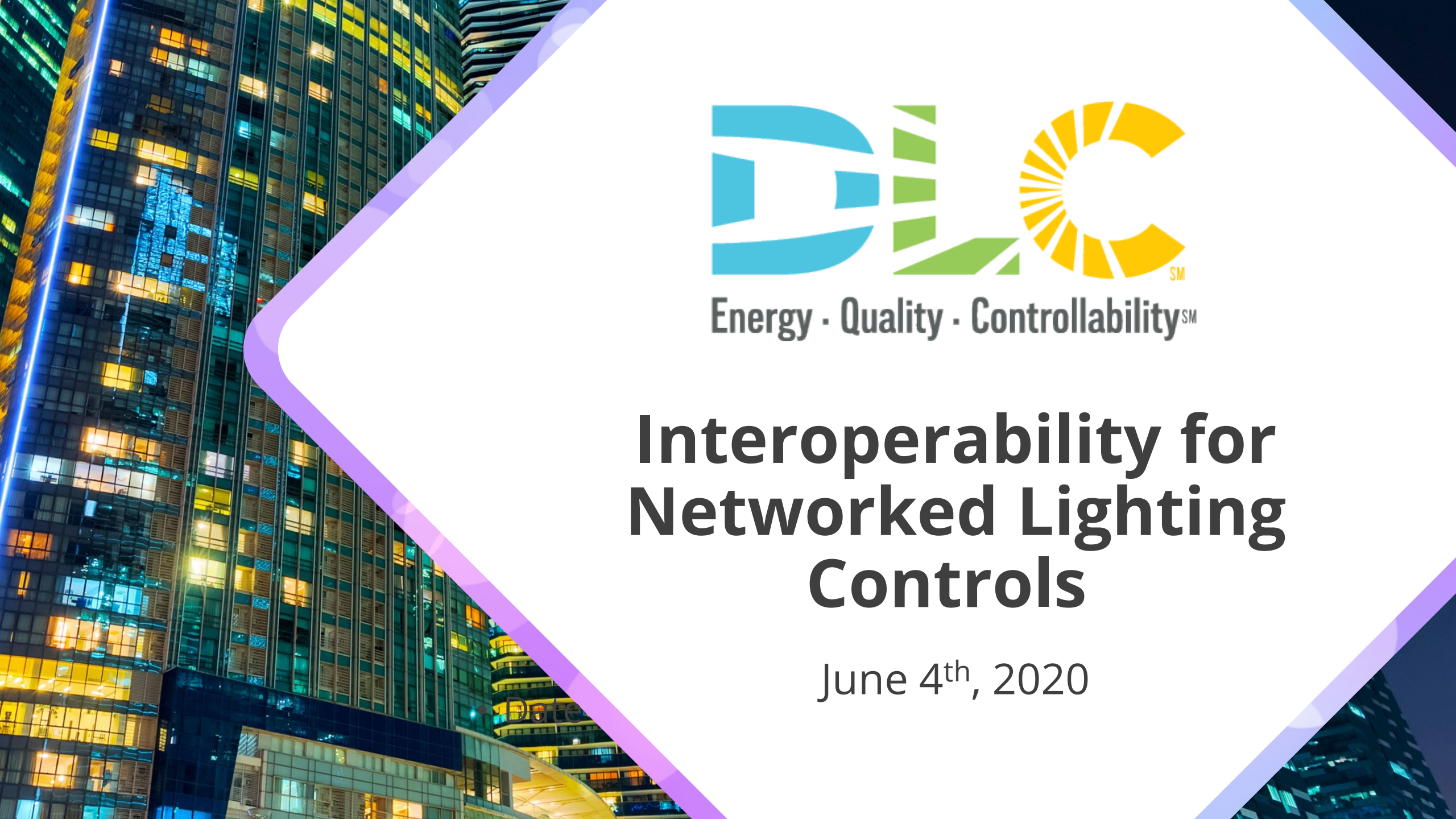

Energy · Quality · Controllability℠

Interoperability for Networked Lighting Controls

June 4th, 2020

• Date

DLC Vision for Interoperable NLC

- Enhanced market value 
- Energy efficient buildings 
- Comfortable occupants 
- Efficient facility operations 
- Market adoption and expansion 
- Saving more electricity 

Research Team & Presenters

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Agenda

- NLC interoperability introduction
- Research overview
- Use cases deep dive
- Bridging the gaps
- Looking ahead

Logistics

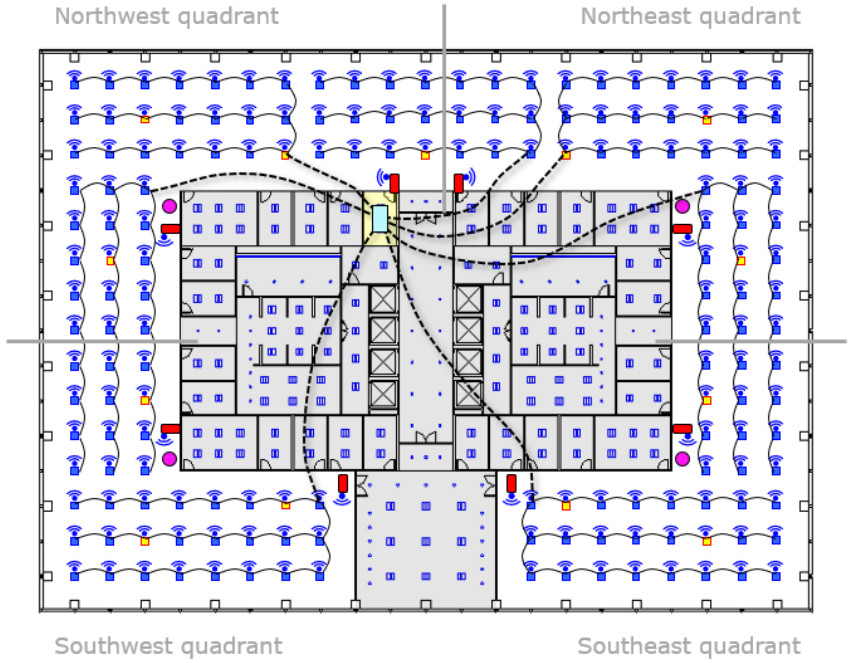
- Audience is muted
- Use the Questions pane for subject matter questions to the panelists
- Use the Comments pane for logistics and discussion

