Power Solutions for the Next Generation of LEDs

Interview with Michael Archer, Co-Founder and CEO, ERP

Better Light for a Better Environment

Outdoor LED Lighting Benefits
What has the world of the future in store for us?

electronica 2016

Once again, electronica will bring the global electronics industry together in Munich for the world’s largest trade fair dedicated to every aspect of electronics technology. From November 8-11, 2016, once again more than 2,800 exhibitors will show us what the world of the future has in store for us.

As an industry institution, electronica has been the global gathering for the electronics industry for more than 50 years. With a close eye on the latest trends, electronica 2016 will revolve around topics such as Automotive, Embedded Systems, LED/SSL, Wearables and Healthcare as well as Cyber Security and the Internet of Things. It will present the entire range of electronics solutions: from semiconductors, sensors and passive components to PCBs and system components. Besides the trade fair itself there are several other highlights.

electronica Automotive Conference

Among leading executives in the automotive sector, the electronica Automotive Conference is a highly regarded part of the conference program. The focus of the 2016 conference is on security, automated driving and interior electronics.

Date: November 7, 2016
Location: ICM – Internationales Congress Center München

Embedded Platforms Conference

This year’s conference will focus on the following topics: Hardware platforms and hardware components for embedded systems, software and tools for embedded development and optimization, and standards and legal provisions for embedded systems.

Date: November 9 and 10, 2016
Location: Press Center East

The new start-up area—electronica Fast Forward

The electronica Fast Forward start-up platform offers founders extensive start-up assistance. Several start-ups and aspiring entrepreneurs will present their innovative ideas at electronica. Further, visitors can look forward to an extensive forum program and the presentation of the electronica Fast Forward Award.

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Scientists at the University of Cambridge have used a liquid light to create a semiconductor switch that’s tiny enough to blur the distinction between light and electricity while also enabling the development of much faster and smaller electronic components.
With the demand for faster, smaller electronics on the rise, and microelectronics reaching the point where quantum effects are challenging the use of electrons as a transporter of data, researchers across the globe are exploring ways to solve these issues.

To create a Polariton Bose-Einstein condensate, laser light is captured between mirrors in a microcavity that’s a few microns in size. Image source: University of Cambridge.

Instead of going about the contemporary methods used to convert between electrical signals and optical ones considered inefficient, the research team believes it’s better to remove the middleman and blend the two together. To achieve this, the researchers created a switch using a new state of matter called Polariton Bose-Einstein condensate to combine electric and optical signals while consuming small quantities of energy in the process.

“The polariton switch unifies the best properties of electronics and optics into one tiny device that can deliver at very high speeds while using minimal amounts of power,” said Dr. Alexander Dreismann of Cambridge’s Cavendish Laboratory.

In order to create a Polariton Bose-Einstein condensate, laser light is captured between mirrors in a microcavity that’s a few microns in size. This is where the light interacts with thin sections of semiconductor material to produce a half-light, half-matter combination of quasi-particles known as polariton, which are made of semiconductor excitons and photons.

If a large portion of polaritons are generated at once in a confined space, they often clump together and condense like water vapor does when encountering a cool surface. The light-matter fluid that forms at during this process is imparted with a particular spin, where it can spin clockwise (up) or anti-clockwise (down). To make the direction of spin controllable, making it usable in an electronic context, the team induced an electric field within the condensate, making it possible to switch between up and down states at will. As the polariton fluid produces light as it rotates, the researchers believe that spin encoded light could convert electrical data to optical signals that can be sent through optical fibers.

The results of this research were published in the journal Nature Materials.

“Your Circuit Starts Here. Sign up to design, share, and collaborate on your next project—big or small. Click Here to Sign Up”
Light emitting diodes (LEDs) technology are quickly revolutionizing the electrical lighting industry due to their relatively high efficacy (higher lumens per watt), secondary optics (better lenses/reflectors), and greater thermal dissipation when compared with conventional incandescent bulbs. The technologies underlying LED lighting have advanced rapidly and the associated costs have dropped dramatically, making LEDs viable lighting solutions for a growing range of applications. Today’s LED bulbs use energy far more efficaciously than conventional incandescents; with little of their energy wasted as heat, they can be six to seven times more efficacious than incandescent lights, often cutting energy use by more than 80 percent. Higher reliability and longer lifetimes are other important advantages LED luminaires offer. However, in order to meet the expectations of higher reliability and longer lifetimes, the lights must be properly protected from electrical hazards. When they are properly protected from overvoltages and other disturbances, LED bulbs can last 25 times longer than traditional bulbs.
LEDs are used in a wide range of applications because of their unique characteristics, which include compact size, ease of maintenance, resistance to breakage, and their ability to focus the light in a single direction. LED luminaires are widely used in roadway lighting, parking garage lighting, wash wall lighting, traffic lighting, flood lighting, digital signage, tunnel lighting, and street lighting.

