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September-October 2016


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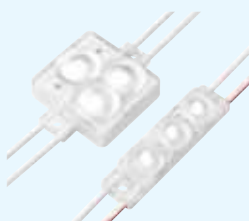
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PUBLISHER'S LETTER



Mahadevan Iyer
Editor-in-Chief

Diwali or Deepavali, the festival of light, is coming. This is the greatest of all Indian festivals, in the sense, during Diwali days, our entire country shines with colourful lights. Keeping aside the religious and mythological backgrounds of the festival, with our unbiased understanding we know that light makes an object visible – thus it goes without saying that effective lighting changes the appearance of any object. This has a profound effect on our minds.

Diwali is the time when lights are put at every nook and corner of our country, which change the appearance of even the apparently bad looking objects. The practice is to instill a psychological change among people. Happiness or unhappiness (including sadness, spitefulness, vengefulness, furtiveness and so on) often originates inside the human mind, because of either constricted vision (narrow outlook) or unnecessary extrapolation of the insignificant events of life.

The light of Diwali changes outer appearance of the things and often that refreshes the inner mind (as an impact of the different look of the surrounding objects), which makes us think with new paradigm and influence of the new energy. Thus, Diwali or Deepavali brings in new rays of hope in every individual's mind, which collectively is supposed to boost the morale of the entire nation.

From the time immemorial, Diwali is being celebrated in India. Formerly, there were earthen (traditional) lamps lit with oil (or ghee) and wicks. This practice is quite symbolic. Light is the symbol of knowledge, which drives away darkness and ignorance. The oil or ghee (used as fuel in the traditional or earthen lamp) represents negative tendencies or thoughts – and the wick is the sign of ego. Thus, when the lamp burns it is assumed to expel all the root causes of argy-bargy, analphabetism and agony.

Although, lighting traditional lamps is not yet a completely obsolete practice, nowadays mostly we are using colourful LED lamps to decorate our homes and surrounding areas. They are safer, less hazardous and low power consuming that is very essential for our power-starved country. As a lighting enthusiast, I suggest use of colour changing LED strip lights with remote control systems. That will definitely elevate your mood during the holidays. Happy Deepavali!

Do send in your comments at miyer@charypublications.in

Mahadevan

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Furniture lighting solutions
by Häfele

AMBIENT Lighting

contents

Vol. 11 | No. 5 | September-October 2016



The idea behind designing a lighting plan for offices is to enhance long-term employee comfort, with a proper balance of energy savings as well as lighting quality. Prudent integration and control of daylight tend to improve employee morale and also cut energy costs...



Great Hall bathed in soft light



Challenges faced by LED Lighting System

articles

Great Hall bathed in soft light	22
Effective Office Lighting	28
Challenges faced by LED Lighting System	36
The Best Creative Lighting Event At The darc Awards	40
Innibos	44
A 360° Approach & Beyond	48
New Lightning Scheme for Laboratory.	54
LightTech Calls On ILUMINARC	58
Features to Seek in an Indoor LED Lamp Driver	61



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Interview



48

LED is now possible to be used as an replacement of outdoor lighting

– Amano Haruki
President, Citizen Electronics Co., (Hong Kong) Ltd.

Interview



“ We Must Go For Technically Efficient Light ”

– Sandeep Agrawal
Director, iLux
Electricals Pvt. Ltd.

16



40

darc Awards



44

innibos



61

Features to Seek in an Indoor LED Lamp Driver

Publisher's Letter	2
Editorial	8
News	10
Appointments.	18
Awards	20
Product Profile	66
Index to Advertisers	67

department



54

New Lighting Scheme for Laboratory



58

LightTech Calls On ILUMINARC

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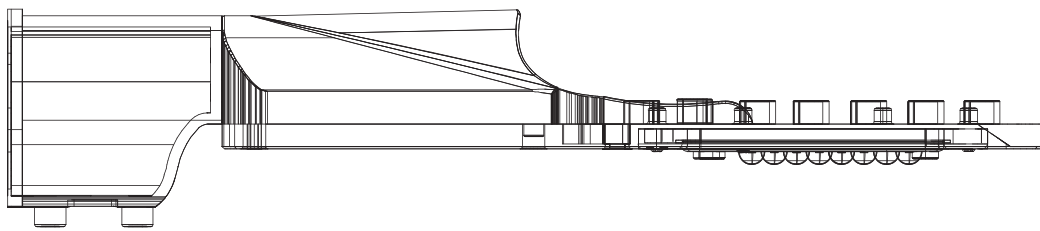
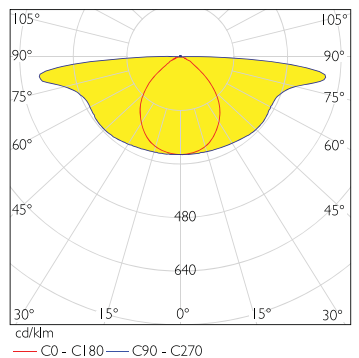
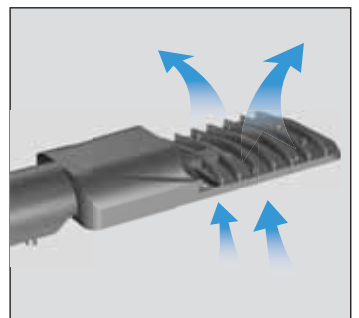
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EDITORIAL



Planning Behind Good Lighting

What is good lighting? When we think about it, we clearly see it is a relative term. To be more specific, it is totally activity-based. Also, in common parlance, if the requirement – of a particular mood, at a particular place, at a particular time, for a particular activity – is supported by the available type and level of illumination then and there, (then) we say that the lighting is good, adequate and appropriate. So, once again I repeat, it is a relative concept. And here the most difficult-to-tackle challenge is – everybody present at a place, at a time is not in the same state of mind.

It may occur to many people (not connected to the niche areas of the lighting industry) whether there is any experimentally established base behind choosing an average lighting scheme. The answer is 'yes'. Let me narrate a recent example. Kyungah Choi and Hyeon-Jeong Suk, Associate Professor of Industrial Design at the Korea Advanced Institute of Science and Technology (KAIST) in South Korea and Head of the Institute's Color Laboratory have recently published a paper. They tested the effect of the three different lighting conditions (3500, 5000 and 6500 K), on the academic performance and recess activities of fourth-grade children in a simulated classroom. To test academic performance, students were given timed arithmetic tests. They found no significant variation in performance under the various conditions. According to their finding, which has been propagated by The Optical Society, USA, the 'stimulating' 6500 K CCT light did not help the students do better on tests. Suk says, "A plausible explanation for the lack of meaningful in-lab results is that the test subjects were placed in an artificial setting and exposed to the lightings for only a short time.

Whereas, when in a preliminary study with adult volunteers in a laboratory setting, they examined the effect of different CCT lighting conditions (3500, 5000 and 6500 K) on the level of physiological alertness, in a room equipped with an LED luminous ceiling, with the CCTs of the ambient lighting controlled by adjusting the red, green, blue and white levels of the light, they found that the 6500 K lighting condition led to the highest level of physiological alertness while the 3500 K condition was the most relaxing.

Thus, any good lighting scheme is always based on experimental findings, otherwise it cannot satisfy majority of the people.

Please e-mail me your views at pkchatterjee@charypublications.in

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Editor: P K Chatterjee

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EESL assures high quality LED Street Lights

Energy Efficiency Services Limited (EESL) strongly refutes all claims of having installed faulty LED street lights in their project in the South Delhi Municipal Corporation (SDMC) area. Under the Government of India's Street Lighting National Programme (SLNP) over 1.98 lakh conventional street lights have been replaced with LED street lights in Delhi. EESL procurements conform to BIS specification and carry a 7-year warranty against technical defects. It conducts appropriate quality checks right from the bidding stage to the field level. This has resulted in the LEDs' overall technical fault being less than 2% in the 14 lakh lights installed by EESL in the country.

As per the contract, the company is required to maintain an uptime of 95%, which in the present case is more than 97%. This is one of the highest in the country. It is also taking proactive measures for grievance redressal through social media, BSES toll free helpline, email complaint system and use of mobile vans for night patrolling.

It is also installing Centralised Control and Monitoring System (CCMS) at a fast pace to enable remote operation and monitoring of the street lights across the Nation. For complaints against non-functioning LED street lamps, the consumers can send a message via WhatsApp or email.

To address all grievances, EESL has doubled its on-field teams, which are deployed for maintenance. There are regular weekly meetings and reviews with SDMC to rectify the problems faced on field that are not covered in the MoU signed by the tri-parties.

EESL has guaranteed reduction in energy consumption by 53%. This project will result in annual reduction of 26.2 million kWh of energy during peak hours. SDMC will benefit by Rs. 41.47 crore over the said period without having to invest any capital upfront. ■

Ministry of UD and EESL sign MoU to promote Energy Efficiency Programmes

Ministry of Urban Development (India) has embarked on a major programme to improve energy use efficiency in bulk water supply, public lighting, transportation and domestic consumption in cities and towns across the country. The ministry recently signed a Memorandum of Understanding (MoU) with the Energy Efficiency Services Limited (EESL), a public sector enterprise under the Ministry of Power in this regard.

According to the MoU, the energy costs account for 40 to 60% of cost of water supply in urban areas – and energy efficiency interventions can reduce this energy cost by 25 to 40%, depending on the type and age of machines being used for bulk water supply. Savings in water supply is said to be Rs.3, 200 crore and 600 MW of power. Emission of Carbon Dioxide, a climate change agent is estimated to be reduced by over 3.9 million tonnes per year.

The performance contracting offers a mechanism for urban local bodies to finance these projects without upfront investment. ■



(L2R): N Mandloi; M V Naidu; P Goyal; S Kumar; Raj Pal, Economic Adviser, Ministry of Power; and Rajneesh Rana, DGM (Contracts), EESL.

Dear Sir,

I have read your article on Horticulture by LED lighting in this link:

<http://www.lightingindia.in/blog/post/id/11389/horticultural-led-products>

I am totally in agreement with you. The area of land for cultivation is reducing because of their conversion into real estate business – and also farmers are disowning the cultivation and settling in urban areas. There will be huge gap (fall) in production of food produces (grains). LED-based horticulture is giving some hope to urban areas, where people can grow some food in their premises.

But, does any Indian agriculture institute conduct research in this domain and data is made available to public? I mean the LED wavelength requirement data for the respective crop/flower/ fruits so that we can develop solutions around this data.

This is of my personal interest on this solution.

Regards,
VS Gopal



Reply from the Editor

Dear Mr. Gopal,

In India, this is not a very prevalent picture yet, owing to our wide availability of agricultural lands. However, globally, this area is gaining good focus. As per the available information, I can say, "PhytoSynthetix and the University of Georgia have developed a biological feedback system that monitors how efficiently the plants are using the light for photosynthesis. The system uses this information to optimise energy use efficiency based on the plants physiological performance. The light output from the LED lights can be adjusted based upon the plant's physiology (photosynthetic efficiency). Based on the plants' requirements, the system autonomously adjusts the LED grow lights duty-cycle to match plants' requirements reducing the system energy consumption."

For further information, you may contact PhytoSynthetix, through their webmail at: <http://phytosynthetix.com> or Tel. No. +1 302-290-1560.

With thanks & regards,
PK

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In addition to the high color rendering LEDs aimed at making the color of objects more faithful, the demands on high chromatic LEDs targeted for making objects more vivid are increasing.

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Citizen Electronics has developed high chromatic LEDs that enable the vivid appearance of objects by selecting LED dice or phosphor and tuning the light emitting spectrum.

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Gujarat becomes the first state to distribute 2 crore LED Bulbs under UJALA

Under the Government of India's UnnatJyoti by Affordable LEDs for all (UJALA) scheme, Gujarat has become the first state to distribute 2 crore LED bulbs. The state has reached this milestone in just 96 days and over 42 lakh households have already benefitted from the scheme. Energy Efficiency Services Limited (EESL), under the administration of Ministry of Power, Government of India, is distributing approximately 2 lakh bulbs daily in Gujarat, which is again a record in itself.

The distribution of 2 crore LED bulbs has led to an annual energy savings of 259 crore kWh, which is equivalent to lighting up 5 lakh Indian homes for an entire year. Alongside the savings in units, the state has also benefitted from daily CO₂ emission reduction of 5,000 tonnes. The programme has also helped the state to avoid 520MW of peak demand.

In Gujarat, 9W LED bulbs are being distributed under the UJALA scheme. These energy efficient bulbs come with a free three year replacement warranty for any technical defect. To avail the bulbs, consumers have an option of paying upfront amount of Rs. 70 per bulb or they can choose an EMI option. Consumers choosing to pay through EMI will have to pay Rs. 75 in total, where an amount of nearly Rs. 20 per LED bulb will be added to their bi-monthly electricity bill for a period of 4 bill cycles. Consumers stand to save nearly Rs. 336 every year on their electricity bills per LED bulb, making the LED bulbs free to the user in just three months. The state government aims to distribute 12 crore LED bulbs across the state. This would lead to energy savings of nearly 650 Crore kWh and cost savings of about Rs. 2,500 crore. ■

DECO Lighting performs exceptionally well

DECO Lighting released the low-profile Gladetino LED Area Luminaire in the month of July 2016. Now, the company proudly states that it has achieved unparalleled performance in the LED area lighting arena. Featuring a sleek, futuristic design, the Gladetino luminaire excels in performance due to superior thermal management and delivers crisp, controlled illumination at up to 146 lumens per watt.

This DesignLights Consortium (DLC) Premium listed figure is an industry-first in a high-powered LED area lighting fixture, surpassing similar products from top competitors by attaining performance that is up to 40% more energy efficient. With a wide variety of technical innovations packed into the low-profile housing, the Gladetino luminaire sets the new standard in area lighting.

DECO Lighting, building its products from a factory located just outside of Los Angeles, California, has developed the all-new LED luminaire to replace existing lighting fixtures in parking areas, automotive dealerships, and other outdoor applications. With power consumption ranging from 20W up to 320W, the Gladetino comes in two different form factors and is available with a variety of unique options, including 95 CRI light output for high definition colour rendering. ■



Gladetino...

Smart Lighting Market to reach USD 19.47 bn by 2022

According to a report by MarketsandMarkets, the total smart lighting market size, in terms of value, is expected to reach USD 19.47 Billion by 2022, at a CAGR of 27.1%; and in terms of volume, the market size is expected to reach 1.27 Billion units by 2022, at a CAGR of 71.3% during the forecast period. The growing consumer demand for energy efficient lighting system is expected to be the major factor driving the market.

The use of applications of indoor lighting within the commercial sector is boosted by the use of lighting control systems, which uses parameters such as occupancy, available daylight, and time of the day to turn lights on or off accordingly, thus providing noteworthy energy and cost savings. These are expected to be the leading factors for this segment.

The gradual reduction in prices of LED components, besides factors such as low maintenance costs, low power consumption are proving to be the main drivers for the growth of the LED light sources within the smart lighting market.

The market in Asia-Pacific (APAC) region is expected to grow at the highest rate between 2016 and 2022. The high growth rate can be attributed to the rapid infrastructure building activities being undertaken in the APAC region.

The smart lighting ecosystem comprises hardware component manufacturers, prototype designers, and Original Equipment Manufacturers (OEMs) – such as Philips Lighting (The Netherlands), Acuity Brands Lighting (U.S.), General Electric Company (U.S.), OSRAM Licht AG (Germany), Honeywell International (U.S.), Cooper Industries (Ireland), Digital Lumens (U.S.), Legrand S.A. (France), Lutron Electronics Company (U.S.), StreetLight Vision (France), Schneider Electric SE (France), and Cree (U.S.) among others. ■

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ProPhotonix extends COBRA CURE FX series

ProPhotonix Limited, a high level technology designer and manufacturer of LED illumination systems and laser diode modules, has recently revealed the COBRA Cure FX3, an extension to its UV LED Curing systems. The COBRA Cure FX3 is the highest intensity air cooled product in ProPhotonix' UV family.

