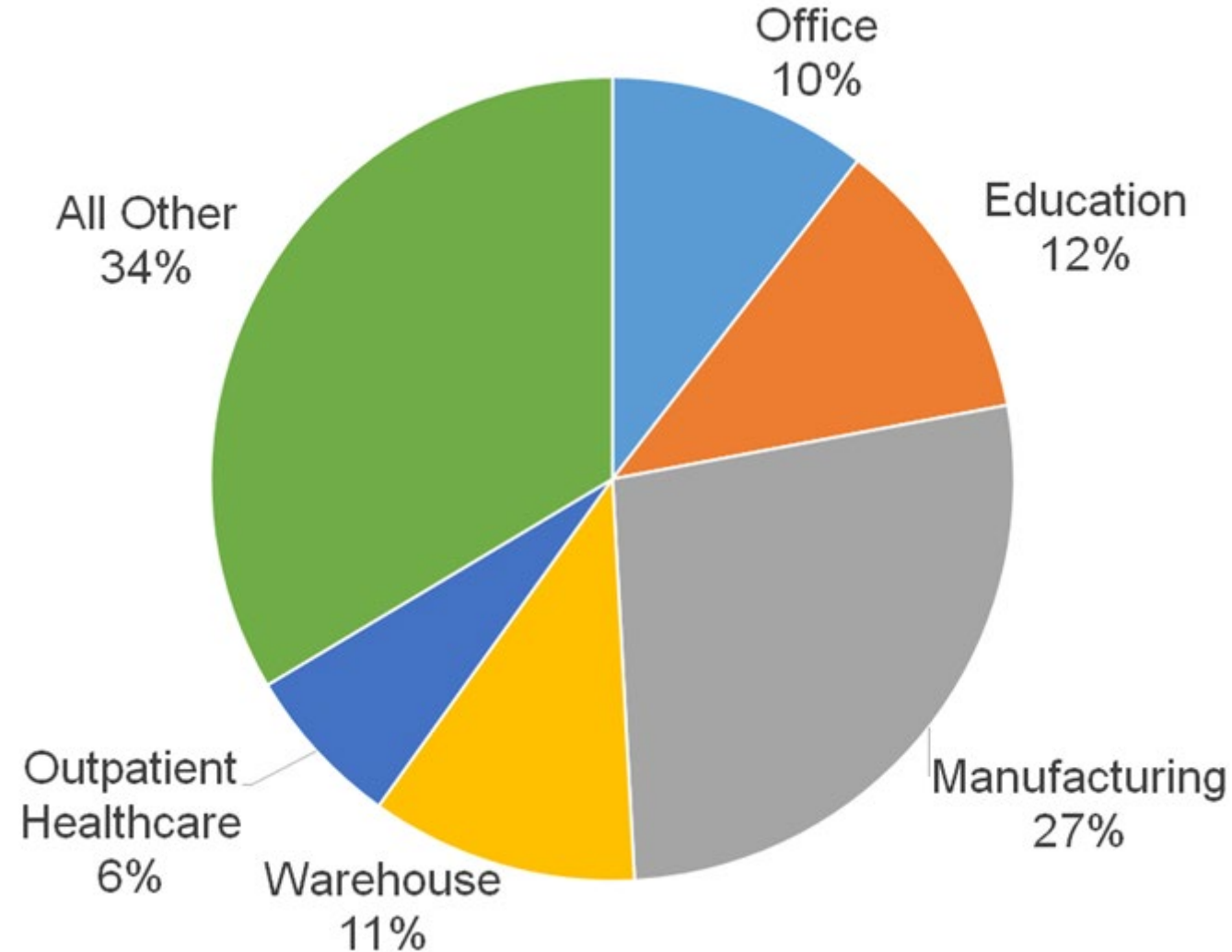
- 1) Secondary research
- 2) Interviews
 - Utility program staff
 - Trade Allies, Manufacturers
- 3) Field work
- 4) Expedited assessment
- 5) Program recommendations



