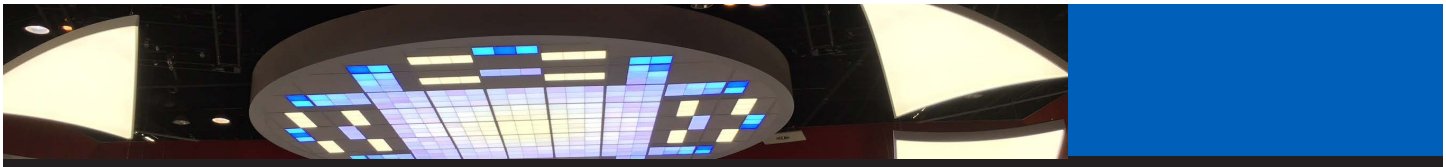
EPRI | ELECTRIC POWER RESEARCH INSTITUTE

LIGHTFAIR INTERNATIONAL 2018: TRADE SHOW REPORT

Chicago, Illinois - May 7-11, 2018

September 2018



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Background

LightFair International (LFI) is the world's largest annual lighting conference. The LightFair conference includes presentations, training, knowledge transfer, innovation awards, and a large trade show. In recent years, EPRI has sent technical staff to the LightFair International tradeshow to remain appraised of lighting industry trends for the purpose of educating EPRI funders regarding various aspects of lighting technologies, and to assist EPRI funders with understanding the potential impact of these trends on utilities.

In 2018, LightFair was held in Chicago, IL at McCormick Place from Sunday May 7th through Thursday May 11th, with the trade show occurring Tuesday through Thursday. According to the Edison Report[1], LFI 2018 covered over 285,000 square feet of floor space, had 600 exhibitors (136 that were headquartered outside the US and 66 new exhibitors) and had over 28,000 registered attendees from 85 countries. This made the 2018 version of LFI the largest so far. There were 47 different product categories displayed at LFI 2018 – including site and roadway, IoT, controls, healthcare, digital signage and solar powered. LFI 2018 exhibitors were organized largely by their product types into six different areas / pavilions on the showroom floor. The 2018 pavilions were 1) Design, 2) Exterior and Roadway Lighting, 3) Global Light + Design, 4) Intelligent Lighting, 5) IoT, and 6) New Exhibitor. Next year, LightFair will be held in Philadelphia, PA from May 19th through May 23rd 2019.

Tradeshow Trends

LightFair 2018 continued the recent LFI trend of LED technology and associated components dominating the show floor. In 2018, this included LED chips, drivers, lenses, luminaires, lamps, retrofit kits, full fixtures, and more. The number of companies even mentioning LED efficacy decreased as most companies were talking about additional features such as color changing, connectivity, intelligence, dimming, and design. The primary trends identified by EPRI that could be of interest to utilities were

- Connected lighting / Internet of Things (IoT)
- LiFi
- Smart cities
- Outdoor lighting
- Color tunable lighting
- Disinfection lighting
- Agricultural lighting
- Retrofit products

These topics are discussed in greater detail in the following sections.

Connected Lighting/Internet of Things (IoT)

As with most other markets, connectivity and control of lighting via IoT functionality is rapidly expanding in the lighting marketplace. LFI 2018 exhibitors displayed numerous lamps and fixtures that can be controlled and monitored by a range of residential ecosystems and commercial lighting control systems. Trends like smart street lighting and smart poles, discussed later in this report, take this concept and expand it outside of homes and buildings to municipalities, utilities and other similar applications.

This connectivity allows for individual fixture as well as centralized system energy monitoring and management, but also allows IoT lighting products to connect to systems like Amazon Echo, Samsung SmartThings, and Google Home. In addition to connecting to cross platform systems, some IoT lighting products are designed to connect to proprietary systems. Many of these proprietary systems allow lighting systems (including exterior ones) to talk to each other, communicate sensor status, be centrally programmed, and offer cloud interfaces for centralized management. At the home or commercial level, these proprietary systems allow the lighting system to connect to disparate devices like HVAC systems, blind systems, fridges, washers / dryers, and other devices from the same brand within one a single ecosystem. A good example of this type of integrated ecosystem is the commercial IoT system made by Enlighted. Representative components of this system can be seen in Figure 1.

Other vendors that displayed IoT lighting systems included Casambi and Lunera. Casambi was a new company displaying a Bluetooth Low Energy mesh lighting control system that required no gateway because a radio is built into every node. Lunera showed their smart lighting platform that has a networked lighting control chip that goes in a fixture. The chip provides control, metering, ADR, asset management and will have an open API. The target price advertised by Lunera is $4/node/year.

This ability to connect to, monitor, control, and integrate lighting with other building management systems may allow utilities to more accurately determine the actual impact of EE programs, as well as utilize lighting within DR programs. However, this would be depen-

[1] https://edisonreport.com/lightfair-international-2018-delivered-largest-footprint-and-increased-registration-over-last-year/

Figure 1 – Enlighted IoT System

dent on utilities partnering with lighting companies, control system manufacturers, ecosystem developers, and regulators to determine how to use connectivity broadly to benefit utility customers, grid stability, the use of generation assets and still maintain customer privacy without impacting safety or security. Customer privacy issues may also be impacted by local / state laws as well as regulator polices.