The COBRA Cure FX3 follows from the previously revealed COBRA Cure FX1, which produces a uniform line with a peak irradiance of 6 W/cm² and peak energy density (dose) of 5 J/cm² and the COBRA Cure FX2, which produces a uniform line with a peak irradiance of 8.4 W/cm² and energy densities up to 17.5 J/cm². The COBRA Cure FX3 delivers best-in-class intensities up to 16 W/cm² and energy densities up to 42 J/cm².

The COBRA Cure FX3 is scalable without any drop in intensity from module to module ensuring consistent edge-to-edge illumination. The design is unique incorporating surge protection, LED segment control, and power control between 5% and 100%. The control of each LED segment is designed to monitor and drive each LED segment providing consistent intensity control across the entire illumination area. Wavelength options include 365nm, 385nm, 395nm, and 405nm configurations as well as integrated multiwavelength options. ■

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Consumers Energy to provide LED bulbs to Michigan families

Consumers Energy recently revealed that it will provide up to 75,000 high-efficiency LED bulbs to Michigan families through food banks in October.

The company is making the contribution as part of its month-long "Buy a Bulb, Give a Bulb" promotion, which starts with an event in Grand Rapids that is part of the nationwide 2016 ENERGY STAR Change the World Tour. For every LED bulb that's purchased at participating retailers, the energy provider will donate an LED bulb to food banks through Feeding America West Michigan.

Tim Sparks, Consumers Energy's Vice President of energy supply operations, said, "We are committed to helping people save energy and to giving back to the communities we serve. Energy-efficient LED bulbs reduce costs for Michigan households, allowing them to put their money toward warming their homes as temperatures start to fall."

Consumers Energy this year received ENERGY STAR's Partner of the Year – Sustained Excellence Award for its work to reduce Michigan residents' energy use, the fourth time the energy provider has been honoured. Michigan homes and businesses have saved over \$1 billion on their energy bills since 2009 through Consumers Energy's energy efficiency programs. ■



OSRAM expands its Modario PS LED trunking range

Osram has extended its Modario PS LED trunking range with the Multilumen version. The new solution has the advantage of setting various lumen levels with just a single luminaire. With its diverse range of uses the new variant scores points with modern lighting solutions in industry, trade and the distribution sector.

Up to ten different luminous flux levels can be set with the new Modario PS Multilumen version of the LED trunking system. Users conveniently select their desired luminous intensity of between 3,000 and 8,000 lumens. Three light distributions and three light colours (4,000 K as standard, 3,000 K and 6,500 K on request) expand the functional performance spectrum of the new LED trunking system. With its white and silver-coloured sheet steel housing the luminaire blends discreetly into its surroundings and the prismatic frosted cover (PS) completely protects from glare while providing high visual comfort. Mounting – designed for heights of 3 to 15 metres – is especially simple and quick.

The Modario PS Multilumen not only ensures more flexibility but also higher efficiency. With each change in the usage situation, luminous flux is automatically adapted according to the target of maximum efficiency (with regard to luminous intensity spectrum). Efficiency of the new lighting solution achieves up to 170 lm/W. Stock-keeping also benefits from the modern trunking – the new luminaire significantly reduces the requisite stockpiling of various types for differing areas of use, in turn simplifying logistics for large projects. ■



Lichtstrom-Tabellen	
lm	W
8000	154
7500	156
7000	160
6500	161
6000	162
5500	163
5000	165
4000	165
4000	167
3000	170

UJALA programme benefits over 5.15 crore Indian households

The Unnat Jyoti by Affordable LEDs (UJALA) programme has been widely accepted across rural and urban areas of the country – and so far over 15.45 crore LED bulbs have already been distributed under this programme. Over 5.15 crore Indian households have already benefitted from this programme and have made their homes brighter.

The UJALA is the world's largest Light Emitting Diode (LED) programme for the residential sector. The initiative is being implemented by Energy Efficiency Services Limited (EESL) a public sector undertaking of Ministry of Power.

The scheme is presently operational in 18 states and 4 Union Territories. EESL will roll out the scheme in West Bengal and North Eastern states in the coming days. In the remaining states and Union Territories, the decision to roll out the scheme is pending with the respective state governments.

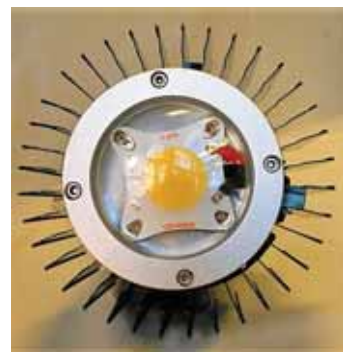
The LED bulbs distributed under the UJALA scheme is one third the market price and these superior quality bulbs also come with a three-year free replacement warranty. Under the UJALA scheme, consumers can avail these LED bulbs at an upfront cost and can save nearly Rs. 336 every year on their electricity bills per LED bulb, making the bulbs free to the user in just 3 months.

Ministry of Power, through Energy Efficiency Services Limited (EESL), has ensured that the common man is made aware of the scheme through various platforms.

Government of India is committed to achieving its target of replacing all the 77 crore inefficient bulbs in India with LEDs. This will result in reduction of 20,000 MW load, energy savings of 100 billion kWh and Green House Gas (GHG) reduction of 80 million tonnes every year. ■

Access Fixtures launches High-CRI LED high bay luminaires

Access Fixtures; well known in commercial, industrial and sports LED lighting; has introduced four new high CRI LED high bay luminaires. Access Fixtures KOTA high bay luminaires are now available with 90 CRI or 95 CRI LEDs for superior colour rendering. Available in 100w, 185w, 240w, and 320w versions, the KOTA high bay luminaires feature Flip Chip Opto COB LEDs and deliver 105+ lumens per watt. KOTA high bay luminaires already offer terrific cost-per-watt value as compared to other LED luminaires. KOTA high bay luminaires with the 90 CRI or 95 CRI option offer similar performance at a slightly higher price.



All KOTA LED high bay luminaires, including those with 90 CRI and 95 CRI LEDs, feature patented Flip Chip Opto COB LEDs that dissipate heat via electrode channels and patented, cold-forged heatsinks that facilitate superior passive cooling. This enables longer life and increased LED lumen output without the need for cooling fans. Cooling fans use electricity and can become an additional source of failure.

Standard features include a loop mount or a mounting bracket, a pre-wired cord, 80+ colour rendering, various Kelvin temperatures. KOTA high bays are rated L70 50,000+ hour rated life, and have a five-year warranty. ■

Anchor Electricals aims to expand Panasonic LED portfolio in 2016

Anchor Electricals (A Panasonic Group Company), recently revealed the launch of its brand new Panasonic LED Luminaires for the Indian market. This latest offering from Panasonic now extends its range of products to the hospitality, industrial and outdoor segments. Along with an already established Trade and Commercial LED luminaires portfolio, the company now aims at growing its presence in the above segments as well.



The 'Neue Archi' is a range of LED luminaires designed especially for the Indian market. This Range of specialty architectural luminaires is equipped with advanced thermal management technology, specially designed transparent thermoplastic diffuser, robust housing, high UV and corrosion

resistance properties; specifically designed, keeping operating conditions of India in view.

The Professional Lighting Product Basket includes commercial, hospitality, industrial, outdoor (landscape) and luminaires. The commercial and hospitality luminaires are equipped with long operational life of 50000 burning hours, high surge protection of 2.5kV, wide voltage operating range from 80-330V, robust housing, and energy efficient electronic drivers. The Industrial Luminaires boast advanced Ingress Protection (IP protection), High Power Factor and Surge Protection of 4kV that prevents the luminaire failure in case of voltage surge caused due to multiple reasons. ■



“We Must Go For Technically Efficient Light”

As lighting has developed into much more than just enlightening the darkness, iLux Electricals Pvt. Ltd. is dedicated to provide excellent product to their customers and never compromise on the quality basis. In an e-interview with **Lighting India**, **Sandeep Agrawal, Director, iLux Electricals Pvt. Ltd.**, is explaining the company's products with its relevance to Indian markets to **PK Chatterjee**. Excerpts...

Q Do you feel in India cost consideration often prevents good lighting schemes to come to reality?

A Yes, it is 100% true. The very first thing comes in our mind is why should we pay more while I am getting the light at very cheap price in the open market? Actually, it's not only the people's fault but since many cheap quality Chinese products and some Indian companies as well have dumped the goods at throwaway price. Due to which consumers are confused and not able to judge the true light. They look for mostly wattages, higher the wattages they willing to pay more but don't compare the efficacy. A light can be judged by seeing its overall system efficacy not just wattages or the initial brightness.

Q What is the USP of iLux Electricals?

A iLux is promoting mostly innovative and technical lights, using high lumen/watt chips and high efficacy drivers to achieve the best system efficacy. iLux is partnered with world's one of the top lighting components manufacture Vossloh-Schwabe, Germany (A member of Panasonic, Japan) on PAN India basis and has special colours (CCT) 3100K (Pearl White) & 3200K (Clear White) which is probably only with VS in the world. These colours are specially designed for Fashion/Clothing lighting and enables very clear/Clean white effect against any other colours.

Q What are the most innovative products that you have introduced in India in this year?

A iLux has introduced LED Solar wall Light this year, which consume zero electricity. The creation of LED solar light is to use in urban and rural area where people's budget gets effected by frequently hike in electricity bills. We always try to give best to our customers with the experience of new technologies and natural lights. It is integrated with a motion sensor which keeps the light dim when there is no movement.

Q What are the advantages of LED Flexi tubes? Are they successfully replacing the traditional glass neon lights?

A iLux LED Flexible Neon Lights are perfect replacement of glass neon tubes and are very flexible, comes in high voltage (direct AC) and low voltage (12V, 24V) as well and can be cut as small as 4.17 cm to make any small letters/design. Our clients are very happy with our flexi LED Light and using for Edge lighting, decoration, signages, pathway etc. etc.

We also have colour jacketed light for which pigmentation is used from Japan, which keeps the colour of jacket unfaded for years.

Q What kind of architectural lighting projects are being done by you in India?

A We are mainly into B2B business, so our clients do the project with our lights, some of the projects are done as below:

A – Priyakant Ju Temple at Vrindavan, Uttar Pradesh India. Which was inaugurated by Amit Shah (BJP President). This lotus shaped temples entire outdoor edge lighting were done by using our product of 5w/meter, 4000K
B – At Mumbai international Airport in a Lounge.

Q What do you say about the quality of the LEDs available in India (especially as far as flicker is concerned?)

A Very good question. Flickering happens mostly when we do not match the LED & Drivers. LED & Drivers are married together, hence they need to be matched properly and we should use proper matching drivers to drive the LED. Due to lack of knowledge, traders lit the LED with any driver though, it may be branded and expensive but if technically it is not matched then flickering may occurred immediately or after several months.

Q What kinds of control products are you offering for LED strips?

A We have RF & IR controllers to control the LED strips, DigiLED manual CA, DigiLED DALI CA, DMX, Wall transmitter etc. We have constant current LED strips which can give without any joint upto 20m/reel against usual available in market 5m/reel. We also have CCT adjustable or tunable, which can be dimmed and can get many colours in between from 3000K to 6000K

Q What would you like to suggest to the LED system integrators?

A In the last, I would like to request not suggest that all manufactures, dealers should educate the customers properly about the system efficacy, prolonged life, L90 as VS have i.e. lumen depreciations at certain hours etc. For example, if a Downlight is of 15 W & its lumens are just 1000 lumens & LED's are 30,000hrs, L70, priced at Rs. 1000/- or less. It would be better to buy a Downlight of 1000 lumens at 10W & L90, 50,000 hrs. as it is more efficient even though it is 25-30% expensive. ■



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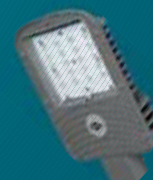
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Marc L'italien joins HGA Architects and Engineers



Marc L'italien

He joins HGA with an impressive resume of award-winning projects throughout the United States...

HG A Architects and Engineers (HGA); an integrated architecture, engineering and planning firm; recently revealed that Marc L'italien has joined the firm as a Principal in the San Francisco office. He joins HGA with an impressive resume of award-winning projects throughout the United States comprising museums, science centres, aquarium and zoo planning and design, learning environments, civic buildings, urban design and community engagement projects.

In addition to working with cultural and educational clients throughout California, he will serve as a key leader of the firm's nationally recognised Arts, Community and Education (ACE) practice, providing strategic planning, project

leadership and design expertise to further strengthen the practice group nationally and support HGA's growing West Coast presence.

Formerly with EHDD for more than 26 years, he served as a design principal for 15 years and was one of five owners responsible for firm management and operations, developing and maintaining client relationships and acquiring and overseeing projects. In addition, he led the design and major client interface on his projects. He opened and directed EHDD's Chicago studio for seven years, which was opened specifically to implement various projects for a facility master plan at the John G. Shedd Aquarium in Chicago, but also focused on community, cultural and higher education projects in the Midwest. ■

Megaman UK brings in New General Manager



Kevin Burns

He is new to the lighting industry, but he has many years' experience with other organisations...

Megaman UK, the UK distributor of MEGAMAN's innovative, well known LED lighting solutions, recently introduced Kevin Burns as the company's new General Manager.

Kevin, who is new to the lighting industry, has many years' experience with other organisations in electrical and freight sectors as commercial director – and is looking forward to specialising in lighting. His main areas of focus at Megaman

UK will be around business development and solidifying MEGAMAN's position as one of the leading manufacturers of LEDs and fixtures.

Kevin said, "The attraction to the lighting industry is that with all the energy saving developments taking place at the moment, it is a really exciting place to be. I am looking forward to ensuring Megaman UK is well positioned to respond to this quick changing market." ■

Thorsten Müller to Head Innovation and Research at Osram



Thorsten Müller

He has held various management positions within the Bosch Group over the past eleven years...

Osram has hired the services of Thorsten Müller as its new Head of Innovation and Research. He is currently the CEO of the Connected Devices and Solutions division at Bosch and will take up his new position as Head of Corporate Innovation at Osram on December 1, 2016.

Müller is a Doctor of Physics and has held various management positions within the Bosch Group over the past eleven years. In his most recent position, he was responsible, among other things, for strategic connectivity projects of the Group and successfully implemented

new Internet of Things-based (IoT) business models. He has also been responsible for developing sensor systems for the automotive sector. He started his Bosch career in central research and development.

Stefan Kampmann, Chief Technology Officer (CTO) of OSRAM Licht AG, said, "Thorsten Müller is an acknowledged expert on the Internet of Things (IoT). He will provide us with valuable impetus for the ongoing digitisation and connectivity in the lighting industry and drive forward our transformation into a high-tech company." ■

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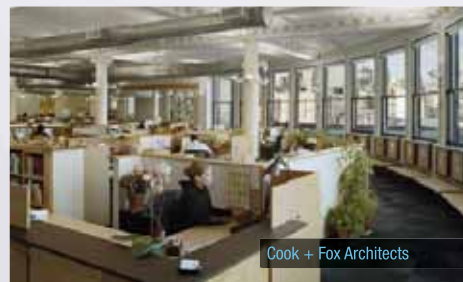
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Varroc Lighting Systems India Receives Automotive Lighting Technology Innovation Award

Global automotive supplier Varroc Lighting Systems India has been named the recipient of the 'India Automotive Lighting Technology Innovation Leadership Award' at the Frost & Sullivan's GIL 2016. Award recipients were judged on a variety of parameters that included revenue growth, market share growth, application diversity and impact of technology.

Todd Morgan, Senior Vice President – Global Product Development, Varroc Lighting Systems, said, "We are delighted to accept this prestigious award for our efforts



towards innovation in automotive lighting technology. This is a testimony of our sustained focus in offering innovative technology to our customers. Such awards and recognition motivate us further to keep doing our best."

"With an experience of over 135 years Varroc Lighting Systems has always

emphasised on making cutting-edge concept design, research and manufacturing of exterior automotive lighting products. Finally, I thank all the employees at Varroc Lighting Systems whose dedication, commitment and constant efforts have led to this award," he further added. ■

ALD Honours Mannie Manim

The Association of Lighting Designers (ALD) presented their second International Fellowship to South African Lighting Designer, Mannie Manim.

The presentation ceremony took place at the Young Vic Theatre, where Manim's latest production, A Man of Good Hope was playing.

ALD Vice President, Rick Fisher, said, "It is an honour for the ALD to present Mannie with the ALD International Fellowship award."