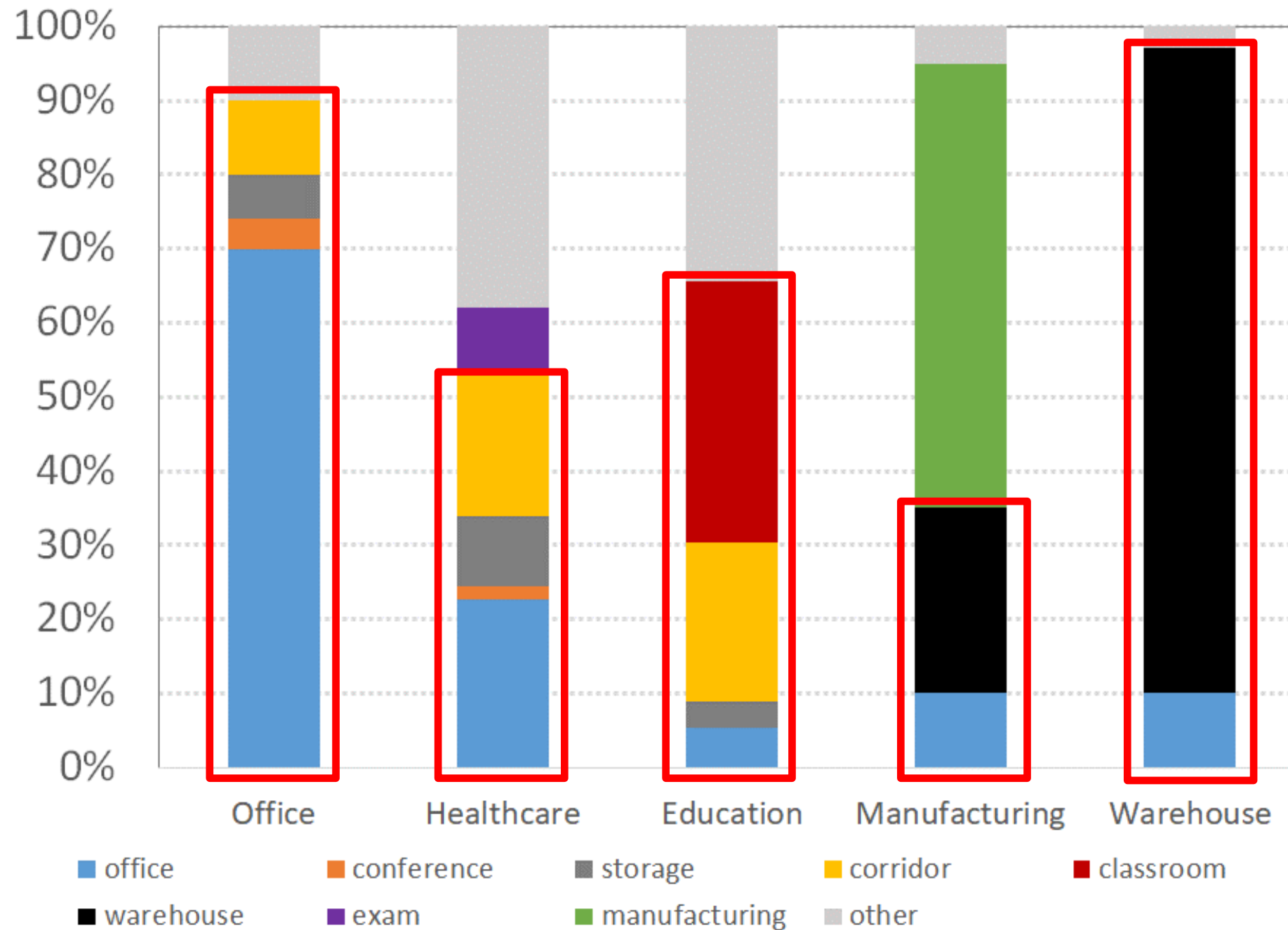
Results: Secondary Research

Segmentation: Commercial Lighting Energy by Building Type

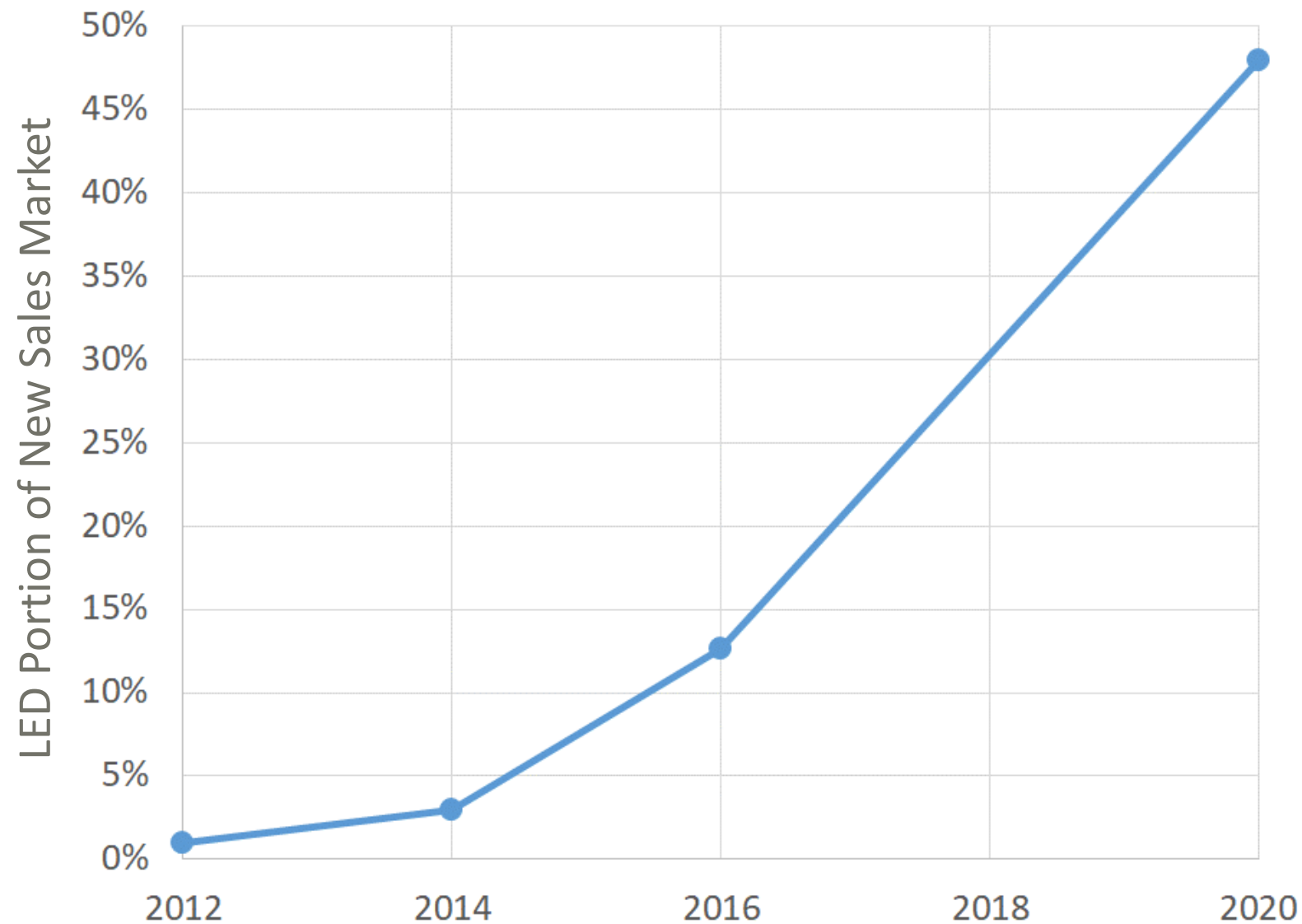
5.3 billion kWh annually



Segmentation: Space Types by Building Type

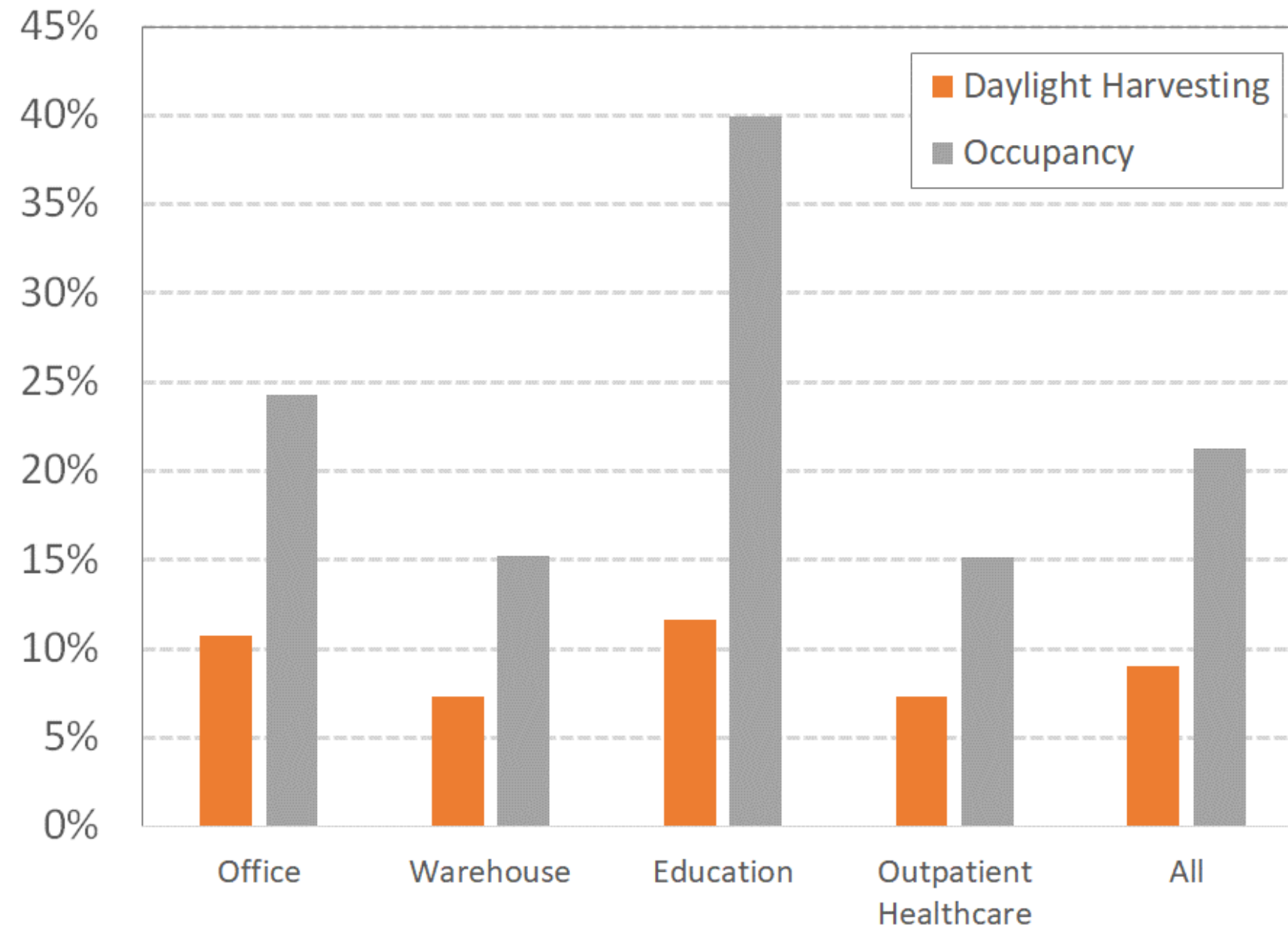