LiFi

In recent years, the discussion of connectivity within lighting has moved to the use of light for purposes of illumination as well as communication. This has been a widely researched and discussed concept that has led to the development of "LiFi" (or Light Fidelity) products that use LEDs for high speed bi-directional data communication. This communication can occur within the visible or non-visible light spectrum. The use of the light for communication provides a much wider range of frequencies than the congested and heavily regulated radio bandwidth. Thus, light based communication not only allows for high speed data, but also reduces the risk of interference.

LiFi lighting products also provides a means for non-light systems and products to communicate with and receive data from the internet. An example of this is the Resilient LumEfficient LiFi Ores downlight that won the 2018 LFI Judges Citation Award. Products like the LumEfficient Ores show why LiFi products are commonly discussed as a potential future replacement for WiFi based communication in commercial, municipality, and public space applications.

LiFi products have also been shown as a means of providing real time position and traffic data. This can provide situational specific data like sale price or coupon for a product, analytics on space utilization, or facility usage which can be beneficial to both the space occupant and the owner (business, municipality or utility). The use of LiFi communication also has a range of potential use-cases in smart city and connected street lighting (discussed below) as it could allow a means to transfer large amount of video and other data at a high speed back to a central location without the use of WiFi, cellular, or wired networks.

SLD Laser showed a 1,000 lumen laser diode chip. The concept is to use laser with optics for specific applications such as facades and spot lights. It could also potentially be used to transfer data in a LiFi application. Laser technology for general lighting is in the early stages of development. SLD Laser was the only company at LFI showing laser lighting.

Smart City Lighting

Smart city lighting builds on the IoT / connected lighting concept. Smart City Lighting allows for the interconnection of outdoor street and area lights via wired or wireless connection. Most products and companies in this marketspace utilize the standardized 7-pin ANSI C136 connector. This allows for control of, and two-way communication with, each streetlight. In most cases, a smart photocell with wireless functionality connects the fixture to the internet through either a gateway using a mesh network or directly through cellular connection. The development and deployment of this communication infrastructure allows for the addition and

control of other devices and systems on street poles. These include but are not limited to:

- Cameras
- Traffic signs
- Power monitoring
- Fault detection
- Weather Sensors
- Antennas
- Speakers
- Electric Displays
- EV Charging stations

Several companies were displaying smart city technologies and platforms. Lumca demonstrated their smart pole technologies which allows for the connection of cameras, electronic billboards, sensors and other features. Sternberg Lighting displayed an Intellistreets smart pole with various features such as camera, electronic billboard, street light, antenna, speakers, and more. Hess showed a smart pole with camera, speaker, EV charger, and light. Selux showed a smart pole with modular columns but not as many smart features as the other manufacturers. NEPSA is a telecom pole manufacturer that integrates small cell[2] with a light pole. The small cell market is one that is primed for rapid growth due to the upcoming 5G infrastructure upgrade that will occur in many cities.

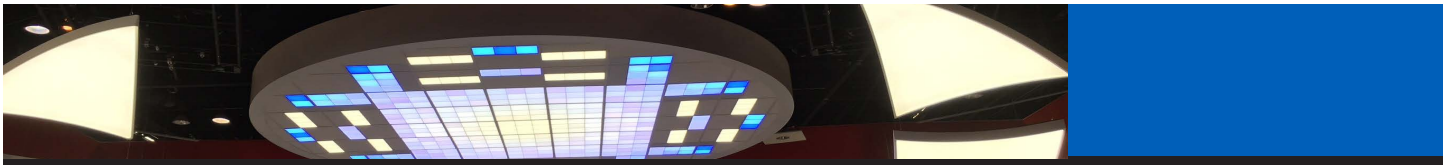
Cimcon has a smart photocell technology called NearSky360 that can power external sensors. They have also worked to integrate small cell onto light poles. Ubiquia showed a smart node for connected street lights. This system is also capable of powering a range of field deployed devices. LED Smart showed a camera integrated into a streetlight fixture with sound recognition.

As in previous years, Philips and GE show their smart city technologies that have already been demonstrated in several cities throughout the US. Philips also showed a sensor-ready streetlight that has a Zhaga socket and a camera integrated into the fixture.

Figure 2 shows a smart city lighting pole by Ghisamestieri – in partnership with the R&D segment of ENEL (ENEL X) – that offers fiber, Wi-Fi, cellular connectivity, EV charging and other functionality.

Figure 2 – Ghisamestieri / ENEL X Smart City Light Pole

[2] A small cell is a radio access point with low radio frequency (RF) power output, footprint and range. Small cells complement the macro network to improve coverage, add targeted capacity, and support new services and user experiences. Source: https://www.smallcellforum.org/what-is-a-small-cell/



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Outdoor Lighting

Street and outdoor area lighting was the first lighting sector that experienced rapid LED adoption. The primary reason for this adoption was the increased lifespan and improved efficiency of LED products versus traditional sources. This provided for maintenance savings in addition to energy savings. Today, LED is the primary technology utilized in outdoor lighting. This rapid market adoption has also resulted in market stabilization. Thus, there were relatively few innovations for street and area lighting at LFI 2018. However, there were still several interesting new and noteworthy concepts in outdoor lighting exhibited.

