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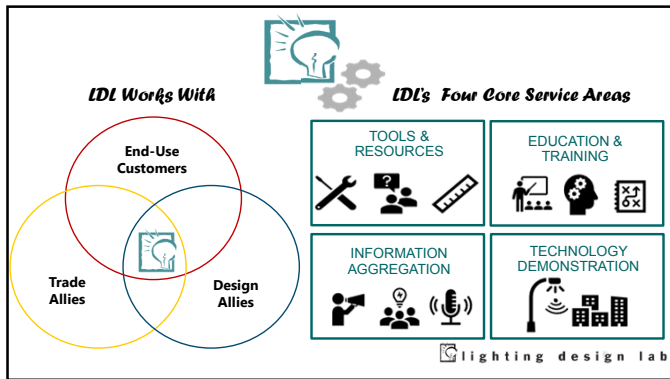
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### Today's Speakers

Shaun Darragh, LC, MIES

Eric Strandberg, LC

Armando Berdiel, M.Eng., LC

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### Understanding, Adapting, and Rising Above the Situation

**lightfair**

**LIGHTFAIR 2020 CANCELED DUE TO ONGOING CORONAVIRUS CONCERNS**  
 Next Staging in May 2021 in New York  
 Returns to Las Vegas in June 2022

**Networked Lighting Controls Hands On (2 Day)**  
 by Shaun Darragh, Lighting Design Lab and Armando Berdiel, Lighting Design Lab

May 03, 2020  
 9:00 am - 5:00 pm  
 \$200.00

[View Details](#)

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# Industry Trends – Light & Health

- Light and Health
- Color Tuning
- Interconnectivity
- Now WFH...

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# Courses that may have been offered at LFI

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# Lighting Design Lab: LFI Institute 2-day NLC Workshop

2019 was a great success...

2020 would have been a great success...

We're looking forward to 2021....

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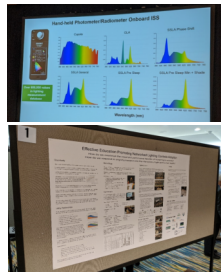
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## Light and Health - US DOE R&D Workshop January 2020

- Co-sponsored with IES
- Expanded format:
  - SSL Materials Research and Product Innovation Track
  - Lighting Science Track
  - Lighting Systems and Building Integration Track
- LDL Poster: *Effective Education for Networked Lighting Controls Adoption*



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## Light and Health

Primary research is ongoing with respect to the interaction human physiology and the non visual effects of light exposure.

- Circadian systems
- Sleep impacts
- Aging Populations
- Dementia
- Behavior Modification
- Alerting Functions
- Flicker
- Blue Light



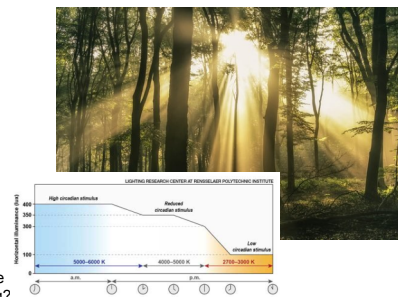
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## Light and Health

### Circadian Entrainment

- Intensity
- Distribution (direction)
- Spectral Power Distribution
- Duration – Dose
- Timing
- Photobiological History



Are we under-lighting the daytime world or over-lighting the evening?

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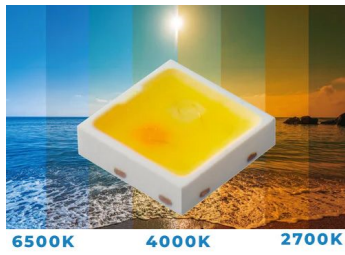
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## Color Tuning / Tunable White

### Spectral Tuning

- Tunable Color
- Tunable White
- Blue pump / phosphor boards?
- Narrow band emitter chip packages?
- How long until most luminaires come standard with tunable white?
- Non Energy Benefits for Controls



6500K

4000K

2700K

Courtesy: Nichia

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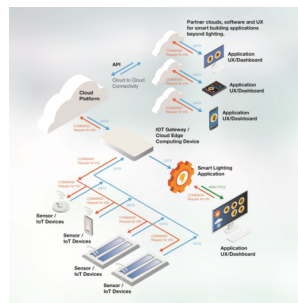
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## Interconnectivity - Controls

What can help to:

- Control light level / intensity
- Control Spectral Power Distribution
- Timing and duration of light exposure
- Provide a platform for the IOT
- Unify the Smart Building Ecosystem
- Save energy
- Improve productivity



Courtesy: Osram

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## Work From Home \_ Possible topic at LFI 2021....

