



Bringing Efficiency to LightSM

SSL V4.4: DRAFT DC/PoE Lighting Requirements
NLC V3.0: 2nd DRAFT Technical Requirements
Review Webinar

April 19, 2018

Webinar Logistics

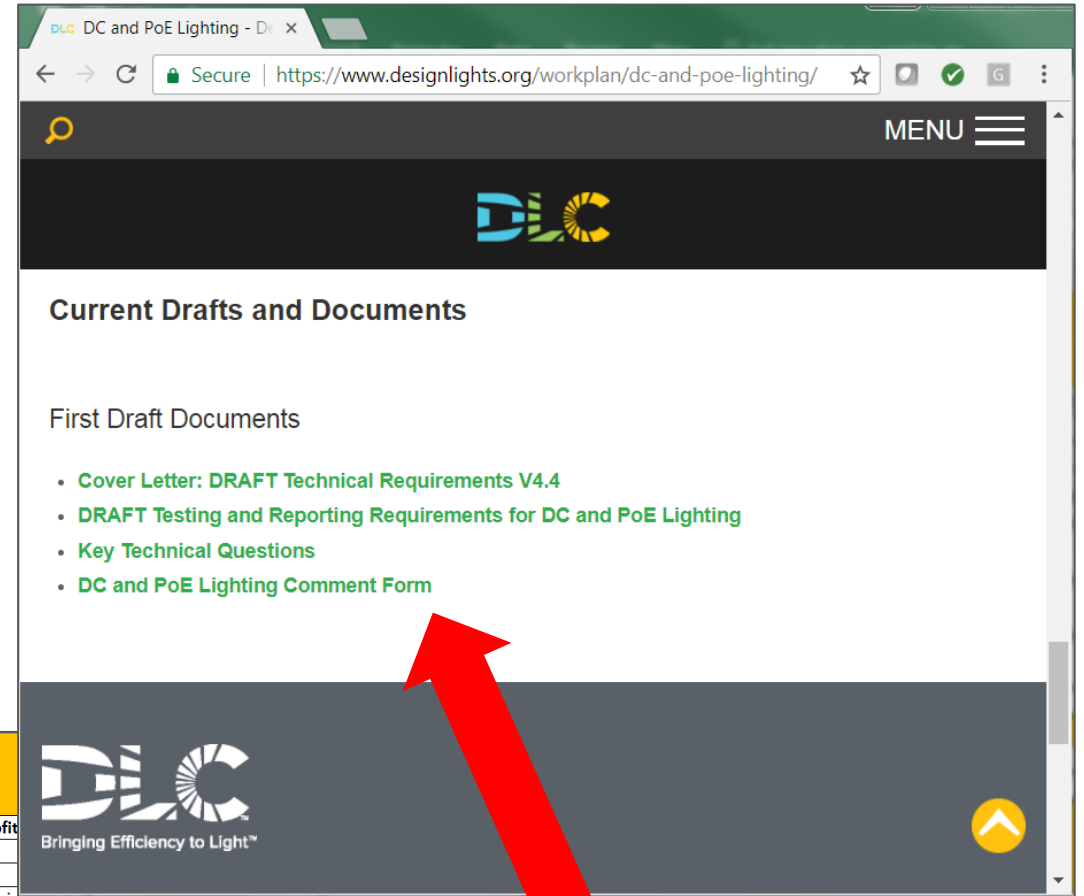
- Slides and recorded webinar will be posted on www.designlights.org after presentation
- All attendees on mute; Please use GoToWebinar Interface (Question pane) to submit questions during today's webinar
- If you experience any technical issues, use Chat feature to let us know

Agenda

- DLC Development Timeline and Process
- Draft 1 SSL V4.4: DC/PoE Lighting
- Draft 2 NLC V3.0 Technical Requirements
- Next Steps
- Q&A

Comment Forms

The DLC now requires all comments to be submitted using DLC Comment Forms. Please download the Comment Form and submit the completed forms to info@designlights.org



DLC		Comment Report Form										
Document:		Testing and Reporting Requirements for Direct-Current (DC) and Power-over-Ethernet (PoE) Lamps, Luminaires, and Retrofit										
Version:		Draft 1 of SSL V4.4										
Comments Due:		COB, Thursday May 30, 2018										
Instructions and Background:		Enter your Organization, Name, Email Address and Phone Number at the top of the worksheet. Then enter any comments in Column "Comment and Rationale". If applicable, please provide alternate approaches, technical justification, or data to support your comment. Provide your proposed change corresponding to your comment in Column E "Proposed Change".										
		Comments to the Technical Requirements that are not related to a specific line number may be added at the bottom of the worksheet.										
		Save the Excel file with your comments, with your initials appended to the end of the filename, and email the file to info@designlights.org by COB, Thursday May 30, 2018.										
		<table border="1"> <thead> <tr> <th>Reviewer Organization</th> <th>Reviewer Name</th> <th>Reviewer Email Address</th> <th>Reviewer Phone #</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>			Reviewer Organization	Reviewer Name	Reviewer Email Address	Reviewer Phone #				
Reviewer Organization	Reviewer Name	Reviewer Email Address	Reviewer Phone #									
Comment	Location in TR (Line or Table & Row numbers)	Topic	Comment and Rationale	Proposed Change								
	1											
	2											

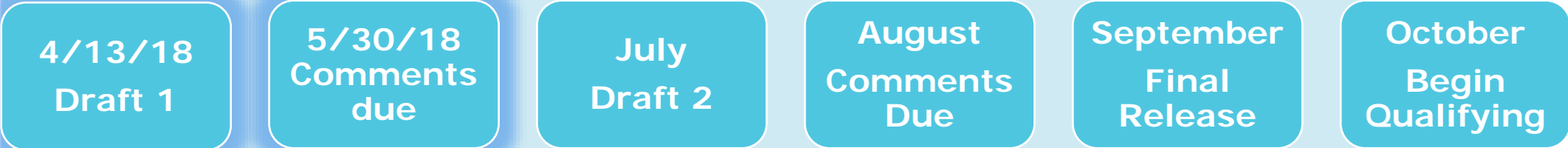
DLC Technical Workplan

	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019
SSL Technical Requirements V4.3												
Color Tuning	FINAL											
Field-Adjustable Products	FINAL											
3ft, 8ft, & 2G11 Base Replacement Lamps	FINAL											
Networked Lighting Controls Technical Requirements V3.0												
Networked Lighting Controls V3.0		DRAFT NEW!		FINAL								
SSL Technical Requirements V4.4												
Horticultural Lighting		DRAFT NEW!			DRAFT NEW!		FINAL					
DC and PoE Lighting		DRAFT NEW!			DRAFT NEW!		FINAL					