Ghisamestieri (fixture shown above) was a new company displaying roadway lighting products this year. They make ornate cast iron poles that have a historic look while still integrating LED technology. Their custom LED fixtures have a slim design with tool-less entry and replaceable LED modules. Leotek displayed an edge-lit streetlight using waveguide technology. Edge-lit designs provide for a glare-free fixture which have largely only been used in indoor fixtures til now. Jezetek showed an LED street light with solar panels integrated into the fixture to help offset energy use. Crestron's SolarSync photosensor won an Innovation award by developing an outdoor mounted sensor that measures the sun and then communicates the color temperature and illuminance levels to interior fixtures to help match outdoor levels. This is an interesting concept that could help further the use of color tunable lighting (discussed below) and daylighting indoors.

Color Tunable Lighting

Color tunable lighting, or the ability to vary the shade or color of light output, continues to be a growing trend in the lighting marketplace. Some of these LED products can deliver up to 16 million colors of output, and most can deliver a variety of shades of white. The ability to vary color temperature and shade offers the ability to set mode, create effects, and potentially impact human health (i.e. circadian rhythm impact). Each of these colors, or shades, has a different efficacy which means the actual wattage varies by color for most products. The addition of connectivity typically adds a small additional load (usually less than 1W) to the fixture's consumption. These products come in a range of formats including screw based, troffer, tubes and exterior façade.

One interesting color tunable product was the Sylvania LEDVANCE human centric wall controller and panel for human centric lighting (HCL). The controller is designed with circadian timing as a focus and can adapt with daylight. The panel ranges from 2700-6500 K and communicates though ZigBee.

Circadian Lighting / Blue Light

Circadian lighting is the most commonly discussed benefit of tunable white lighting. Circadian lighting is generally defined as tunable LED lighting that can change white color temperature to help assist or maintain human circadian rhythm[3]. The increasing interest in circadian-assisting lighting was seen at LFI 2018 in a number of displays. These displays focused on how LED color temperature could be used and deployed in various lighting applications including homes, schools, and offices. Cree showed a color tunable 2x2 troffer concept that mimics daylight called Arcadia. The fixture is a recessed box with color tunable walls and a blue ceiling to represent the sky. The walls change colors of white to mimic the sun's movement throughout the day. Arcadia could also mimic cloud coverage by producing a gray color.

Apart from lighting assisting circadian rhythms, there is also discussion on blue rich light impacting human health in a negative manner. Some have even linked high blue light content as being a potential cause of disease and ailment. BIOS Lighting showed lights scientifically designed for humans with minimal blue wavelengths and increased green wavelengths.

There is currently limited research around blue light's health impacts, especially as it pertains to LEDs. Due to this, EPRI is currently working on a project exploring the impact of LED light on circadian rhythm and human health. This project is a partnership between EPRI's environment sector (P62 Occupational Health and Safety) and EPRI's power delivery and utilization sector (P170 End Use Energy Efficiency and Demand Response). This report is on track to be completed in late 2018 / early 2019 and will be available via EPRI's TI program.

Disinfection Lighting

A few LFI booths displayed lighting products targeted at a new application: disinfection. These fixtures were aimed primarily at the health care marketplace, but these technologies also have application in the areas of human safety, food processing, restaurants, clean manufacturing and other applications that require clean

[3] Circadian rhythms are physical, mental, and behavioral changes that follow a daily cycle such as sleeping at night and being awake during the day.

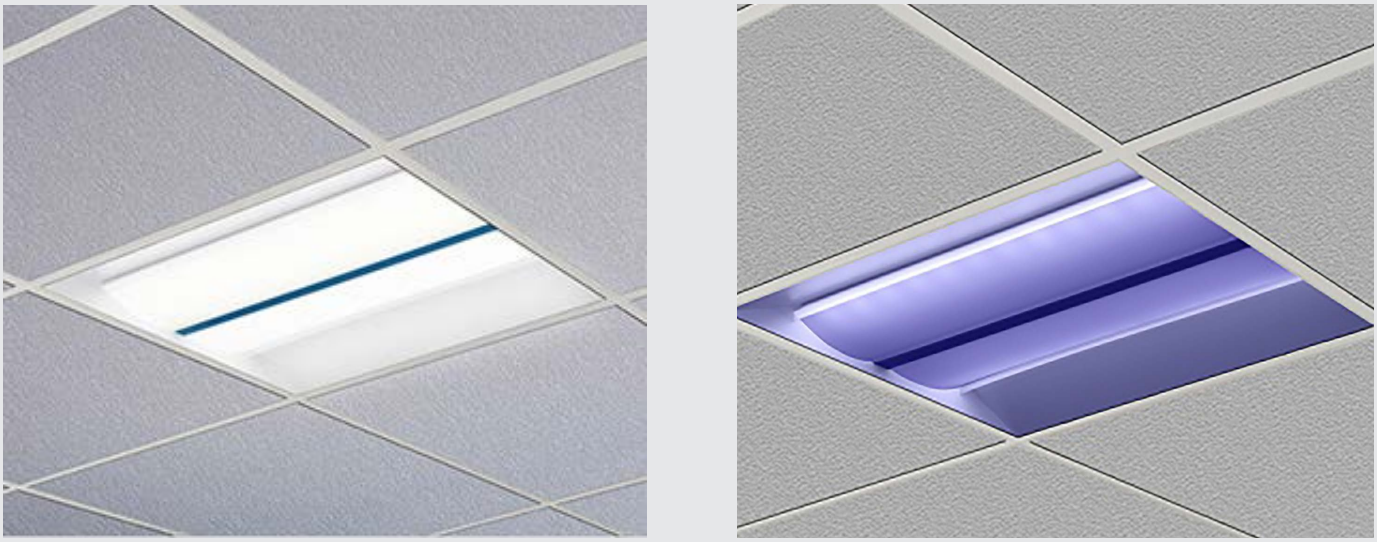


Figure 3 – Visa Jasper Troffer – white disinfection mode (left) and eco disinfection mode (right)