Approximately, one-third of the savings LED installations make possible are the result of the longer lives of LED fixtures. Reducing maintenance costs is crucial to ensuring the long-term cost-effectiveness of LED installations. Outdoor luminaires that aren’t protected properly can fail at any time, even before they pay for themselves through power savings. Given that government agencies and property owners are paying 2X to 4X the price of legacy lighting when replacing it with LED fixtures, they need to recoup their investments. If damaged, LED lighting must be repaired by a contractor or the street light owner.

In order to protect outdoor LED lighting from failing within an investment payback period of about five to seven years, the lighting must offer high durability and reliability. Transient surge events in AC power lines, which can damage lighting fixtures, represent a significant threat to outdoor LED lighting installations. No lighting installation, conventional or otherwise, is without issues. The causes of some of these, such as weather or line voltage spikes and fluctuations, are largely outside of the control of either the installation owner or product manufacturer.

The GATEWAY Program

The U.S. Department of Energy’s (DOE) GATEWAY Program has obtained a variety of important observations and results from a lighting evaluation project it conducted. The program supports evaluations and demonstrations of high-performance solid-state lighting (SSL) products in order to develop empirical data and experience with in-the-field applications of this advanced lighting technology. The DOE GATEWAY Program focuses on providing a source of independent, third-party data for use in decision-making by lighting users and professionals; this data should be considered in combination with other information relevant to the particular site and application under examination.

Each GATEWAY evaluation compares SSL products against the incumbent technologies used in that location.

LSP Thermally Protected Varistor Modules from Littelfuse are designed specifically for outdoor and commercial LED lighting applications. Their built-in thermal disconnect function provides additional protection from catastrophic failures and fire hazards, even under the extreme circumstances of MOV end of life or sustained overvoltage conditions. LSP05 and LSP10 modules are replaceable. The LSP10 series-connected version has a special indication function that turns the light off when it is activated.

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<td>Max Surge Capability (1 strike)</td>
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<td>UL Recognized</td>
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<td>Coordination Performance</td>
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*See datasheets for details

VIEW THE VIDEOS: https://vimeo.com/158555540
https://vimeo.com/180662907
Outdoor LED lighting is subject to a variety of environmental overstresses, including wide temperature swings, contamination and corrosion, rain and moisture, sunlight/UV radiation, wind and vibration, and electricity fluctuations. Though products used in the GATEWAY program may have been prescreened for performance, DOE does not endorse any commercial product or in any way guarantee that users will achieve the same results through use of these products.

DOE’s Study on LED Lifetime—The Experiment on the I-35W Bridge

The I-35W Bridge in Minneapolis remains one of the oldest exterior LED installations in continuous operation in the United States. The DOE has released a report on the longer-term performance of the LED lighting system that was installed on this bridge in September 2008. The report is a welcome addition to the literature on LED lighting, which will benefit from additional data in the area of longer-term field performance.

A recent study of the DOE on the decay of LED luminance over time anticipates a 30% lumen depreciation over the installation’s lifetime. Over a 6-year testing period, two power supply units out of twenty failed. Outdoor LED lighting is subject to a variety of environmental overstresses, including wide temperature swings, contamination and corrosion, rain and moisture, sunlight/UV radiation, wind and vibration, and electricity fluctuations. Transient voltages in power line represent significant threats to luminaire reliability. Even though there is no solid evidence about power supply unit failures in the field, the DOE report indicates that at least some power supply unit failures are due to insufficient surge protection.

As more field experience is gained, and the causes and impacts of the various other factors become better documented, the specification process for a given site must be adjusted accordingly. One such example is the luminaire’s suitability for meeting the local conditions. The luminaires were installed on the I-35W bridge before the specifiers had the benefit of knowledge gained through years of outdoor LED field experience. That means the installation is likely subject to some otherwise preventable issues like the measured reduction in luminaire power use and corresponding output, or perhaps even the two documented power supply failures. Without knowing the cause of these issues, it is impossible to say with certainty, for example, whether they could have been circumvented with a higher level of surge protection against local voltage transients. Over time, more detailed specifications matched to the needs of a given site will help reduce or eliminate complications that negatively affect field performance.