Important Dates

SSL V4.4 – Horticultural Lighting, DC / PoE



NLC V3.0 – Networked Lighting Controls



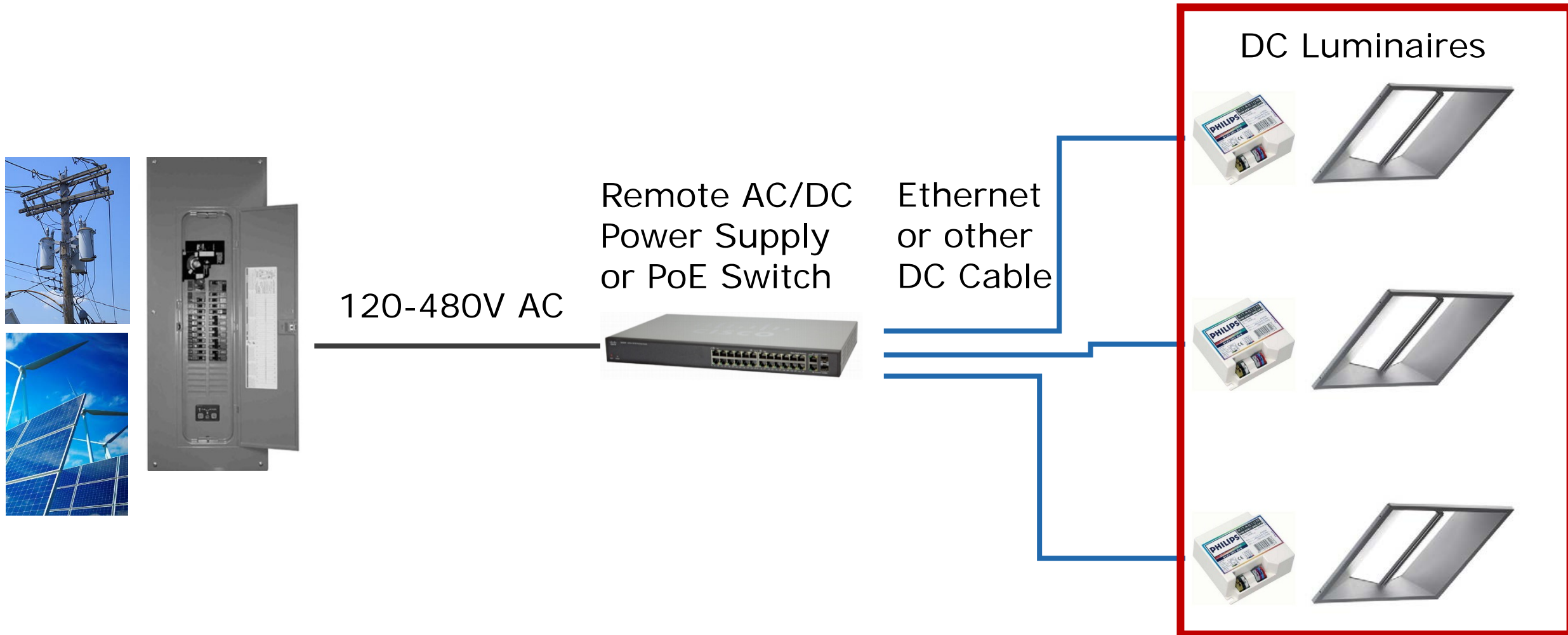
DC and PoE Lighting

Motivation and Background

- DC and PoE-based lighting systems have potential for significant energy savings and value from integration with networked controls and DC microgrids with generation.
- DC and PoE luminaire, lamps & retrofit kits are currently ineligible for listing on the DLC QPL



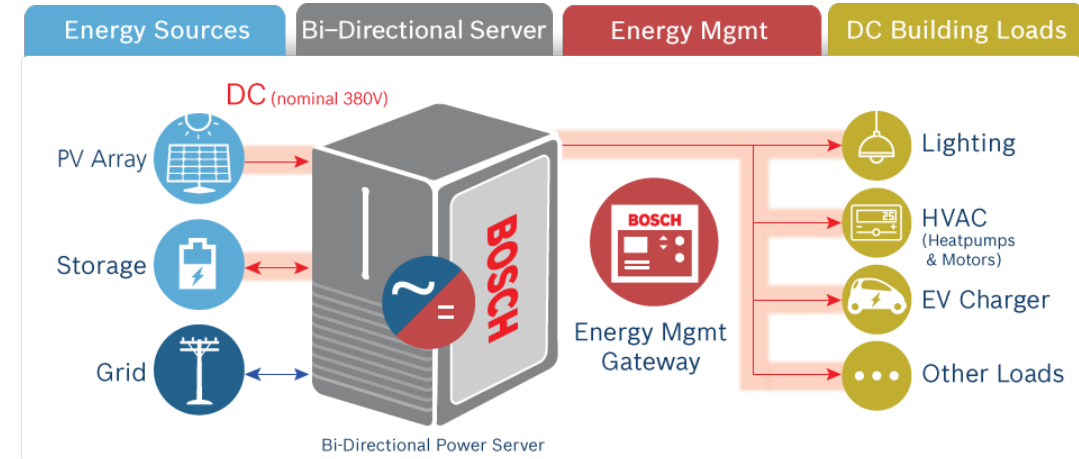
Example DC or PoE System Architecture



DC Power Supply

- “DC Power Supply” is used to indicate the device(s) that connect AC mains to the lines directly providing DC input power to the DC/PoE product. A DC Power Supply may be known as any of the following:
 - AC-to-DC Power Converter
 - Power-over-Ethernet Power Sourcing Equipment (PoE PSE), also known as a PoE Switch
 - AC/DC Multi-Directional Inverter
 - Bi-Directional Power Server