Interoperability

Intelligent Buildings

- Highly autonomous and “think” on their own
  - Efficient operation
  - Comfortable, productive environment for occupants
  - Contribute to modern electric grid
- Intelligence relies on “interoperability”
  - The ability to communicate and exchange actionable information across building systems

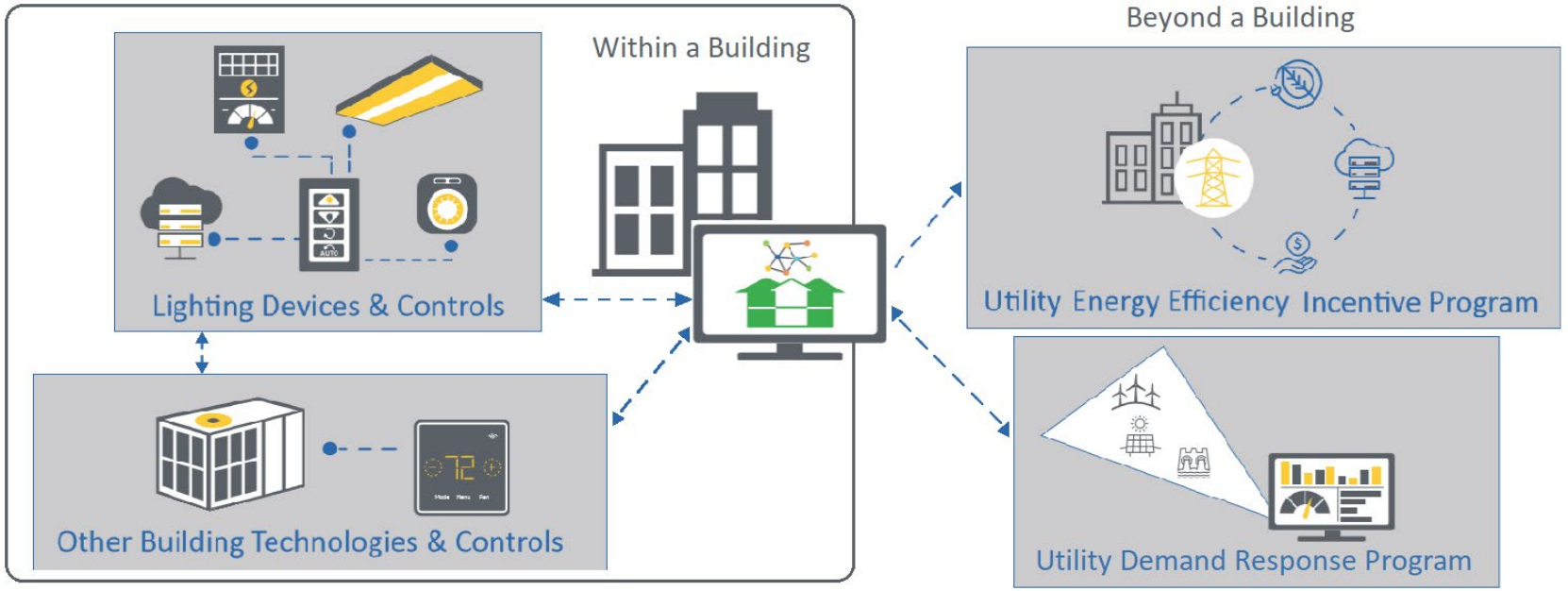
Ideal Sensor Placement:
Networks for Power & Communication



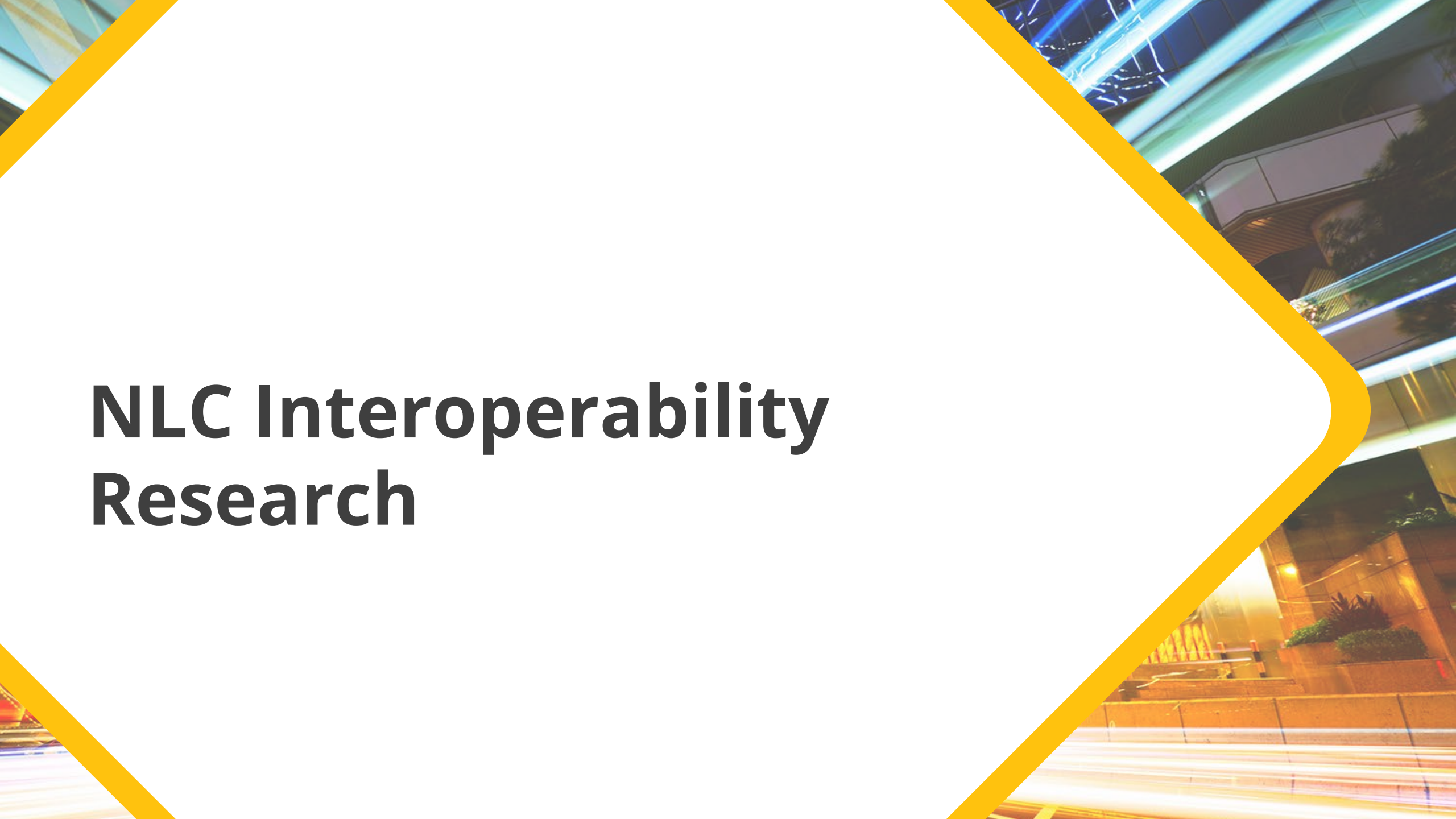
As the backbone for rich sensor data, interoperability provided by Network Lighting Controls (NLCs) plays an increasingly important role!