- Get outside into the daylight each morning for 30 minutes if possible
- Work near a window to provide daylight and view - remember to pause and look outside
- Focus on far objects to relax your ciliary muscles from time to time
- LRC put together a nice video:  
<https://www.youtube.com/watch?v=0AdudlypSg>



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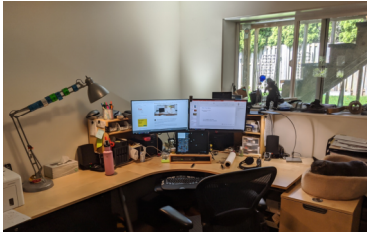
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## Work From Home

- Provide light near your work area for visual tasks – more than you might normally use at home.
- Use specific task lights when possible
- Try to minimize contrast between bright screens and darker surrounds
- Try to consider ranges of light between day and evening for circadian entrainment



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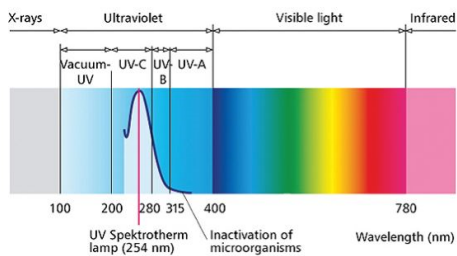
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## Light and Health - A Different Perspective



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## Industry Trends – UV Lighting Products for Wellness

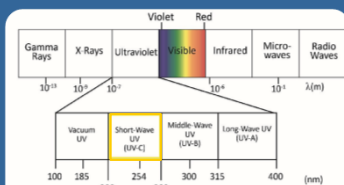


Figure 1-1. The ultraviolet portion of the electromagnetic spectrum.

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IES CR-2-20-V1

### IES Committee Report:

## Germicidal Ultraviolet (GUV) – Frequently Asked Questions

**Authoring Committee:** IES Photobiology Committee

This Committee Report has been prepared by the IES Photobiology Committee in response to the 2020 COVID-19 pandemic, with the specific goal of providing objective and current information on germicidal ultraviolet irradiation (UVGI) as a means of disinfecting air and surfaces. The IES provides this information freely and will update it periodically, as more information becomes available.

*Publication of this Committee Report has been approved by the IES Standards Committee April 15, 2020 as a Transaction of the Illuminating Engineering Society. ([www.ies.org](http://www.ies.org))*

<https://www.ies.org/standards/committee-reports/>

The following slides are excerpted directly from the Committee Report with minimal editing. Most of the graphics are from 3<sup>rd</sup> party sources not associated with the IES and used for visual interest and clarity only. For the complete document see the address above for a free download.

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IES CR-2-20-V1

### IES Committee Report:

## Germicidal Ultraviolet (GUV) – Frequently Asked Questions

**Edited Excerpts**

Figure 1-1. The ultraviolet portion of the electromagnetic spectrum.

**1.3 Can UV-C kill viruses as well as bacteria?**  
**Yes,** UV-C kills living bacteria, but viruses are technically not living organisms; thus, we should correctly say “inactivate viruses.” Individual, energetic UV-C photons photochemically interact with the RNA and DNA molecules in a virus or bacterium to render these microbes non-infectious.

