Energy · Quality · Controllability℠

NLC Technical Requirements Version NLC5, Final Release

July 2, 2020

Date

Today's Team

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Webinar Logistics

- Slides and recorded webinar will be posted to www.designlights.org after presentation (News and Events / DLC Webinars)
- All attendees on mute; Please use GoToWebinar Interface (Question pane) to submit questions as we go
- DLC will answer simpler questions at the end, as time permits; and follow-up directly with attendees with any unanswered questions
- If you experience any technical issues, use Chat feature to let us know

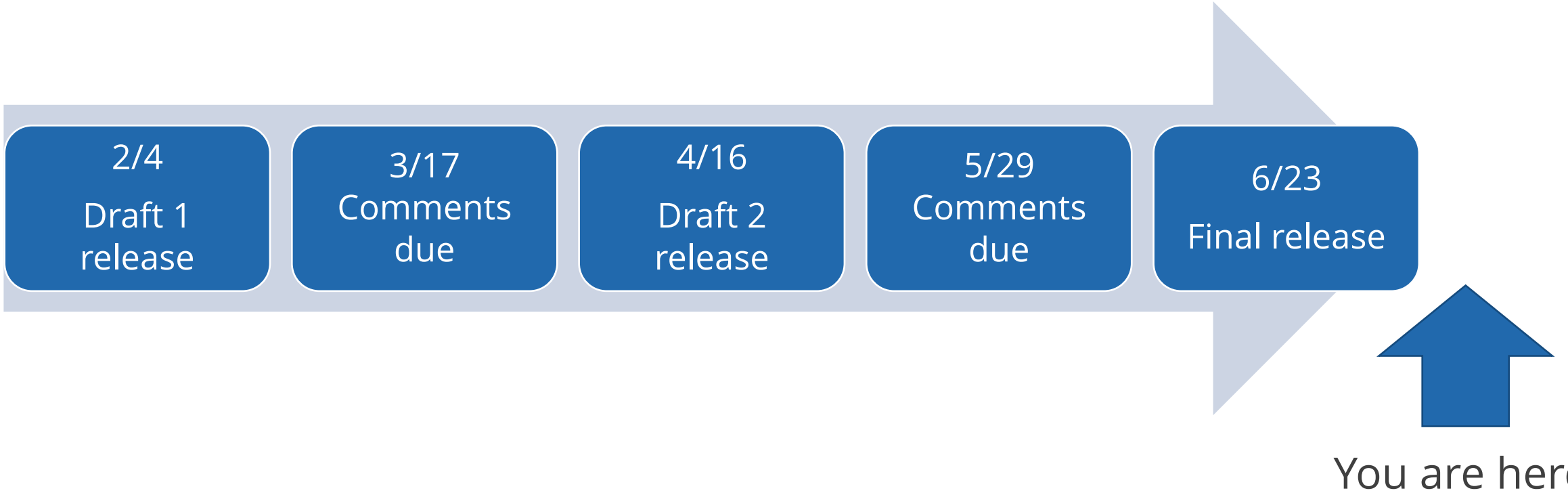
Agenda

- Introduction
- Interoperability
- Cybersecurity
- Misc.

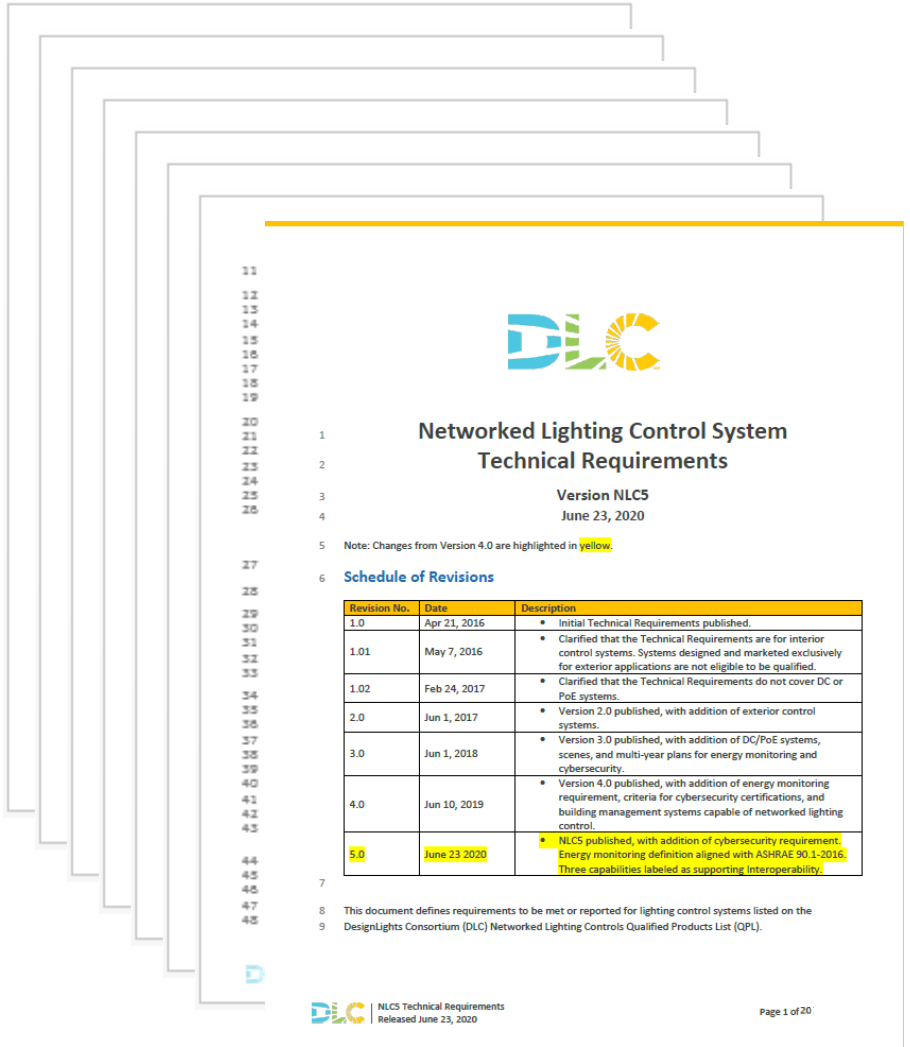
NLC Technical Requirement Evolution

June release	Version	Main Topics
2016	1	Initial release for interior applications
2017	2	Add exterior applications
2018	3	Add DC/PoE; and multi-year plans for energy monitoring and cybersecurity
2019	4	Require energy monitoring, and define cybersecurity
2020	5	Introduce interoperability which includes energy monitoring; and require cybersecurity

Timeline for NLC5 Release



Changes from Version 4.0 are highlighted in yellow.