Interoperability Driven by “Use Cases”

- A series of interactions between an actor (NLC) and another actor
- Defined functionalities, data sets, and communication pathways
- To achieve a specific goal



NLC Interoperability Research



Research Objective

- Identify critical interoperability use cases
  - High stakeholder value
  - High energy savings, operational efficiencies, occupant satisfaction
  - Technologically feasible within the next 3 - 5 years
- Identify supportive interventions to advance the interoperability use cases
- Identify opportunities for DLC to accelerate the adoption of NLC interoperability

Research Methodology

Develop a catalog of interoperability use cases

- 32 specific use cases identified across all sectors

Identify qualitative metrics

- Market size
- Energy savings
- Cost savings
- Performance enhancement
- Technical feasibility

Conduct outreach for stakeholder priorities

- Interviews with industry experts
- Online survey

Assess and select the top 3 use cases

- External systems integration
- Demand response/ load shedding
- Energy monitoring

Deep dive into the 3 top use cases

DLC's Research Methodology Engaged All Key Stakeholders

End Users

Lighting Designers, Engineers & Architects

Contractors & Energy Consultants

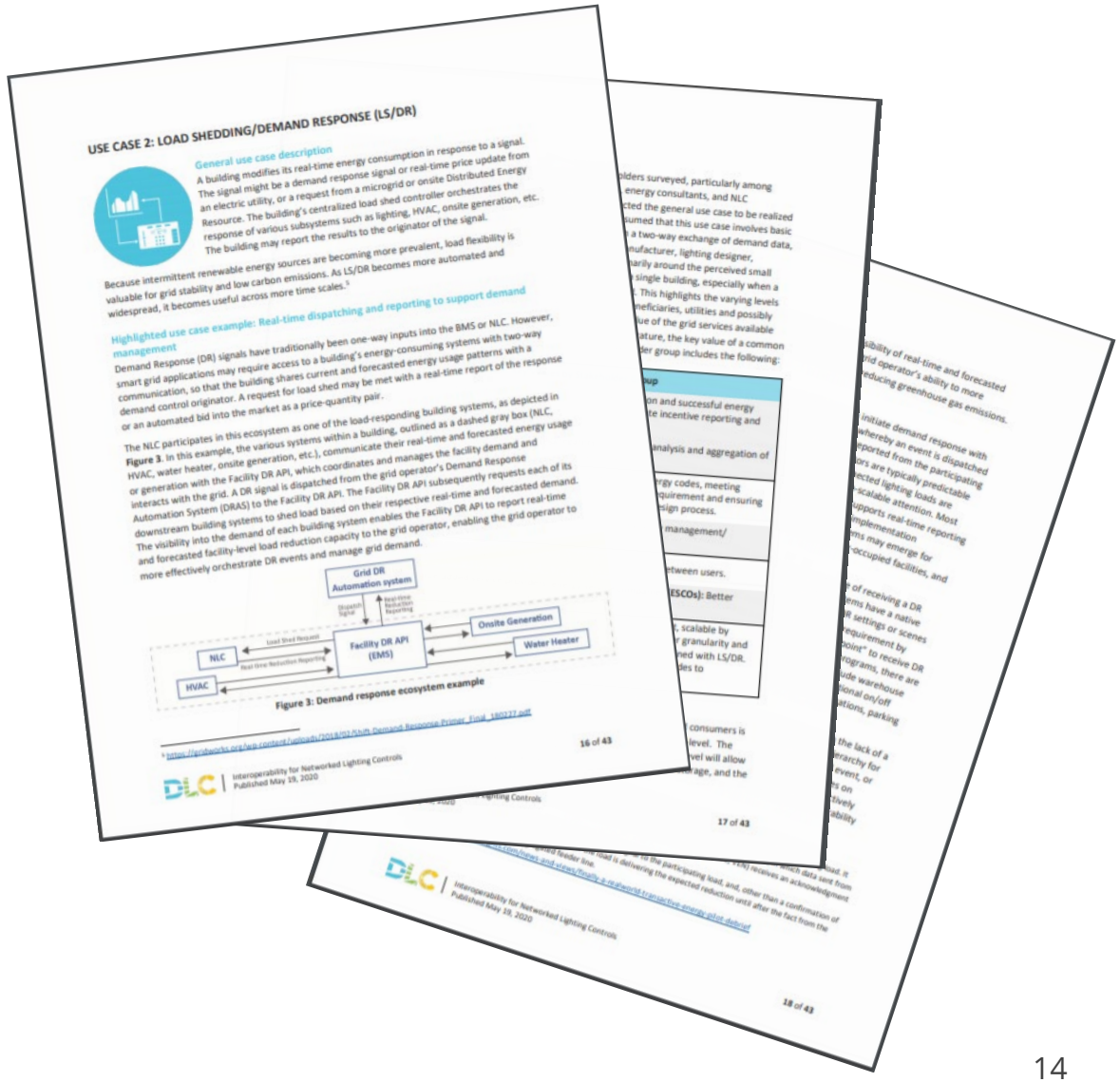
NLC Manufacturers

Integrators & Value Added Service Providers

Utilities

Research Report Discusses Use Cases in Great Detail

- General use case description
- Highlighted use case example
- Stakeholder value
- Energy savings potential
- Market status and barriers
- Technical feasibility and gaps
- Supportive interventions