**1.4 Can UV-C effectively inactivate the SARS-CoV-2 virus, responsible for COVID-19?**  
**Yes,** if the virus is **directly illuminated by UV-C at the effective dose level.** UV-C can play an effective role with other methods of disinfection, but it is essential that individuals be protected to prevent UV hazards to the eyes and skin as elaborated in **Section 4. UV-C should not be used to disinfect the hands!**

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IES CR-2-20-V1

### IES Committee Report:

## Germicidal Ultraviolet (GUV) – Frequently Asked Questions

**Edited Excerpts**

**1.5 Can near-ultraviolet (UV-A) lamps, such as UV insect traps, be used for GUV?**  
**No.** UV-A and longer (visible) wavelengths do not have germicidally effective emission wavelengths to inactivate viruses. **Their relative disinfection capability is very minimal on the order of 1,000 times less** effective in terms of fluence rate than the low-pressure mercury germicidal lamp. There have been only very special applications of wavelengths in the UV-A and violet (e.g., 405 nm), which **require very high doses not practical in an occupied environment** and were not recommended for viral sterilization. The trace amount of UV-B that is emitted from some white-light fluorescent lamps probably has similar efficacy.

Light-emitting diodes (LEDs) have been available for some time in the UV-A region. The advantage of UV-A or visible-light LEDs would be that they can easily be incorporated into LED-based luminaires, and there might be no need for protective gear. **However, the efficacy of violet or UV-A energy that is not harmful to the skin or eyes is minimal.**

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IES CR-2-20-V1

Edited Excerpts

IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

**2.3 How can airborne spread viruses be reduced?**

For the airborne component, ventilation, social distancing, and other means of air disinfection are expected to have a role. Natural ventilation outdoors and in homes can be highly effective where conditions are optimal in terms of airflow and temperature. **Mechanical ventilation can be effective, but 6 to 12 air changes per hour (ACH) are recommended** in general for air disinfection or dilution.

Upper-room GUV air disinfection is a primary means of safe and highly effective air disinfection, provided it is planned, installed, commissioned, and maintained according to current international standards. A knowledgeable consultant is recommended. **Room air cleaners, disinfecting air through HEPA filters, in-duct UV lamps, or other methods seem attractive, but their clean-air delivery rate when converted to room ACH is often trivial—no more than 1 or 2 added ACH.** GUV in-duct air disinfection is a secondary approach to treating any recirculated air.

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IES CR-2-20-V1

Edited Excerpts

IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

**2.5 Has GUV been useful in medical treatment facilities?**

**Yes.** Some hospitals have used portable GUV fixtures to **disinfect air and surfaces in unoccupied, locked rooms as a supplemental control measure** to reduce the spread of healthcare associated infections. However, well controlled studies of efficacy are very difficult to conduct and therefore lacking. Medical treatment facilities are using GUV in three primary ways:

- 1) upper-room GUV fixtures with air mixing, for controlling airborne pathogens in an occupied space;
- 2) mobile GUV units, to disinfect high-touch surfaces; and
- 3) GUV in HVAC air handling units, to treat recirculated air and to reduce mold growth on cooling coils.

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Edited Excerpts

IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

**2.6 Can whole-room UV-C effectively inactivate the SARS-CoV-2 virus responsible for COVID-19?**

While UV-C could be a *secondary infection control measure* for disinfecting potential germ-carrying deposits on accessible (not-shadowed) surfaces, its great value would be in disinfecting air in areas where this may be a concern (e.g., intensive care wards, hospital intake facilities [or tents]). **Upper-air GUV is the safest, most effective application of UV-C.** - continued

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IES CR-2-20-V1

Edited Excerpts

IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

Note that this space is unoccupied!

2.6 Can whole-room UV-C effectively inactivate the SARS-CoV-2 virus responsible for COVID-19?

-continued- In special locations, where viral transmission is highly likely, whole-room **UVGI\*** (from suspended fixtures directing UV-C downward) could be applied, provided strict precautions can be followed. **It is critical that any persons remaining in the space being disinfected from overhead and side UV-C lamps wear protective clothing and eye protection**, or exposure to harmful UV will occur. Whole-room GUV has been safely applied in unoccupied rooms where entry is forbidden during the UVGI.