environments. Apart from food and "clean" applications, these products may also be used in public spaces (airports, train stations, bus terminals), classrooms and locker rooms where bacteria are common and are easily spread.

Disinfection lighting products use specific spectrums of light to sanitize spaces. These products use frequencies within the human visible spectrum or in the UV spectrum to reduce or eliminate bacteria and micro-organisms. Disinfection can occur in real time, or be set to occur on a scheduled pattern. Some of these LED disinfection fixtures offer both illumination and disinfection modes. This ability to switch between modes also results in variance in fixture consumption and in fixture load profiles as some of these fixtures could be in operation at some level every hour of the year.

VISA lighting displayed products they developed in partnership with healthcare company Vital Vio. These products (an example of which is shown in Figure 3) focuses on reducing salmonella and E. coli bacteria. In fact, Vital Vio claims their technology can result in up to a 90% reduction in bacteria like MRSA, E. coli, and salmonella within a few weeks.

The Hubbell disinfection fixture used High Intensity Narrow Spectrum (HINS) technology licensed from the University of Strathclyde in Glasgow to suppress bacteria in air by using a narrow spectrum of visible light.

GE showed a UV-A spectrum product for disinfection. The company claims it is safe for humans to be under this light, but like most of the disinfection products, it would be difficult for a human to remain under this light for very long because of the disorienting color. This is a similar concern in horticultural applications where purple light is common.

Agricultural/Horticulture Lighting

With the continued advancement of LED chips and expanding interest in indoor agriculture, horticulture lighting was a focus of numerous displays at LFI 2018. LED horticulture products have the unique ability to produce specific wavelengths that can be beneficial for certain plant activities. There is much ongoing research about the effects of various wavelengths on various plant types.

Horticulture lighting does not utilize the same metrics of performance as traditional residential, commercial, industrial and exterior lighting products. Horticulture lighting is focused on lighting intensity and specific spectrums of output, not efficacy and color rendering. The key metrics for horticulture are:

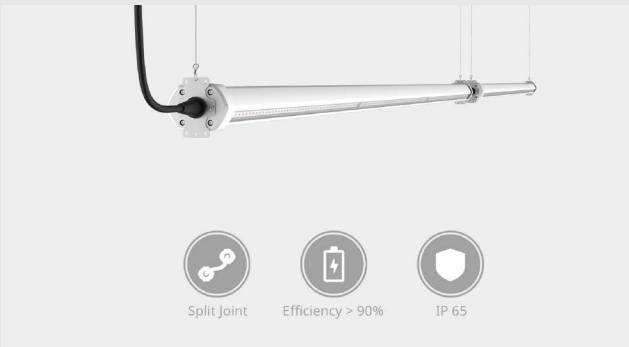
- Mole - a measured amount of light photons, equivalent to 6.02 x 10^{23} particles of light
- Photosynthetically Active Radiation (PAR) – the amount of plant useful light and focuses on the absorption of specific wavelengths - Chlorophyll A (430 to 662nm), Chlorophyll B (453 to 642 nm) and Carotenoids (450 to 454nm). PAR is measured in micromoles per second per meter squared (µmol/s-m^2).
- Photosynthetic Photon Flux (PFF) – the total amount of light that is produced by a light source per second measured in micromoles per second (µmol/s).
- Photosynthetic Photon Flux Density (PPFD) – the amount of light that arrives at the plant or crop measured in micromoles per meter squared per second (µmol/m^2/s).
- Daily Light Integral (DLI) - total amount of light delivered to a plant every day measured in moles of photons per square meter per day (mol/m^2/d).
- Photosynthetic Photon Efficacy (PPE) – amount of PAR light output divided by wattage input. Since a watt equals one joule per second and plant lighting is evaluated based on µmol per second, the PPE value is measured in J and is measured in micromoles per second / joule (µmol/J).
  - PPE Reference values 400W HPS with magnetic ballast – 0.9 µmol/J, double ended 1000W HPS with electronic ballast – 1.7 µmol/J

ATOP Lighting showed a range horticulture fixtures designed for a range of applications (cannabis, floriculture, vine crops and leafy greens). The ATOP T8 offerings range from 9W to 36W in 2ft to 6ft lengths. The products range from 18 to 72 µmol/s PPF depending on wattage and length. One of the most interesting ATOP horticulture fixtures was the Horti-Bar fixture which is IP 65 rated, has an efficiency above 90%, and is designed to be daisy chained together. This fixture comes in 75W, 100W and 150W configurations, with the 150W configuration offering >2.1 µmol/J system efficacy and > 322 µmol/s PPF output.