Segmentation: LED Penetration



LEDs currently installed in ~11% of commercial area in existing building stock in Minnesota

Segmentation: Lighting Controls





Results: Program Review



Program Review: Staff Interview Key Takeaways

- 60-90% of lighting program savings stem from one-for-one replacement projects.
- Concern about savings decline in future
 - More stringent codes
 - LED market saturation
- Most contractors do not measure light levels or do photometric calculations.



Program Review: Staff Interview Key Takeaways

- Interest in light level optimization if:
 - Customer and program economics are viable
 - Occupant preferences are addressed
 - Programming process can be simplified
 - Messaging does not imply that LED retrofit under-delivered on expected savings



Results: Stakeholder Interviews



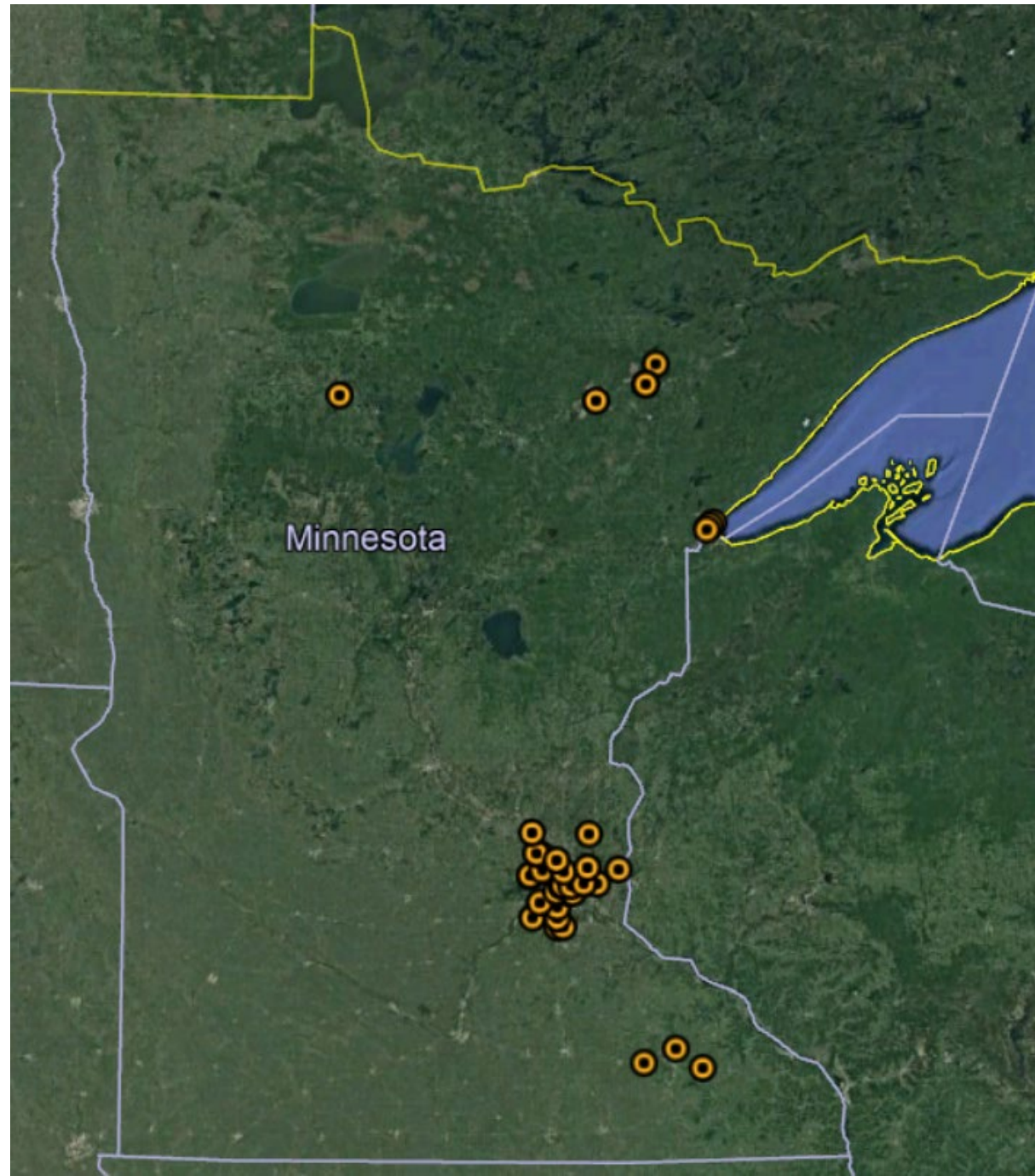
Program Review: Stakeholder Key Takeaways