\*UltraViolet Germicidal Irradiation

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Edited Excerpts

IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

4.1 How useful are UV-C rays in disinfecting surfaces?

While UVGI (UV-C in the appropriate range; see Section 1) is an excellent surface disinfectant, it does not penetrate surfaces and cannot disinfect soiled surfaces. The inability of the UV radiant energy to reach shadowed recesses of surfaces or to penetrate coverings like dust and other matter may negatively affect disinfection. For these reasons, UVGI is typically used as a supplemental control measure for disinfection.

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Edited Excerpts

IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

4.2 Can GUV be used to disinfect surgical masks and the N95 respirator mask?

Hydrogen peroxide (H2O2)-vapor disinfection has been the most recommended method now in use. However, if this is not available, studies by several laboratories have shown surprisingly effective UV disinfection despite the fact that UV photons will not have a straight-line pass through all the porous filter structure. Therefore, forward-scattered photons have to penetrate the mask, and substantial doses are required.<sup>15</sup> This should only be attempted within a light-tight enclosure.

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Edited Excerpts

IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

**4.3 Are GUV wands effective for disinfecting surfaces?**

Hand-held, compact GUV products (see Figure 4-1) have been marketed for more than a decade for disinfecting small objects such as cell phones. Most of these emit less than 2 mW-cm-2 of 254-nm UV-C at contact, meaning that the wand has to be **held to the surface for several seconds** for an effective multi-log unit disinfection. **Waving it over an object such as a postcard for one second will not provide reliable disinfection.**

*Even if safely used, these might provide a false impression of effective disinfection.*

Figure 4-1. Small UV-C mercury lamps and 270-nm LEDs used in hand-held wands are available on the internet (middle and bottom). Small air-space disinfectant units (top) are also sold. (Image courtesy of David Sliney)

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IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

**5.3 Do eye or skin hazards differ depending upon the lamp type used?**

Low- and medium-pressure mercury UVGI lamps emit UV energy that poses a hazard to the cornea and skin. Some UVGI LED devices emit near 270 nm, which poses a hazard to the cornea and skin. “Far UV-C” lamps that emit around 222 nm can pose a hazard to the cornea, and recent studies have been inconsistent regarding whether far UV-C lamps pose a significant skin hazard.<sup>22,23</sup> Differences may be the result of different glass envelopes allowing some longer-wavelength radiant-energy transmission.

DNA ABSORPTION CURVE

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IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

**6.2 What is currently the most widely used lamp source of UV-C for GUV?**

The most practical method of generating germicidal radiant energy is by passage of an electric discharge through a rare gas (usually argon) at low pressures ...enclosed in a special glass tube with no fluorescent coating that transmits short-wavelength UV. Hot-cathode germicidal lamps are identical in shape, electrical connection, operating power, and life to standard fluorescent lamps, both linear and compact types. **Maintaining the transmission of the lamp over life is more difficult than for standard fluorescent lamps.**

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IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

Figure 7-1. Germicidal lamps for air disinfection in occupied rooms: (a) open unit used in rooms over 3 m (10 ft) in height; (b) louvered unit used where ceilings are lower than 3 m (10 ft). Dimensions: A, 6 m (20 ft); B, 3 m (10 ft); C, 2.1 m (7 ft); D, 3 m (10 ft). (Source: *The Lighting Handbook*)

7.4 Can less-louvered fixtures be used in very high-ceiling (high-bay) areas?

Yes, with high-bay areas, high-ceiling warehouses, or high-ceiling marketplaces, a **highly louvered UVGI fixture should not be required**. Instead, much more efficient, properly installed open-lamp fixtures—wall mounted or suspended—are quite effective. (Note: This was common in industrial sites many decades ago.) The UV radiant energy is all directed upward, as shown in Figure 7-1. Low-velocity ceiling fans (not shown) ensure good vertical air movement.

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IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

7.6 Can GUV be used in the home?

As described in Section 4.3, handheld, compact GUV products (see Figure 4-1) are sold but are considered a serious safety concern in a general household environment, where children, pets, or careless adults can easily be overexposed. These products are typically less than 10 watts, with open and exposed mercury lamps. They may come with a safety timer; a person places the open lamp on a table or in a convenient location, sets the timer for several minutes to an hour, and is given a 10-second delay to quickly exit the room and close the door.