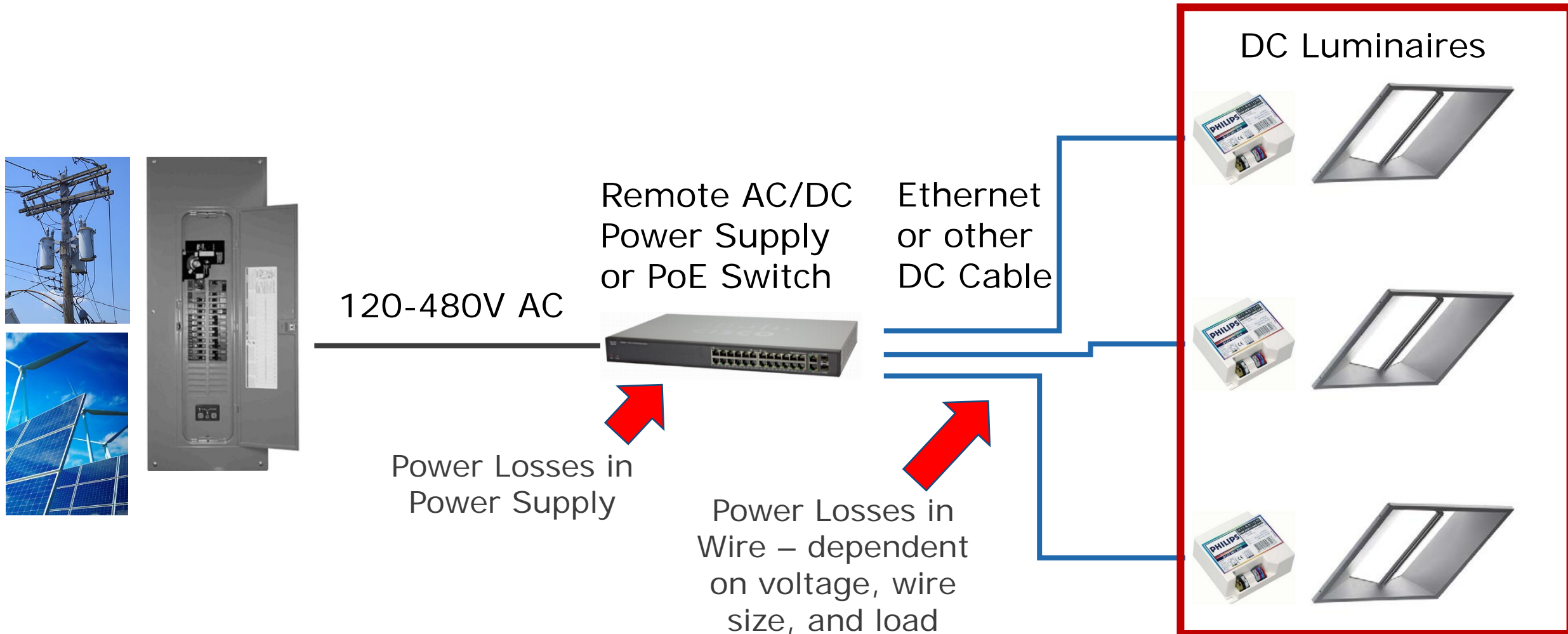
Bosch Microgrid System



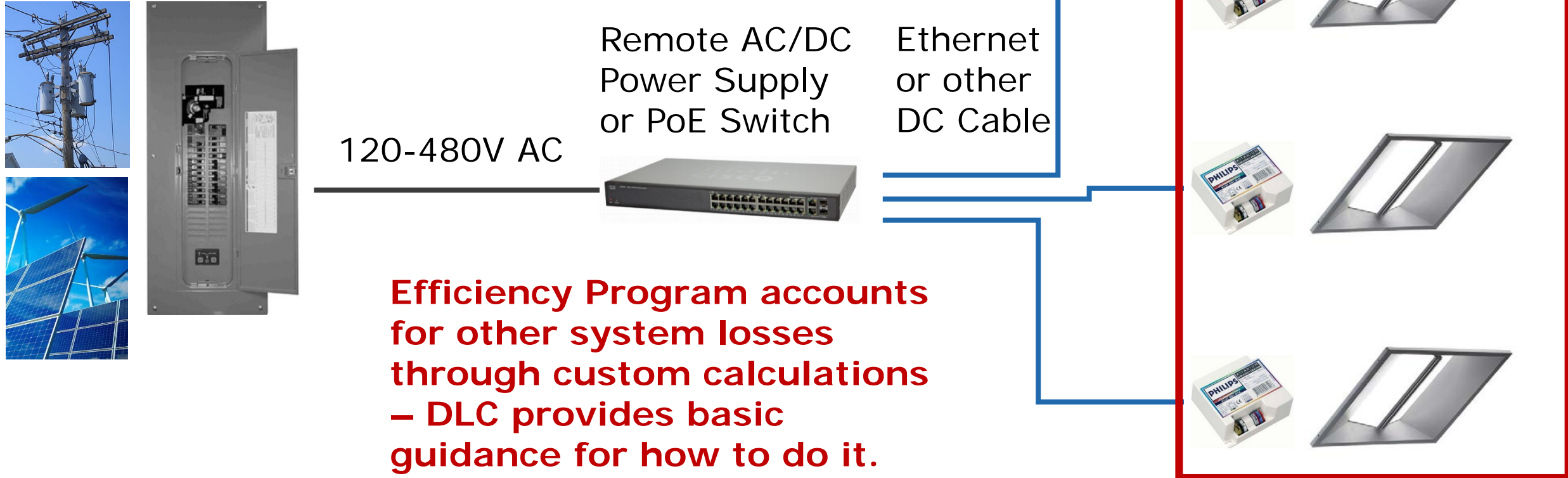
Philips Connected PoE Switch



Example DC or PoE System Architecture



DLC Proposed Approach





Scope and Definition of Proposed Requirements

- DC/PoE products are defined as SSL lamps, luminaires, and retrofit kits that are powered by a DC voltage.
- If DC/PoE products are also capable of being powered by AC and the manufacturer desires to have them listed for both AC and DC, then the AC listing must have a distinct model number from the DC listed product and must be separately qualified.
- Though some DC products may be used entirely disconnected to the AC power grid, the primary focus of this policy is grid-connected SSL lighting.