Networked Lighting Control System Technical Requirements

Version NLC5
June 23, 2020

Note: Changes from Version 4.0 are highlighted in yellow.

Schedule of Revisions

Revision No.	Date	Description
1.0	Apr 21, 2016	• Initial Technical Requirements published.
1.01	May 7, 2016	• Clarified that the Technical Requirements are for interior control systems. Systems designed and marketed exclusively for exterior applications are not eligible to be qualified.
1.02	Feb 24, 2017	• Clarified that the Technical Requirements do not cover DC or PoE systems.
2.0	Jun 1, 2017	• Version 2.0 published, with addition of exterior control systems.
3.0	Jun 1, 2018	• Version 3.0 published, with addition of DC/PoE systems, scenes, and multi-year plans for energy monitoring and cybersecurity.
4.0	Jun 10, 2019	• Version 4.0 published, with addition of energy monitoring requirement, criteria for cybersecurity certifications, and building management systems capable of networked lighting control.
5.0	June 23 2020	• NLC5 published, with addition of cybersecurity requirement. Energy monitoring definition aligned with ASHRAE 90.1-2016. Three capabilities labeled as supporting Interoperability.

This document defines requirements to be met or reported for lighting control systems listed on the DesignLights Consortium (DLC) Networked Lighting Controls Qualified Products List (QPL).

Lighting Controls

Search Results:

50

Results Per Page: 50

Search by model, brand name, or manufacturer

Customize Columns + Display As Tiles Sort By +

Download the QPL

Questions? Contact Us

Report Logo Misuse

FILTER RESULTS

Clear All Filters

- **Manufacturer** +
- **Technical Requirements Version Number** +
- **Ease of Implementation** +
- **System Scope and Application** +
- **Advanced Capabilities** +
- **User Interface** +
- **Integral Controls such as LLLC** +
- **Wired or Wireless Communication** +

Company	System	Product Scope	LLLC (Control + 2 Sensors)	
Acuity Brands	Xpoint	Interior	true	Show
Acuity Brands	Atrius Dimming	Interior	false	Show
Acuity Brands	nLight Air	Exterior	true	Show
Acuity Brands	nLight Air	Interior	true	Show
Acuity Brands	nLight	Interior	true	Show
Acuity Brands	nLight	Interior	true	Show
Amatis Controls	Amatis Controls	Interior	false	Show
Autani, LLC	Energy Center	Interior	true	Show
Autani, LLC	Energy Center	Exterior	false	Show
Avi-on Labs, Inc.	Avi-on Lighting Control Platform	Interior	false	Show
Cree Lighting	SmartCast	Interior	true	Show

NLC5 Focus Areas

Interoperability

- The capability of lighting and/or building systems or components to exchange actionable information
- Unlocks new energy savings by connecting different systems
- Includes External Systems Integration, LS/DR, Energy Monitoring

Cybersecurity

- The practice of defending networked systems and data from malicious attacks
- Critical for customer trust and adoption

Table 1: "Required" and "Reported" Capabilities for Interior Lighting Systems

'Required' Interior System Capabilities	'Reported' Interior System Capabilities
Networking of Luminaires and Devices	Control Persistence
Occupancy Sensing	Scheduling
Daylight Harvesting/Photocell Control	Device Monitoring/Remote Diagnostics
High-End Trim	Type of User Interface
Zoning	Luminaire Level Lighting Control (LLLC, integrated)
Individual Addressability	Personal Control
Continuous Dimming	Plug Load Control
Cybersecurity	Emergency Lighting
	Color Changing/Tuning
	Ease of Implementation
	Scene Control

Table 1.1: Interior Lighting System Capabilities Focused on Interoperability

'Required' Interior System Capabilities	'Reported' Interior System Capabilities
Energy Monitoring (except room-based systems)	Energy Monitoring (room-based systems)
	Load Shedding/Demand Response
	External Systems Integration

Table 2: "Required" and "Reported" Capabilities for Exterior Lighting Systems

'Required' Exterior System Capabilities	'Reported' Exterior System Capabilities
Networking of Luminaires and Devices	Control Persistence
Occupancy Sensing AND/OR Traffic Sensing	Device Monitoring/Remote Diagnostics
Daylight Harvesting/Photocell Control	Type of User Interface
High-End Trim	Luminaire Level Lighting Control (LLLC, integrated)
Zoning	Emergency Lighting
Individual Addressability	Color Changing/Tuning
Continuous Dimming	Ease of Implementation
Scheduling	Scene Control
Cybersecurity	

Table 2.1: Exterior Lighting System Capabilities Focused on Interoperability

'Required' Exterior System Capabilities	'Reported' Exterior System Capabilities
Energy Monitoring	Load Shedding/Demand Response
	External Systems Integration

Pages 15-20

Table 3: Definitions of Capabilities and Requirements

Row	Capability	Definition
1	Networking of Luminaires and Devices	The capability of individual luminaires/lamps and control devices to exchange digital data with other luminaires/lamps and control devices on the system. This capability is required at the room, space, or area level, but not at the whole building level or beyond (e.g. non-lighting systems, or the internet).
2	Occupancy Sensing	The capability to affect the operation of lighting equipment based upon detecting the presence or absence of people in a space or exterior environment. Exterior systems must include either occupancy sensing or traffic sensing. They may include both, but that is not required.
•••		
23	Scenes	The capability of a system to provide two or more pre-programmed light level settings for a group or multiple groups of luminaires to suit multiple activities in a space, and allow for recall of these settings via a switch, control device, or signal from a BMS or API.