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Edited Excerpts

IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions

7.7 Does UV degrade paints and other wall materials, or hurt plants?

UV rays in general **will degrade paint, yellow plastics, and destroy air filters** based on their composition (thus, UV-C irradiation of respirators for reuse should be only be a last resort in a pandemic). Furthermore, shorter-wavelength UV photons have higher energy potential than longer-wavelength UV photons, and may have an accelerated aging effect on materials and paints. **UV-C may damage plants**; therefore, hanging plants should not be placed in the disinfection zone in upper-room applications or in whole-room UV-C applications.

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IES Committee Report:

Germicidal Ultraviolet (GUV) – Frequently Asked Questions


Authoring Committee: IES Photobiology Committee

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<https://www.ies.org/standards/committee-reports/>

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www.iuva.org/IUVA-Fact-Sheet-on-UV-Disinfection-for-COVID-19

Are there performance standards and UVC validation protocols for UV disinfection devices?

Given the wide array of UVC devices marketed for disinfection of air, water and solid surfaces, the lack of uniform performance standards and the highly variable degree of research, development and validation testing that is performed on different devices, the IUVA urges consumers to exercise caution when selecting equipment and look for evidence of third party testing as well as certification of device materials and electrical components by well-known organizations such as NSF, UL, CSA, DVGW-OVGW or other international requirements as applicable.



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Industry Trends – Connectivity and IoT





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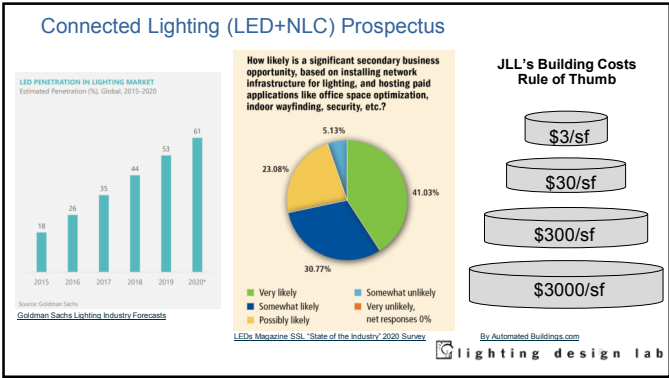
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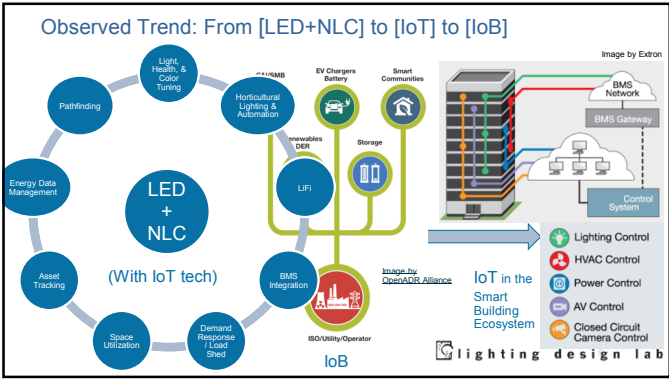
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### Examples of NLC Systems using the OpenADR Standard

From Lutron Vibe's Programming Guide

From Acuity's OpenADR Interface Page

From Cooper's Trellix Page

OpenADR listing Enlighted as a Member

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### 2020 Strategic Collaborations & Acquisitions


Image by Cree and Lutron



**Cree & Lutron**

- April 2020
- Cree's Stylus Linear Series with Lutron Vive
- Lutron's Limelight with Cree IG Series fixtures

Image by Signify




**Signify**  
ACQUIRES  
**COOPER**  
Lighting Solutions

Formerly known as Eaton  
Formerly known as Cooper

- March 2020 (finalized)
  - Cooper's Trellix
  - Signify's Interact

Image by RCA



**RCA Lighting** acquires  
**LG Lighting**

- December 2019
- Simple Choice LLLC Troffers
- RCA Sensor Connect

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### DLC QPLs Focusing on Interoperability and Quality of Light

**SSL Requirements Highlights**

- V5.0** – 2/14/2020
  - Continuous Dimming for indoor luminaires and retrofit kit
- V5.1 Draft** – Live by 7/1/2020
  - Glare (UGR), CCT, SPD, and BUG performance reporting
  - Required dimming and protocol listed
  - Report integral control capabilities and type.