Manim has, throughout an exceptional career, been a company manager, producer, technical director, founder, administrator and trustee of many theatre organisations.



Mannie Manim

Still flourishing in his seventies, his work started as an usher at the Brooke Theatre, Johannesburg in 1955 and he rose through the ranks from stage hand to Managing Director of PACT Drama, and created the Doornfontein Arena. Courageously he and Barney Simon created the world renowned Market Theatre in Johannesburg. Executive Director of Baxter and Fugard Theatres in Cape Town, producing and lighting his own productions, his work has been often in South Africa but also extensively seen internationally.

Mannie Manim joins American lighting designer Jennifer Tipton, who received the first ALD International Fellowship, awarded in 2012. ■

Bandit Lites Nominated For Lighting Company Of The Year

Bandit Lites, well known for its concert lighting, has been nominated for 'Lighting Company of the Year' for its exemplary work in 2016 for PLSN and FOH Magazines' annual Parnelli Awards.

Called 'The Oscars of the Live Event Industry,' The Parnelli Awards recognise top visionaries, technology and innovators, both on an individual and company scale. Bandit Lites has been nominated every year since the inception of the Parnelli's and has won five times.



Garth Yankee Stadium

but multiple Bandit clients have been honoured with nominations in various categories. Lighting Designer Mike Swinford is nominated for Set/Scenic Designer of the Year and Lighting Director Keith Hoagland is nominated for Lighting Director of the Year for their work on Jason Aldean's epic Six String Circus Tour. Additionally, Bruce Rodgers is also nominated for Set/Scenic Designer of the Year for the awesome spectacle that

Not only is Bandit Lites nominated for its amazing year, was Garth Brooks at Yankee Stadium. ■



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Great Hall Bathed In Soft Light

Project Musée Bourdelle, Paris / France

Architect DBLH Architects, Paris / France

Lighting Designers Julia Kravtsova, Vyara Stefanova

Products Grasshopper, Light Board, Logotec, Parscan, Pollux

Photo credit ERCO GmbH, www.ercos.com, Photo Edgar Zippel



Antoine Bourdelle – along with Auguste Rodin – is one of the pioneers of 20th century monumental sculpture. The Musée Bourdelle in Paris has recently been given a lighting update with LED technology using ERCO's photometric precision to enhance the dynamic style of Bourdelle's sculptures for optimised three-dimensionality.



Tucked away on a quiet street near, and yet so far from, the bustling Gare Montparnasse in Paris, the Musée Antoine Bourdelle is an unexpected oasis of tranquillity and meditation that is reminiscent of a modern ancient temple. This is where Antoine Bourdelle, a pioneer of 20th

century monumental sculpture, lived and worked from 1884 until 1929. Bourdelle's work was frequently inspired by mythological themes, which he captured in powerful and dynamic sculptures using materials such as plaster, bronze or marble. The structures on the premises are from a number of

different periods. Once the home and studio of Bourdelle, the buildings originating from the 19th century were turned into a museum. The "Great Hall" was built by architect Henri Gautruche to mark the 100th anniversary of Bourdelle's birth, whilst the extension to the museum was added



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in 1992, designed by architect and Pritzker Prize winner Christian de Portzamparc.

Recent renovations of the Musée Bourdelle included an upgrade of the lighting system with LED technology. The lighting inside the museum was optimised for maximum visual comfort with lighting tools from the ERCO Light Board, Logotec, Parscan and Pollux ranges. Designed to overcome great distances, the luminaires bathe the Great Hall in superbly uniform and glare-free light across an impressive height of 10m, allowing visitors to look at the monumental sculptures from different angles. Using various lenses and different beam characteristics as well as two light colours with 3,000K and 4,000K, the sculptures are illuminated with photometric precision, accentuating their surfaces in varying nuances depending on the texture.

The Musée Bourdelle has several landscaped gardens with lawns, bushes and trees that provide a natural setting for Bourdelle's bronze sculptures. Embellished with a green patina, the sculptures blend effortlessly with the lush vegetation. The artwork as well as selected garden features are illuminated effectively from different angles using outdoor luminaires of the ERCO Grasshopper range with neutral and warm white light. Designed with a compact housing, the lighting tools remain virtually invisible, whilst precise light distributions eliminate glare for the visitors and neighbours, so as not to detract from the enjoyment of the sculptures as well as the gardens and night sky. ■

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Energy-efficient LED lamps for horticulture

Philips Lighting a global leader in lighting, today announced the launch of the Philips GreenPower LED flowering lamp 2.0, an even more energy efficient way to extend daylight or interrupt the night growing cycle in greenhouses for growers that cultivate strawberries, cut flowers, bedding plants and cuttings. The new Philips GreenPower LED flowering lamp 2.0 builds on the first generation of Philips GreenPower LED flowering lamp and comes in two different spectral versions with light recipes for growing cut flowers and soft fruit. The new highly energy-efficient lamp is designed to increase the yield, quality and consistency of crops and accelerate flowering. Its design draws upon over twenty years' experience that Philips Lighting has in horticultural lighting to serve the needs of growers.

The first generation of the Philips GreenPower flowering lamp provided an important benchmark for energy efficiency following trials in 2014 and 2015 at the Research Centre Hoogstraten in Belgium, an independent horticultural research center. The next generation lamp provides an optimum spectrum and high light output and allows growers to save electricity costs by being 90% more energy efficient than conventional incandescent lamps. The lamps have a standard E27 or E26 fitting allowing them to be used in existing installations, avoiding unnecessary modifications and reducing set-up costs.

Effective for crops

To help growers achieve the best results for their crops, Philips Lighting has invented light recipes which combine the following elements: light spectrum, intensity, uniformity, timing and positioning. The Philips GreenPower LED flowering lamp 2.0 is available with two different spectral versions: one offers a combination of deep red and white (DR/W) and the other a combination of deep red/white/ far red (DR/W/FR). The DR/W light version inhibits flowering of short-day plants, and has for example been very effective with chrysanthemums. The DR/W/FR light version is ideal for photoperiodic lighting of bedding and perennials. It can extend the day or interrupt the night cycle to promote elongation of the stems of



strawberries and stimulate flowering.

"Being the first to market with a flowering lamp almost seven years ago, the Philips GreenPower LED flowering lamp 2.0 pushes the boundaries of how growers can gain control of crop quality and yield for their customers even more," said Udo van Slooten, business leader for Philips Lighting's Horticulture business.

Lower maintenance costs

The Philips Green Power LED flowering lamp 2.0 looks like an incandescent lamp, but is made of robust plastic that mitigates the risk of damage to crops that can occur from broken glass lamps. To reduce maintenance costs, the lamp is designed to last at least 25,000 hours* and is rated for IP44 and UL damp and dry conditions indoors. Trials in countries which use photoperiodic lighting to produce cuttings or cut flowers have reported that the flowering lamp 2.0 is much more stable on the energy grid compared to incandescent or "twisters" (CFLs), so there is less risk of quality issues in crop production. The two spectral versions of this new LED flowering lamp are available to provide full installation flexibility. ■

www.philips.com/horti

Effective Office Lighting



The idea behind designing a lighting plan for offices is to enhance long-term employee comfort, with a proper balance of energy savings as well as lighting quality. Prudent integration and control of daylight tend to improve employee morale and also cut energy costs...

Designing an office lighting plan involves more than calculations and luminaire selection.

The lighting solution affects the ambience of the office; the psychological wellbeing, interest, and enthusiasm of its employees. It should enhance the feeling of wellbeing and productivity, so consideration must be given to the design of the office interior to create a stimulating work place. Employees need to perform tasks comfortably and effectively in the environment where they spend one third of their lives.

Goals of office lighting

Lighting is one of the best, and easiest, ways to improve the office environment. The challenge is that office lighting plans must be cohesive – and effectively illuminate different types of spaces that coexist under one roof: the reception area, open office space and private cabins of varying sizes. It must represent and reinforce the corporate image. The goals need to be followed are:

- Create a cohesive environment that enhances the feeling of wellbeing and productivity of the office staff.
- Create a flexible lighting plan that enables employees to perform tasks

comfortably, effectively and safely.

- Integrate and balance ambient, task, accent and decorative lighting into each area of the office.
- Allow a comfortable transition from space to space.
- Design a lighting plan for long term employee comfort, with a proper balance of energy savings and lighting quality.
- Integrate and control daylight to improve employee morale and cut energy costs.
- Address energy efficiency and energy codes.

The primary function of lighting in the office space is to support work. It effects the ambience in the office; it effects how employees, clients and customers view the company and its image. It has a profound effect on the feeling of wellbeing and productivity of the office staff. Therefore, it is essential that office lighting be included as a vital consideration towards the successful operation of any business.

The Designer or Architect must consider a variety of key characteristics when developing their lighting plan including lamp life, system efficiency, lumen maintenance, colour rendering

and appearance, daylight integration and control, lighting distribution, points of interest, cost, system control and flexibility.

Colour reflection and contrast

Choosing light with the right colour temperature is crucial. Lighting is a key factor in projecting and supporting company image and affects the feeling of the space itself. All light sources are not equal. Two white light sources may look the same, but can render colours differently or provide a different feel to the space. By using lamps of the same Correlated Colour Temperature and with the same, or very similar, Colour Rendering Indices, the space will have even, consistent illumination throughout.

Reflection and glare are both useful and potentially harmful to office lighting; well-designed lighting can allow the eye to see tasks and devices clearly, but also may create unproductive and damaging conditions. Using luminaires with good glare control avoids direct glare and disturbing reflections on specular surfaces. A very bright space is not the most effective lighting solution. Proper fixture selection and placement of luminaires create a welcoming and productive environment (Refer figure 1).

Layers of light

There are four layers of light typically used in office lighting: General (also called Ambient) lighting, Task lighting, Accent lighting, and Decorative lighting. Combining and balancing these lighting types gives visual interest to the space and creates a more attractive, exiting and inviting environment.

General lighting

General lighting is the main source of illumination in a space. This uniform, base level of lighting can easily become the focus of energy reduction, as the light levels from other fixtures can be lowered, especially when using LED and Metal Halide lamp sources.

Perimeter lighting, or wall washing, helps define spaces, provides vertical lighting, and makes the space feel larger (Refer figure 2). Done with



Figure 1
Picture showing the comfortable and effective lighting environment inside an office area...



Figure 2
Picture showing
the effective
use of
general lighting
inside an
office...

sconces or wall washers, vertical lighting creates a pleasant, welcoming environment. It is important that vertical surfaces are lit for visual comfort, spaciousness and visual and directional cues. Vertical brightness makes orientation easier, helps in defining spaces, and aids in making the space's appearance to be larger, open and more welcoming.

Task lighting

Task lighting is used to illuminate an area for a specific task; providing a focused, localised, and higher level of illumination. Necessary to the functioning of a space, it is important to use energy efficient sources to reduce operating costs.

Task lighting is most effective when used as a supplement to general lighting in workspaces, conference areas and on counter tops. Effective task lighting should eliminate shadows on the specific illuminated area, while preventing glare from the lamp or off



Figure 3
Picture showing
the effective
use of task
lighting inside an
office...



Figure 4
Picture showing
the effective use
of accent lighting
inside an office...

surfaces. Glare impedes office work, and is easy to control by increasing the brightness of surrounding areas, decreasing the brightness of the glare source, or both.

Task lighting reduces the reliance on overhead lighting, and provides a better quality of light for specific tasks (Refer figure 3).

Accent lighting

Accent lighting reinforces design aesthetics and creates a dramatic emphasis on shapes, textures, finishes, and colours using a focused, or point, light source or sources.

If this light is directed ambiguously, the end result may have many unwanted shadows as well as distracting glare.

The key is to make this illumination more precise and of higher intensity than the surrounding ambient light. Track fixtures, recessed housings with adjustable trims and concealed adjustable illumination with point source lamps provide directional control and are especially effective for accent lighting (Refer figure 4).

They are easy to aim precisely to highlight objects' best attributes. Accenting everything and emphasizing nothing is a common mistake with accent lighting; always keep in mind that there is such a thing as providing too much light.

Decorative lighting

Decorative lighting serves a dual purpose: not only to contribute to the lighting layers in an office environment, but also to enhance the look of the space as a design element. Decorative lighting includes pendants, chandeliers, table and floor lamps, and cylinders. Decorative lighting should complement and add visual interest to the interior, as well as provide or contribute to the overall lighting plan (Refer figure 5).

Adding decor, beauty and style using decorative lighting is also an important reflection of a company's image, and reinforces the theme and style of the space. Decorative lighting can also contribute a feeling of hospitality and comfort. By combining



Figure 5
Picture showing the
effective use of
decorative lighting
inside an office...



Figure 6
Picture showing
the effective use
of lighting in reception
and corridor area...

and layering these lighting types, the office environment will be more attractive, exciting, and inviting.

Considerations for office lighting

The best lighting is integrated into the architecture of the space: enhancing the architect's conception of the space, reinforcing the activity occurring in the space, and highlighting prominent areas. When lighting office spaces, a 'one size fits all or modular' approach is unsuccessful, as different areas require different lighting needs. It is important to work on a space-by-space basis to determine specific lighting design criteria with enough flexibility for personal touch. The lighting design needs to be kept simple to avoid visual clutter; use a family of luminaires for cohesiveness in the design. It is important to layer the light, ambient (general), task and accent to get the best balance of light in the space.

Reception Area

The first impression of your business is often formed when visitors and potential clients enter your space. Lighting needs to

complement the architecture, provide a safe exterior- to-interior transition, and convey a strong corporate image (Refer figure 6). This area usually needs lighting two separate conditions: a task area for the receptionist as well as an area for waiting visitors. Care should be taken to light the receptionist's face so they appear approachable. Lighting in the waiting area should be restful, but provide sufficient illuminance for simple tasks.

Corridors

The corridors throughout the office must remain illuminated for long, if not continuous, periods of time. To conserve energy, provide at least one-fifth the illuminance level of the surrounding areas. This is a safe, navigational level, and will not affect eye adaptation when moving in and out of the hallways. If the walls and ceilings are lit, the area will feel larger and more open. All corridors must have emergency lighting, as they are paths of egress (Refer figure 6).

Conference rooms

The conference room serves many different functions: from video and power point presentations to

brainstorming sessions, the lighting design needs to accommodate the range of activity occurring in the space. It is vital that the lighting in these spaces is designed for maximum flexibility and visual comfort.

General lighting in the room, at a comfortable, navigational level, needs to be dimmable to vary the illuminance level for visual presentations. Appropriate task lighting needs to be provided for reading and writing at the table, and ample illumination on the people seated at the table also needs to be provided (Refer figure 7).

Open office areas

Open plan office space is a dynamic space where a wide variety of different tasks are carried out. The ambient light level in the open plan office needs to provide a comfortable, functional light and be lit consistently with the overall lighting plan. The furniture used in the space will have a major impact on the



Figure 7
Picture showing
the effective use
of lighting in the
conference
room...

distribution characteristics and general luminance of the ambient lighting. It is important to keep the open lighting plan very flexible, as the transient nature of work stations will alter the planned lighting layout.

Private cabin areas

Private offices are used for individual work as well as group meeting space. The ambient light in the room should be sufficient for navigation and conversation with adequate task lighting over the desk and other work surfaces.

Accent lighting can provide variety and interest, and serves a dual purpose by creating simple light patterns on the whole highlighting artwork or other work-related materials.

This can be achieved with adjustable recessed housings or track heads. Luminaire design and style should complement the architectural and interior design qualities of the room (Refer figure 8).