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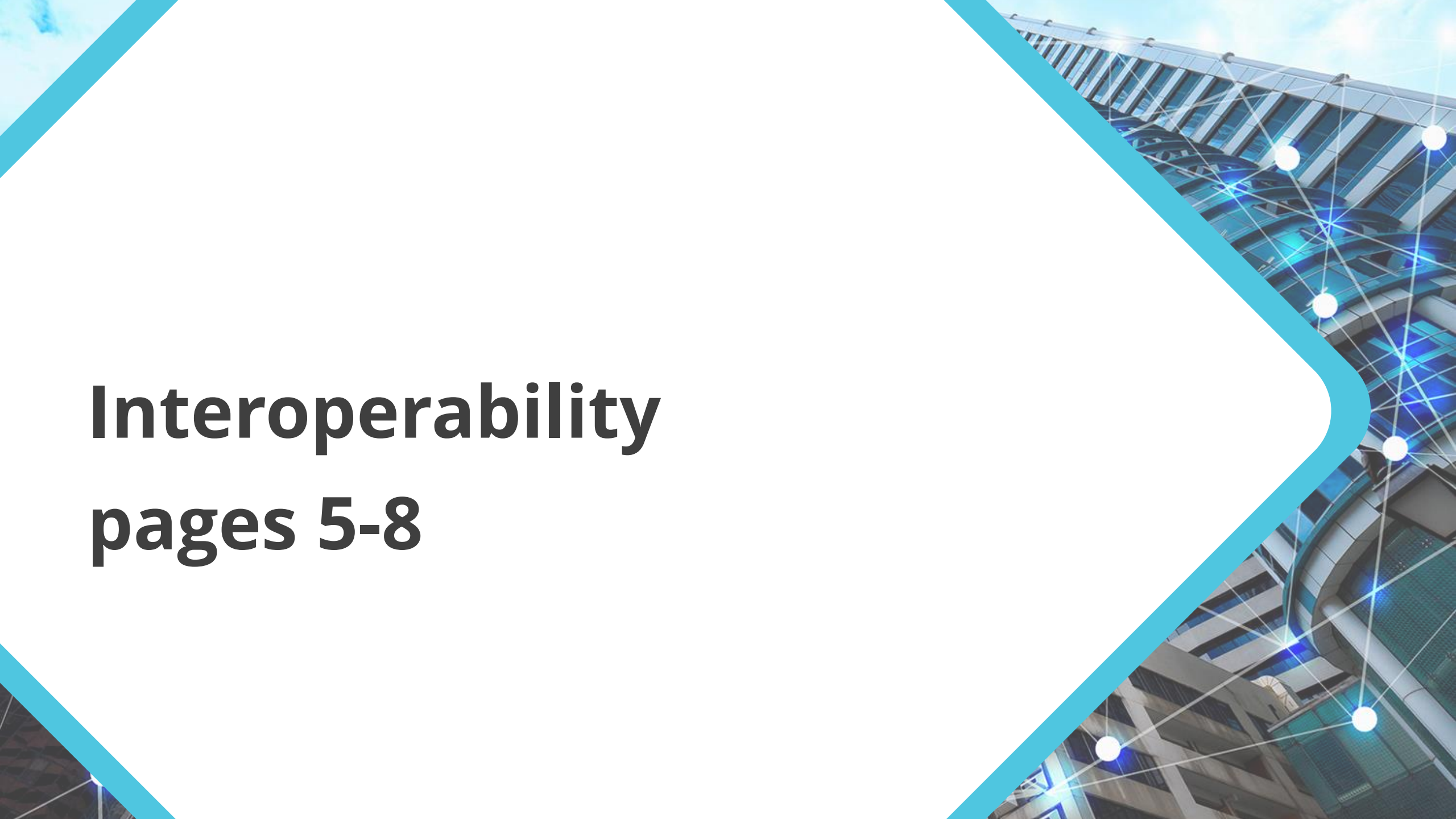
Interoperability