- Incremental cost of dimmable fixtures is low.
- Agreement that spaces are often over-lit.
- Brightness preferences and perceptions drive importance of occupant feedback.
- Barriers to controls and task tuning include perceived complexity and low awareness of control benefits.



Results: Field Study

Field Study: Buildings Visited



Building Type	Number Visited
Office	9
Education	9
Warehouse & Storage	10
Manufacturing	8

Field Study: Spaces Characterized

Space Type	Number Visited	Target Sample
Open Office	28	44
Private Office	50	44
Conference Room	36	44
Warehouse	27	44
Corridor	25	44
Classroom	19	44

Field Study: Spaces Characterized – Private & Open Office



Field Study: Spaces Characterized – Conference & Corridor



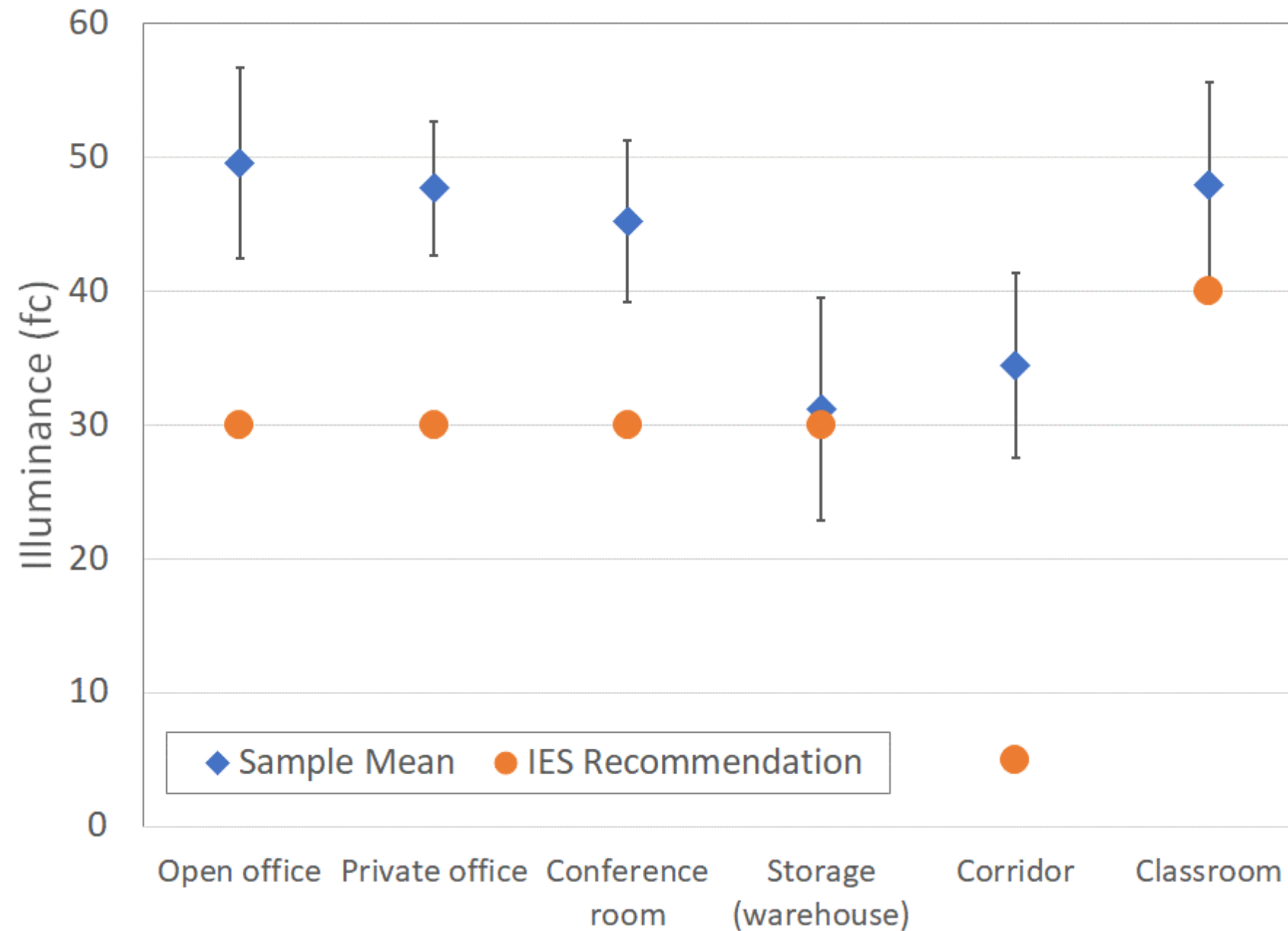
Field Study: Spaces Characterized – Warehouse & Classroom



Field Study: Mean Illuminance vs. IES Recommendation

Space Type	Mean	IES Recommendation	% Reduction
Open Office	49.6	30	40%
Private Office	47.7	30	37%
Conference Room	45.2	30	34%
Warehouse	31.2	30	4%
Corridor	34.5	5	86%
Classroom	48	40	17%