Exit and emergency lighting

When general lighting systems fail, exit and emergency lighting direct the safe exit of the building's occupants. If no exit is required, the lighting should

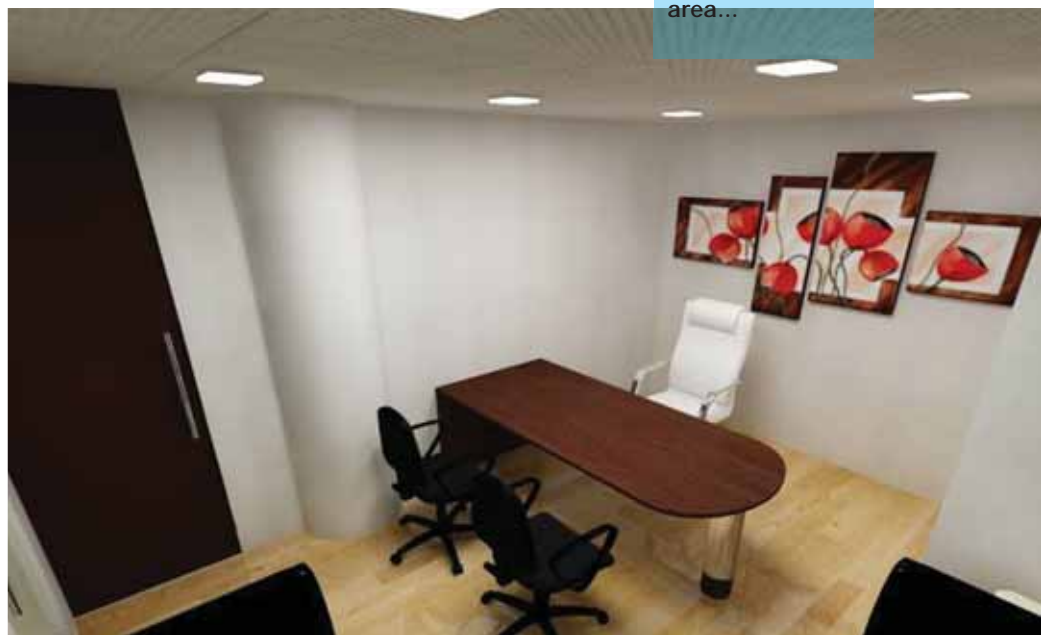


Figure 8
Picture showing
the effective use
of lighting in the
private cabin
area...

provide security and comfort until the general lighting can be restored.

Conclusion

As knowledge holders, idea creators and driving forces, modern office employees integrate themselves and their ideas for the success of the company, which in turn directly benefits from the diversity of its employees.

Appropriately conceived working surroundings are required – so that individuality and ideas appear together to flourish creativity and reflect a team spirit.

Light is a decisive factor in this respect. More clearly, its effects: how it motivates people, how it promotes creativity, and how it builds up the atmosphere in which people work... determine the quality of output and the level of productivity. ■



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Challenges Faced By LED Lighting System



LEDs are basically direct band gap P-N junction semiconductor diodes, which emit energy in the form of visible lights when activated through a power source. The colour of light primarily depends on the band gap of the semiconductor material used...

The amount of energy consumed today, by lighting sources is approximately 20% of total electrical energy consumed in the world. Hence, the development of energy efficient lighting system is very essential in today's scenario.

In the recent past, LED lighting has emerged as a better energy efficient and environment friendly solution for the general lighting purpose.

As compared to other artificial sources of light, LEDs are not only more energy efficient and mercury free but also they have other attributes like compact size, high reliability, chromatic variety, improved efficacy (more than 120 lumens/watt), good colour rendering index, low maintenance requirement. They are also growing popular due to their robustness, excellent vibration resilience and longevity (typically more than 50,000 hours) due to the absence of glass casing. LEDs are available in a wide range of colours – and moreover light output can be changed as per the requirement (easily dimmable). They emit a narrow band of visible light in the regime without harmful rays like infra-red and ultra-violet. They are better than the compact fluorescent lamp, which uses the gaseous discharge and the traditional incandescent light that uses filament to make heat radiation. Therefore, LEDs are more suitable for background lighting, commercial lighting, decorative and household lighting applications.

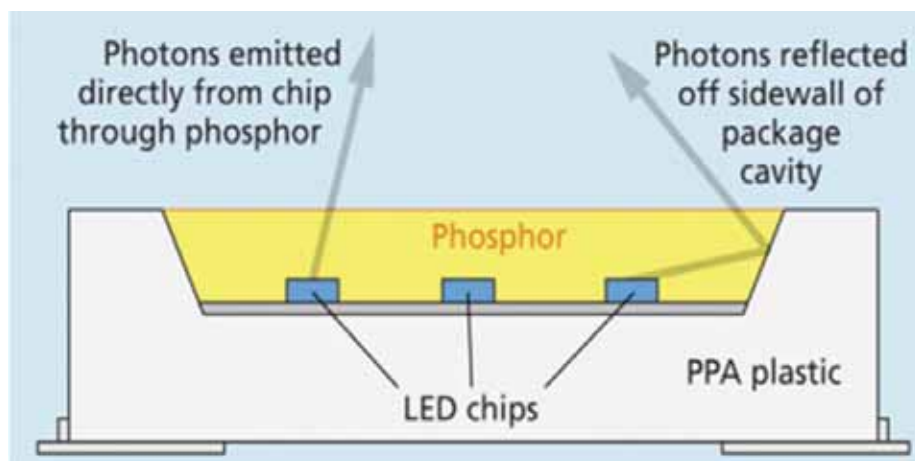


Fig. 1: Basic structure of LED package...

On the basis of the above mentioned characteristics, they have been inevitably accepted as a lighting source worldwide – and have actually started penetrating into the area of high power lighting fixtures and general illumination market. Growing demand for energy efficient lighting system, increasing environmental concerns, the advancement in lighting materials and manufacturing process are making LEDs more attractive and attention drawing, both for the industry as well as academia.

LEDs are basically direct band gap P-N junction semiconductor diodes, which emit energy in the form of visible lights when activated through a power source. The colour of light primarily depends on the band gap of the semiconductor material used. Various colours of LEDs are possible depending upon the material and process used to

make the LED chip. Power LED is the High Brightness LED (HB-LED) and it is made with blue LED chips with a phosphor coating on the top of the LED chips. When the photons of blue light pass through a layer of phosphor then they convert the blue light into white light (Fig. 1). Different types of phosphor layer can produce different light output. The colour, quantity and quality of emitted light from an LED chip can also be affected with the type of phosphor material. Phosphor technology is therefore an important measurement in LED industries. Manufacturers can produce white LEDs that are 'warm white' with a correlated colour temperature (CCT) of around 2700K, which is similar to an incandescent bulb and can also produce 'cool white' with a CCT of 5000K (Fig. 2). Even various colours can be created by the application of different phosphor materials. Though

having a lower CCT does not intend to detrimental efficacy (lumens/watt), but due to the other efficiency factors, cool white LEDs are little more efficient than warm white. Another common method of producing white light by mixing coloured LEDs such as Red, Blue and Green (RGB). This kind of colour mixing of LEDs is quite popular in entertainment. They require more space and the quality of output light is also not up to an extent as desired.

A traditional GLS incandescent bulb produces around 10% of its consumed energy into visible light, rest 90% is wasted due to heat and Infra-Red (IR) emissions. A typical LED might produce 15% visible light and 85% heat. Especially for high power LEDs, this high amount of heat reduces its efficiency and life. Commercial LEDs are available with a light conversion of 25%, which is an improving figure day by day. Now-a-days, due to growing concern for energy saving, people also start preferring energy efficient dimming technology with the lighting modules.

Thus in all aspects, LED is the best solution so far. Therefore, the research on LED lighting systems has reached to an imperative degree of interest in modern illumination era.

Being a solid state device, it offers many challenges to the designers and power electronics engineers, to design energy-efficient drivers with long life as well as high reliability and safety. The luminous flux of an LED strongly depends on the current flowing through



Fig. 2: Warm white and Cool white LED lighting with CCT of 2700K and 5000K...

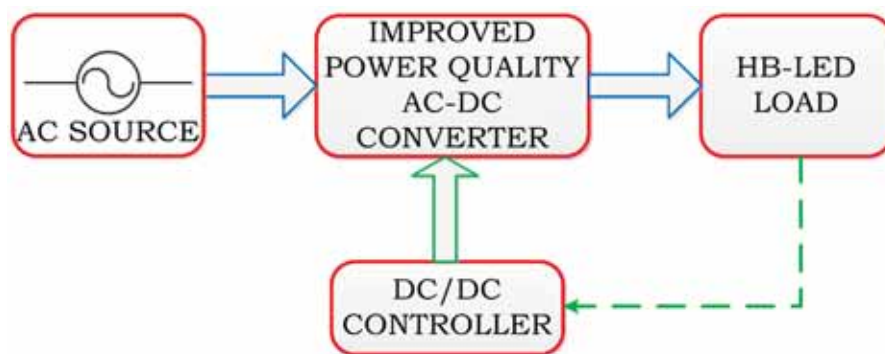


Fig. 3: Single-stage scheme for PQI in LED lighting systems...

it. Increase in driver current increases flux as well as forward voltage and power, which also increases junction temperature and reduces flux or light output. Thus, an efficient LED driver needs to ensure the constant current to drive its load. An AC-DC power conversion with load current regulation can be performed by a single-stage approach or two-stage approach (Fig. 3). In low and medium power applications, like households and offices, considering size, cost and efficiency, the single-stage solution is commonly preferred. When the power requirement is high, like stadium or street-lighting applications, a two-stage solution is preferred. The isolated and non-isolated Improved Power Quality Converters (IPQC) are being used in LED lighting for different applications.

For low power lighting applications DCM (Discontinuous Conduction Mode) operation is preferred due to simple control and reduced size of magnetics to achieve better Power Quality Improvement (PQI) at AC mains. Selection of converter topology for any applications is a tradeoff between performance and cost. In non-isolated category buck, boost, buck-boost, Cuk, SEPIC, Zeta etc., are widely used for improving the power quality and current regulation as well. Although boost converter is considered to be the best solution for power quality problems it cannot be used as a single-stage solution due to the requirement of low output voltage. A basic buck converter-based LED driver could be an economical solution – although it shows

discontinuous input current at zero crossing point of the AC mains voltage. This is due to its buck operation when the line voltage is greater than the load voltage. The boost converter is not suitable in single-stage operation because of low voltage requirement for LEDs. On the other hand, the buck-boost converter exhibits excellent performance in terms of PQI. The load voltage of this converter can be higher or lower than the AC mains voltage, it also demonstrates inherent PFC (Power Factor Correction) operation in DCM.

Unfortunately, this converter has some drawbacks as inverse output polarity – and requires a floating drive for the power switch. It also shows discontinuous current both at its input and output. Other non-isolated buck-boost converters such as SEPIC (Single-Ended Primary-Inductor Converter) and Zeta converter are also having

nearly identical PFC performance with the Cuk converter. These two converters expose poor EMI (Electro-Magnetic Interference) performance and require large EMI filter at the front end, due to the discontinuous input current (Zeta Converter) and output current (SEPIC) operations. Therefore, for lighting applications, where the SELV (Safety Extra Low Voltage) operation is not truly applicable, a non-isolated Cuk converter with continuous input and continuous output current is the right choice. Hence, this converter operating in DCM can also reduce the ripples of the line current and the current through the LED load. Ripples in the voltage and current of an LED are the important measures while selecting the converter, which produces unwanted flicker in the emitted light. The Cuk converter exhibits zero current 'turn-on' in the power switch and zero current 'turn-off' in the power diode, which also reduces switching losses in the semiconductor devices.

In single-stage isolated category Flyback, Cuk, SEPIC and Zeta converters have been widely used for mitigation of power quality problems and better current regulation for an LED load. Flyback converter works efficiently for low power (<75W) LED lighting solutions – but when the requirement of load is little high with dimming capability, then it exhibits poor efficiency



– typically 60 to 80%. Even due to the presence of air gap in the Flyback inductor, it offers higher Electro-Magnetic Interference (EMI), and also higher leakage inductance which offers higher ripples to the load.

Zeta converter has the functionality similar to the buck-boost converter but it has continuous output current, hence it offers low ripple contents for LED load as compared to SEPIC converter. The reduced ripple contents in output current are very much recommended for LEDs, as LEDs are very sensitive to the voltage variations. Moreover, due to discontinuous current at output, SEPIC converter requires bigger DC link capacitor hence more cost as compared to Zeta converter.

However, these single stage converters have some limitations in terms of power handling capacity for

higher loads and efficiency. Hence, for medium/high power lighting applications, a separate PFC operation is preferred cascaded with DC-DC converters to the LED load. This two-stage solution can therefore independently deal with PQI.

Each stage is then optimised for only one or two tasks, and therefore improving overall converter efficiency with better control and power handling capability. The boost converter as a PFC at the front end is reported as a popular topology among all DC-DC converters.

Recently, LLC and LCC based half-bridge resonant converter with front end boost PFC have got higher acceptance in high power LED lighting systems with intelligent dimming concepts. Bridgeless topology in power converters has become very popular in recent years. This is quite attractive in terms of

converter efficiency for high power lighting applications. This topology is beneficial especially for 100W or more, but for low power lighting applications, it involves additional costs without providing significant advantage.

Moreover, dimming in LED lighting solutions is often needed for energy savings. Different commercialised dimming methods are 1-10VDC, DALI (Digital Addressable Lighting Interface), DMX (Digital Multiplex), PWM dimming, TRIAC dimming are widely used in lighting industry. Although the TRIAC dimming concept is very much popular in low cost LED lighting applications, but it has severe power quality problems. So, to address the problems related to power quality in LED lighting systems, the front end isolated or non-isolated DC-DC converters are used as mentioned above. ■



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LED is now possible to be used as an replacement of outdoor lighting

After having developed an electronic device business focused on LEDs, Citizen Electronics aims to be a solid global company with a passion for manufacturing and spirit for meeting a challenge. In an e-interview with **Lighting India, Amano Haruki, President, Citizen Electronics Co.,(Hong Kong) Ltd.** is explaining the current scenario of LED lighting market to **PK Chatterjee**. Excerpts...



Q How is the LED lighting market shaping up in the developing economies?

A The LED conversion ratio in the emerging countries currently is very low, but we expect a rapid growth in the future.

Citizen Electronics is a Japanese company. As an example in Japan, the LED conversion ratio is already more than 70%. In the Western countries the LED conversion ratio has also seen to be around 50%. We cannot expect the rapid growth that we have been seeing till now but just a gradual growth.

During the introduction period the LED conversion ratio in the developed countries was slow. In the growth period the LED conversion ratio was fast. Now for the emerging countries it looks to have come to the stage of the rapid growth period.

Especially, we could see the expansion is focused on the retrofit (LED Bulb/LED Tube) which driven from the direction of reducing power consumption. The introduction of outdoor lighting from the public facility area is also accelerating.

Q What kind of price battle are you observing in these markets?

A CITIZEN focus Chip on Board (COB) as a specialised product line-up. The aforementioned LED Bulb / LED Tube used many SMD type. The price decline in SMD type was highly exceeded expectations.

On the other hand, the applications which require COB include the light distribution control fixture (store lighting, etc) and high wattage fixture (outdoor lighting, stadium lighting, etc). Those applications require the control of light and the quality. There is price decline but it is not similar to the situation that we have seen in SMD.

As our effort to deal with the price decline, not just the raw materials' cost reduction, we also develop more high-efficiency products, improve the input current value, the Tj-Max, increase the light output (lm/\$), the way we follow the market is not just focused on the product unit price.

Q In general, what are the top demands emerging in the global market as far as the quality of the LEDs is concerned?

A The quality requirement of each fixture and application is different. Normally we talk about life and degradation level. However almost all customers follow LM80 as a guideline.

The LED lighting as long life, low power consumption is not the topic to argue anymore (with the LM80 data), recently "the quality of light" as "the quality" has been the key topic.

In 20** CITIZEN is in the first company to implement Mac Adam 3 step, now it has become the standard requirement in COB. Recently the requests to reduce colour variation such as 2 step have been increased. The matching between fixture and lens has an impact on it but currently the quality requirements on the LED as an engine is regarded as "the quality of light".

Q Your company is also into other LED -associated products... How is the growth of the overall segment, and where do you see your company in the next five years?

A Currently in the LED lighting, we speculate that our market share in COB is No.1 (our own research). To maintain our share as No.1, we continue our effort to follow market price (high efficiency to achieve lm/\$).

On the other hand, we launch new products on new markets and applications through our marketing work, which increase our CITIZEN brand status.

Recently we focused on "strong colour = Vivid" products. We add the technology of "the quality of light" in the fixtures, which are commonly used in stores. In Japan the major manufacturers who already used it have received very good feedback from their customers.

In overseas (mainly Europe) this kind of "quality" the need is high. Such technology has been used in a world's famous painting.