Conclusion

LED luminaires represent an early state of the art of LED lighting technology, but they continue to exhibit comparatively reliable operation when compared with legacy lighting fixtures. At the current point of roughly 20,000 hours of cumulative operation, the bridge would have required at least one complete re-lamping by now if the lighting designers had chosen the conventional lighting route, as well as additional premature failures, as is typical with any common lamp-based technology.

Six years of testing and studies from 2008 to 2015 by the DOE on the LED street lights on the I-35W Bridge in Minneapolis prove that the usage of LED luminaires always provides a high return on investment. Higher level of surge protection may further minimize power supply failures and enhance reliability. All outdoor LED lighting produced after 2015 must adhere to standards from the American National Standards Institute (ANSI) for getting maximum life from LED luminaires.

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Light happens to be one of the key triggers for our rhythmic clock. This clock (known as our circadian rhythm) is apparently pervasive throughout our bodies, and like any clock it works best with a reference point or regular reset. Light provides that.
Recently, on the topic of light and circadian impact, there has been a flurry of articles in response to guidance published by the American Medical Association (AMA) regarding LED street light applications. The AMA certainly has raised the tenor of the conversation. With the increasing deployment of LED streetlights, they felt it important to recommend that warmer color temperatures (in the 3000K range) are preferred over the traditional cooler temperatures (in the range of 4500K or higher) to avoid what they termed as “detrimental effects” of blue radiation found at a higher degree in cooler color temperatures. The response to their recommendation was swift, clear and broadly sourced. A small sampling includes: Department of Energy (DOE) SSL Postings, Lighting Research Center (LRC) at RPI as well as others. A good discussion can be found in the Municipal Solid-State Street Lighting Consortium (MSSLC) July Newsletter. Also, a nice analytical framing of the issues was written for the ASSIST group at RPI by Mark Rea, et. al. back in 2012 and a recent NIH workshop on shift work at night provides an in-depth look at the discussion.

Often, a controversial position, such as the AMA’s guidance, serves to spark a useful conversation beyond the initial topic. Most of the responses to the AMA have been well-balanced; seeking to affirm the common goal for LED adoption and energy savings, while also bringing a more data- and application-driven discussion to the forefront.

Since the first arc lamp streetlights of the 1800s (glare, short life, high UV emissions), lighting professionals have worked to match the best light source to each application and balance cost with benefit. One hundred percent darkness at night might be a great solution for some, but short of going back to pre-industrial time, it is unrealistic to expect us to give up the productivity, 24x7 medical care and safety that artificial light provides. Conversations like the one surrounding the AMA guidance are important to drive broader understanding and enable us to take full advantage of what LED lighting has to offer. Through a rational debate we gain education and alignment, without creating drama, fear and hyperbolic press. Many useful conversations have occurred over the past several years: What is a lumen and how many does a 60W incandescent bulb really produce? What is CRI and why does it matter? How sensitive are we to flicker? These questions and ensuing debates have helped educate consumers and manufacturers alike. The conversations have shifted from: Conventional vs. LED lighting, to lumens and CRI, to lumens per watt (LPW) vs. quality.

Now that LED lighting is essentially a given and customers are familiar with Lumens, CRI and LPW, the conversation can be elevated further, asking how the quality and intelligence of a fixture can provide us with a healthier and more comfortable environment. Efficiency is only useful if it is not at the expense of a quality experience—a lesson learned with compact fluorescents. Every application deserves maximized LPW and minimal cost, but if achieving this yields harsh glare-bombs, we sacrifice the quality of our living environment. Loosely stated, physiology looks at the functions and activities of life and living matter, while physics tends to consider the properties and interactions of matter and energy. LED lighting provides one of those unique instances where the physiology intersects with the physics. Light is where energy meets the physiology; where life gets energy! We have grown to expect clean water and clean air, and now, we should expect high-quality light. All three support a healthy environment.

We now have a light source that can be tailored in spectral content, design and layout to efficiently meet the application-specific and environmental goals. So, whether the goal is to reclaim the night sky for more people to enjoy, reclaim our ancestral rhythmic balance and health in a society focused on 24x7 productivity or to have the safest high-quality light for the application, LEDs offer more opportunity than any technology that came before.

No matter what your goal, the shared truth is that LEDs are not the problem, they are the solution. With smart, high-quality LED lighting, we can enable our transition to a better environment.