Field Study: Mean Illuminance vs. IES Recommendation



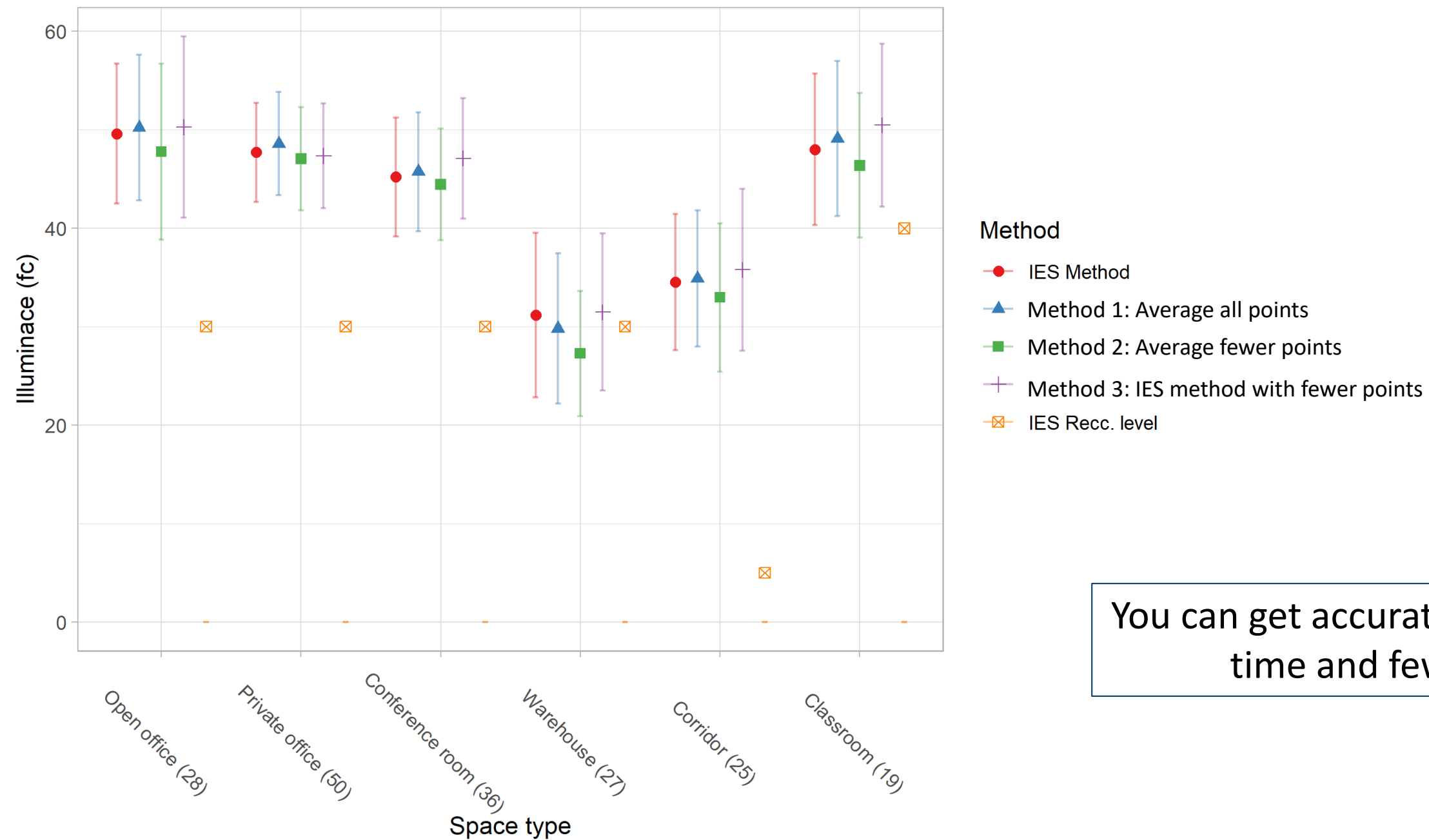
Field Study: Typical Savings

Building Type	Typical Electricity Savings (kWh/ft ²)	Typical Peak Demand Savings (W/ft ²)
Office	1.03	0.23
Education	0.46	0.13
Manufacturing	0.14	0.03
Warehouse	0.17	0.04



Expedited Assessment

Expedited Assessment: Reduced Sampling



You can get accurate results with less time and fewer points!

Numbers in parentheses by x axis labels indicate sample size.

Expedited Assessment: Photometric Analysis

Space Type	Fixture Type	Measured Illuminance (fc)	Modeled Illuminance (fc)	% Difference
Open Office	Whole Fixture	34.2	35.4	3.5%
Open Office	Tubular LED	32.0	31.1	2.8%
Private Office	Whole Fixture	63.7	66.2	3.9%
Private Office	Tubular LED	86.5	84.1	2.8%
Warehouse	Whole Fixture	64.2	59.0	8.1%
Warehouse	Tubular LED	35.6	35.3	0.85%
Warehouse	Tubular LED	18.1	17.9	1.1%
Warehouse	Tubular LED	26.9	25.8	4.1%
Classroom	Whole Fixture	57.5	53.0	7.8%
Classroom	Tubular LED	55.0	59.9	8.9%



Conclusions and Recommendations

Conclusions: Program Savings Estimates

Building Type	Estimated electricity savings (MWh)	Annual dollar savings (\$)	Avoided GHG emissions (tCO2 eq.)
Office	95,520	\$10,354,346	86,827
Education	45,433	\$4,924,901	41,298
Manufacturing	9,183	\$995,481	8,348
Warehouse	16,805	\$1,821,677	15,276
Total	166,941	\$18,096,405	151,749

Conclusions: Cost Effectiveness

Space Type	Cost Savings (\$/ft ²)	Simple Payback (yr)	Simple Payback (yr)
		New Construction	Existing
Office	\$0.121	0.5	0.9
Conference	\$0.090	0.6	1.3
Warehouse	\$0.005	10.7	21.4
Corridor	\$0.177	0.3	0.6
Classroom	\$0.036	1.6	3.1

Conclusions: Occupant Comfort

Task tuning should be conducted with occupant feedback in order to balance energy savings with visual comfort





Conclusions: Program Approaches

Strategy	Description	Incentive Approaches
1 - Prescriptive lighting program enhancements		
2 - Task tuning of previously-installed dimmable LED lighting		
3 - Advanced lighting incentives		

Conclusions: Program Approaches

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	De-lamping incentives	\$/unit
	Incentive bonus for including task tuning in the lighting retrofit project scope	\$/ft ²
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	Stand-alone initiative to revisit buildings that have installed dimmable LEDs + controls; measure light levels and tune to IES recommendations	\$/ft ²
3 - Advanced lighting incentives		

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	Stand-alone initiative to revisit buildings that have installed dimmable LEDs + controls; measure light levels and tune to IES recommendations	\$/ft ²
3 - Advanced lighting incentives	Incentives for installation of Networked Lighting Controls (NLC), luminaire-level lighting controls (LLLC), design assistance, commissioning	\$/ft ² \$/unit \$/kWh

Questions?