Top 3 Use Cases

External Systems Integration

Demand Response/ Load Shedding

Energy Monitoring

External Systems Integration

Use Case #1

Data from NLC components, such as luminaires, sensors, and controllers, is made available through an Application Programming Interface (API) to be utilized by other building systems to improve their

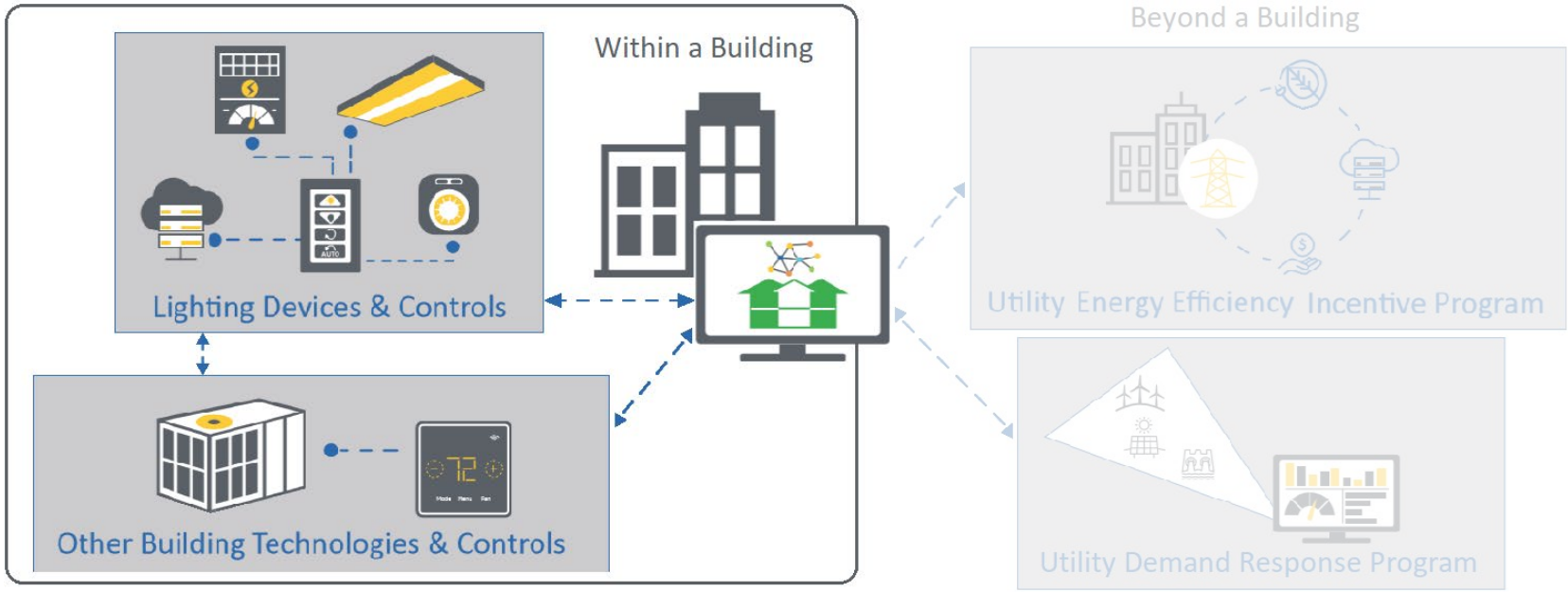
Example highlight:
Occupancy data from NLC to inform HVAC operation

Zone-level real-time occupancy status from NLC occupancy sensors is used by the BMS to control HVAC parameters, e.g. ventilation rate and thermostat reset.

The BMS may roll up the zonal data to inform system-level controls and operations, e.g. chilled/hot water temperature adjustment and chilled/hot water flow rate reset.

Primary value – Building operators will benefit from higher operational efficiencies, lowered equipment and installation costs, and deeper energy savings.

Interoperability Within a Building



Market Status & Barriers

- Current standard practice
  - Data from the lighting system is seldom shared with BMS or HVAC systems
  - Systems-dedicated sensors and devices with largely duplicative functionalities
- State of NLC support
  - 45% of the DLC listed NLCs provide zone-/luminaire-level occupancy status data through an API
- Market barriers & technical challenges
  - Lack of a consistent representation of occupancy status exposed through the API across NLCs
  - Lack of cross-system integration specification in consulting engineering designs