pages 5-8



DLC Vision for Interoperable NLC

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

Intelligent Buildings

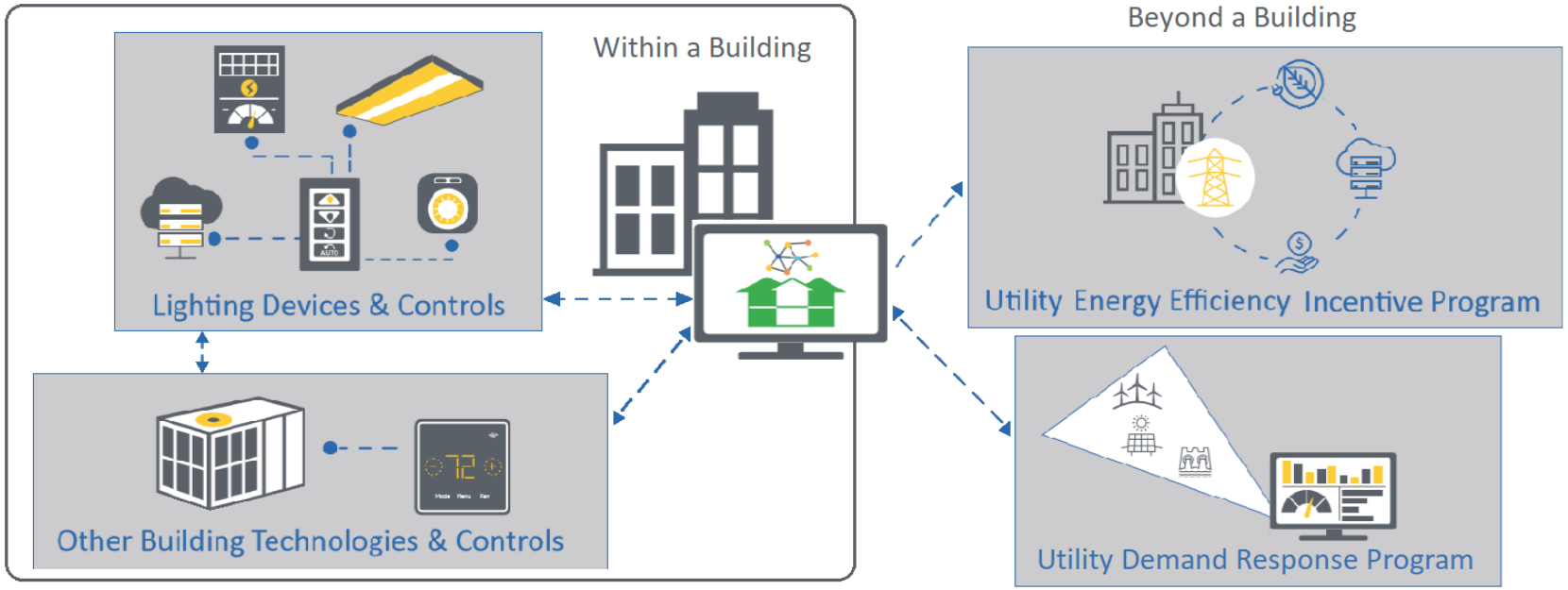
- Highly autonomous and “think” on their own
  - Efficient operation
  - Comfortable, productive environment for occupants
  - Contribute to modern electric grid
- Intelligence relies on “interoperability”
  - The ability to communicate and exchange actionable information across building systems