Improve your commercial light levels and save on cost



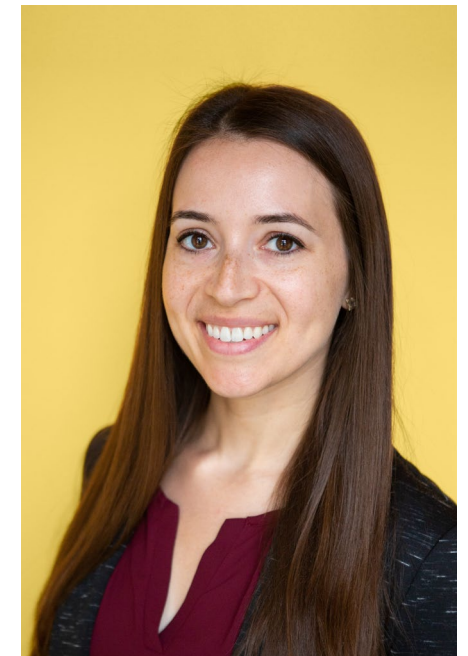
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Send us your questions using GoToWebinar Q&A box

CARD Project Resources

Industries & Agencies

Energy

Solar Industry

Wind Industry

Bioenergy Industry

Energy Environmental Review & Analysis

Energy Efficiency

Distributed Energy Resources

Financial Assistance

Technical Assistance

Commercialization Assistance

Utilities

Annual Reporting

Utility Resources & Rates

Conservation Improvement Programs

Planning & Policy Guidance

Technical Reference Manual

Applied Research & Development

Fact Sheets, Guides & Tools

CARD Program Webinars

Projects & Rates

Service Providers

Financial Institutions

Insurance

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Securities, Franchises & Subdivided Lands

Fuel

Scales & Meters

Applied Research and Development

Funds projects to identify new technologies or strategies to maximize energy savings, improve the effectiveness of energy conservation programs, or document the carbon dioxide reductions from energy conservation projects.

Background

The Next Generation Energy Act of 2007 (the Act) established energy conservation as a primary resource for meeting Minnesota's energy needs while reducing greenhouse gases and other harmful emissions. The Act also established a savings goal of 1.5 percent of annual retail electricity and natural gas sales for all utilities in the state. The utilities may reach this annual goal directly through its utility Conservation Improvement Program (CIP) and, indirectly, through energy codes, appliance standards, behavioral and other market transformation programs.

To help utilities reach their energy savings goal, the Act authorizes the commissioner to assess utilities \$3,600,000 annually for grants for applied research and development projects:

- \$2,600,000 for the Conservation Applied Research and Development (CARD) program through which Commerce awards grants in a competitive Request for Proposal (RFP) process.
- \$500,000 for the Center for Sustainable Building Research to coordinate activities related to Sustainable Building 2030 (SB2030)
- \$500,000 for the Clean Energy Resources Teams (CERTs) for community energy technical assistance and outreach.

Project Info

Stakeholder Info

Grantee Info

CARD Project Information

CARD projects quantify the savings, cost-effectiveness and field performance of advanced technologies; characterize market potential of products and technologies in the State; and investigate and pilot innovative program strategies. Completed CARD projects provide utilities with informative and timely information to enhance energy efficiency program designs within their CIP portfolios.

To learn about specific CARD projects and project results you can:

- Use our CARD Grant Search tool to see a list of all CARD projects or to find the most relevant CARD projects and final reports for your applications(s).
- Go to our CARD Webinars page to view a webinar on the results of a completed CARD project or program event.

RESOURCES

CARD search

CARD Webinars & Videos

Request for Proposals

Proposals & Evaluations

Fact Sheets, Guides & Tools

QUESTIONS?

For questions related to the CARD program, upcoming events, or if you'd like to provide feedback or suggestions, contact:

Department of Commerce

Mary Sue Lobenstein, R&D Program Administrator

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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



Thanks for Participating!

Upcoming CARD Webinars:

- **October 20** – Portable Dehumidification in MN Single-Family Homes (Center for Energy and Environment)
- **November 10** - Market Potential for Saving Energy and CO2 with Load Shifting Measures (Slipstream)
- **November 19** – Reconsidering Minnesota Cooling Loads (Center for Energy and Environment)

[Commerce Division of Energy Resources e-mail list sign-up](#)

If you have questions or feedback on the CARD program contact:

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651-539-1872



Location:

<https://app.keysurvey.com/f/41511019/113a/>