Leadership in Supportive Interventions

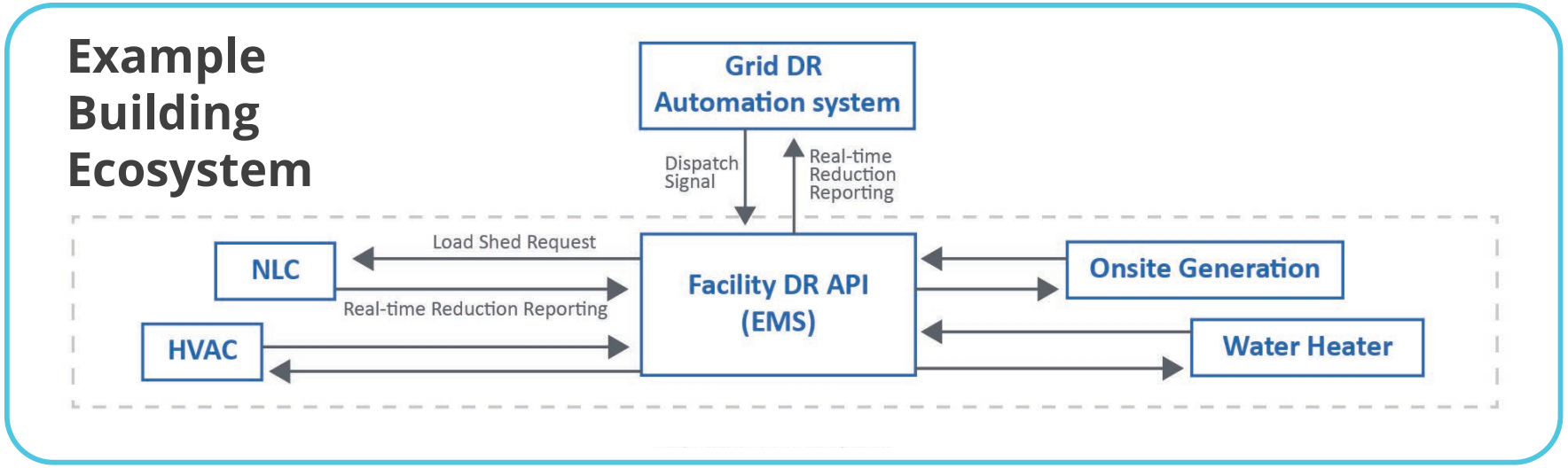
- Manufacturer
  - Provide public documentation of product integrations from two or more manufacturers
  - Include APIs as part of the NLC system purchase without restrictive terms and conditions
- Trade associations
  - Publish large-scale studies of energy and/or cost savings from integrations
  - Sponsor training and certification for specialists in lighting/HVAC/BMS integration
- Policy
  - Develop a standard for sharing occupancy status data through API
  - Specify integration of NLC/HVAC occupancy control as a pathway for building energy codes and green building programs

Load Shedding (LS)/ Demand Response (DR)

Use Case #2

Two-way communication between a lighting system or building and a grid operator, energy aggregator, distributed energy management system, or microgrid to facilitate grid services beyond peak load reduction.

The NLC assesses occupant needs and communicates its load flexibility at any point in time, receives grid requests or incentives, modifies its energy consumption to meet grid needs, and reporting the power demand and energy consumption impacts that result from its modifications.



Use Case #2 Example

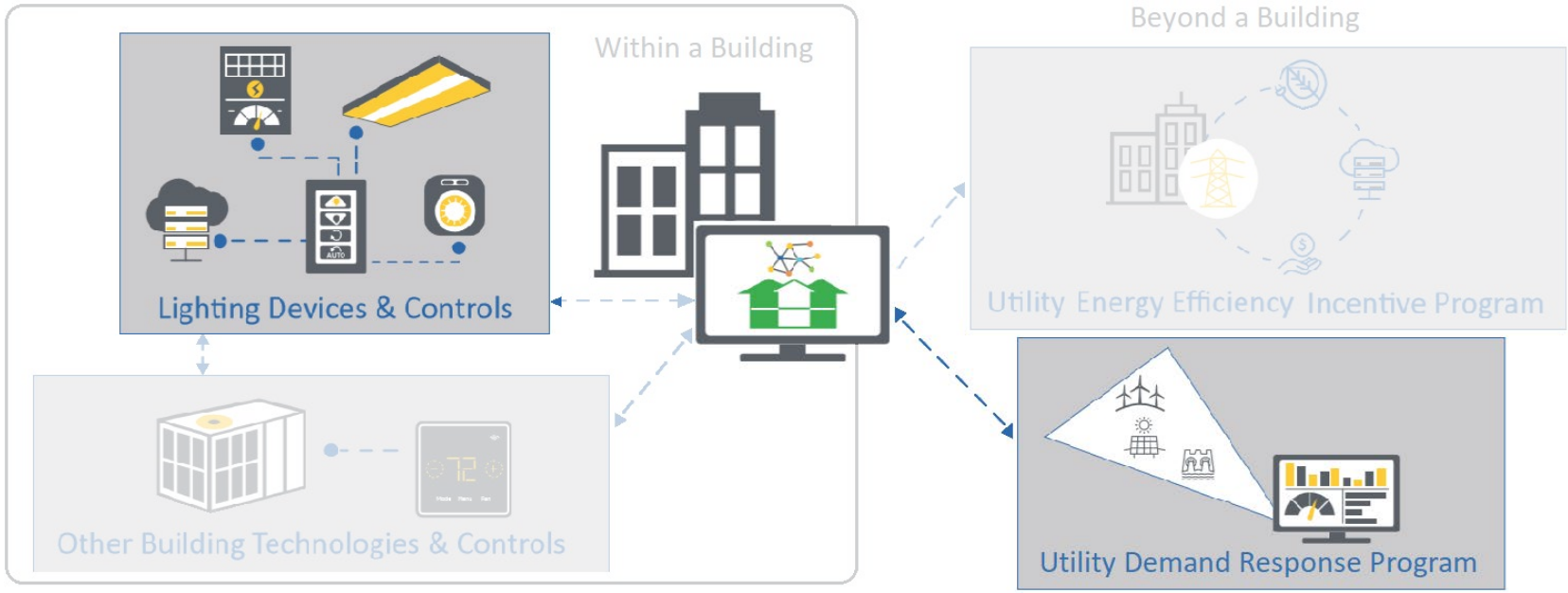
Example highlight:
Real-time dispatching and reporting

A grid service request is dispatched to the building Energy Management System (EMS) from the grid administrator for a load reduction estimate to which the building can commit. The EMS polls each subsystem, including the NLC, for the predicted load shed capacity at some future point in time, and responds back to the grid administrator.

During the actual dispatch event, the EMS continues to poll the real-time power demand and energy consumption from the end-use systems and reports the overall building performance to the grid administrator.

Primary value – Utilities (grid operators) can keep energy procurement cost low and return the savings to the customers as program participation incentives.