Technical Requirements

- Must meet all DLC Technical Requirements with the exception of THD and Power Factor
 - If luminaire has a DC-to-DC driver, then an LED Driver ISTMT is required for DLC Premium
- DC/PoE products may also have Color-Tunable or Field-Adjustable product features, in which case they are also subject to the relevant DLC requirements

Table 1: Luminaire Requirements

#	Category	General Application	Requirements							Primary Use***	Distribution
			Minimum Light Output (lm)	DLC Standard			DLC Premium**				
				Minimum Efficacy (lm/W)	Minimum Warranty (years)	CCT / CRI / L70	Minimum Efficacy (lm/W)	Minimum Warranty (years)	CCT / CRI / L70		
1	Outdoor	Outdoor – Low Output	250-5,000	90	5	≤5700 / ≥65 / ≥50,000	110	5	≤5700 / ≥65 / >36,000 / ≥50,000	<ul style="list-style-type: none"> • Outdoor Pole/Arm-Mounted Area and Roadway Luminaires • Outdoor Pole/Arm-Mounted Decorative Luminaires • Outdoor Full-Cutoff Wall-Mounted Area Luminaires • Outdoor Non-Cutoff and Semi-Cutoff Wall-Mounted Area Luminaires • Bollards • Parking Garage Luminaires • Fuel Pump Canopy Luminaires • Landscape/Accent Flood and Spot Luminaires • Architectural Flood and Spot Luminaires • Stairwell and Passageway Luminaires • Specialty: _____ 	See Primary Use Zonal Lumen Density Requirements in Table 4, below
2		Outdoor – Mid Output	5,000-10,000	95			115				
3		Outdoor – High Output	10,000-30,000	100			120				
4		Outdoor – Very High Output*	≥30,000	100			120				
5	Indoor	Interior Directional	250-4,500	65	5	≤5000 / ≥80 / ≥50,000	90	5	>36,000 / ≥50,000		
6		Case Lighting	≥250 lm/ft	80			125				
7		Troffer	≥1,500	100			125				
8		Linear Ambient	≥375 lm/ft	105			130				
9		High Bay	≥5,000	105			130				

Testing

1. Testing shall be in accordance with LM-79 for DC devices with the following additional DLC clarifications:

- a. Measurement of the luminaire efficacy shall be made under DC power without inclusion of line losses.
- b. Many DC/PoE products, for example PoE+, utilize multiple pairs of conductors. LM-79 Test Reports shall reflect and document the number and combined power analysis of all conductors.
- c. Where the test laboratory is in doubt about the proper interconnection or placement of voltage sensing leads for power measurement, they should consult the manufacturer

DC/PoE: Testing

2. Products must be LM-79 tested at up to 3 voltages:

- a. The minimum luminaire DC input voltage
- b. The maximum allowable DC voltage
 - If max voltage is <5% increase over part a), max testing is not required.
- c. The mean of the maximum and minimum voltages
 - If mean voltage is <5% increase over the minimum voltage in a) or b) is not required, testing at the mean voltage is not required.

The DLC seeks feedback on this approach and any suggestions for alternative approaches that may reduce the testing burden while providing efficiency programs with the tested range of performance of these products.

DC/PoE: Testing

- 3. Manufacturers must provide clear instructions to the testing lab for how to achieve the full light output state mandated by the DLC for LM-79 testing.**
- 4. Lumen Maintenance: ISTMT must be conducted the same as with AC luminaires in worst-case condition**

DC/PoE Listing on the QPL

- DC/PoE product performance will be listed according to their lowest efficacy from the (up to 3) LM-79 test(s)
- The highest and lowest tested wattage will also be displayed as additional fields
- All existing QPL fields will apply to DC/PoE products except for Total Harmonic Distortion (THD) and Power Factor (PF)

DC/PoE Listing on the QPL

Four new fields will be required for DC/PoE listings and one existing field may be modified:

1. **System Type/Power Supply Type/Voltage Type:** AC, DC, or PoE
2. **Test Voltage:** A numerical value that lists the voltage from the LM-79 test report (e.g. 24 Volts, 300 Volts, etc.) that corresponds to the luminous efficacy listed for that product.
3. **Voltage Range:** Either be a text value that lists the range of acceptable voltage for the product (120-277VAC, 44-57VDC) or be a text field that lists Class 1 or Class 2, or alternatively High or Low Voltage
4. **DC Efficacy:** Will be different from the current efficacy field of existing products, which may be changed to “AC efficacy” to differentiate

The DLC seeks input on these fields. See the “Key Questions” document released with the proposal.



Model#

Manufacturer:

Brand:

Technical Requirements Version: 4.3

Date Qualified: 04/18/2018

Product ID:

New fields added:

- System Type (AC, DC, PoE, etc.)
- DC Efficacy
- Test Voltage (24 Volts, 300 Volts, etc.)
- Voltage Range (120-277VAC, 44-57VDC)

Categorization

Main: Indoor Retrofit Kit

General Application: Troffer

Primary Use: Linear Retrofit Kits for 2x2 Luminaires

Classification: Premium

Is Parent Product: Yes

DLC Family Code: IIIIVT

Listing Status: Listed

[View Notes](#)