Others like High Wattage products (for bulky type lighting fixture for example stadium), plant growth special spectrum product, low colour temperature product for port (to replace HTPS), etc. have been our new proposals.

By doing so we can fulfill a variety of needs.

Q What are the virgin areas where LEDs will witness a great potential soon?

A In the area of general lighting the focus is on the outdoor lighting. Due to the high efficiency of LED, the LED products as an alternative to replace 2KW's HKD is currently released.

Therefore, technically LED is now possible to be used as an replacement of outdoor lighting. Even though cost is the future challenge, there are many large projects led by the government like outdoor lighting (street lamp, flood light, etc) has become the driven force to the LED conversion.

Q How are you planning to capture those areas?

A Like I mentioned earlier, the efficiency improvement in COB is one of the key points. At the same time we tie-up with the related companies who develop accessory parts as we are trying to create an environment for customers who can use COB even more easier. Specifically, speaking the connector, heat sink, lens, reflectors, power supply,

etc, a system that we are developing as a solution provider not just the COB.

Q Do you have any India-specific plan and/or target?

A Currently the LED conversion ratio in this market is low, but we expect the market to grow significantly in the future. From the area of electricity supply to the political guideline the retrofit demand is moving forward quickly. Meanwhile the outdoor market like the public facilities, highway is on the highlight. There are peripheral solutions (connectors, heatsink, lens, etc) as a partnership on CITIZEN products which created an environment with many solutions incorporate with COB. Currently in India we have 3 agents (SCI, SETSUYO, NETWORK) to handle daily sales activities.

As we anticipate the market to expand, to establish a local subsidiary is also in our consideration. As one of the most important markets it attracts our attention.

Q What did you gain from participating in the Guangzhou International Lighting Exhibition (GILE) 2016?

A Not just GILE, for nearly 10 years we also participated in major exhibitions which include North America LFI, Europe LB, HKLF. We captured the opportunities to meet a very large number of customers.

We also met exhibitors who are the fixture manufacturers and communicate with them to determine the future lighting trend and direction as this is a very good opportunity.

Smart lighting is kind of good example. In the past (the introduction period) we used it as a place for sales promotion and business negotiation. Recently, we participated as a "Show" to exchange information with related people in very details.

Q What kind of after-sales service do you offer?

A Since CITIZEN is a device manufacturer, unlike the finished product (fixture) we short of the after-sales service concept. However we can support general Warranty response, others likes FAE that we assigned in different regions and divisions, the process and work advice (Handling precaution) in accordance with the customer requirements.

Q What are your suggestions to your prospective B2B buyers?

A Currently, in each country and region we are doing business with major leading lighting manufacturers. Taking the advantage of it, we can propose a variety of under-developing products in advance and present our products with nearly completion based on customers' opinions. We also develop application products, spectral tuning technology, modularisation as a light engine which all use COB as a basis. Not just the COB but through the proposal of a variety of application products, the existence value of CITIZEN has been increased. ■

The Best Creative Lighting Event At The **darc awards**

The Night of Heritage Light (NoHL) organised by the Society of Light and Lighting (SLL), has been named the Best Creative Lighting Event at the darc Awards...

On 1st October 2015, the the Society of Light and Lighting (SLL) lit 9 UNESCO World Heritage sites in celebration of the International Year of Light, including Fountains Abbey in Yorkshire, Blenheim Palace, the Tower of London and Ironbridge Gorge. Each site was allocated a design team, led by a recognised lighting professional and SLL member. The event was also supported by over a hundred lighting professionals, representing 50 organisations.

On behalf of the Society, past-president Liz Peck accepted the award, accompanied by members of the organisational team behind NoHL (The Night of Heritage Light); Simon Fisher MSLL, SLL Secretary, Brendan Keely and SLL Coordinator, Juliet Rennie. Also integral to NOHL were Rhiannon West and Dan Lister, who were unable to attend.

Jeff Shaw, President of the SLL, said, "It is very exciting to receive an award that is given by our peers in the lighting industry, and a tremendous honour to be recognised by leading designers from around the world. The Night of Heritage Light represents all that is exciting and challenging in our industry, and it's tremendously inspiring to existing lighters and those just joining the profession to see what can be done. Lighting is an art as well as a science, and both these elements were on top form to bring this extraordinary event together."



Liz Peck, past-president, said, "The Night of Heritage Light was an amazing reflection of the Society and its diverse membership. I couldn't be prouder of the Society, everyone who took part and the talented teams of industry experts who made it all happen. It is an honour to collect this award in recognition of all they achieved."

Supported by the Chartered Institution of Building Services Engineers (CIBSE), of which the SLL is division, the Night of Heritage Light was designed to showcase the skills and creativity of lighting design professionals to the nation as a whole. It achieved 26 media appearances including the BBC's The One Show, as well as featuring in 14 regional publications, reaching an audience of over 13 million people.

The Night of Heritage Light was up against similar installations throughout the world, and overcame London's Lumiere 2016, Rome's Colosseum Light Messages, San Francisco City Hall Centennial Celebration in the USA and the Manchester Festival of Light and Sound Art, among others. ■

Image Courtesy: darcawards.com





Event: Night of Heritage Light

Location: 9 UNESCO World Heritage Sites across the UK

Organiser: Society of Light and Lighting, UK

Client: 9 UNESCO World Heritage Site Stakeholders across the UK

Main Partners: Arup, BDP Lighting, F Mark Ltd, LPA Lighting, Apollo Lighting, Cundall Light4, Designphase, DPA Lighting, G3 Lighting Design, Hoare Lea, Light and Design, Lite-Ltd, Michael Grubb Studio, Edinburgh Napier University, Ramboll, Speirs + Major, Troup Bywaters & Anders

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Innibos Features Robe once again

Lighting was designed by Johan Ferreira of BF Productions and Levan van der Merwe respectively ...



Innibos – an action-packed high profile arts and music festival staged in and around Mbombela (Nelspruit) in South Africa during the winter presenting Afrikaans music, theatre, literature and visual arts – again featured Robe moving lights on the Main and the Rock performance stages in 2016.

Lighting was designed by Johan Ferreira of BF Productions and Levan van der Merwe respectively ... with kit supplied by MGG (Main) and EPH Productions (Rock), both companies have large rental stocks of Robe luminaires.

These were just two of seven live stages, all fully scheduled with all types of entertainment for the family-friendly 5 day extravaganza of imagination and fun ... that culminated in a free Sunday Gospel show on the Main Stage.

The event united hundreds of artists, musicians and actors from multiple genres showcasing their talents and works, who were lit with around 170

Robe fixtures among other lights. The event was attended by over 109,000 people who also enjoyed a lively proliferation of arts, craft and food-stalls along with other cultural and brain-stimulating activities like poetry reading and a 'book crawl'.

Main Stage

Johan Ferreira, who also runs his own production company, has been involved with Innibos since 2005 (it started in 2004) at that time designing one of the smaller stages. He has also been using Robe products in his work for some time.

In 2006, he was asked to light the Main Stage ... and he's been designing and technical directing an eclectic line up appearing on it ever since!

The Main Stage production design process – which also includes set and video – typically starts around 10 months in advance, and Johan will look at all aspects of the technical stage presentation working in close conjunction

with FOH engineer Murray Lubbe.

As Main Stage technical directors, the pair are an integral part of the wider festival creative team.

Johan's creative starting point for lighting the 2016 event was to shift it away from a 'conventional' music festival set up with bands and artists appearing in quick succession – conveyor belt style – instead, he wanted to establish a theme that could carry on with a bit more depth and visual interest through all days of the event, and work equally well for the different musical genres.

His theatrical roots also come into their own, and he looks at the Saturday night showcase and a peak point and the line up going on throughout the event, then creates a stage and set that will work all these demanding scenarios – the grand opening on the Wednesday; Thursday night's all-out rock show; the Friday night variety performance ... and of course, the large Gospel production that closes the festival on Sunday.

The primary requirement is to be flexible and extremely dynamic.

This has driven him to specify Robe moving lights for some years ... steadily

in increasing numbers! This year some 150 Robe fixtures were on the rig, including LEDWash 600s and 1200s, BMFL Blades, LEDBeam 100s and CityScape 48s ... together with other lights.

The 24 x LEDWash 1200s were scattered around on the overhead trusses and used for vibrant stage washes. The ones on the front truss were used for band key lighting, and worked in unison with 28 x LEDWash 600s which were also distributed on the over-stage trusses as well as along the top of the PA wings for shooting into the audience and pulling them into the action.

The six BMFL Blades were upstage. They gave huge backlight effects on artists and bands and were used to produce complex and stunning gobo looks.

The 48 x LEDBeam 100s were divided into two banks of 24, each suspended on three upstage trusses and Johan's idea was to create an array of beams that would resemble the look of stadium lights and enlarge the perception of space.

The 44 x CityScape 48s were used as footlights and basic washes for artists strutting up and down the thrust stage.

LEDWashes have long been a favourite fixture of Johan's and he loves "the output, the beam spread and colour mixing / correction". He says he's always surprised by the "incredible brightness" and he can use them as a full stage wash one minute or a tight special the next ... an adaptability essential to his theatrical style approach to lighting an environment like this.

"The colour mixing is incredible" from the deepest saturates to the most delicate pastels" he declares and he loves being able to use them to create eye and camera-candy with the individual ring control.

He's also equally enthusiastic about the BMFL Blades... "It's by far one of the best profile luminaires in our industry today, packing a massive punch!"

On this show, it was vital to have a unit with enough impact to produce mid-air effects in spite of a huge mega-bright upstage LED screen and he was delighted with the speed and accuracy

of the BMFL beam-shaper, the colour system and the "beautiful but practical" set of gobos.

The little LEDBeam 100 is also a favourite fixture "and will be for the foreseeable future", being small enough to place anywhere onstage or around the rig, but powerful enough to produce highly visible beams. "Using LEDBeam 100s rigged in an array-style gives almost endless possibilities".

The biggest challenge of lighting the Main Stage this year was illuminating the 28.8 metres wide by 4.8 metres deep thrust section into the audience, as he didn't have the luxury of any lighting towers in the public area on which filler lights could be rigged to assist. As it was, the CityScape 48s worked very well.

The other challenge was the sheer amount of content in the show ... each night there are over 50 numbers to keep looking new, fresh and invigorating, and that's a lot of intense programming to ensure a WOW factor for each song!

Commenting on Robe generally, Johan thinks they are currently "one of the best" lighting manufacturers. "Care is taken with every fixture. They are robust and can take the strain of an outdoor environment like Innibos" he expands, saying that he enjoys the fact

that "Robe pushes boundaries with every new fixture and takes the time to listen to LDs when it comes to the design of new products".

He can't wait to get his hands on the new Spikies and hopes to include it on the plot for Innibos 2017.

Johan adds that the local support from Robe's southern Africa distributors DWR is "Fantastic"!

He loves many things about being involved with Innibos including the family atmosphere and the fact there is a fantastically fluid creative and collaborative chemistry between everyone when it comes to producing the event. "There is really an endless horizon of fabulous and inventive ideas," he concludes.

Rock Stage

The Rock Stage is also popular – as you might expect – particularly with diehard rock fans and among the younger elements of the festival population and Pretoria based rental company EPH productions has been involved as an equipment supplier to that stage for several years.

However it was Levan's first year as LD, having joined the company in late 2015, which he thought was a very special opportunity.

Naturally he designed a completely new lighting scheme and this had Robe

Pointes, LEDBeam 100s and 1000s right at the heart. "I wanted the lighting to be a new and unforgettable experience for the audience and artists – something that they'd never seen before," he stated.

The eight LEDBeam 1000s were located upstage in the roof, with three Pointes at each end along the sides and the remaining six Pointes on the deck. The LEDBeam 100s were positioned along the top front of the roof structure for audience effects.

Levan loves the "Incredible zoom and powerful fat light-source" of the LEDBeam 1000s. On the LEDBeam 100s he likes the piercing narrow beams and the macro effects and on the Pointes he likes just about everything including prisms, gobos, zoom and the spot and beam effects.

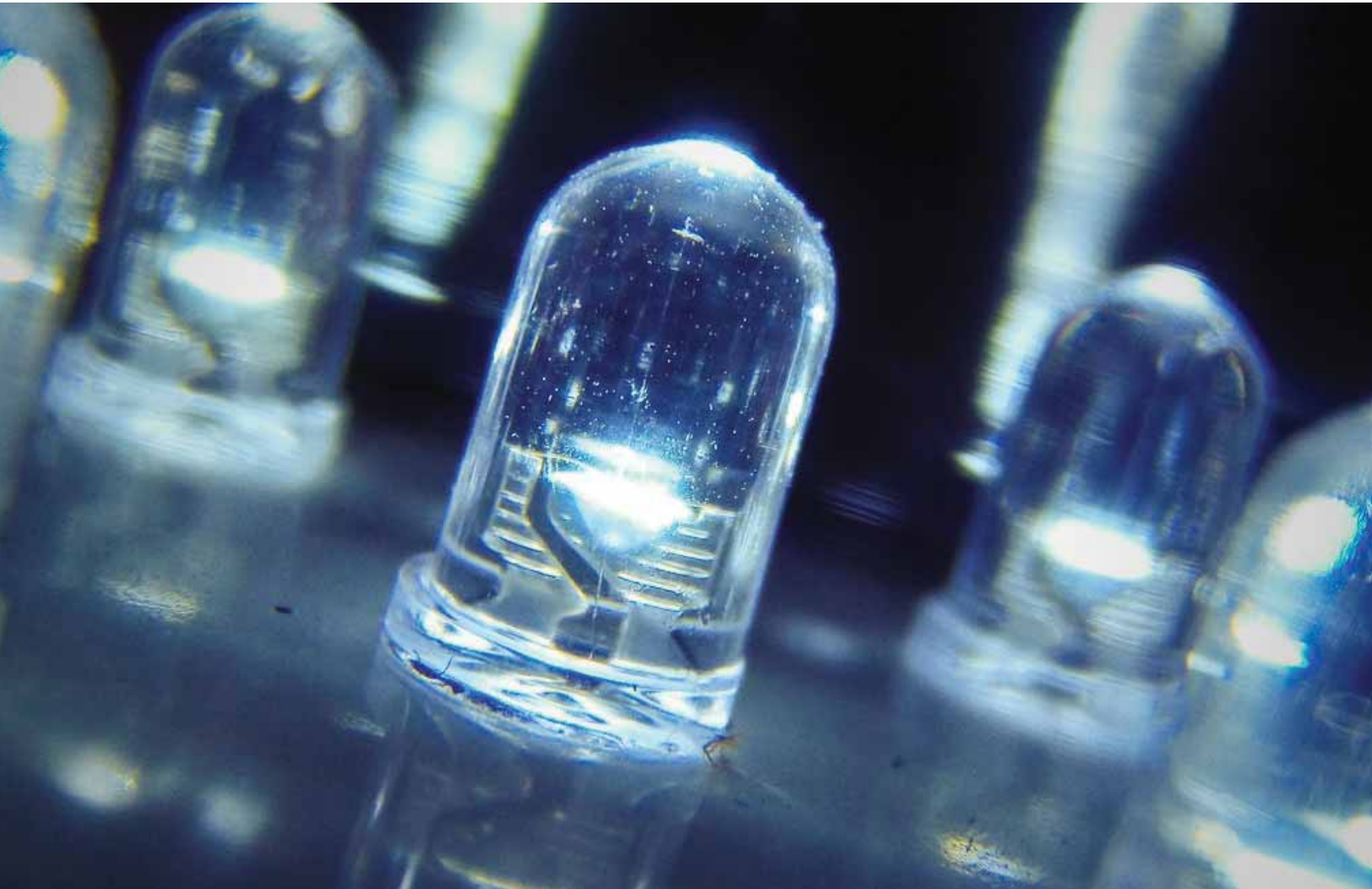
Talking generally, he thinks the optics "are great" on all Robe products, and that the brand represents great value for money. ■



Louise Stickland
Freelance Journalist
working with Loosplat
company, UK.



A 360° Approach & Beyond



LED lighting is the best choice to reduce energy consumption. It uses only 20% energy than an equivalent incandescent lamp. It also liberates much less heat than an incandescent bulb which in turn reduces the heat load on air conditioning...