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



First 3 Use Cases

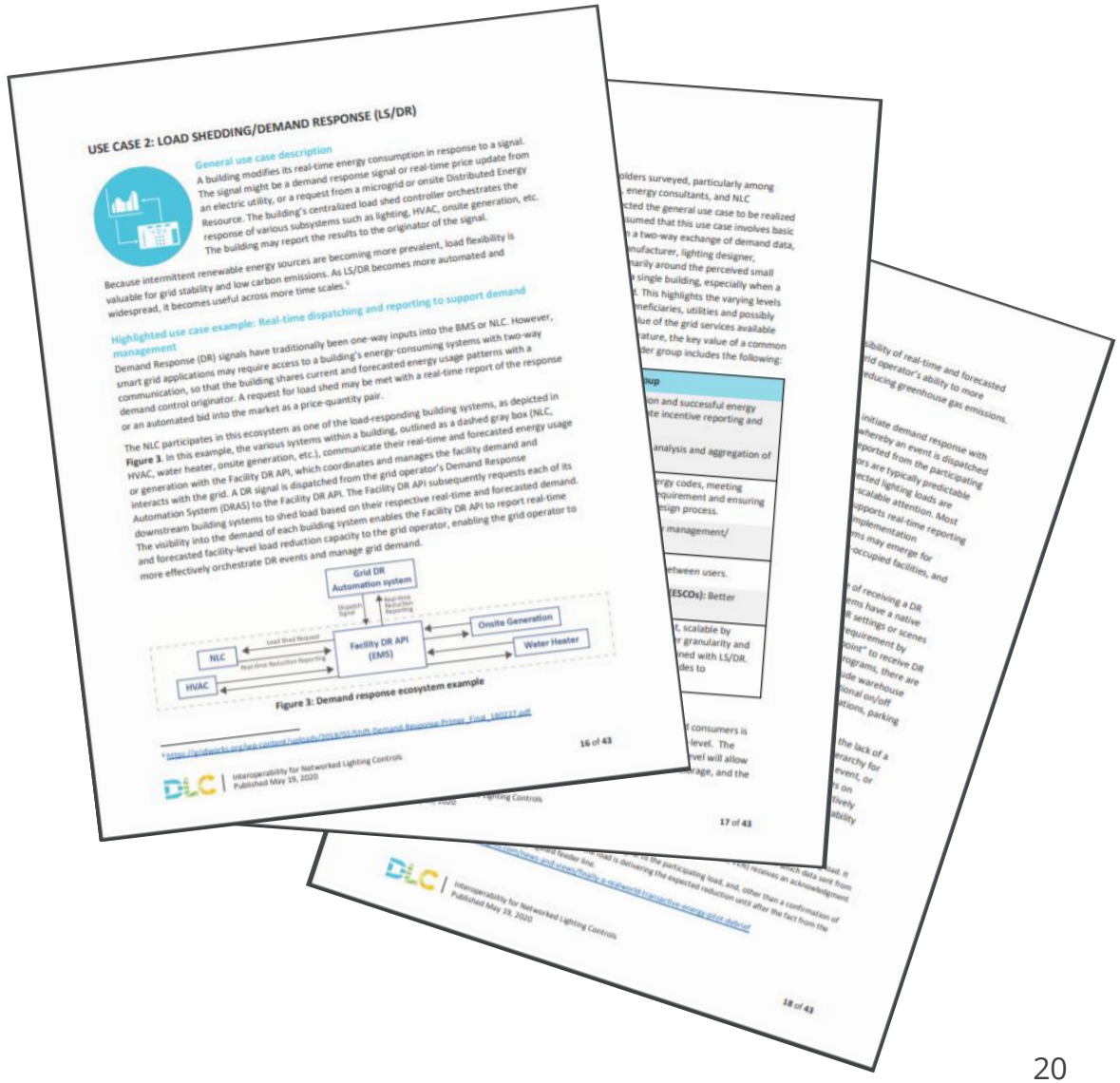
External Systems Integration

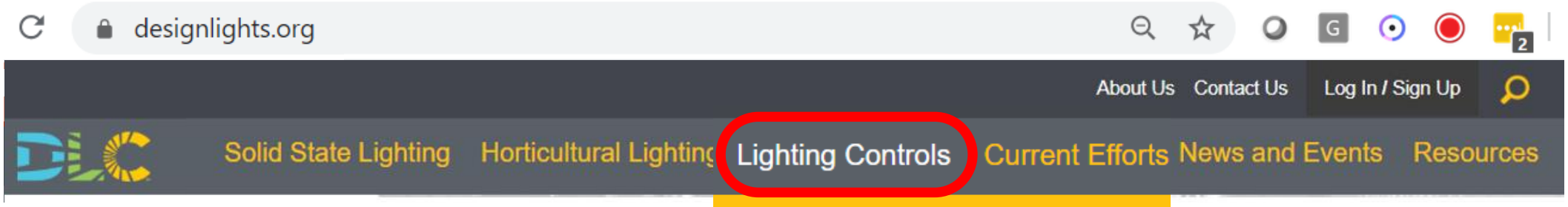
Load Shedding/ Demand Response

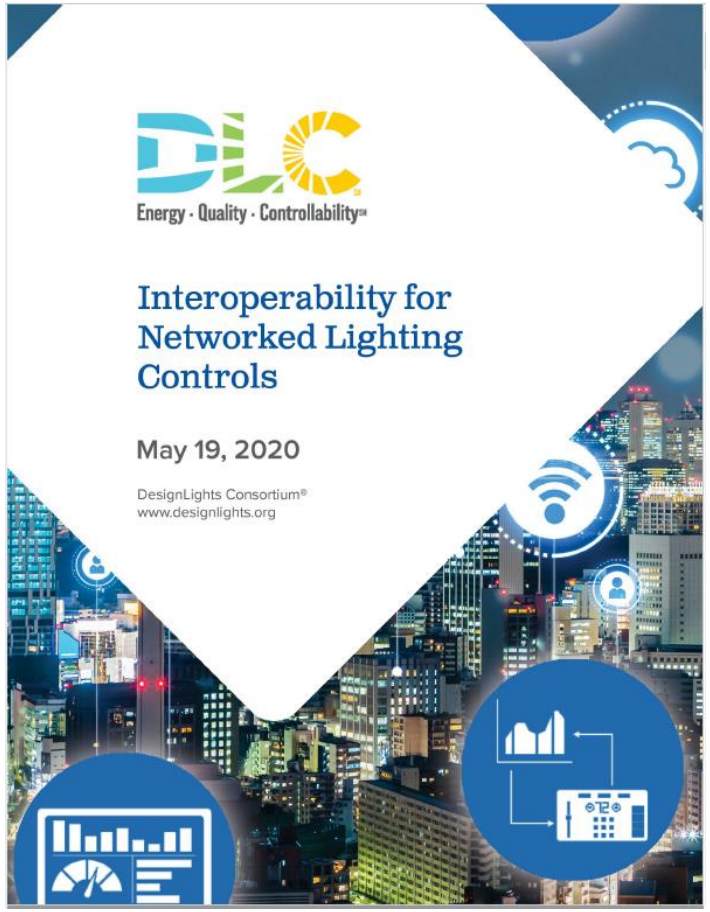
Energy Monitoring

Research Report Discusses Use Cases in Detail

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







https://www.designlights.org/lighting-controls/reports-tools-resources/interoperability-for-networked-lighting-controls/

With the financial support:

Natural Resources Canada

Ressources naturelles Canada

Canada

Main Interoperability Changes from NLC4

- Introduce Interoperability as an expansion of Energy Monitoring Plan
- Add Energy Reporting Tables EM-1 and EM-2 as recommendations
- Align EM with ASHRAE 90.1-2016 language
- Add optional Energy Reporting by room-based systems

Interoperability Changes for Final Release, details compared to Draft 2 of NLC5

- Create Tables 1.1 and 2.1
  - Clarify that 3 existing capabilities are now recognized as relevant to Interoperability
- Remove LS/DR Data Table
- For energy reports, recognize state change data as an alternative to 15-minute interval data
- Clarify Energy Reporting exception for room-based systems
- For External Systems Integration, recognize BMS in addition to API

Energy Monitoring Multi-Year Plan

June 2018 V3

- The Energy Monitoring type was **Reported**.

June 2019 V4

- Energy Monitoring Capability is **Required**
- Energy report .CSV and/or API
- Exception for room-based systems
- 1-year grace period

June 2020 V5

- Data requirements
  - 15-minute timestamped interval data, or state changes
  - Record retention ≥ 2 years
- Guidance for contents, Tables EM-1, EM-2

Reporting guidelines for Energy Monitoring (pp.7,8)

Table EM-1: Recommended Energy Data Reporting Guidelines for .CSV or API; Static Data

Row	Topic	Data Element	Definition	Note
1.1	Headings	For each field	Each type of data element is identified by a heading.	Text such as "Manufacturer", "Product", etc.
1.2	System	Manufacturer	The manufacturer of the NLC system	Text
1.3	System	Product	The name of the NLC system	Text
1.4	Site	Building/Business Type *[*Note A]*	The main business function in the portion of the building where the NLC system is installed	From ASHRAE 90.1-2016 Table 9.5.1
1.5	Baseline for NLC	Maximum Rated Power with no control strategy enabled	The maximum possible power consumption of the lighting system without any control strategy in effect. If a luminaire retrofit has occurred, this value is equal to the maximum rated power of the new luminaire(s). The spatial granularity matches the energy measurements. For instance, if energy is reported at each luminaire, then the baseline power is reported at each luminaire.	Separate data for interior vs. exterior. Units = kilowatts
1.6	Energy	Energy Reporting Interval *[*Note B]*	The frequency an energy measurement is reported (15 minutes or less)	Units = minutes
1.7	Energy	Data method	How is energy interval data calculated?	Text such as "15 minute average from 3 samples spaced 5 minutes apart"
1.8	Energy	Energy Data units	Energy data is in Wh or kWh?	Units = text such as "Wh" or "kWh"

Table EM-2: Recommended Energy Data Reporting Guidelines for .CSV or API; Dynamic Variables