Large companies like GE and Lumileds showed LED based agriculture fixtures and LED tubes. GE showed the Arize LED tubes for horticulture. There were also several companies whose primary focus is LED based agriculture lighting. These included BIOS Lighting, TSR Lighting, and LumiGrow.

Nebula showed a horticulture control system for HPS or LED that also has weather prediction incorporated. This is important for greenhouses that use the daily light integral to determine how long the electric lights should operate.

Though the majority of horticulture fixtures shown were LED based, there were a few HPS and MH based fixtures focused on horticulture applications. In fact, Maxlite showed LED as well as metal and double ended HPS horticulture fixtures in their booth.



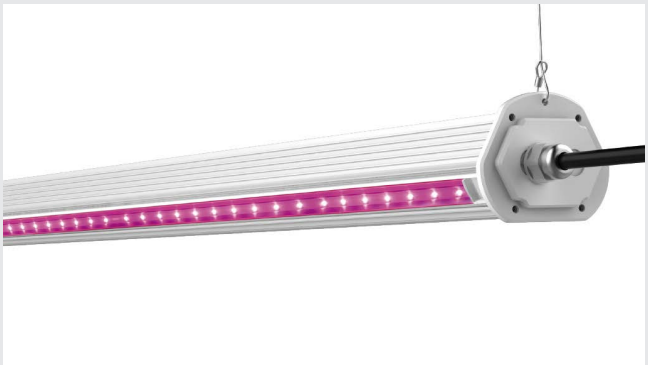


Figure 4– Horti-Bar 150W Grow Light – Source ATOP Lighting

Figure 5 – Lumileds horticulture lighting

Retrofit Lighting

The retrofit of existing lamps and fixtures to LED based products is still an expanding segment of the lighting industry. Though the retrofit lighting market is expanding, based on Q4 2017 NEMA data[4] LED screw based lamps represented only about 36.1% of the screw based market (shown in Figure 6). This same NEMA data shows that the majority (47.8%) of installed screw based lamps are still halogen lamps.

With the backstop provisions of EISA 2007 (i.e. EISA 2020) slated to go into effect about 18 months, effectively eliminating halogens and incandescents in most applications, the market penetration of LED products in the screw based market space is poised to rapidly expand.

To address this expanding market, there were numerous exhibitors at LFI 2018 showing a variety of screw based lamps. One of the LFI 2018 award winning products was a 25W screw based LED

[4] https://www.nema.org/Intelligence/Pages/Lighting-Systems-Index.aspx

lamp from Green Creative designed to replace 70 to 100W HID lamps. This is just one example of how retrofit and replacement LED products are becoming easy retrofit solutions to a wide range of lighting applications. Other retrofit products on display included the Sylvania voice controlled filament lamps. LED filament lamps are becoming increasing popular, and now Sylvania has released a smart filament light that connects via Bluetooth.

The troffer market seems to be split between interest in full LED troffers (which are slightly higher in initial cost and designed to maximize LED performance optically) and retrofit LED tubes that allow for use of existing fixtures. LED tubes are lower cost, but also generally have shorter lifespans. There are types of UL recognized LED tubes, but only Type A LED tubes are dependent on fluorescent ballasts (which may have a shorter lifespan than the LED tube) to operate. Long term, full LED troffers will likely be the primary product selected, but in the short term, LED tubes are likely to have a noticeable market share.