**NLC Requirements Highlights**

- V4.4** – 6/10/2019
  - Energy Monitoring
  - Cybersecurity
  - BMS-NLC intersections
- V5.0 Draft** – Live by 7/1/2020
  - Interoperability
    - External System Integration (via API)
    - Energy Monitoring aligned with ASHRAE 90.1-2016
    - Load Shedding/Demand Response

Updates to SSL Technical Requirements V5.0 due to COVID-19  
 ^ Link to COVID-19 Update Page  
 ← Link to QPL here

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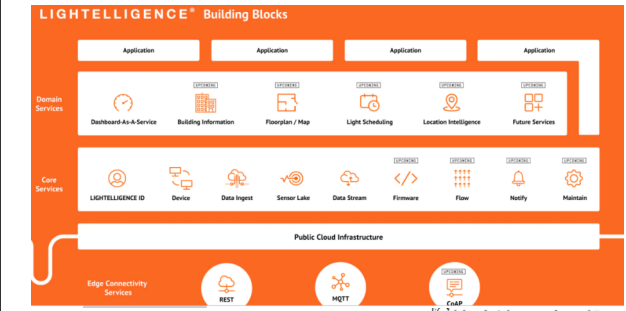
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### What I call the NLC "SMARTS Race"

**LIGHTTELLIGENCE® Building Blocks**



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### Sample Data Set for NLC Manufacturer "SMARTS Race"

	Signify	Cooper Lighting	Lutron Electronics	Igor (PoE Lighting)	Acuity
<b>NLC System</b>	Interact Office	Wavelinx	Vive	Igor	nLight
<b>Smart Platform</b>	Interact Pro	Trellix	Vive Vue -> Enterprise Vue	Nexos	Eclipse -> Atrius
<b>Shared Features</b>	Reporting Dashboards, System Control & Diagnostics, Dynamic Scheduling, Energy Monitoring, BMS Integration (digital), HVAC Integration (digital and analog), Floorplan View, Luminaire Level Lighting Control, Space Utilization Reporting, Tunable White Control				
<b>Unique Features</b>	Energy Optimization, System Asset Mgt, Room Scheduling, Scene Mgt, Indoor Positioning, Pathfinding, Bio-Adaptive Lighting, Open API	Energy Optimization, System Asset Mgt, Room Tracking, Room Scheduling, Security Integration, Demand Response via OpenADR, Open API	Aggregate Lutron Systems' data, Demand Response via OpenADR	Pair almost any device (analog or digital), Asset Tracking, Room Scheduling, Security Integration, Air Quality Monitoring, Open API	Asset Tracking, Contextual Spatial Analytics, Indoor Positioning, Demand Response via OpenADR, Open API
<b>DLC QPL?</b>	Yes	Yes	Yes	Yes	Yes

From Each Manufacturer's Sell Sheets

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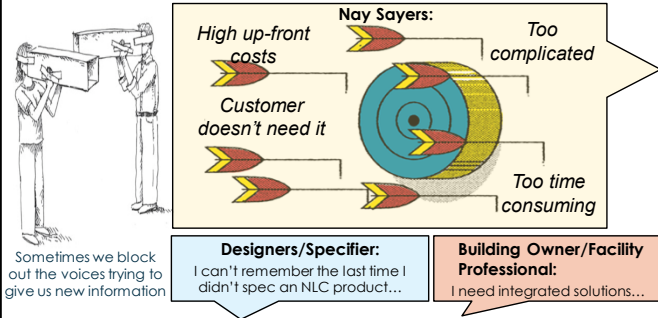
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### Message of Forewarning... and of Continuity



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### Staff Pics – Product/Trend Snapshots



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### Acoustic Control

Courtesy: Mudo, Buzzspace, Luxbox, Lucaplan, Focal Point, Sattler

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### Tunable White / Color Tuning / Dim to Warm

Almost every significant manufacturer of spec grade product is now touting some means of color tuning...