Light Emitting Diode (LED) is regarded as 4th generation of light sources following incandescent lamps as first generation, fluorescent lamps as second and High Intensity Discharge (HID) lamps as third.

High efficiency, long life, compactness, light weight, mercury free, very weak Infrared (IR) and Ultraviolet (UV) emission etc. are their merits.

Presently LEDs are used in sign and display devices, spot lighting, base lighting, security lighting etc. Their applications are growing tremendously.

LED technology

LEDs are solid-state devices that convert electric energy directly into single coloured light. In it, most of the energy is delivered in the visible spectrum. LEDs don't waste energy in the form of heat. Therefore, it is called 'Cold' light generation technology.

LED smart control system has two concepts, first is through the sensor which changes the Lumen of LED and let the light accommodate people; second, light as the transmission medium, human as the acceptor. The control system is not only to change the luminosity but also for communication, sensing, computing, Internet and other modern technologies. The effect of light goes beyond illumination.

Lighting efficiency

The efficiency of a light source is determined by luminous flux emitted per unit of power consumed by it.

LED lighting is the best choice to reduce energy consumption. It uses only 20% energy than an equivalent incandescent lamp.

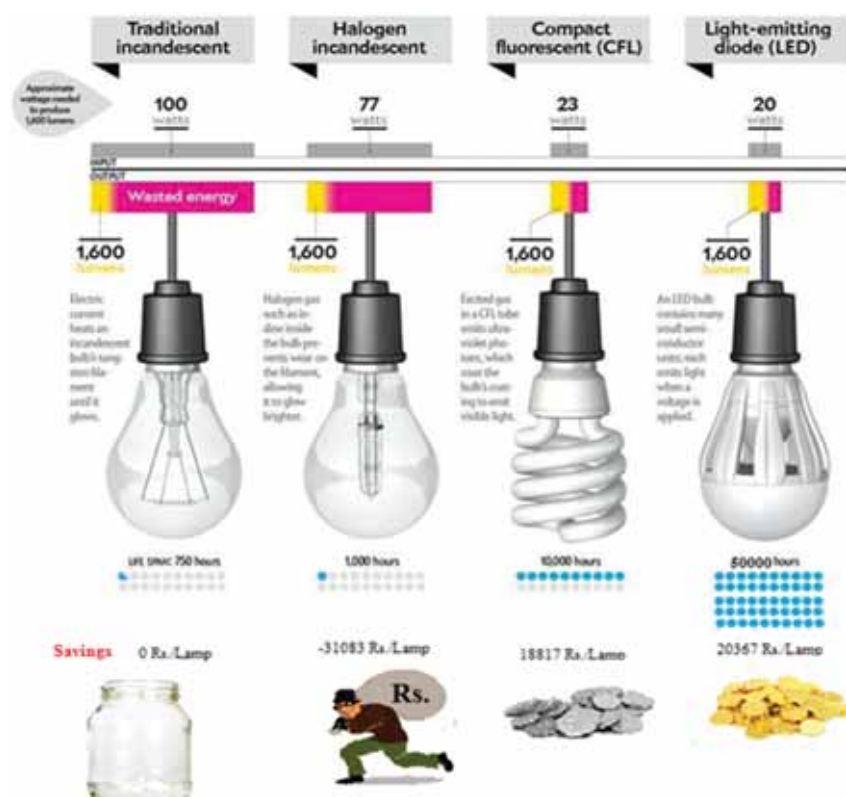
It also liberates much less heat than an incandescent bulb, which in turn reduces the heat load on air conditioning. Also, LEDs last significantly longer than incandescent or fluorescent bulbs thereby reducing maintenance.

Annual operating cost comparison

Annual operating cost comparison of LED, CFL and Incandescent lamps is given in the following table 1.

Figure 1: The analytics below shows operating cost of LED is much lower than others...

Measures	Unit	Light Emitting Diode (LED)	Compact Fluorescent Lamp (CFL)	Halogen Incandescent	Incandescent
Watts per Lamp (Equiv. 100 watts)	Watt	20	23	77	100
Projected lifespan of Lamp	Hrs.	50,000	10,000	1,000	750
Cost per Lamp	Rs.	300	220	750	10
Electricity used over 50,000 hours	kWh	1000	1150	3850	5000
Cost of electricity	@ 5 Rs./kWh	5000	5750	19250	25000
Required Lamp for 50k hours of use	No.	1	5	50	67
Expenses equivalent to 50k hours	Rs.	300	1100	37500	667
Total cost for 50k hours	Rs.	5300	6850	56750	25667
Saving with respect to Incandescent Lamp	Rs.	20367	18817	-31083	0



Comparison of latest generation lamp with first generation lamp...

Transformation of workplace lighting

Transformation of lighting from first generation to latest generation is helping in saving energy as well as improving office environment.

Some guidelines are given herewith for workplace lighting transformation.

Upgrades that pay for themselves

Some organisations provide funds

for energy-saving projects and recover it from the savings on electricity bills.

Controls over fingertips

The most efficient light source is one that can be controlled smartly.

The controls have come on a fingertip with the rise of LEDs.

It should be adopted for improvements in user interfaces for an existing building.

The end of louvre

To avoid glare on a computer screen, the latest guidance for the transformation of workplace lighting can be adopted, i.e., put the focus where it is required.

Adapting task lighting

To improve staff productivity and energy saving in their domain, task lighting is getting more popularity. Some countries have a stronger tradition of task lighting.

Well-being and productivity

Health, happiness, and productivity are now big considerations for workplace lighting. This can be achieved by smart control of lighting like an intense blue-rich light in the morning or at times of alarms, softer light during afternoon and evening.

Energy Management System (EMS)

Bigger energy savings can be achieved by spotting patterns and understanding, 'how buildings are used?' This can be identified by an Energy Management System (EMS).

Manual-Auto-Smart Control

The trend of building lighting control system continues like Manual-Auto-Smart.

Smart control of lighting for building reflects digitisation, intelligent building networks, 'safety and security' technologies, and the impact of light on humans.

The smart control system can be programmed for pre-determined patterns of light, to highlight a special piece of art, to dim or brighten them, and for automated impact on a location with a simple click of a button.

Smart control of office light

In the office, there are several places where lighting can be controlled smartly by the task-oriented lighting controller.

Meeting room

Occupancy and daylight sensors can be programmed for need-based lighting.

Moreover, by use of a dimmer with on/off control light level can be controlled.

Toilets

A simple Passive Infrared (PIR) sensor will ensure that the lights are only ON when a person is there.

Corridors

Daylight and occupancy sensors can control the illumination. Only care should be taken for positioning of sensors. It should be positioned properly so the lights switch ON before the person crosses the corridor.

By the windows (Daylight harvesting)

To use sunlight, luminaires can be zoned into groups. Thus, fixtures located near the windows may be dimmed during the day and the people away from windows will get full artificial light.

The boardroom

For meetings, presentations or events, choice of 'scenes' is needed to make sure that the illumination suits 'what's going on.'

If people are scrutinising the notes, put light on the table. If they are watching a presentation, dim the lights to focus them on the projection. If they are watching a speaker, dim the lights and highlight the speaker.

Clusters of desks

In the office, the area of work and walk can be differentiated. Zone the lights so these areas can be treated differently.

Position the sensors accordingly to control the illumination level.

The last man out

A 'last man out' switch is one way to make sure your lights do not leave ON needlessly when there is nobody.

Energy efficient office lighting scheme

For successful, energy-efficient office lighting scheme, do not get hung up on the watts per square metre figure. That's the advice of 'Andrew Bissell,' Head of Cundall's lighting division. Actually, energy efficient office light should be need-based with smart controls.

Latest trends in lighting technology

In lighting technology various developments are going on.

Some of the latest trends in lighting technology are given below.

Built-in light sources

Since LED light sources do not have to be replaced very often, and because no standards have emerged for what they should be like, manufacturers have got used to building them into fittings, rather than designing new luminaires around replaceable 'lamps.'

New power technologies

In LED lighting, Drivers are often the first component of a lighting system to fail. Therefore, manufacturer developed a lamp with a DC LED chip that needs no driver at all. The latest innovation is power-over-Ethernet that provides electricity through data cables.

Retrofit lamps – on borrowed time

Manufacturers begin to wonder "What happens once the market for these long-lasting lamps is saturated?". World class manufacturers accepted the challenge – and added value to this product like Internet connectivity, colour-changing and so on.

Revolutionary materials- Graphene LED

Researchers at the University of Manchester say graphene's high conductivity will make LEDs brighter, longer-lasting and more efficient. They hope to have a graphene LED lamp in the market soon.

Advanced efficiency of DC-LED lighting system

In an advance study, innovative DC LED lighting system instead of the conventional AC LED lighting systems is proposed. The benefit of using DC LED lighting system is to overcome the drawback, to convert AC voltage to DC voltage using SMPS for each LED unit, however, using only one SMPS with high efficiency is enough to supply the DC LED lighting system. According to the study, DC LED will save 17.4% of more energy than AC LED lighting system.

LED lighting: challenges

Connectivity

With LEDs comprehensively in the mainstream, the next frontier in

Measures	Unit	Incandescent	LED
Power consumption	Watt	50	6
Power consumption	kWh/ Lamp/ Hour	0.05	0.006
Operating hours	Hour/ day	10	10
Carbon emissions	Tonnes/ year/ Lamp	0.152083	0.01825
Reduction in Carbon footprint	Tonnes/ year Lamp		0.133833
Carbon emission	Tonnes/ year/ House	6.84375	0.82125
Reduction in Carbon footprint	Tonnes/ year/ House		6.0225

LED helps to reduce carbon footprint...

lighting is controls. Dimmers and sensors have been around for donkey's years, but the challenge now is to make them more sophisticated, get them to communicate with other devices.

From T5 to LED

Some areas have been slower to adopt them than others. The efficiency of T5 has been tough to beat in offices, and LEDs have struggled to match the output of floodlights.

What's next?

Beyond lighting

Lighting is not just about light anymore. It is about data. Technologies such as Li-Fi that tracks person's position using LED luminaires and smartphones. It is based on visible light communication. It sends data in light instead of the radio wave. This is done by modulating the light from LEDs in a way that's invisible to the human eye, but can be picked up by a receiver attached to a computer. The result is a super-fast wireless connection.

Helps to improve business

Poor quality of light makes a shop, café or office look dreadful. But the improved quality of light by LED helps in attracting the customers.

The Internet of things

Currently not only computer, laptop or smartphones are connected to the Internet, but also, your fridge, your coffee cup, your heart monitor and your LED lights are also connected to the Internet. Lighting is an ideal network for 'Internet-of-things' services to be built on – because it is already there in the

ceiling of every building, looking down at us, wired up and ready to go. Similarly, every building in the world already has lights all over its ceiling. Only have to add a few sensors or cameras and some kind of data connection to build the perfect network of 'Internet of Things.'

Look, no wires

Everything is going wireless these days, and lighting control is no exception. It is particularly appealing for retrofit projects.

As well as radio-frequency-based systems, there are technologies such as power-line communication, which uses mains power lines to carry data to and from your fittings.

And even for traditional wired control systems, it is going to be more and more common for the user's control device to be a tablet or phone that's not wired to anything.

Healthier lighting

Light quickly recovers a patient from illness. The manufacturers are putting this knowledge into practice and making products that promote health, by adjusting the brightness and colour of the light.

In maternity ward in Hillerød Hospital in Denmark uses a programme of light and sound to help mothers feel more relaxed.

LED helps in reducing carbon footprint

Studies show that 17% carbon footprint is due to lighting alone. The carbon footprint is directly correlated

with the amount of electricity consumed. LED lamps and tubes not only consume a fraction of the energy consumed by the incandescent bulbs, they have the double benefit of lasting almost forever and containing no mercury.

By doing nothing except installing LEDs in the home, it is possible to reduce one's carbon footprint by a whopping six tons per year.

To put it in perspective this saving of six tons is equivalent to reducing gasoline consumption by 700 gallons.

Electrical pollution by LED (Power Quality)

LEDs are versatile and energy efficient. But most of the LED lamps produce a high level of harmonics as compared to the standard set by IEC 61000-3-2. Harmonics adversely affect the power system.

In the three phase power system, triplen harmonic (odd multiple of third like, 3rd, 9th, 15th, 21th...) is the harmonic of primary interest. Since the percentage of higher order harmonics as compared to lower order harmonics remains low, it does not proportionately affect the system.

In case of even harmonics wave shape of negative and positive half cycle (like, 2nd, 4th, 6th...) are identical so they cancel each other. The third harmonic in each of three phase conductors always remains in the same phase. Therefore, when these harmonic currents come together in neutral conductor, they actually add.

Thus, resultant current in neutral becomes more than phase current. As a result, overheating of neutral conductor occurs which deteriorates the insulation. To overcome neutral heating, power system designers have started to recommend four core cables instead of three and half core cables for lighting circuits. ■



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New Lightning Scheme For Laboratory



In this article, the authors have explained the energy saving at source energy vs site energy and payback period using the new lightning scheme (LEDs) against the old four feet long fluorescent tubes (FTL). We

have also done one case study with calculation to explain the advantages of LEDs lightning scheme. At the end of article, the authors have discussed the comparison between FTLs versus LEDs...

Energy is needed for economic growth, for improving the quality of life and for increasing opportunities for development.

Some 600 million Indians do not have access to electricity and about 700 million Indians use biomass as their primary energy resource for cooking. Ensuring life line supply of clean energy to all is essential for nurturing inclusive growth,

meeting the millennium development goals and raising India's human development index. This must be done in a technically competent, economically viable and environmentally sustainable manner using different fuels and forms of energy, both conventional and non-conventional.

The production of one kWh electricity can be made using different energy sources, each source can be characterised by a factor that indicates how many kilograms of CO₂ are

Table 1: Comparison of watts / brightness guidelines

Incandescent Watts	CFL Watts	LED Watts	Lumens (Brightness)
40	8 – 12	4 – 5	450
60	13 – 18	6 – 8	890
75 – 100	18 – 22	9 – 13	1210
100	23 – 30	16 – 20	1750
150	30 – 55	25 – 28	2780

released into the atmosphere to produce 1 kWh electricity (these factors are changes that depend efficiency of the single station and the distribution network). Some of the sources of energy are oil, natural gas, coal, municipal waste (thermal), enriched uranium (nuclear, gradients of water (hydroelectric), heat of the earth (geothermal), wind (wind), sun (photovoltaic, solar thermal), biomass, etc.

Every nation has a mix of power plants that use different energy sources, then the value of kg CO₂/kWh will be different for each country, this factor can be used to calculate the kg of CO₂ emissions.

Indian coal has the general properties of the Southern Hemisphere

Gondwana coal, whose seams are inter-banded with mineral sediments. Run-of-mine coals typically have high ash content (ranging from 35–50%), high moisture content (4–20%), low sulfur content (0.2–0.7%), and low calorific values (between 2500–5000

kcal/kg, which is much less than the normal range of 5000 to 8000 kcal/kg. The calorific value of the Ohio (USA) coal is 6378 kcal/kg and that of the Long Kou (China) is 6087 kcal/kg¹⁴ (Visuvasam et al., 2005). The design rating of a coal-fired burner in USA is at 6214 kcal/kg.

Lumens is for brightness not watts

In past we had always compared brightness of a light by comparing wattage of the bulbs. But after using CFLs we realised that same amount of light can be achieved through lesser

Table 2: LUX level for Various tasks

Activity	Illumination (lux, lumen/m ²)
Public areas with dark surroundings	20 – 50
Simple orientation for short visits	50 – 100
Working areas where visual tasks are only occasionally performed	100 – 150
Warehouses, Homes, Theatres, Archives	150
Easy Office Work, Classes	250
Normal Office Work, PC Work, Study Library	500



Actual Photo of lab where skim is applied

Table 3: New Lightning Scheme for Lab

Total Illumination Required for study Room	250 lumen/Sq.m (Lux)
Required No. fixture or lamp	Required lux*Room Area / MF*UF*Lumens per lamp $= 250 \times (5 \times 5) / 0.85 \times 0.85 \times 1085$ (12 W LED lamp -1085 lum. 15 W LED lamp -1355 lum.) $= 6$
No. of Lamp Selected	3 (12W) 2 (15W) 1 (09W)
Power Consumption	12 W * 3 = 36W 15 W * 2 = 30W 09 W * 1 = 09W
Total Power Consumption	75W
Power Saving	300W - 75W = 225W

wattage. So is watt a good representation of brightness? No. The actual technical term for brightness is Lumens. More the lumens, brighter the light is. The number of lumens is different for different bulbs and some of the branded lights do have this information, but most bulbs available in our country do not have this information. Guidelines for comparison refer table 1.