Tested Data

Reported Data

Zonal Lumens

Spacing Criteria

Product Features

Version History

Family Data

Light Output: 2207.3 lm

Wattage: 18.13 W

Efficacy: 121.75 lm/W

Power Factor: 0.9048

CCT: 4082 K

CRI: 84.1

Total Harmonic Distortion: 19.34 %

NLC Requirements V3.0

Draft 2

Networked Controls Revision Cycle

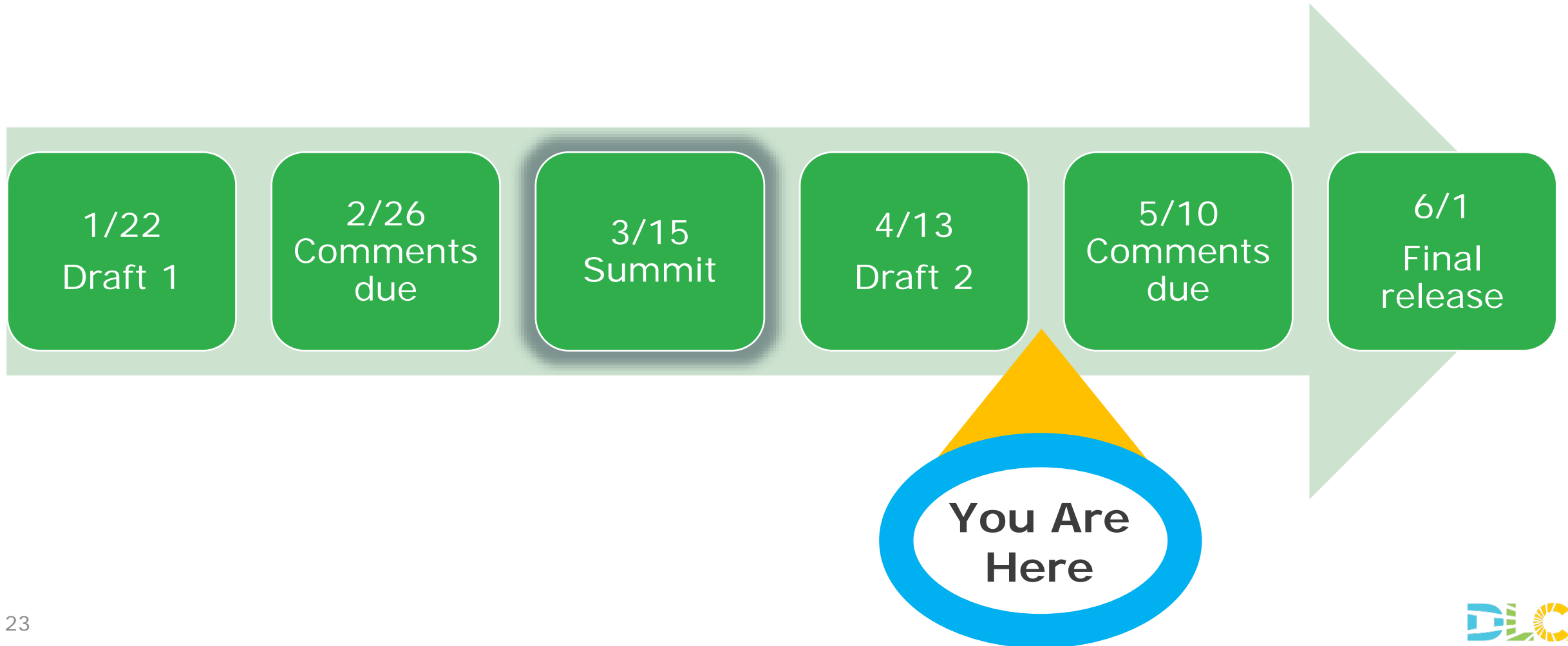
Technical Requirement
Revised Annually every June 1

Revision process begins every
January to allow time for
stakeholder input

One Year Grace Period:
re-apply under last year's version.



Timeline for V3.0 Controls Technical Requirements



Session Logistics



Topics

- Energy Monitoring
- Cybersecurity
- Public Information
- DC / PoE

- Draft 1
- Summit
- Draft 2

Energy Monitoring

Summit Brainstorm Topics

- Preparing for Full Scale Adoption – New Construction
- Preparing for Full Scale Adoption – Retrofit
- Utility Incentives
- Program Approach and Marketing
- Ease of Use
- Training Needs
- NEBs

Energy Monitoring: 3 Approaches

- 1. Direct Measurement** – Lighting system measures energy use with integrated meters in devices and/or circuit level controllers
- 2. Calculated** – Lighting system calculates energy use from dimming signal and factory-programmed wattage
- 3. Calculated with Manual Input** – Lighting system calculates energy use from dimming signal and fixture wattage input into system by installer or commissioning agent



Concerns about Calculated Methods

- Nobody gets paid to enter accurate wattage info
 - Initial installation
 - Maintenance changes in luminaire or driver
- Error can be 40% at ends of range
 - Max choice is less than actual max of some luminaires at full power
 - Min choice ignores parasitic power
- Subject to human error

Energy Monitoring: First Draft Proposal

June 2018 V3

- The Energy Monitoring capability is **Reported**, not Required.
- This optional capability can only be claimed if **Direct Energy Measurement** is used. Calculated methodologies will not be accepted.

June 2019 V4

- The Energy Monitoring capability is **Required**. In order to qualify, a system must be capable of Energy Monitoring.



Stakeholder Comment Summary

Standards

DLC should not disallow “calculated” methods. Some “calculated” systems might theoretically be able to achieve an accuracy standard. Rather DLC should require an accuracy standard, and not specify the means to achieve it.

Granularity of Measurement

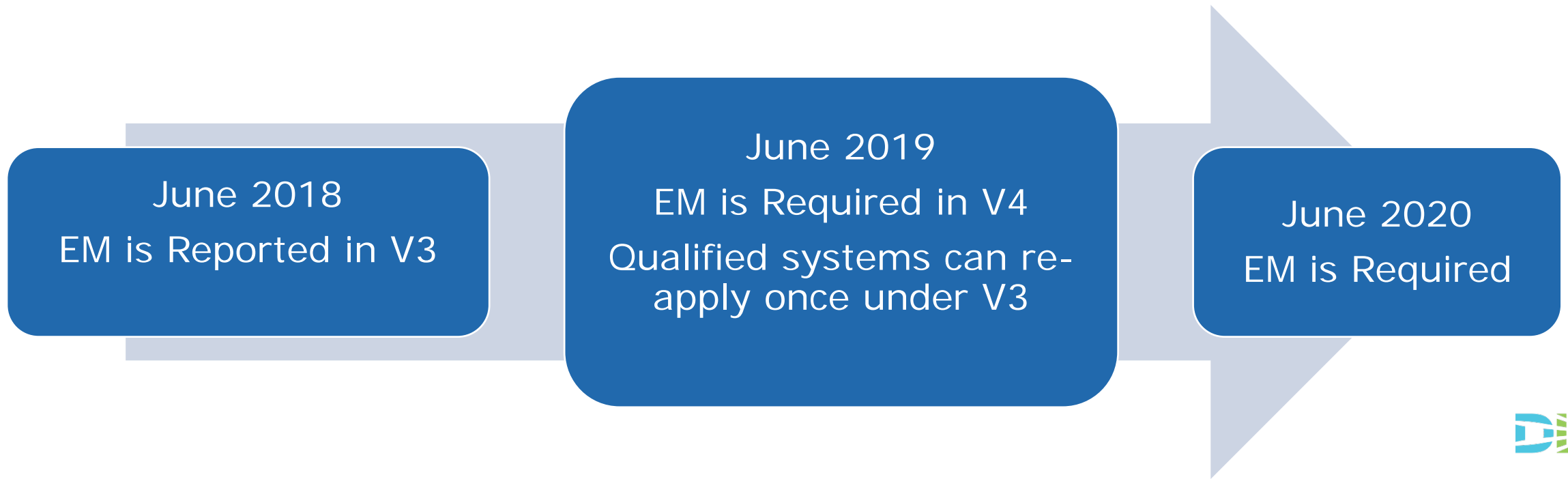
Confirm that circuit-level metering is an option and fixture level is not required.