Row	Topic	Data Element	Definition	Note
2.1	Headings	For each field	Each type of data element is identified by a heading.	Text such as "Unix Time", "Energy Data kWh", etc.
2.2	Energy	Timestamp	Date and time of each energy measurement	Unix time or RFC 3339 time
2.3	Energy	Energy Data	The actual energy readings that are recorded for each luminaire or group of luminaires	Units = kWh or Wh
2.4	Energy	Confidence Level	The percentage of all possible samples expected to include the true population parameter.	Units = %
2.5	Energy	Nominal Accuracy	% accuracy of the energy data *[*Note C]*	Text such as "+/-3% or 0.005 kWh, whichever is larger"
2.6	Energy	Recorded Period	Months of 15 minute interval data in this particular record	Units=months

Energy Monitoring definition updates in Table 3

11	Energy Monitoring	• The basic, "required" capability of energy monitoring is aligned with ASHRAE 90.1-2016 Section 8.4.3. as follows:
		  ○ Energy use by interior lighting (if applicable), exterior lighting (if applicable) and receptacle circuits (if monitored by the NLC) can be monitored independently.
		  ○ For buildings with tenants, the data for each tenant space can be reported to each tenant.
		  ○ The lighting system energy use can be recorded at least once every 15 minutes and reported at least hourly, daily, monthly, and annually, or recorded and reported upon state change.
		  ○ Energy use data can be transmitted to a building control system (if present) and graphically displayed.
		  ○ System shall be able to store data for at least 24 months.
		• Energy monitoring is "reported" for room-based systems, but not "required". In order for room-based systems to claim the optional energy monitoring capability:
		  ○ Energy data can be retrieved by a user in the room when required - hourly, daily, monthly or yearly; or on demand.
		  ○ Energy data can be retrieved in the form of a CSV file and/or API.
		• In order for a system to qualify for the room-based exemption, the DLC review process will confirm that the product claims only "Room or Zone" for interior scope as listed on the DLC QPL.

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

Cybersecurity pages 9-11

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

An Authentication Vulnerability Assessment of Connected Lighting Systems

March 2020

Michael Poplawski[1], Adam St. Lawrence[2], and Hung Ngo[1]

Pacific Northwest National Laboratory[1], Underwriters Laboratories[2]

https://www.energy.gov/eere/ssl/downloads/authentication-vulnerability-assessment-connected-lighting-systems

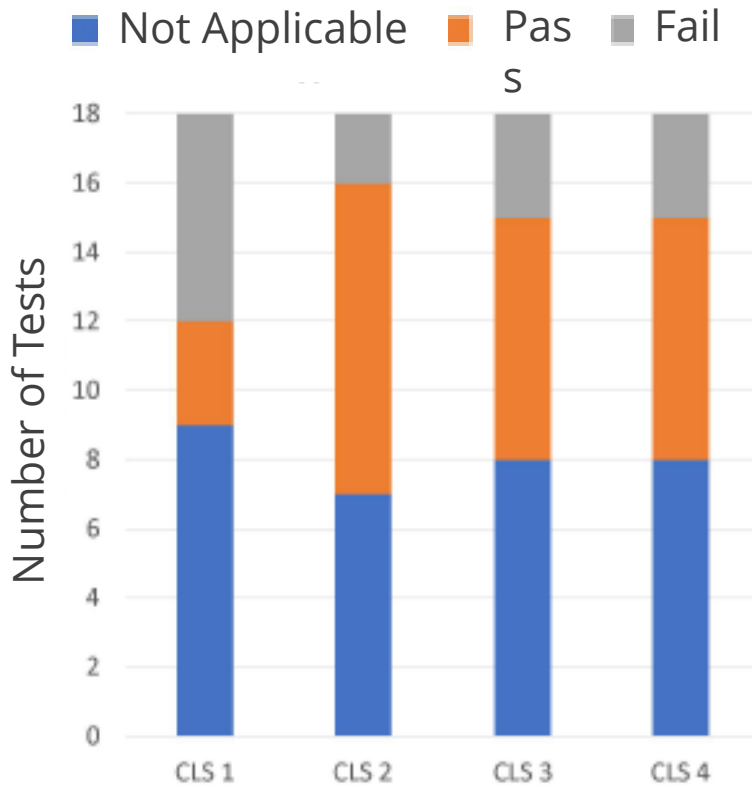


Figure 4. Authentication vulnerability testing results, by CLS.

DLC Cybersecurity Intent

What DLC wants to do:

- Ensure that listed Manufacturers have addressed cybersecurity in a formally recognized way
- Cite 3rd party standards or services
- Disclose those efforts for users of the QPL

What DLC wants to avoid:

- Claiming assurance or responsibility or liability for cybersecurity performance of listed systems

Cybersecurity Plan

June 2018 NLC-3

Any cybersecurity activity is reported.

June 2019 NLC-4

Establish criteria to qualify a set of cybersecurity standards.

Only products that comply with a qualified standard may declare the **optional** cybersecurity capability.

June 2020 NLC-5

Cybersecurity is **Required**. Products must comply with at least one standard or service that meets the DLC criteria, or be listed under NLC-4 in the grace period.

Delisting date: Feb 28, 2022

Cybersecurity is **Required**.

All products without cybersecurity are removed from the list on Feb 28, 2022.

