

LED Lighting Systems in Product Displays

With modern advances in LED lighting technology, it has become possible to incorporate lighting in designs that simply were not feasible with traditional light sources. While we are under increasing regulations for reducing our energy consumption, LED Lighting technology seems to fit naturally within that regulatory space. In general, LEDs are a DC driven device. This allows great flexibility with luminaire design, system functionality and increasing light output while offering even more options for energy reduction efforts. There are several LED system types that can be described by their power source. AC to DC power, battery power, or combination solar/battery. The most utilized system today is the AC to DC converted Luminaire. As power reduction demands from consumers increase, it's natural for the ultra-high efficacy and solar systems to increase in popularity. As with most technology that offers options, each system type does have its advantages and disadvantages. It is in the best interest of the client to work with a qualified lighting professional to fully define the real needs and expectations of the LED system over its expected lifetime before selecting the system to meet those requirements. Without that "Partnership", there is a greater chance the client will experience disappointment in the system performance. Here we'll examine some details and applications of those three systems.

Battery Powered LED

Traditionally, we all think of battery powered LED lighting in the form of flashlights and lanterns. These products have clearly taken over this niche in the highly portable lighting market. More recently, with higher efficacy LEDs, we've seen less portable products emerge in outdoor and even indoor products. Here are some examples:

Indoor applications

- Closet ceiling
- Wall sconce
- Drawer
- Desk lamps
- Children's toys
- Under cabinet

Outdoor applications

- Flashlights
- Lanterns
- Bicycle headlamps/warning lamps
- Mounted Spot lights
- Safety lighting (blinkers)
- Security Lighting

There are many more battery-powered products on the market meant for specialty applications. These lighting options provide a much simpler installation than AC or solar powered. It is important to note these products are targeted toward residential applications and typical use is sporadic or for short periods. Battery lifetime is usually rated at 6 months to one year, some as little as one month. If you look closely at the hours rating, you'll see a very short life from as little as 2 hours and up to 40 hours of run time. The cost of replacement batteries and used battery disposal will add up quickly over time. For higher use battery powered LEDs, it would be best to use rechargeable batteries. Although, this does present the consumer with yet another device to plug in and charge.

For commercial displays, the brightness requirements are typically 3 times the ambient lighting levels. For most display projects, clients want to maximize the light output and minimize the installation requirements (no electrician). When calculating the battery size and charger requirements, it is common to need multiple deep cycle automotive batteries and multiple large multi-bank battery chargers. These will require store personnel to plug in the chargers nightly or swap out the large heavy batteries daily.

PROs

- Highly portable products
- High power LEDs for short periods of time
- Sporadic use locations
- Fit where traditional wired lights won't – no wires
- Easy to install
- Specialty applications

CONs

- Only use for short periods
- Battery replacement expense
- Mostly residential uses
- Large or high-power systems require large batteries and large chargers
- Charging batteries
- Where to put the large battery and chargers so they are accessible.

Solar Powered LED

For outdoor products, there is a wireless charging option with unlimited free energy! Solar cells! Notice I said “outdoor” products. Yes, we've all seen calculators with solar cells and no battery. These work well with small LCD screen calculators when there is plenty of daylight coming into the building. They also work well in rooms with no windows IF the room is using incandescent or fluorescent ceiling lights. If that room is ever outfitted with LED lamps, your calculator will likely

stop working. The Photovoltaic cells simply cannot harvest enough radiation from the LED lamps to supply the calculator. So, we need daylight for the solar cell.

Indoor applications

- Calculator
- Wireless keyboard
- Cell phone chargers
- Desk lamps

Outdoor applications

- Flashlights
- Lanterns
- Warning signs/lamps
- Mounted Spot lights
- Safety lighting (blinkers)
- Motion security lighting
- Landscape Lights
- Post top lanterns
- Street lights
- Off grid cabin lighting

Typical Solar lighting is used in combination with a photocell so the lights only activate at night. Since this lighting is being used in a very dark ambient space, most don't require a huge lumen output to overcome the daylight. This does allow the devices to use smaller battery options but the general experience is the batteries simply don't last through the night. These lights can also benefit from easier installation since they usually don't require wires.

PROs

- Highly portable products
- High power LEDs for short periods of time
- Sporadic use locations
- Fit where traditional wired lights won't – no wires
- Easy to install
- Specialty applications
- Less expensive voltage converters than AC

CONs

- Only use for short periods at night
- Batteries still have to be replaced usually within 2 years
- Mostly residential uses
- Large or high-power systems require large batteries and large solar arrays
- Lights typically don't last all night
- Daylight is not always available
- Where to put the solar array

AC to DC Powered LED

This is the most utilized system for LED luminaires today. All LED lighting has a converter to provide the correct drive current to the LED array. This is important for LED lifetime and reliability. This category of LED luminaires has two options for the AC to DC converter, 1) Built-in Driver (Integral) or 2) Remote Driver (External). The largest perceived obstacle for this design is thought to be the availability of an AC power source. When no AC source is available, it requires the services of an electrician to provide an AC source and sometimes the low voltage (DC) wiring for the LED luminaire. This will clearly impact the up-front investment in the LED system. Even with this expense, the ROI can be a few months or immediate when factoring the cost of batteries, chargers, maintenance, routine service and replacement batteries over the lifetime of a system. There are too many applications to fully describe here but here are a few of the most common.

- Any traditional ceiling application
- Wall sconce
- Under cabinet, in cabinet
- Showcases
- Shelf displays
- Architectural
- Traditional outdoor applications
- Landscape
- Advertising/Signage
- Security Lighting
- Roadway lighting
- Parking lot lighting
- Traffic lights
- Museum displays

The remote driver systems do require more knowledge of the system limitations/capabilities during the design phase. This is where the client working closely with the lighting professional is extremely beneficial. There is an almost infinite number of ways to layout the system and it's important to have the layout within specifications so the user will experience frustration free operation and maximize energy savings. All of Hera Lighting's remote Driver systems use Class 2 safety specifications for the LED lighting. This allows easier low voltage wiring methods.

The Integral Driver LED systems are even simpler to install. There is no distributed low voltage system to manage. The lights simply connect to an AC source. Where larger systems are needed, the lights can interconnect with each other to minimize the quantity of outlets needed. Optional controls, switching, dimming, etc. are easily added inline or source driven. There are many advantages to these systems.

PROs

- Highly reliable products
 - High power LEDs for up to 24 hours/day operation
 - Attractive ROI options
 - Possible energy rebates available for retrofit products
 - Easy to install
 - Low power consumption illumination option.
 - Configurable design to fit most any applications.
- No batteries to maintain
 - No chargers to maintain
 - No staff to retain or train to manage batteries or changers
 - Commercial and Residential
 - Brightness levels can easily be managed.

CONs

- Up front electrician investment
- Not highly portable

Conclusion

There are many advantages to the installation of these three LED luminaire systems. With modern advances in LED lighting technology the real long-term value is the consumer working with a lighting professional to select the best system for the environment and application. It is that partnership that will manage expectations and provide the best results. There will be many more advances in LED technology in the coming years. It will be a rewarding challenge to incorporate those advances into our product lines and work those into consumer designs.

David Slaton
Technical Support Engineering Manager
Hera Lighting L.P.