ABOUT THE AUTHOR

Dr. Robert Glass is vice president of technology at Cree. In this role, Rob works cross-functionally with the Cree’s business units to drive research and development of new technologies and products. Rob has held several other positions at Cree including executive vice president, Materials and Optoelectronics; vice president, Operations and Manufacturing; vice president and general manager, Materials, Materials Manufacturing Manager, and manager of Crystal Growth. Prior to his employment at Cree, he worked at Westinghouse Electric Corporation.
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Power Solutions for the Next Generation of LEDs

The lighting industry is shifting its focus to LEDs as an alternative to traditional lighting sources. This shift brings with it the need to power large-scale LED grids in a small but powerful way. Energy Recovery Products, or ERP, helps to provide the necessary power with their line of professional-grade commercial LED drivers. Michael Archer, co-founder and CEO of ERP, utilized his expertise cultivated from creating power architectures for computers to develop a line of efficient LED drivers for architectural, commercial and industrial applications. EEWeb recently met with Michael to discuss how ERP is working to power the LED lighting industry and what the future of LEDs looks like.

Interview with Michael Archer, Co-Founder and CEO of ERP
INDUSTRY INTERVIEW

Lighting Electronics

Give us a bit of your background. How were you inspired to start ERP?

I went to school in Germany, came over to the United States in 1982, and have been working my way through the power electronics industry ever since. I’ve been specifically focused in LED lighting for the past 12 years. Early in my career, I was a scientist developing the first practical resonant converters that dominate the power electronics market today. I worked in the computer business, designing the power architectures for notebook, desktop and server computing platforms for companies like Apple, Dell, HP, IBM, Texas Instruments and others.

I refer to myself as a serial entrepreneur who enjoys building companies from scratch. I created my first startup, EOS Corporation, in my garage when I was 30, and grew it to $35 million. My inspiration for starting ERP came when I saw how LEDs were extending beyond networking, computing and storage devices to lighting. Where there are people, there is a need for lighting, and I wanted to power lighting innovation with small, smart and efficient LED drivers for architectural, commercial and industrial applications.

What is ERP’s main focus?

We focus on professional-grade commercial LED lighting applications (rather than consumer/residential) because quality, size, reliability, energy savings, dimmer interoperability, intelligent controls and total cost of ownership matter, and are required by our customers.

If you look at an LED light assembly, it is made up of the LED, a mechanical assembly and a cosmetic housing designed for different sizes, shapes, styles and locations. In order for the LED to operate, a constant current LED driver is needed. Most AC power relies on a circuit in the wall as it’s voltage source. The LED power supply has to convert that voltage source into a current source to regulate the light output in the LED. ERP makes a wide variety of these converting devices for LED lights deployed in architectural, area, digital signage, emergency, entertainment, horticulture, hospitality, industrial, office, pathway, retail, recreational and roadway lighting applications.

We design our products in California and manufacture in both California and Asia. Most of the processes we use to manufacture LED drivers are very similar in topology, manufacturing techniques, and logistics to processes used to manufacture power supplies in the computing industry.

What excites you most about the growing LED lighting industry?

The fact that there is still so much ground to cover. We’ve had lighting technology around since Edison in the 1870s that fundamentally didn’t change much until the last 10 years. Now, we find ourselves in an era where the ability to deliver light (and data) in any shape, form or size is possible. Immersive, interactive experiences are enabled by LED lights. With technologies like Li-Fi (whose roots began with Alexander Graham Bell in the 1880s) you’ll see LED lights deliver high-speed data access for billions of Internet of Things (IoT) devices. There is a huge thrust of creativity going on right now. I believe we’re going to see the way lighting is used change drastically, and it’s exciting to be literally powering that change.

Is ERP currently focusing more on developing new technology or optimizing the manufacturing process?

Optimizing our manufacturing is a continual process, and one that we always have our eye on. On the technology side, a lot is happening. The new products we’re developing and introducing to the market later this year are fully programmable and wireless enabled with intelligent control and mesh communications capabilities. They are able to communicate the status of the LED light itself, tell us how much power is being consumed, if there are power interruptions and if there are thermal faults. With energy efficiency standards like California’s Title 24 and the U.S. government’s Energy Star 2.0—lighting needs to be smart. We live in an information age, and it’s clear that the lighting industry as a whole is following in that vein.

What are the key competitive advantages of ERP’s LED drivers?

We apply our “small, smart and efficient” expertise from computing into the LED lighting industry. That expertise enables ERP to deliver high efficiency, high density power using advanced resonant LLC converter topologies.

LED drivers are the natural place to embed intelligence for lighting controls as they are able to communicate the status of the LED light itself, tell us how much power is being consumed, if there are power interruptions and if there are thermal faults. Beyond lighting—drivers can also integrate with a variety of sensors—acting as a backbone for access to Internet of Things (IoT) applications. We call it the Internet of Lights.
that reduce switching losses and boost conversion efficiency. Being small, yet powerful, ERP LED drivers give electro-mechanical engineers more flexibility to create unique lighting fixture designs without worrying about the size of the power supply. Dimmer interoperability is also a key advantage as ERP drivers work with most of the different types of dimming techniques and protocols. Being programmable means one ERP LED driver model can work effectively in multiple lighting fixture designs which lowers costs for our customers. ERP driver intelligence enables wired and wireless remote control and monitoring to optimize energy savings.