Interoperability Beyond a Building



Market Status & Barriers

- Current standard practice
  - Lighting loads rarely participate in DR events, and do so very modestly when they do, in order to facilitate utility direct control/dispatch while simultaneously managing the risk of not meeting occupant needs
  - Advanced DR protocols already support two-way communication but are not yet utilized in retail DR programs
- State of NLC support
  - 62% DLC listed NLCs can receive a DR dispatch signal
  - 15% DLC listed NLCs can report real-time power demand and energy consumption
- Market barriers & technical challenges
  - Lack of a well-established grid service ecosystem
  - Lack of well-defined and proven strategies for assessing occupant lighting needs and communicating load flexibility in varying future time frames

Leadership in Supportive Interventions

- Stakeholders
  - Manufacturers and energy scientists provide guidance for assessing and communicating lighting load flexibility in varying future time frames for specific lighting applications, building types, and prioritizations.
  - Lighting scientists and specifiers provide guidance for assessing and communicating occupant lighting needs in varying future time frames for specific lighting applications, building types, and prioritizations.
  - Utilities integrate energy efficiency and LS/DR programs and conduct pilot programs that utilize two-way LS/DR communication
- Trade associations
  - Develop training programs to for configuring NLC for LS/DR purposes
- Policy
  - Standardize NLC energy reporting accuracy and other requirements for LS/DR purposes
  - Standardize protocol and data model for communicating load flexibility and response across building systems

Energy Monitoring

Use Case #3

Lighting system energy data is reported by the NLC and shared with authorized entities over the Internet.

Example highlight:
Energy data reporting to a utility for incentive savings verification

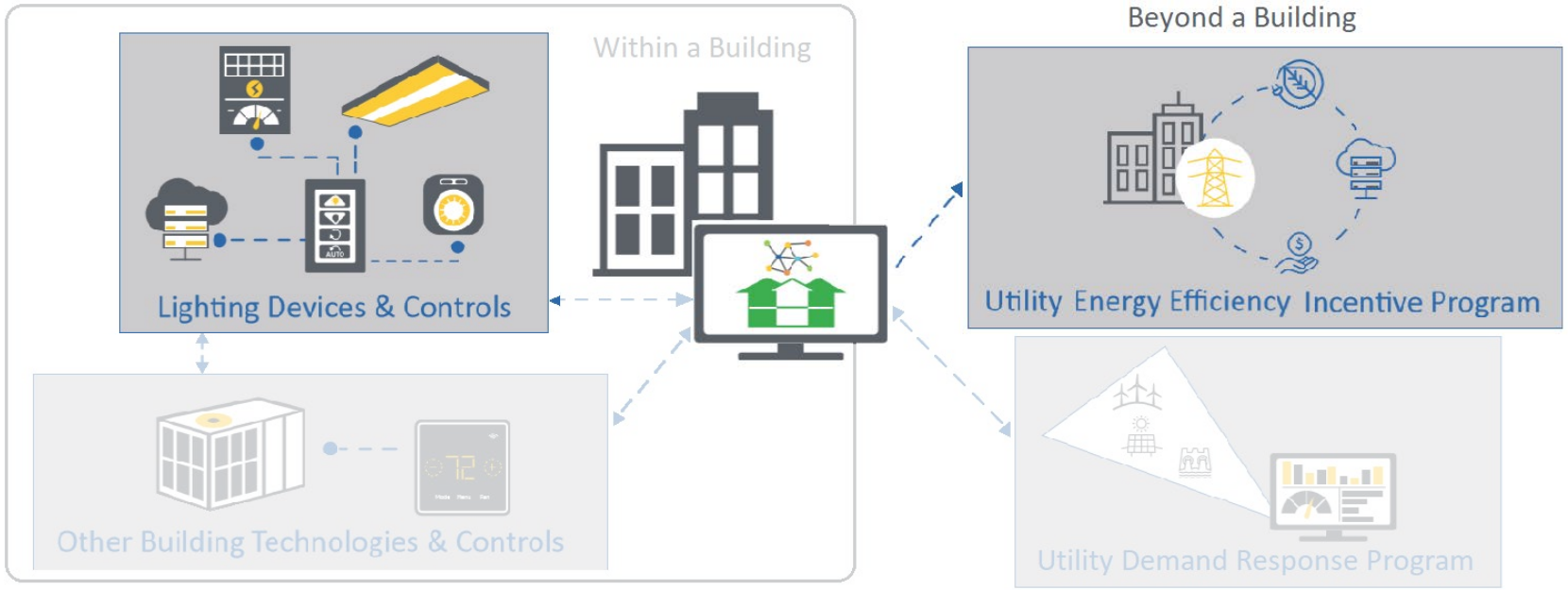
A utility's energy efficiency program requires the NLC to report system-level energy usage at a 15-minute interval in standard API format for the duration of one year.

The energy data is transmitted to the utility's repository over the Internet at a regular interval. The energy data from all program participants is used to verify:

1) energy performance of individual incentivized systems, and
2) program-level effectiveness and cost benefit.

Primary value – Utilities can claim more accurate program savings, streamline program implementation, and provide higher incentives to the customers.

Another Interoperability Beyond a Building



Energy Efficiency Programs Requiring NLC Energy Data

- AEP Ohio – Networked Lighting Controls Program
- ComEd – Networked Lighting System Incentives (page 6)
- Consumers Energy – Networked Lighting Controls Incentives (page 18)
- Focus on Energy – Networked Lighting Controls Offering
- Energy Trust – Whole Building and Path to Net Zero Offering

Market Status & Barriers

- Current standard practice
  - Several utility NLC programs require submissions of NLC energy data to verify savings
  - CSV export is the predominant method of extracting energy data from NLCs

- State of NLC support
  - 87% DLC listed NLCs support energy monitoring in various capacities
  - 21% DLC listed NLCs support API access to historical energy data