Timing

2019 is too soon to require Energy Monitoring and no longer allow “calculated” methods. 2020 may be acceptable.

Clarifications

- Circuit level metering is acceptable. DLC will revise definition.
- Grace Period Policy: The 1-year grace period enables a qualified system to re-apply in 2019 under V3, to remain qualified until June 2020, 2 years from now.



Energy Measurement: Four-Part Puzzle

- ANSI C136 (Roadway/Area)
- ANSI C12 (Revenue)

Testing Method

- ANSI C137

Use Case Research

Statistical Justification

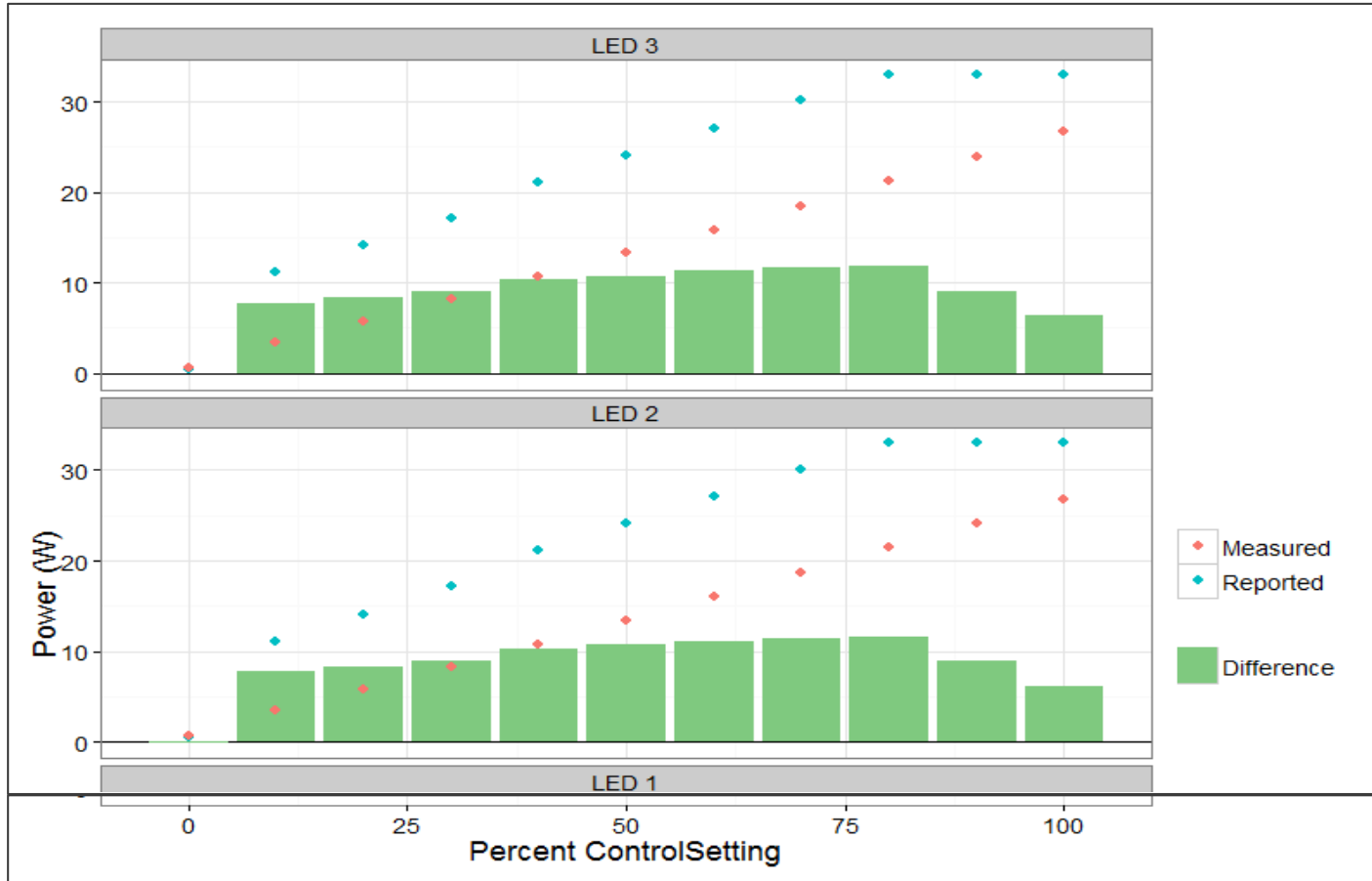
Product/
Capability
Standards

- TBD (Multiple)
- ANSI C136 (Roadway/Area)



Advanced Lighting Controls

Step Dimming—LED Calibration



Energy Monitoring: Revised Proposal

June 2018 V3

- The Energy Monitoring type is **Reported**, whether “Direct Measurement”, or “Calculated”.

June 2019 V4

- Energy Monitoring Capability is **Required** & must comply with forthcoming ANSI accuracy standard.
- If ANSI standard is not available yet, then calculated methodologies will not be accepted. Manufacturers will self-report accuracy of direct measurement methods.
- Option to reapply under V3 with 1-year grace period.