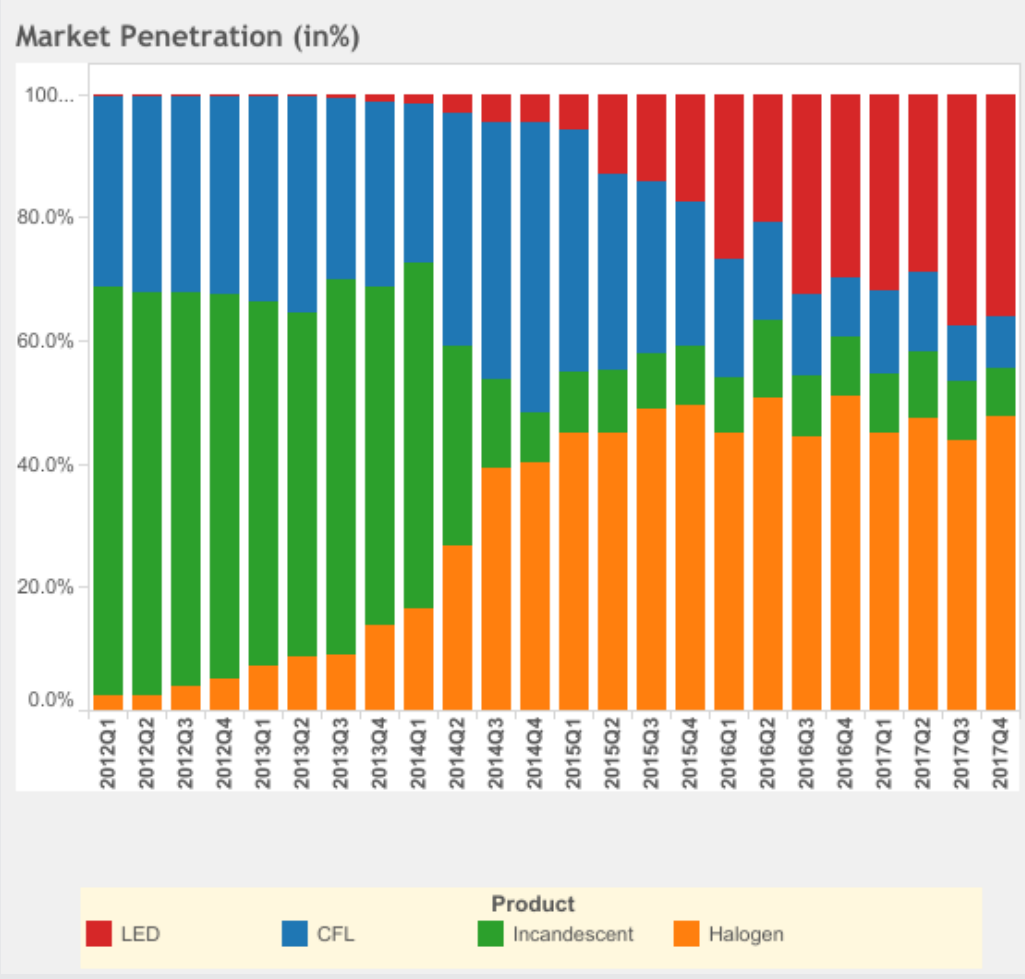


Figure 6 – NEMA Screw Based Lamp Market Penetration – By Technology

Non-Energy Benefits and Lighting as a Service (LaaS)

As noted in previous sections there are a range of new features, options and trends emerging in the LED lighting marketplace. A commonly under-utilized option is networked lighting controls which provide individual luminaire control, energy reporting, and wealth of other data. These features are often overlooked when specifying a new lighting installation because traditional lighting systems did not offer this, and significant energy savings can be achieved without networked controls. Additionally, once the conversion to LED takes place, the potential for controls and data to offer significant energy savings is reduced. Since these additional control systems are also initially costly, it can be difficult for controls and sensor systems to offer acceptable payback to the customer.

To address the underutilization of controls, many control and sensor products shown at LFI 2018 highlighted non-energy benefits. These benefits included the ability to adjust light levels to individual or task specific levels. This functionality will likely result in energy savings, but the driver is comfort of the space occupant. As with light level control, color tunability can deliver energy savings, but it may also result in increased energy consumption since fixture consumption is dependent on the selected color of light. Use of this functionality is not driven by energy consumption. Its key drivers are increased satisfaction with lighting levels or improved sleep patterns / human health.

Many of these non-energy benefits are driven by sensors, edge computing and other IoT driven features. This means their control, data and other functionality can be combined. In some product offering, these combined functions result in creating offerings called Lighting as a Service (LaaS). These services basically allow lighting to be sold by an aggregator, a third party or a vendor though a subscription model instead of being sold via an upfront / one-time equipment purchase model. The vendor would be responsible for maintaining and optimizing the lighting system. An example of how these LaaS systems are packaged and work can be seen in Figure 7.

Whether for non-energy benefits or LaaS concepts, the ability to collect data from the fixture provides building owners, facility manager, and others with large amounts of data about operation. This may result in tuning or adjusting the fixtures to deliver additional energy savings, but a key additional value is that the collected data can be used to schedule preventative maintenance, analyze operational cycle data, evaluate space usage, and deliver insight into other similar operational facets.