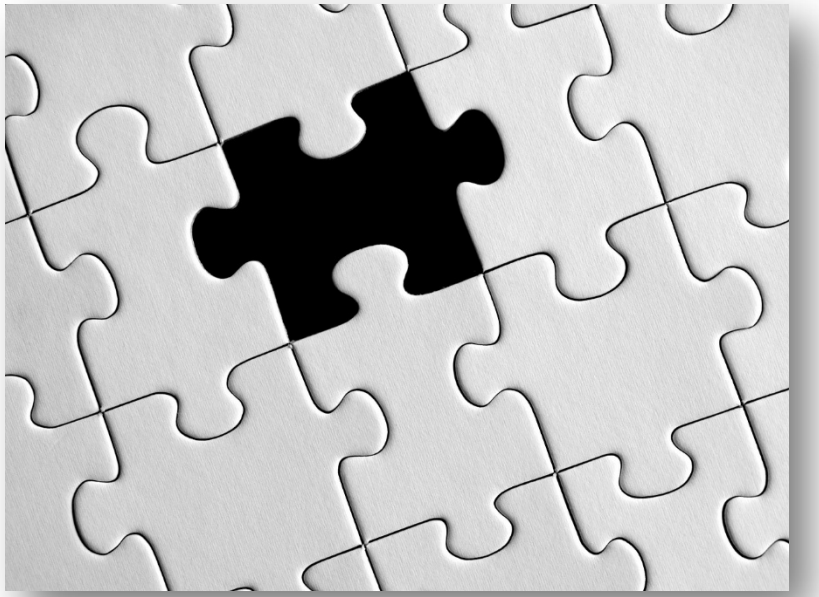
- Market barriers & technical challenges
  - Inconsistent data access and reporting format requirements
  - Lack of standard for automatic data intake mechanism and process

Leadership in Supportive Interventions

- Utilities
  - Define the energy data formatting and reporting requirements for energy efficiency programs, consumable by APIs
  - Establish an energy data repository and an automatic data intake process under energy efficiency programs
- Policy
  - Standardize data model for NLC energy reporting to utility efficiency programs
  - Develop test procedures for native NLC energy monitoring accuracy and application-specific accuracy recommendations

Bridging The Gaps

Overarching Gaps



- Data requirements
  - Data format and granularity not fully articulated for each interoperability use case
- Project development examples
  - Quantifying value to the stakeholders
  - Resolving conflicts amongst industry actors
  - Developing consensus-based data and interoperability standards
- Product development
  - Products and systems not designed with the foresight for interoperability, causing sharing data across systems and utilizing shared data a cost-prohibitive afterthought

Bridging the Gaps & Looking Ahead

- Stakeholder groups with the most to gain to assume leadership and drive the realization of the specific interoperability use case
- Create a virtuous cycle to realize the use cases
  - Sponsor demonstrations and case studies to quantify values and identify best practices
  - Result in policy-level impact for standardized implementations
- Realize the next high-impact use cases leveraging the virtuous cycle

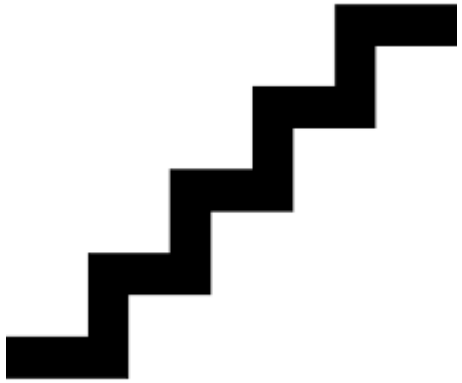
Specify Interoperability

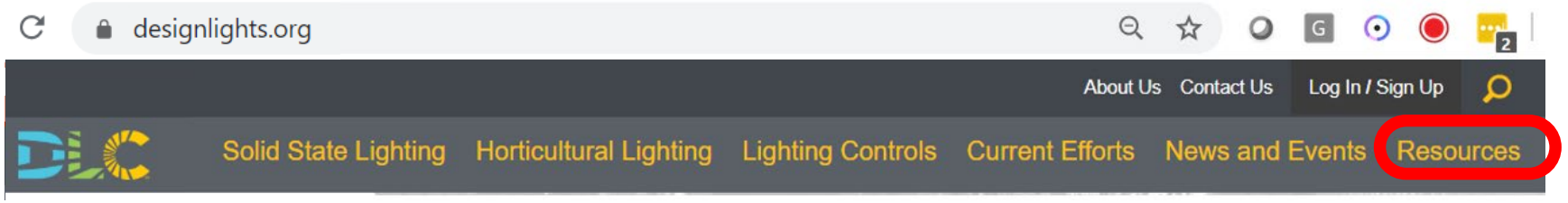
The report can help specify interoperability:

- Describe interoperability needs by use cases
- Capture the use cases following the same thought process described in the report
- Follow the examples provided in the report to analyze each use case and identify technical design criteria

Next Steps: Develop DLC's Role in Interoperability

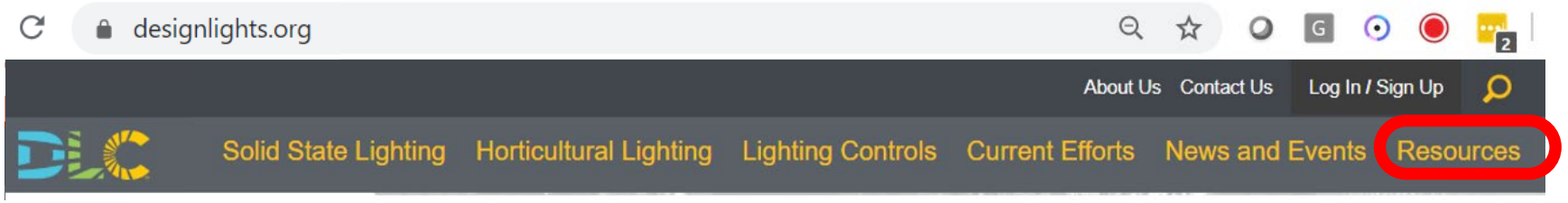
- Interoperability is essential to the DLC's mission
- Advancing the state of NLC interoperability
  - Multi-year plan for the DLC NLC Qualified Product List (QPL)
  - Work with DLC stakeholders to promote interoperability based on use case value