Main Cybersecurity Changes from NLC4

- Cybersecurity is required for NLC5.
- Add Table CS-2: Cybersecurity Services Recognized by the DLC
- Add Table CS-3: Proof of Cybersecurity Standard Compliance

Cybersecurity Changes for Final Release, compared to Draft 2 of NLC5

- Add ioXt to Tables CS-1 and CS-3
- Update Table CS-3 details

Cybersecurity

- Goal: accept proprietary standard certifications, while maintaining quality

Criteria for acceptable cybersecurity standards:

The DLC recognizes the cybersecurity standards listed in Table CS-1 that meet criteria 1-3 below, and the cybersecurity services listed in Table CS-2 that meet criteria 2-3 below:

1. Certifiable with a methodology established through either:
    a. A voluntary consensus process such as ANSI, ISO, IEC, etc.
    b. A federal agency of the USA or Canada
    c. A collaborative multi-stakeholder engagement process such as the Cloud Security Alliance
2. Applies to one or more of the following:
    a. Product development process lifecycle
    b. Components/Embedded Devices
    c. System
    d. Cloud Services
3. Includes at least 3 of the following technical content, for (2. b, c, d) above:
    a. Penetration testing
    b. Communication robustness testing
    c. Vulnerability identification testing
    d. Multiple levels of security

Cybersecurity Tables, page 11

Table CS-1: Cybersecurity Standards Recognized by the DLC

Standard	Process	Components/ Embedded Devices	System	Cloud Services
ANSI/UL 2900-1	y	y		
ANSI/ISA/IEC 62443	62443-4-1	62443-4-2	62443-3-3	
SOC 2	y		y	y
ISO 27001	y			
ISO 27017 (with 27001)				y
FedRAMP				y
CSA STAR				y
ioXt		y	y	y

Table CS-2: Cybersecurity Services Recognized by the DLC

Service	Proof of Compliance
UL IoT Security Rating (UL 1376)	Copy of certificate or letter from UL
CSA Cybersecurity Verification Program (CVP) (CSA T200)	Copy of certificate or letter from CSA
Intertek Cyber Assured	Copy of certificate or letter from Intertek

Table CS-3: Proof of Cybersecurity Standard Compliance

Renewal is required at least every 3 years in order for a certificate to remain valid.

Standard	Proof of Compliance
ANSI/UL 2900-1	Certification claim listed on applicant's website, plus a compliance letter or copy of certificate issued by an accredited certification body.
IEC 62443	ISASecure registry of a component, system, or Certified Development Organization at https://www.isasecure.org/en-US/End-Users/ or Copy of IECEE certificate, or listed at https://certificates.iecee.org/ods/cb_hm.xsp or Copy of certificate from other accredited agency, such as UL, VDE, DEKRA, etc.
SOC 2	Certification claim listed on applicant's website, plus a compliance letter from 3rd party auditor.
ISO 27001	Copy of an accredited certification from a member of the ANSI-ASQ National Accreditation Board as listed at http://anabdirectory.remoteauditor.com/
ISO 27017 (with 27001)	Copy of an accredited certification from a member of the ANSI-ASQ National Accreditation Board as listed at http://anabdirectory.remoteauditor.com/
FedRAMP	"Authorized" at https://marketplace.fedramp.gov/#/products?status=Compliant;FedRAMP%20Ready&sort=productName
CSA STAR	"Certification" or "Attestation" at https://cloudsecurityalliance.org/star/registry/
ioXt	Copy of ioXt certificate or letter from accredited testing organization or certified at https://compliance.ioxtalliance.org/products

Cybersecurity Tables, page 11

265 **Table CS-1: Cybersecurity Standards Recognized by the DLC**

Standard	Process	Components/ Embedded Devices	System	Cloud Services
ANSI/UL 2900-1	y	y		
ANSI/ISA/IEC 62443	62443-4-1	62443-4-2	62443-3-3	
SOC 2	y		y	
ISO 27001	y			
ISO 27017 (with 27001)				
FedRAMP				
CSA STAR				
ioXt				

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267 **Table CS-2: Cybersecurity Services Recognize**

Service	Proof of
UL IoT Security Rating (UL 1376)	Copy of ce
CSA Cybersecurity Verification Program (CVP) (CSA T200)	Copy of certi rom CSA
Intertek Cyber Assured	Copy of certificate or letter from Intertek

269 **Table CS-3: Proof curity Standard Compliance**

270 *Renewal i 3 years in order for a certificate to remain valid.*

	pliance
	aim listed on applicant's website, plus a compliance letter or copy ued by an accredited certification body.
	y of a component, system, or Certified Development tps://www.isasecure.org/en-US/End-Users/
	ficate, or listed at https://certificates.iecee.org/ods/cb_hm.xsp
	rtificate from other accredited agency, such as UL, VDE, DEKRA, etc.
	ertification claim listed on applicant's website, plus a compliance letter from 3rd party auditor.
ISO 27001	Copy of an accredited certification from a member of the ANSI-ASQ National Accreditation Board as listed at http://anabdirectory.remoteauditor.com/
ISO 27017 (with 27001)	Copy of an accredited certification from a member of the ANSI-ASQ National Accreditation Board as listed at http://anabdirectory.remoteauditor.com/
FedRAMP	"Authorized" at https://marketplace.fedramp.gov/#/products?status=Compliant;FedRAMP%20Ready&sort=productName
CSA STAR	"Certification" or "Attestation" at https://cloudsecurityalliance.org/star/registry/
ioXt	Copy of ioXt certificate or letter from accredited testing organization or certified at https://compliance.ioxtalliance.org/products

FAQ coming soon

Miscellaneous

Additional Requirements (in addition to Tables 1, 2, 3)

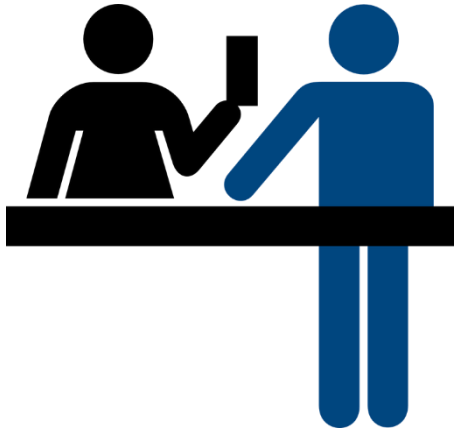
"Customer Available Information": In order for an applicant to claim a capability listed in Tables 1 and 2, the manufacturer's customer literature must specify that the system has the capability, with instructions for how to configure and/or use this feature.