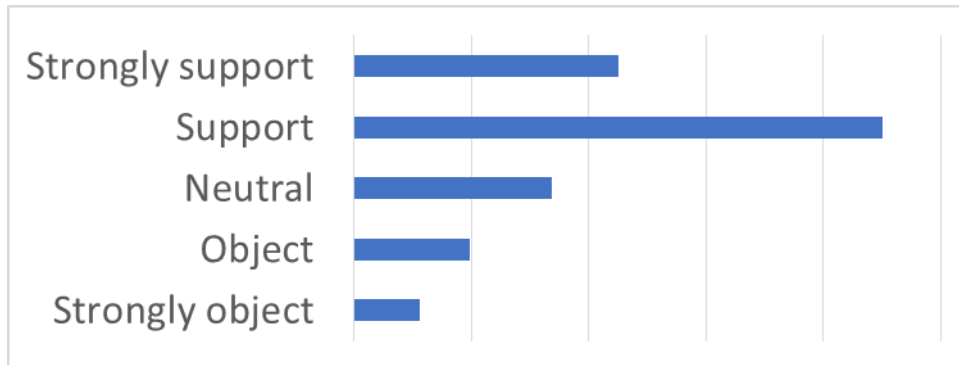
June 2020 V5

- Energy Monitoring Capability is **Required**

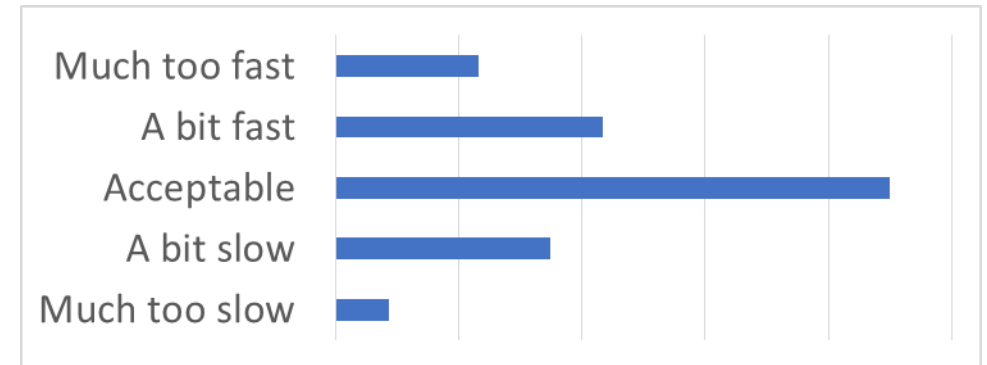


Energy Monitoring

General Direction



Timing



Cybersecurity

What's so important about cybersecurity?



ANSI UL 2900

Cybersecurity for Network-Connectable Products

Design methods

Building blocks

- Open source software

- Integrated circuit hardware and firmware

Known vulnerabilities of each block

Try to hack, see what happens

Test each networked component SKU (not the system as a whole)



<https://industries.ul.com/cybersecurity/ul-2900-standards-process>

ANSI UL 2900 Standards Process

Cybersecurity for Network-Connectable Products

UL 2900-1:2017 applies to network-connectable products that shall be evaluated and tested for vulnerabilities, software weaknesses and malware.



<https://industries.ul.com/cybersecurity/ul-2900-standards-process>

Introductory Webinar recording about lighting

<https://industries.ul.com/events/lighting-systems-and-cybersecurity-are-your-systems-ready>

Some industry-specific versions available

- UL 2900-2-1: Healthcare systems
- UL 2900-2-2: Industrial control systems
- UL 2900-2-3: Security and life safety signaling systems such as Automated Teller Machines, Fire Alarm Control...

Cybersecurity: First Draft Proposal

June 2018 V3

Cybersecurity is reported for components that comply with ANSI UL 2900-1:2017

June 2019 V4

Compliance with ANSI UL 2900-1:2017 is required, or with other standards as available.



Cybersecurity: Comment Summary

- Consider alternatives to UL 2900-1.
 - Concerns about IP in submitting to UL
 - Other standards exist that should be considered (NERC-CIP, NIST SP800-82, ISO 27000, IEC 62433 etc.)
 - There should be other providers besides UL
 - Current UL-2900-1 if applied in full to all components is very expensive
- Clarify requirements regarding endpoints, internet-connection vs. freestanding, components vs. whole systems
- 2019 is too soon, but 2020 might be acceptable

Clarifications

- DLC is looking for equipment level tests and standards that can address cybersecurity aspects of devices
- DLC may also consider cybersecurity standards and certifications that can be applied to the manufacturer or vendor
- Cybersecurity practices implemented at customer installation sites by the customer and/or installer are important – but outside DLC's purview

Cybersecurity: Overview of Standards

Standard	Applies to	Compliance audit available?	Relevant to report on QPL?
NERC-CIP	Large utilities	Only for utilities by regulators	No
IEC 62443	Industrial control systems	Only for automated factories (\$\$\$)	No
NIST SP800-82	Industrial control systems	No	No
NIST Cybersecurity Framework	Organizational IT best practices	Yes but nonstandard	?
ISO/IEC 27,001	Organizational IT best practices	Yes	Yes
ANSI UL 2900	Products	Yes	Yes

If a different lighting standard is needed

UL takes the ANSI/CAN/UL 2900-1 standard as a starting point

- Form an Industry Advisory Group(IAG) based on industry vendors, experts and asset owners
- IAG meets and provides guidance on what requirements are needed
 - Time to test
 - Complexity of Requirements
 - Cost of standard testing
 - ETC..
 - 3-6 month window
 - **A DRAFT IS CREATED BY THE IAG BASED ON 2900-1 REMOVING AND ADDING REQUIREMENTS**
- UL works with IAG to develop and publish changes as a 2900-2-X that references UL 2900-1 and includes additions and deletions
- UL publishes 2900-2-X and works through the ANSI process (6-9 month window)

Cybersecurity: Revised Proposal



June 2018 V3

Cybersecurity is reported for components (UL 2900-1:2017; etc.?) & for manufacturers (ISO 27001-1, NIST Cybersecurity Framework; etc.?).

June 2019 V4

With market research and stakeholder input, identify a set of cybersecurity standards that includes UL 2900-1. The stakeholder input process will propose which components, systems, and/or manufacturers must be certified, and to which standard, in order to claim this optional capability.

June 2020 V5

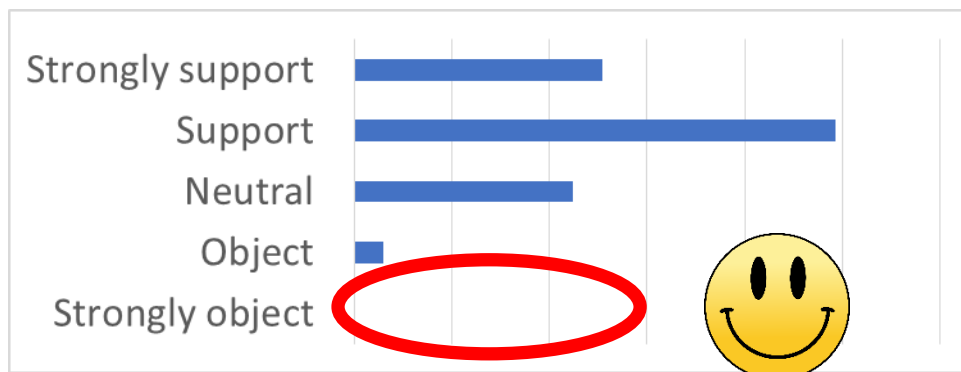
Cybersecurity is **Required**. Products must comply with at least one standard identified in V4 (or reapply under V4 with the 1-year grace period).