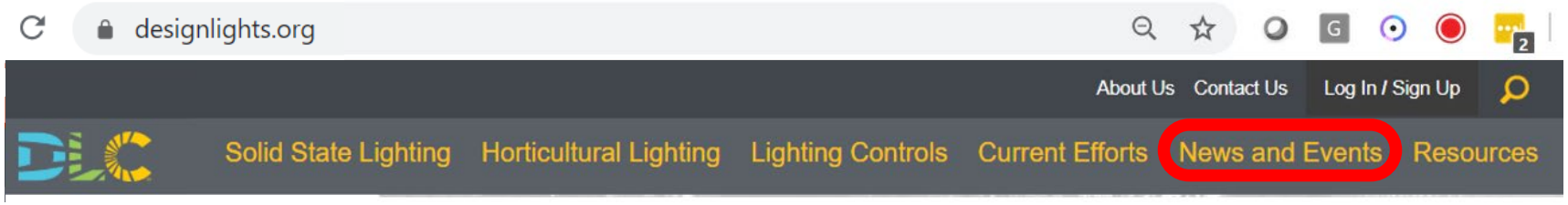
Resources Now

- Research Report – Interoperability for Networked Lighting Controls
  - https://www.designlights.org/lighting-controls/reports-tools-resources/interoperability-for-networked-lighting-controls/



Resources Soon in June

- Blog Post – Moving Closer towards Intelligent Buildings: Interoperable Networked Lighting Controls
  - https://blog.designlights.org/



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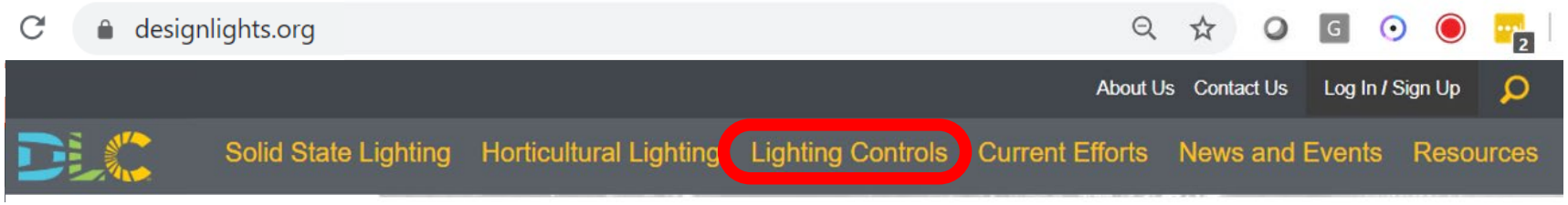

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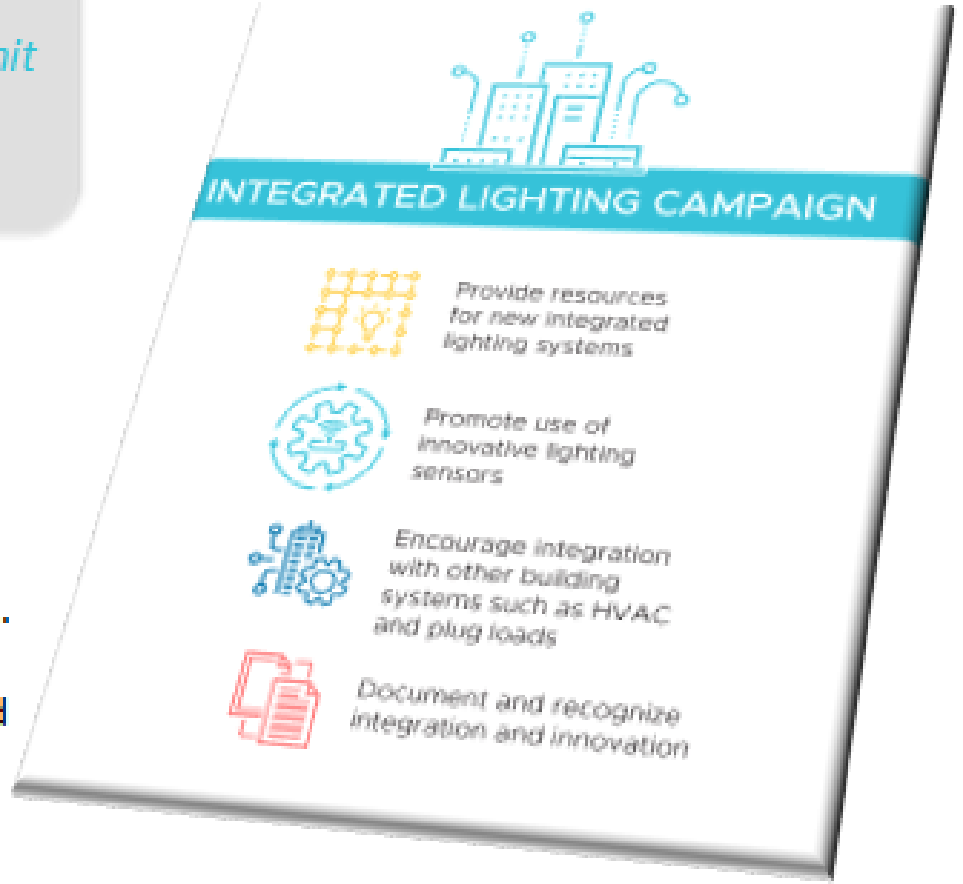
- This webinar
  - https://www.designlights.org/news-events/webinars/
- DLC NLC Technical Requirements
  - https://www.designlights.org/lighting-controls/qualify-a-system/technical-requirements/

Thank You to Our Co-Sponsor

Integrated Lighting Campaign (ILC)

to launch during the 2020 Better Buildings, Better Plants Summit
https://betterbuildingssolutioncenter.energy.gov/summit



- ✔ Simple and free to join
- ✔ Access and updates about valuable resources
- ✔ Recognition for innovative lighting installations

Supporters promote the ILC to their customers. Their feedback about customer's needs regarding lighting system integration is welcomed as the campaign develops resources to further increase lighting integration.

Participants gain recognition for innovative projects. There is also limited technical assistance for planning, analyzing, or implementing integrated lighting systems.

Workshop about the ILC at the Summit on June 10th -
The Next Frontier in Lighting: Get Connected with the Integrated Lighting Campaign
https://betterbuildingssolutioncenter.energy.gov/summit/2020-sessions#Wednesday

GSA · Better Buildings · DLC · NALMCO · Illuminating Engineering Society · LCA Lighting Controls Association · IFMA

The DLC is a non-profit organization whose mission is to achieve energy optimization by enabling interconnected solutions with a focus on quality for people and the environment.

https://www.designlights.org/