How is that controlled?

Courtesy: Prudential, Kiri/Lesco

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### LIGMAN

#### Odessa GOBO

Designed to match and be interchangeable with the whole ODESSA 2 range, the **ODESSA 2-G** fixture utilizes the same rear casting and mounting options as its standard counterpart, maintaining the IP-66 rating and finish options, but we have designed a completely new graceful tapered cast-aluminium front end around a new special 45W LED source and which houses precise lens optics, a gobo holder rail system and three different focal lengths offering Narrow, Medium and Narrow beam options.

PLS Represented in the Pacific NW by: Pacific Lighting Systems- 206-323-2200

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**LUCIFER**  
LIGHTING COMPANY

STELLR is a surface or pendant mount fixture that combines both a directional and volumetric source into an elegant package. For focused task lighting, the downlight can be used for drama and horizontal illumination. To soften the space, and light the walls and ceiling, a volumetric source may be used. Both sources can be illuminated together or independently. Various CCT, 80/90 CRI, 34 watt combined.

Represented in the Pacific NW by:  
Electrical Reps West-206-767-7722

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**axis**  
axislighting.com

CoeLux AXHT 25 allows great design freedom, it's distinctive 25 cm thickness is suitable for recessed installation even in shallow depths, false plasterboard or modular ceilings. It can be installed in different compositions and the subtle design of the frame facilitates the creation of semi-continuous windows, creating the perception of large portions of sky.

The optical design of AXHT 25 helps to create the sun perceived at infinite distance. The observer, moving in space, will have the impression that the sun is always positioned above his head.

Represented in the Pacific NW by:  
Electrical Reps West-206-767-7722

Product Name	AXHT 25
Total light output	5000 lm
Lumen maintenance (LM80)	> 50000 h
LED CRI (Ra)	> 95
CCT of transmitted beam	5350K
CCT of the Sky	>10000K

lighting design lab

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**Great For:**

- Offices
- Co-work spaces
- Public areas
- Hospitality
- Industrial
- Industry 4.0

**WiFi:** Transmit data through Radio Frequency

**LiFi:** Transmitting data at high-speeds through visible light, ultraviolet, and infra red

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LED+™ & PRO LED+™ by Lutron Electronics



LED+ Dimmer



Incandescent dimmer



LED+ Sunnata Touch Dimmer



PRO LED+ Maestro Dimmer



PRO LED+ HW Dimmer



PRO LED+ Phase Adaptive Energy Saver Node

- Adjustable low-end trim
- Smooth, flicker-free dimming
- Published lamp compatibility reports
- Microprocessor for intelligent dimming

- Real Time Illumination Stability System
- Phase adaptive/selectable dimming
- Inrush Current Management
- Neutral optional for wall box dimming



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Questions



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Upcoming LDL Online Events

LDL Course	Delivery Date	Time
Introductory Daylighting <i>feat. U-Dub's Integrated Design Lab</i>	May 19	10:00 – Noon
NLC for Utility Staff	June 2	11:00 - Noon
Light Sources & Luminaires	June 16	10:00 - Noon
Communicating the NLC Value Proposition	June 30	10:00 - Noon
Fundamentals of NLC (Side A – Theory & Technology)	July 14	10:00 - Noon
Fundamentals of NLC (Side B – Practical Application)	July 15	10:00 - Noon

Today's slide deck and previous online courses can be found on our [website](#)



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Call... Click... Connect...

**Today's Presenters**

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**Visit us online**

<p><b>Education</b></p> <p>Advance your knowledge of complex lighting systems and energy-efficient strategies. From the science of light to the best practices of design...</p> <p><a href="#">LEARN MORE</a></p>	<p><b>Resources</b></p> <p>Linking you to programs and technology experts that enhance your projects and support your business.</p> <p><a href="#">TAP INTO</a></p>
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**OR**

**Email Us**  
[lightingdesignlab@seattle.gov](mailto:lightingdesignlab@seattle.gov)

**Today's slide deck will be posted here!**



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 **Seattle City Light**



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