To conserve the Electrical Energy in the best way means to reduce the energy consumption using less of energy services. e.g. in a case of a room using fluorescent tubes (FTL) 50 Watts, we are getting 5000 Lumen being replaced by 12 W LED lamp -1085 lumens, and 15 W LED lamp -1355 lumens. Through, this does lead

to a reduction in electricity bills; we are conserving energy after putting the room into partial darkness will be there in the room. This is because by using a LED with fewer efficacies, we are working against the other means to reduce energy use-namely energy efficiency.

How much light is required?

Amount of lighting is required for a room depends on the size of the room and the purpose of the room. Complicated tasks require more lighting and just moving around the room requires much less light. The amount of light required in an area is defined as "LUX" level that is equal to lumens/area (lm/m^2). Table 2 gives a good idea of LUX level for various tasks.

So if you have a room that is 5 meter x 5 meter (which is 25 m^2) and you want to do easy office work in the room, then the amount of light required in the room is 250×25 i.e. 6250 lumens. About 5bulbs of 75-80 Watt can achieve this.

If you have a small area of a square meter and you use it for pc work, then a 12-watt CFL is good for it.

Task based lighting can be done in a room accordingly.

New Lightning System for Laboratory

As per the requirement of laboratory the rating of different bulbs are selected

with suitable area. Moreover one case study is done which shows the consumption of electricity using LEDs bulbs in the laboratory and how much power can be saved using LEDs bulbs. Refer table 3.

Energy Saving

Table 4: No. of Unit saved in a day

Daily Energy Saving	225*8hr (8 hour working hour / day) = 1800wh
Unit Saving / day	1.8 KWh = 1.8 units/day

Table 5 shows the efficiency and its ranges from generating station to transmission station and distribution station to customer premises. At end user the efficiency at different stages gets cascaded.

Case Study

A research shows:

1 Unit Consume at consumer End = 2 units generated generating station.

Viewing, this from generating side we can say that

1 Unit saved at consumer End = 2 units saved at generating station.

As we have seen in Table 4 that using new lightning scheme at consumer premises we can save 1.8 KWh/day.

In other words number of unit Saved at Generation Station (source side) = 3.6 KWh /day

Energy Saving /day:

Energy saving in term of KiloGram of coal = 0.66 KG (average Indian coal Calorific value 4500 Kcal/Kg)

Energy saving Kcal.: -3096 Kcal

Energy Consumption by different petroleum

1 kg kerosene = 11110 Kcal.

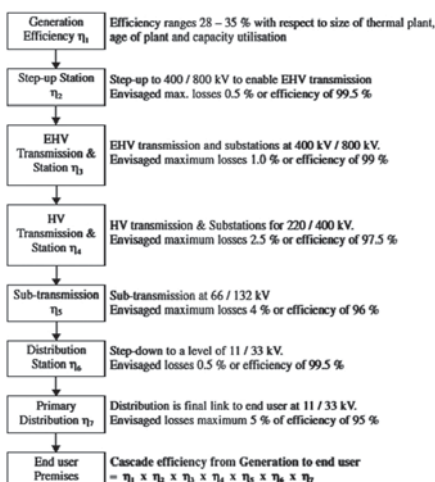
1kg petro = 11200 Kcal.

1kg LPG = 12500 Kcal.

1m3 Natural gas = 9500 Kcal [5]

With new lightning system 3.6 KWh saving per day it means that per day saving in different petroleum due to utilisation of new lighting system Energy saving in Kcal = 3096 Kcal

Table 5: Efficiency from Generation to end User



Kerosene saving= 0.278 lit.
 Petrol saving= 0.276 lit.
 LPG saving= 0.247 kg
 Natural gas saving= 0.352 m³

Investment and Pay Back

Unit saving consumer end = 1.8 kwh/day
 Unit saving per month = 54 kwh/month
 Unit rate is Rs. 8 /unit as per college electricity bill by MGVC, Gujarat.
 Monthly saving = Rs. 432
 Yearly saving = Rs. 3456 (Assume 8 working month per year)

Initial investment

No.	Name	Price (Rs.)	Quantity	Total (Rs.)
1.	15W LED lamp	520/-	2	1040
2.	12W LED lamp	420/-	3	1260
3.	09W LED lamp	250/-	1	250
4.	Wire	10/- per meter	70 meter	700
5.	Conduit	—	—	500
6.	Accessories	—	—	200
Total: Rs. 3950				

Payback period= Total investment / Saving per year = 3950/3456 = 1 Yr. 1 Month 2 Days..

Outcome

In Gujarat output power per day of 1 kilowatt solar PV plant is 4.2 units.

Using the new lighting design in Laboratory (Room No. 140A), the Energy saving is Equal to Installation of 850 watt Roof top PV power generating station.

850 watt capacity of solar PV System daily generation for 7 sunny hours per day is equal to 3.7 units per day [6].

Common Indian family Electricity requirements is 1 unit per day (For 100 Watt load)

Energy saving with new lighting system in Laboratory is Equal to connecting approx. 6 common Indian families with Electricity ■



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LightTech Calls On ILUMINARC

To Harmonise NY Club Deck With Seaside Setting

Photo Courtesy Jason Blends

John(Gonzo) Gonzalez, Lighting Director of MSNBC's Morning Joe Show met Steven Retas, who was lighting the Christmas celebration at Brooklyn's Saint Joseph's Co-Cathedral's façade. Then? Read on...



Christmas is almost certainly not the first thing that comes to mind for the large number of people who are enjoying summer evenings on the elegantly appointed deck of Howard Beach's Vetro Restaurant and Lounge. Yet it was an unexpected Yuletide meeting that resulted in the rich, warm and continuously changing lighting display that washes this rooftop area and is as much a part of its captivating charm as its warm ocean breezes and stunning seaside vistas.

Created with a collection of LED fixtures from ILUMINARC, Vetro's lighting design can be traced back to December 2014, when John (Gonzo) Gonzalez, lighting director of MSNBC's Morning Joe Show, attended the Christmas celebration at Brooklyn's Saint Joseph's Co-Cathedral. It was there he met Steven Retas, who was lighting the church's façade with holiday-themed colors and gobos. The two men struck up a friendship and Gonzalez showed Retas the work that he and Leon Saddler of LightTech had done illuminating the interior of the 103-year-old church, a stunning design achievement that earned them international attention.

Duly impressed, Retas asked Gonzalez if LightTech could help him create a signature look for the newly designed rooftop deck at Vetro. The award-winning (International Five Star Diamond) restaurant was looking for something that would give its deck lounge a distinctive and memorable look. Working with programmer Jason Ayala, LightTech was able to help Retas achieve this vision at Vetro in breathtaking fashion.

"Steven asked Gonzo to use his design talent to create the mood for a completely different club-like venue here," said Saddler. "We used state-of-the-art lighting effects to unite different elements in the room and create a light space that harmonized with the beautiful surroundings."

LightTech positioned 23 of Iluminarc's Ilumiline 36 IP linear LED architectural wash lights around the deck. An additional 20 of the Ilumiline fixtures were used to illuminate the cabana drapes on the seaside deck. Measuring 38.6" long by 2.7" wide by 4" deep, the IP67-rated RGB fixtures fit

well even in the tight space to ensure widespread coverage of the area.

"The Ilumilines gave us a lot of flexibility," said Gonzalez. "We didn't have to compromise our plans because of tight configurations. Plus the colour rendering is excellent. The perimeter fixtures are used as wall washers and they really colourise the room beautifully. The other fixtures are used to light the sheer curtains wrapping the cabanas, which creates an elegant touch."

Additionally, a pair of Ilumiline 21g2 IP fixtures were positioned to be used as downlights at the entrance columns to Vetro. The LightTech team also positioned two Ovation.

F-95WW Fresnel fixtures from ILUMINARC's sister company CHAUVET Professional over the DJ booth on the

Ayala created a flexible program that could change with the mood of the evening and was equally well-suited for used by a seasoned DJ or an inexperienced bar staff member.

"The programming is intended to flow with the evening," said Ayala. "We have the lighting preprogrammed so it starts off low-keyed for the early evening, then picks up in intensity for the prime partying hours. I used a grandMA system that will allow an LD to operate it when necessary. Yet there are plenty of good presets for those times when there is no LD and the bar staff is operating the system. The system is really achieving a good balance between being elegant, yet providing tasteful flash when there's a dance party."

For his part, Gonzalez shares this enthusiasm. "Everything about this project really fell into place beautifully and the end



Vetro deck to provide soft, flat warm white light for the performer. "The Fresnels allow us to illuminate the performers in a flattering way without detracting from the overall ambience created by the architectural lighting," said Saddler. To give their richly textured lighting display an added dimension, the LightTech team called on the services of Ayala, a well-known club LD and programmer in the New York area.

result is stunning," he said. "It's funny how things work out sometimes; we hooked up at a Christmas event and end up creating a beautiful deck environment as a result." ■

Credit

ILUMINARC

Features To Seek In An Indoor LED Lamp Driver



Image Courtesy: NXP Semiconductors

The controller IC - SSL5511 allows dim level control with either an analog or digital control input. It facilitates continuous (analog) regulation of LED current in both the dimming modes. It also allows a large dimmable range...

The availability of high-brightness LEDs and intelligent LED controllers is the key enabler driving the widespread proliferation of LED lighting. Though the product designers face numerous challenges such as thermal management, driver topology, existing lamp shape and regulation compliance, the availability of a choice of semiconductor driver chips has made the task relatively easy. In this article, we cover some of the important features that one should look for in an LED driver.

Though Light Emitting Diodes (LEDs) have been in use in electronic systems for many decades, their initial usage was primarily as indicator lights in electronic devices. Later with availability of more colours and brightness, their use expanded to applications such as mobile phones, media players and commercial lighting applications. However, with the emergence of high brightness LEDs, the lighting world is witnessing a revolution that has hitherto not been seen in it over a century long history.

The new lighting element, namely an LED, has numerous advantages over the earlier ones, such as fluorescent tubes. While the LEDs permit a unidirectional flow of current and operate on a DC supply, the earlier technologies including fluorescent tubes operate with an alternating (AC) supply. At an initial glance, it may appear that it would be easier to design ballast or a driver for fluorescent tubes since our power supply is essentially an AC system. But this is not the case. An efficient ballast that operates at a high PF needs to convert the AC supply to a regulated DC supply – and then again convert the DC back to AC before subjecting it to the fluorescent lamps. On the other hand, an LED driver has a single stage topology with few components and a small size at a low cost.

Moreover, the LEDs are low voltage devices with each LED being subjected to about 3 volts while the earlier fluorescent tubes were high voltage devices requiring

hundreds of volts. While these two aspects have been primarily responsible for making the design of a driver simple, and its bill of materials low cost, together they have enabled manufacture and sale of a 7 Watt LED bulb for under ₹100/-. Also, when it comes to dimming, it is far simpler to dim an LED. In sharp contrast, the fluorescent tubes required a more complicated frequency based dimming system.

In India, the government has launched numerous schemes to be part of this revolution. For example, the Demand Side Management based Efficient Lighting Programme (DELP) in Delhi, Maharashtra and other States is an on-bill financing model under which a consumer is eligible to purchase up to 4 Nos. of 7 Watt LED bulbs at an upfront cost of ₹10 each. The balance of ₹83 is recovered from the electricity bill at ₹10 / month for the next nine months. Across Maharashtra alone, a total of 18 crore LED bulbs will be distributed to 1.76 lakh domestic consumers.

When the lighting sector is undergoing such a massive transition, lack of enforcement of quality is leading to uncontrolled injection of harmonics and consequential drop of Power Factor (PF). These poor quality LED lamps are fast becoming a major threat to the

quality of the AC mains supply.

In this article, we are going to take a look at some of the important features that should be sought after, while designing or purchasing an LED lamp.

For the designers, we also take a close look at a lighting controller that offers most of the much sought after features. We will focus on an LED controller IC that can drive strings of LEDs or high voltage LEDs from the AC mains. Also, a controller that can operate in high-efficiency switching modes – buck, flyback or buck-boost and drive an external power FET.

Lighting Controller

For our study of features, we choose an offline dimmable controller IC – SSL5511T developed by NXP Semiconductors. This IC has been designed to drive dimmable LEDs in general lighting applications such as remote controlled luminaires and smart lamps.

Block Diagram

To understand the main benefits of using the lighting controller, let us take a close look at the internal blocks of the SSL5511 (see Figure 1). It is an 8 pin chip whose pin description is as shown in Table 1.

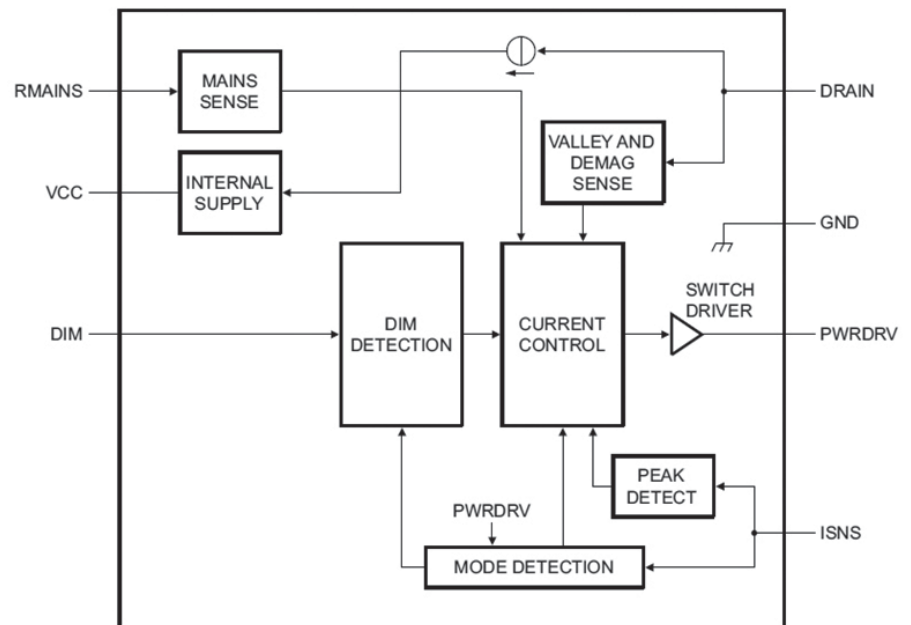


Figure 1: Block Diagram of a Lighting Controller (Courtesy NXP)...

Table 1: Pin Description of the SSL5511...

Symbol	Pin	Description
RMAINS	1	mains detection input
VCC	2	IC supply input/output
DIM	3	dim-level control input
TST	4	IC test pin, to be connected to ground in application
ISNS	5	peak current sense input
PWRDRV	6	external MOSFET gate driver output
GND	7	ground
DRAIN	8	external MOSFET drain sense input

Pin Description

The SSL5511 is an eight pin chip. The pin description is as given in Table 1. Let us now take a look at the function of each pin. It would be clear from the description below that some pins have multiple functions.

The RMAINS pin takes in a current that represents the rectified mains voltage via the resistors R2 and R3 (see Figure 2). The information about the input mains voltage waveform is used to shape the output current waveform to offer very low THD (LTHD mode). It is also used for internal timing synchronisations.

The VCC pin and its associated capacitor is generally fed from the auxiliary winding. However, at power-up, the voltage on VCC is charged

using the HV current source from the DRAIN pin. Abnormal voltage levels on VCC trigger different protection modes to ensure safe operation.

The Dimming Level Control (DIM) pin accepts an analog or digital control signal as input – and translates it to a target output current level. It also acts as an ON/OFF control pin.