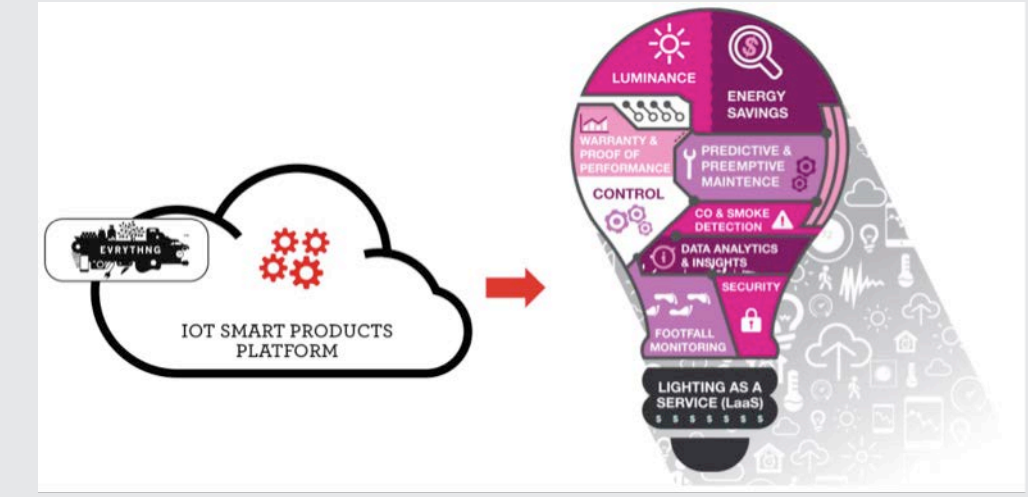


Figure 7 – Lighting as a Service (Laas) Concept Overview

Additional Notable Products

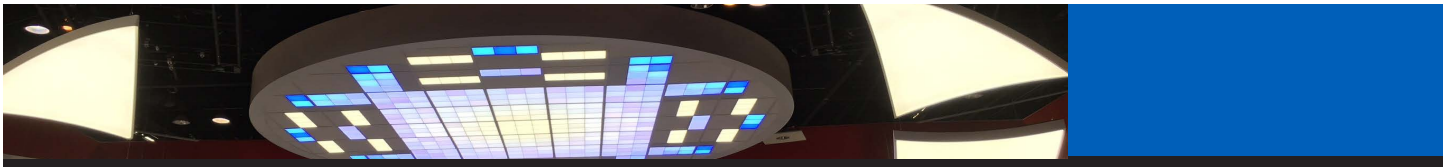
Noon Home was a company in the new product pavilion with an interesting wireless smart switch. The product is a residential wall dimmer that has an OLED screen integrated into the button. The product is designed to work with all dimmable lamps and light fixtures. There is a bulb discovery feature that detects the lamp type in order to apply the appropriate dimming curve. Noon has an app that allows for remote control of the lighting circuit. The Noon switch / systems is shown below.

Litesheet displayed their line of AC direct LEDs that advertise 'no driver' and '15-year warranty'. They achieve dimming through their SmartCor™ technology which is a power line carrier signal which transmits a 0-10V signal to the fixture. They exhibited troffers, highbay, linear and other fixtures which are DLC listed.

OLED Works showed their newest OLED technologies including the Brite 3 which has warm white efficacy up above 75 lm/W. They claim to have no UV light output (like LED) and zero harmful blue light. One of the struggles that OLED technology faces is moisture. Moisture can cause shorts in the array so many companies like to use glass casings.

Cree showed a product called Onespec that allows the distributor to set the color temperature and lumen output of the troffer while it is still in the box. The Onespec distributor uses a special tool to activate a NFC (near field communication) chip and set the fixtures color temperatures and lumen output. The fixture is then set for install and is not be changeable by the end-user. This allows the manufacturer to reduce their number of SKUs by using one product or fixture to meet a range of applications

Figure 8 – Noon Home Switch



Innovation Awards

One of the primary events of interest LFI is the annual Innovation Awards show. Each year, LFI selects a panel of lighting industry experts to judge submitted products to award the year's Innovation Award winners. There were 14 product categories this year to which manufacturers could submit their products. Innovation awards are presented to the winners of each category. Additionally, after winners from each category are determined, the judges designate four products for overall excellence. These overall awards are the Design Excellence Award, the Technical Innovation Award, the Judges' Citation Award, and the Most Innovative Award. The table below is a description and picture of this year's award winners.

Table 1 – 2018 Innovation Award Winners

Category	2018 Innovation Award Winners	Picture
Most Innovative Product of the Year & 6. Recessed Downlights, Wall Washers and Multiples	**LEDRA Brands** *Vector – Downlight uses molecular reorientation to enable dynamic beam shaping from 10° to 55° without moving parts through an app or wall switch*	
Technical Innovation Award & 10. Controls: Component, Sensors, Interfaces and Software	**Crestron Electronics** *CCT & Lux Sensor (GLS-LCCT) -This small, outdoor (IP67) rated sensor detects ambient light level and the color temperature of that light to simulate outdoor light conditions indoors by determining the outdoor light color temperature in order to drive the indoor lighting to match.*	
Design Excellence Award & 11. Dynamic Color, Theatrical, Cove, Strips and Tape	**Juno** *FlexConnect - industry's smallest, most configurable linear optic luminaire system. Juno FlexConnect delivers up to 400 lumens per foot and features silicone optics in 15°, 20° x 45°, and asymmetric distributions. FlexConnect can be shaped to follow architectural curves. And it can be field-cut and reconnected in six-inch increments. Rated for indoor or outdoor use.*	
Judges' Citation Award	**Resilient** *LumEfficient LiFi – LED downlight fixture that embeds light based communication (LiFi) capability to allow devices to connect to and communicate on the internet. LiFi communication uses the light spectrum to provide broad data and bandwidth capacities for communication. This is in contrast to the saturated radio spectrum band which is used by WiFi for communication.*	
1. Non-Luminous Products: Research, Productions, Software and Specialty Hardware	**LEDIL, Inc.** *HEKLA Family – Solderless twist and lock connector that supports many COBs and 8 optics for ease of adoption.*	