Which ERP technology innovations and products provide these key advantages?

The most successful products we have in the marketplace, even from 5+ years ago, are all resonant LLC power topologies because the result is an extremely efficient and small LED driver that enables LED designers to effectively hide the power supply. The power supply tends to get in the way of the aesthetic design aspect of the lighting fixture. Our high density products enable that important flexibility for the end designer. ERP is fortunate to be powering many of the award-winning lighting fixtures in the industry today.

Where, in terms of industries, regions or countries, are you seeing customers deploy intelligent lighting controls?

Certainly Europe and the United States are picking up speed very quickly. I think Europe has been slightly ahead of the United States. When it comes to lighting, the European market has typically been a bit more advanced, but that gap is quickly closing. In the next year or so, the United States will probably be surpassing Europe through the deployment of integrated wireless control systems. Buildings that are monitored at the power supply level of granularity for energy consumption are really taking off in the United States right now.

Why do you think customers make the investment in intelligent lighting controls?

If you’re in Europe, where lighting ambiance is very important, the intelligent LED lighting controls are used to ensure ambient light experiences. In the United States, we are seeing a pragmatic focus on reducing power consumption and lowering utility costs on a larger system level to comply with government regulations and initiatives designed to ensure the stability of the utility grid while reducing requirements for fossil fuel power generation. Ambiance and pragmatism are competing goals. Fortunately for ERP, the core technology enables both goals to be achieved. Even though the markets are different in different countries, ERP can service both desires because of the intelligence and programmability embedded in our LED drivers.

You mentioned intelligent lighting controls at the industry and government levels. Do you foresee this being adopted at the consumer level as well?

Currently, the products available to facilitate lighting and power controls are primarily designed for higher power megawatt/gigawatt consumption office buildings, retail stores, factories, stadiums and warehouse, rather than the kilowatt residential or consumer side. We’re helping accelerate what’s happening in power control and affordable management for street lights, ambient outdoor lighting, industrial and commercial complexes. Beyond that, I would speculate that eventually utilities will want some control over lighting systems across the board, which is something that a wireless lighting system can supply. However, right now, wireless lighting systems in homes are typically used for ambiance control rather than energy savings.

What will your next generation of products bring to the market?

ERP’s next generation LED drivers will be more powerful to address high-wattage / high lumen fixtures in street lights, stadium lights and other outdoor lighting applications while continuing to be smaller and more efficient than our competitors with all the wireless connectivity and intelligent controls. We also are developing some innovative dimming approaches where the driver is integrated with the dimmer to power multiple lighting fixtures. This will lower the cost of wireless lighting controls in residential and small office environments since the intelligence will be embedded in one integrated dimmer/driver that can deliver ambiance and energy savings for all the lights a room.

What advice do you have for electrical engineers just starting their career today in power electronics?

I think the important thing for new engineers in power is to not get too caught up in the digital side of everything. While it’s important to understand the digital side, don’t forget that power is analog. We still use reactive components to transfer power from one location to another, or from to...
one form to another. It’s very important to stay in touch with the analog roots of power to be effective in the long term throughout your power electronics career because digital needs analog.

Is there anything else you would like to share with our readers about the lighting industry or, more specifically, ERP?

ERP invites you to collaborate with us as we power the future of LED lighting innovation. We are happy to provide electro-mechanical lighting designers with samples of our products; and earn the right to your business by making things easy when it comes to pairing the right driver with the LED components you have selected. We are fortunate to be the power inside many of the industry’s leading lighting fixtures. ERP envisions a future where LED lighting will be the backbone of the Internet of Things (IoT), enabling a completely new connected world where light becomes data and delivers engaging, interactive experiences for people everywhere through the Internet of Lights.

Michael Archer

Michael is co-founder and CEO of ERP Power. Established in 2004, ERP designs and manufactures energy-efficient LED driver power electronics for commercial and industrial lighting applications. Small, yet powerful, ERP products deliver an industry-leading combination of compact size, extensive dimmer compatibility, and high efficiency at competitive cost. Headquartered in Moorpark, CA, ERP owns and operates its own ISO 9001 certified manufacturing facility to ensure quality of design, sourcing, production and testing.

ERP is an Angeles Equity Partners portfolio company.

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ERP invites you to collaborate with us as we power the future of LED lighting innovation.

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