...

The following capabilities from Table 1 and 2 are exempt from this requirement:

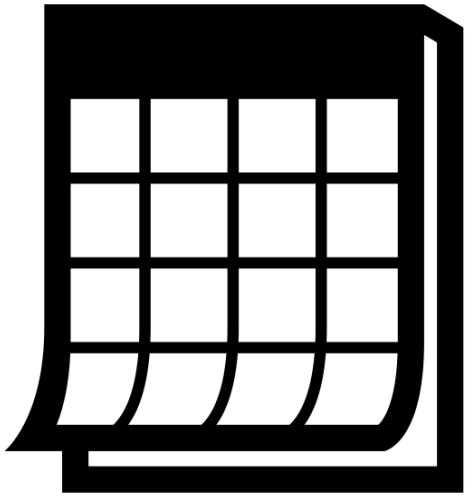
- Continuous Dimming
- Individual Addressability
- Luminaire Level Lighting Control (LLLC, integrated)
- Networking
- Ease of Implementation
- Type of User Interface
- Cybersecurity
- Control Persistence

Commercial Availability



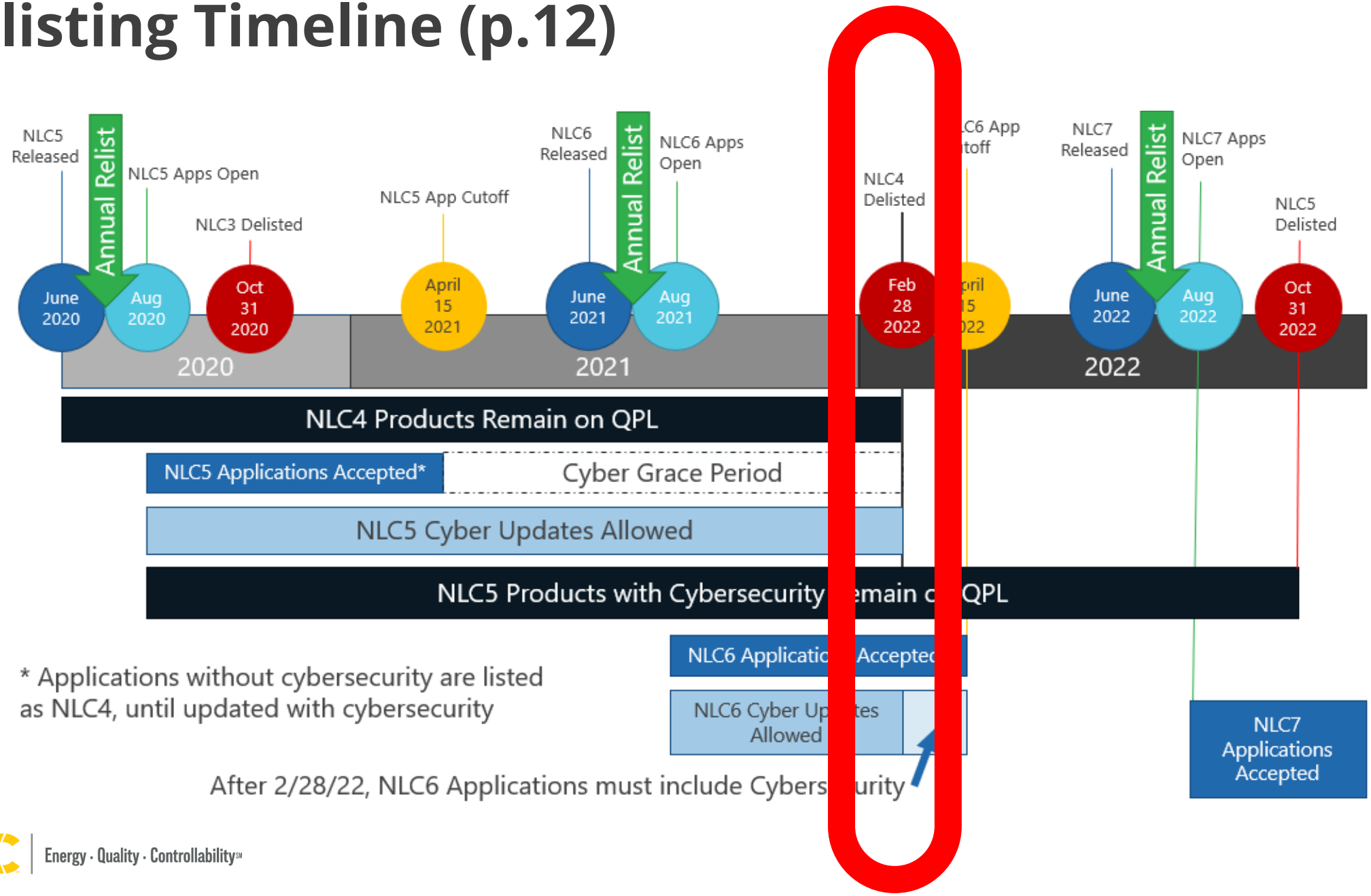
Commercial Availability and Verification: All systems must be fully commercially available in the U.S and/or Canada, able to be purchased, and with complete, final documentation and literature readily available on the manufacturer's website before they can be listed. The DLC requires that a qualified system has been installed and operated successfully in at least one actual field installation at a third-party site (not occupied by the applicant or an agent of the applicant). The DLC will verify this through a case study and/or a customer reference. The facility can be of any size where all of the required capabilities are functional. Multiple sites may be used; for instance, occupancy sensing may be implemented at one site and high-end trim at another. If daylight harvest is not available at a third-party site, then it can be demonstrated in an installation at a building owned by the manufacturer, in a live webinar. Daylight harvest is the only required capability eligible for this exception.

Change from NLC5 Draft 2



- Grace period extended for COVID-19 interruptions of development cycle

Delisting Timeline (p.12)



Applications

- NLC5 Applications for new products available July 7
- Pre-populated re-applications for listed products available early August

Questions