Table 1 (continued) – 2018 Innovation Award Winners

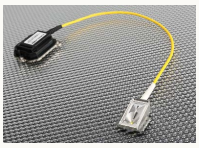
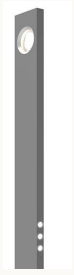
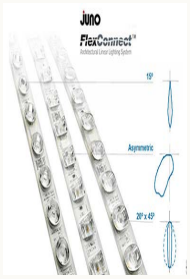
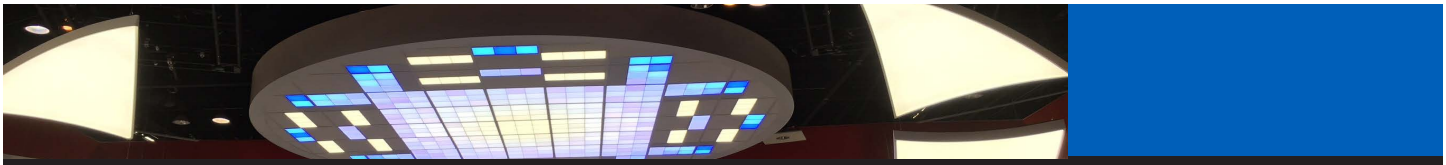
Category	2018 Innovation Award Winners	Picture
2. Lamps: Conventional, Retrofit and Replacement	**Green Creative** *HID LED 25W LAMP – 70-100W HID replacement lamp utilizing a traditional enclosed-rated A23 form factor for bollard, post top, & low bay applications.*	
3. LED/OLED Chips and Modules	**SLD Laser** *LaserLight Fiber Module – High luminance in a remote, fiber optic delivery enabling collimated beam angles of 2° from a 1″ optic diameter*	
4. Ballasts, Transformers, LED Drivers, Systems and Kits	**IOTA Engineering** *POE Emergency Lighting LED Battery Pack – Emergency lighting LED battery pack for PoE Lighting systems which delivers 12W of constant power in Emergency mode.*	
5. Indoor Decorative, Task Lights, Track, Undercabinet and Shelf	**ZUMTOBEL Lighting Inc** *SUPERSYSTEM II – Slim profile track system offers a range of small luminaires for diverse application needs*	
6. Recessed Downlights, Wall Washers and Multiples	**See Most Innovative Product of the Year Above**	
7. Indoor Decorative	**USAI Lighting** *Tik Tak – LED rods suspended in tandem pairs on multiple levels, perpendicular to each other with each rod independently positioned as up or down light.*	
8. Parking, Roadway and Area Luminaires	**Philips** *Gardco PureForm – Reimagined family of 5 luminaire styles, two light engines, comfort and precise optics and multiple control options for a cohesive site lighting solution.*	
9. Sports, Step, Landscape, Pool & Fountain Luminaires	**HESS America** *Portal – 8″ or 10″ architectural column adds a striking accent and functionality to feature spaces with optional low-level marker lights.*	

Table 1 (continued) – 2018 Innovation Award Winners

Category	2018 Innovation Award Winners	Picture
10. Controls: Components, Sensors, Interfaces and Software	**See Technical Innovation Award Above**	
11. Dynamic Color, Theatrical, Cove, Strips and Tape	**See Design Excellence Award Above**	
12. Industrial, Vandal, Emergency and Exit	**Acuity Brands Lighting** *Lithonia Lighting Quantum ELM2LF Fixed Optics Emergency Luminaire –the ELM2LF emergency luminaire combines LED and optical technologies to deliver a wall-mount design with fixed optics. It requires no contractor aiming, yet provides uniform distributions that deliver broad spacing up to 35′ and low max-to-min ratios that exceed code requirements. The lithium battery option adds constant light output during the 90+ minutes after power loss.*	Product Image Release Not Given to EPRI by Manufacturer
13. Commercial Indoor: Troffers, Suspended and Surface Mounted	**Acuity Brands Lighting** *Mark Lighting Chisel – indirect recessed luminaires that allows interplay of lighting and shadows to reveal the shape of light. Five forms, three texture options which allows ability to present soft luminous gradients and textures. Available in tunable white and a unique array of directional luminous gradient options.*	Product Image Release Not Given to EPRI by Manufacturer
14. Control and Distribution Systems, Connectivity and Analytics	**Legrand** *Wattstopper RACCESS – first product offering within Wattstopper's Connected Services suite. RACCESS enables remote diagnostics and technical support of networked various lighting control systems through a secure cellular gateway and dedicated Wattstopper remote operations center. Systems allows Wattstopper experts to connect directly to the system and provide immediate support, addressing many issues remotely without an on-site visit for resolution.*	



Conclusion

LEDs are quickly becoming the most commonly purchased lighting technology in the world. Though they are still a few years away from being the most commonly deployed technology, they are gaining market penetration in virtually every application. Increased LED product sales have allowed product performance and cost to solidify based on application. In a cyclical fashion, this ability to develop and sell low-cost and high-performance LED products resulted from the increased production of LED chips at set efficacy levels. Improved optics and designs appear to be the main research areas for LED product manufacturers currently. Though LEDs have the potential to continue to increase in efficiency and efficacy, the market appears to be stabilizing in efficacy, outside of a few niche applications, in order to increase adoption. Manufacturers and customers appear to be more interested in low cost fixtures with innovative designs instead of paying higher costs to save an additional few watts.

There is, however, much work still to be done. While LED may seem to be the de-facto lighting technology, there are still many users who do not understand the long-term cost savings that LED technology enables. Commercial LED adoption is in the early stages of deployment. Networked lighting controls have significant benefits in terms of energy and non-energy benefits, but many consumers are hesitant to pay the additional costs. Lighting for indoor food production is a growing market that still is largely driven by HID technologies. Many questions still exist around the health impacts of lighting. EPRI will continue to research these topics and to scout for new lighting technologies to help meet the needs of utilities, municipalities, end-users and evaluate the impact of lighting on the electric grid.

EPRI RESOURCES

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End-Use Energy Efficiency and Demand Response

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