The ISNS pin senses the voltage across the sense resistor R7 generated due to the inductor current flowing through the external MOSFET. At start-up, the ISNS pin also enables us to set the operation mode. The value of resistor R6 at the ISNS pin allows us to choose between a low ripple mode ($PF < 0.7$), or eco-LTHD ($PF \sim 0.75$), or LTHD ($PF > 0.9$).

The IC also contains a MOSFET driver

whose output is available on PWRDRV pin. The switching slope of the transitions (low to high and back) is controlled to limit the high frequency radiation. The value of resistor R8 on the PWRDRV pin allows us to choose between flyback or buck-boost or buck and in each mode to operate either in HF or LF.

The DRAIN pin is used to derive energy to charge the VCC pin at the time of start-up (before switching starts). The signal on this pin is also used to detect demagnetisation and to determine the 'valley' of the ringing voltage for starting the next primary stroke.

In order to increase the efficiency of the LED driver, a dedicated Valley detection and switching circuitry is built in. As can be observed from Figure 3, the transition is minimum at the valley point. The capacitive switch-on losses can be reduced to a minimum through valley switching.

Features

1. **Dimming Support:** The controller IC - SSL5511 allows dim level control with either an analog (according to IEC60929 annex E) input or digital control input. It facilitates continuous (analog) regulation of LED current in both the dimming modes. It also allows a large dimmable range. Dim curve selection based on the control input type.
2. **Remote-Controlled Applications:** It supports remote-controlled LED lamps with accurate dimmable current output.
3. **Selectable Modes:** One can choose between High Power Factor or Low Ripple modes. The IC also supports various converter topologies – buck, flyback or buck-boost.
4. **Small PCB Footprint:** The controller IC includes most of the circuit blocks for a simple single stage topology with minimal external components. The application can fit in common form factors like PAR, GU10, A19 and the candle form factor.
5. **Wide Range of Power Levels:** The IC drives an external switch for easy power scaling. Since external components determine the power

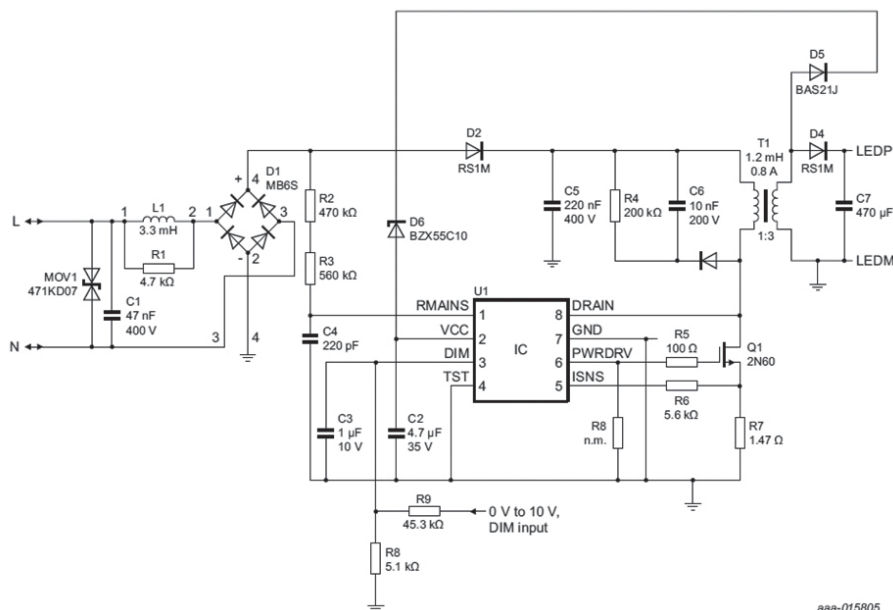


Figure 2: Circuit Schematics of a Flyback Topology (Courtesy NXP)...

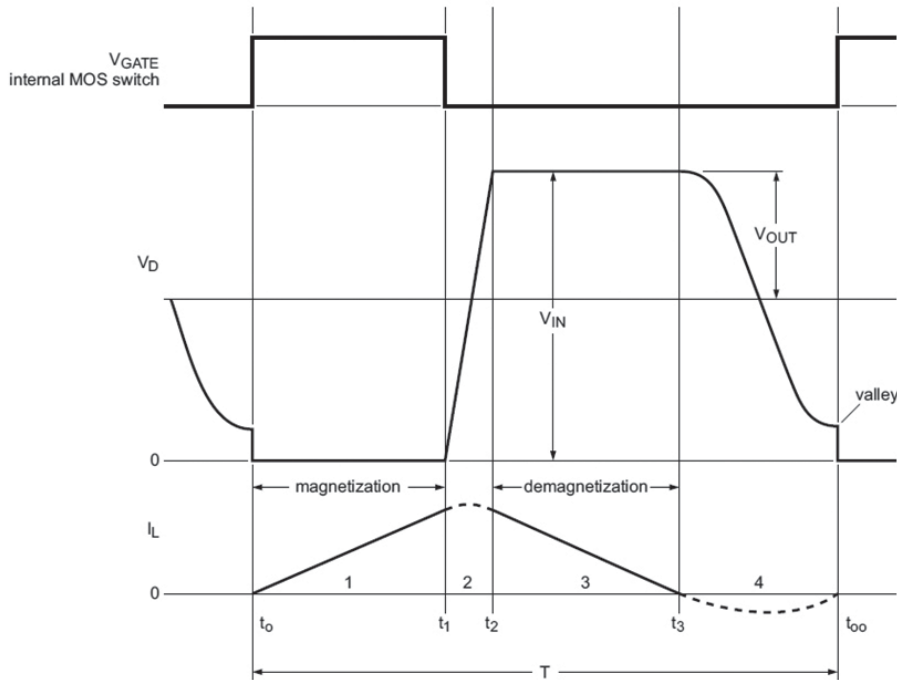


Figure 3: Buck Waveforms and Valley Detection (Courtesy NXP)...

level, it can range from 4 W to over 25 W.

6. **Wide Range of Input Voltages:** The IC supports AC mains connected LED lamps for single or universal mains voltages, including 100 V, 120 V, and 230 V (AC).
7. **Low Bill of Material (BOM):** Since the IC integrates even the start-up JFET, it offers the benefit of low electronic BOM and low component count.
8. **Ease of Design-in:** Through external resistor value settings, the IC offers trade-offs between output current ripple, the mains THD, and application size. This simplifies the design process for developers.
9. **Low Switching Losses:** Zero current switching at switch turn on. Also, zero voltage or 'Valley' switching at switch turn-on.
10. **HV Start-up:** The IC has been designed to start-up directly from the High Voltage (HV) supply by an internal high voltage current source. Subsequently, to minimise losses, an external auxiliary winding could offer the low voltage supply on the VCC pin directly.

11. **No Binning Required:** Usually the LEDs need to be binned based on its forward voltage. Due to feedback control the LED current is well regulated with an accuracy of $\pm 4\%$ across variations in LEDs, other components and conditions. The need for binning can, therefore, be dispensed with.

12. **Primary Side Sensing:** Primary side sensing lowers BOM cost since expensive opto-couplers required for secondary side sensing can be eliminated. The primary side sensing provides accurate output current control.

13. **Wall Switch Compatibility:** Compatible with wall switches with built-in indication light during standby.

14. **Reliability:** IC lifetime matches or surpasses LED lamp lifetime.

Protections

To ensure that the IC lifetime surpasses the 60,000 hours of LED lamp life expectancy, well designed protection circuits play a very important role. The SSL5511 IC has the following inbuilt protection circuits that come into action under various abnormal conditions.

Almost all of them are un-latched protections, except for the 'Output Open Over-Voltage' protection (OVP) which is a latched one. This means that when normal external conditions get restored, it automatically leads to the safe restart of the converter automatically. The OVP protection for safety reasons is a latched protection and requires power-off cycling to exit the latched state.

1. **Preventing Continuous Conduction Mode (CCM):** The CCM prevention feature has been built in to enable application design without having to include margins to ensure Discontinuous Conduction Mode (DCM). The IC monitors the time gap between the end of the secondary stroke and the start of the next cycle. If this time becomes shorter than a predetermined idle time of about 1.8 microseconds, the controller reduces the switching frequency to ensure DCM.

2. **Under-Voltage Lock-Out (UVLO):** When the voltage on the VCC pin drops below the threshold value ($V_{CC(stop)}$), the IC stops switching. The internal HV current source is enabled to allow the voltage on the VCC pin to rise once again. Once the voltage has increased to $V_{CC(startup)}$, the IC restarts after one second delay. In case the IC goes into the UVLO mode repeatedly, it means that the auxiliary winding is unable to sustain an adequate voltage on the VCC pin.

3. **Over-Current Protection (OCP):** A highly accurate peak current detector gets triggered whenever the voltage at pin ISNS reaches a threshold $V_{th(ISNS)}$. The circuit is activated after the leading edge blanking time. The propagation delay between the peak current detection and the switch actually switching off causes the actual peak current to be slightly higher than that set by the current sense resistor. However, the control loop compensates for this difference ensuring output current accuracy.

4. **Brownout Protection:** This protection

is designed to limit the switch-on time in case of low input voltage. If it weren't for the brownout protection, the built-in peak current control would cause the input current to otherwise increase slowly while no power is transferred to the output in a flyback configuration. The IC specifies a maximum ON time of the switch.

5. **Output Short Protection (OSP):** If a 'Valley' is not detected within the off-time limit $t_{off(high)}$, during the secondary stroke (Switch-off time), the output voltage is typically less than the minimum limit allowed in the application. This condition can occur either during start-up or to a short. To ensure that a real short-circuit exists, we need to differentiate it from a temporary start-up situation. The IC has an inbuilt timer which is started when $t_{off(high)}$ is detected and stopped only if a valid valley detection occurs in one of the subsequent cycles. If no valley is detected for $t_{det(sc)}$, the IC concludes real short-circuit exists and enters standby mode. Later the IC will try to restart after a minimum of nine seconds back-off time.
6. **Output Open Over-Voltage Protection (OVP):** If we have an output open situation, no power is

delivered to the output, causing the V_{CC} to exceed $V_{CC(max)}$. The IC enters a standby mode upon detection of this event. Since this is a latched protection, the IC does not restart as long as the mains voltage is present. Power-off cycling is required to exit the latched state.

7. **Internal Over-Temperature Protection (OTP):** When the temperature exceeds a threshold value - $T_{th(act)otp}$, the OTP function gets triggered and the converter stops operating. This protection is an auto-restart one and the IC restarts as soon as the temperature drops down below a lower threshold value $T_{th(act)otp}$.
8. **Mains Synchronisation Loss Protection:** In the absence of the AC mains, the input current at the RMAINS pin fails to cross the 'zero crossing detection' value of the $I_{l(RMAINS)}$ since no mains cycles are detected. The IC stops switching if this situation persists for a time $t_{d(mld)}$. The IC restarts once a valid mains signal is available again.
9. **Leading Edge Blanking (LEB):** After switch-on, a blanking time is implemented to prevent premature detection of the inductor peak current. At the opening of the

MOSFET switch, due to capacitive discharge of voltage over the drain and source, a short current spike can occur. So as to disregard this spike, current detection is disabled during the leading edge blanking time - t_{leb} .

Conclusions

This article has described more desirable features than that one needs to look for while choosing a good LED controller.

Using the intelligent LED controller - SSL5511T, a designer could build LED driver solutions with various topologies, power ranges, and input current/ output current behaviour.

We have also described the various protections that a good Light Emitting Diode (LED) controller IC should possess to ensure reliable performance to match the long lasting LEDs. ■



Dr Vithal Kamat
Managing Director
Baroda Electric Meters Ltd.

Dilip Kumbhat elected as National President of ISLE

The Indian Society of Lighting Engineers (ISLE), a professional body in the field of illumination engineering and head quartered in Delhi, has elected Dilip Kumbhat of K-LITE Industries, Chennai, as its National President. An election to the Governing Body for the four year term 2016-20 was held recently in the city.

As the head, Dilip Kumbhat would helm the high profile team of the society with a commitment to the upgradation of the domain giving due importance to advancing education and research in illumination engineering; promoting the illumination engineering services; maintaining liaison and technical interaction with national/international organisations; creating awareness on latest trends and innovations through



technical seminars / exhibitions; organising trade fairs for improving trade; and providing guidance to lighting fraternity to continue to cater to the needs of evolving lighting market with solutions of international standards.

He's an industrialist and a mechanical engineer with more than 40 years in the manufacture of luminaires. He has earlier held prestigious position as Chairman of a Government of India joint sector company Chennai Auto Ancillary Industrial Infrastructure Upgradation Company (CAIUC) in Ambattur. He was the Chairman of Chennai State Centre of ISLE since inception till 2011 and Vice President of ISLE, Governing Body. ■

Louis Poulsen launches PH ARTICHOKE with an exclusive new look

One of the world's biggest lighting design icons is being released in a new polished steel version. This adds a fourth member to the light fixture family, which today comprises copper, white painted metal and brushed steel models.

The new version looks elegant in new and old architectural settings alike and produces a fascinating effect as the surroundings are reflected in the changing angles of the leaves. The light is ideal for large and small rooms, private homes, companies and public buildings. The PH ARTICHOKE is sculptural and decorative lighting that has proven its enduring design and function over more than 50 years.

The PH ARTICHOKE story began in 1958, when architect Poul Henningsen precisely arranged the 72 leaves to create a light for Langelinie Pavillonen in Copenhagen. Since that time, the iconic fixture has been enchanting people around the world with its charismatic presence and atmospheric light.

The PH ARTICHOKE has been regularly updated to keep up with technological developments. We have also regularly considered alternative materials. However, very few materials meet our strict requirements and provide the lighting experience we expect of the PH ARTICHOKE. The new polished steel version has therefore been thoroughly tested before being finally approved in line with Louis Poulsen's lighting philosophy. The new PH ARTICHOKE is being released in the same LED version as the three largest versions of the fixture were launched in last year. ■

Email: info@louis Poulsen.com



LuDela offers Wi-Fire Technology to control real-flame candles

LuDela has introduced the world's smartest and safest real-flame candle. Featuring unprecedented Wi-Fire technology, the LuDela smart candle is the first to feature a real flame that can be lit, extinguished and controlled via a smartphone and eliminates the need for matches or other fire starters. LuDela addresses safety and aesthetic concerns that candle burners have faced for centuries, resulting in a safer, more convenient, and hassle-free approach to burning candles that delivers increased peace of mind and enjoyment to users.

"There's nothing quite like the glow, smell, and ambience of candles, but with it comes the fire risk, wax mess, hassles with wicks, and the time it takes to light and extinguish multiple candles," said Jamie Bianchini, Co-founder & CEO, LuDela. "LuDela addresses these issues with a smart candle that delivers the convenience and increased safety benefits of LED candles, but with the magic and fascination of a real flame. Combined with our social mission, LuDela delivers better light and better lives around the world."

LuDela melds the beauty of traditional candles with 21st century Wi-Fire technology. Its innovative burning design utilises 100% of the natural candle wax with no buried wicks and an 'Everbrite Flame' that guarantees the candle will always shine bright. The LuDela smartphone app lights, extinguishes, and controls multiple candles with the touch of a button. ■

Website: www.ludela.com



LuDela world's smartest and safest real-flame candle with Wi-Fire

Image Courtesy: Business Wire

WAC Lighting presents new BRIC LED Wall Sconce

A luminary building block, BRIC is an interior pocket sconce that provides warm ambient illumination with a diminutive form. Mounts in any direction, upward or downward, or arrange luminaires together in clusters for a geometric display of light and shadow for theaters, fine restaurants and boutique hotels.

With a colour temperature of 3000K, BRIC has a CRI of 90 and a long rated life of 80,000 hours. The LED luminaire dims beautifully.

CEC Title 24 compliant, this LED luminaire is available in a White Powdercoat or Brushed Nickel plated finish. The design features concealed hardware for a finished look at any viewing angle. The luminaire is ADA compliant and is available for 277-volt systems. BRIC is damp location listed. ■

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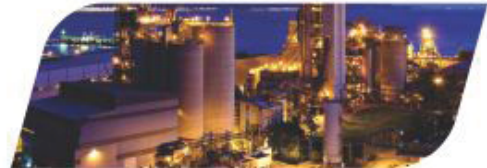
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