June 2021 V6

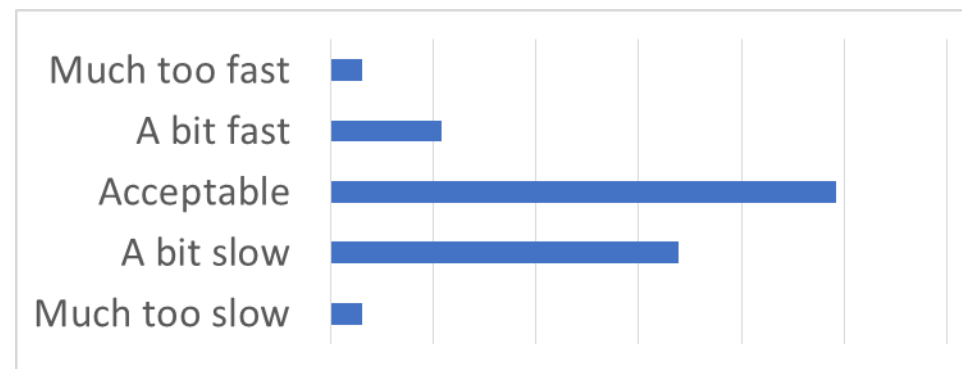
Cybersecurity is **Required**.

Cybersecurity

General Direction



Timing



Publicly Available Information

Publicly Available Information: First Draft

Proposed Change

- In order for an applicant to claim a capability, a reference to that capability must be available in public documentation.

Goals

- To assist specifiers in product selection
- To encourage qualified products that are well documented
- To address major market barriers: confusion and unfamiliarity

Publicly Available Information: Comments

Comment Summary

- Some details are only available to customers in contract documentation
- Propose “available directly to customer, or made available upon request of a customer”
- Require description and/or operational instructions, beyond merely the name of the capability
- 500+ answers are too many for public references
- Remove “some exceptions”. Transparency is needed for interoperability

Publicly Available Information: Clarification

20 topics, not 500

Required Interior Capabilities

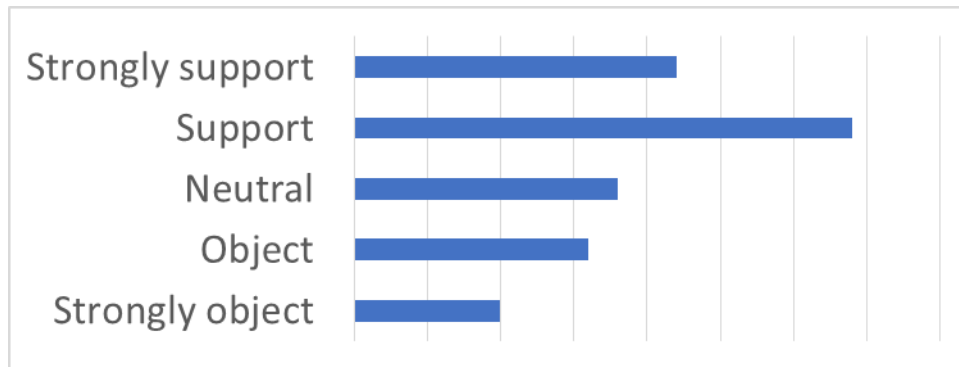
Networking of Luminaires & Devices
Occupancy Sensing
Daylight Harvesting/Photocell Control
High-End Trim
Zoning
Luminaire and Device Addressability
~~Continuous Dimming~~

Reported Interior Capabilities

Control Persistence
Scheduling
Energy Monitoring
Device Monitoring / Remote Diagnostics
Type of User Interface
Luminaire Level Lighting Control
(LLLC, integrated)
Personal Control
Load Shedding (DR)
Plug Load Control
External Systems Integration
(e.g. BMS, EMS, HVAC, Lighting, API)
Emergency Lighting
Security
Color Changing / Tuning
~~Start Up and Configuration Party~~
Scene Control

Publicly Available Information

General Direction



Any or all of these?

- Customer Brochure
- User Instructions for Operation and Maintenance
- CSI Spec (Construction Specification Institute)



Publicly Available Information: Revised Proposal

“Publicly Available Information”: In order for an applicant to claim a capability listed in Tables 1 and 2, the manufacturer’s publicly available literature must specify that the system has the capability and **operational instructions for that capability must be publicly available** in an instruction manual, except for “continuous dimming” and “startup and configuration party”.

“Publicly available” means the documentation is a finished product available publicly on a website, included with the product packaging, or provided to the customer upon request. It should not be a document produced for the sole purpose of obtaining DLC qualification without further use for customers. DLC reserves the right to accept, reject, or require changes to documentation to satisfy this requirement.

Misc.

Topic	Plan
Presentations	Reuse for reapplications
Scene Control	New reported capability
Emergency Lighting	Revise the definition
DC / PoE	Accept, timed with SSL 9/2018

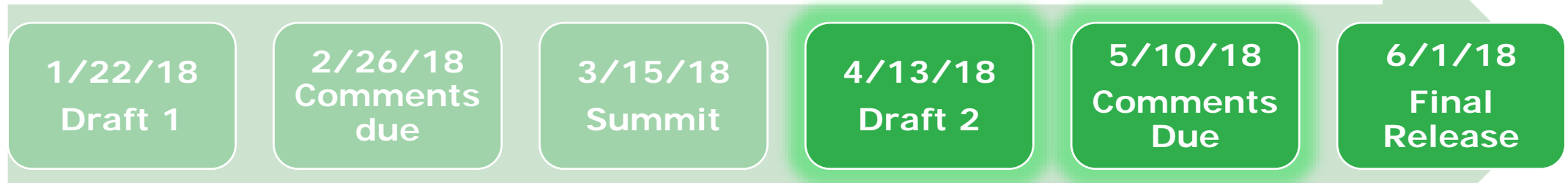
Next Steps

Next Steps

SSL V4.4 – Horticultural Lighting, DC / PoE



NLC V3.0 – Networked Lighting Controls



Thank You!

Gabe Arnold
Levin Nock

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