VOL.1 Issue 1

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IllumiNation

JANUARY 2019

THE LIGHTING MAGAZINE

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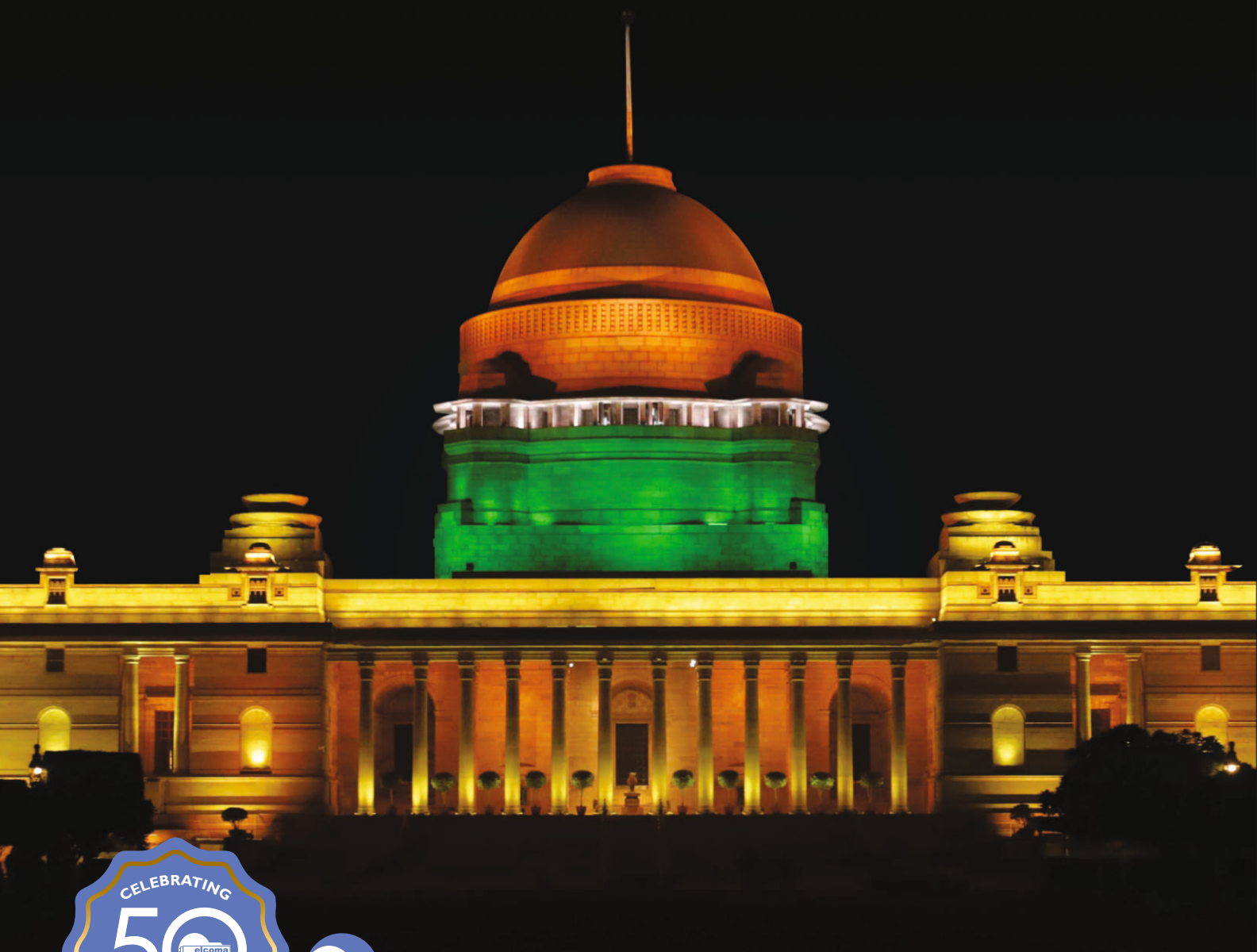

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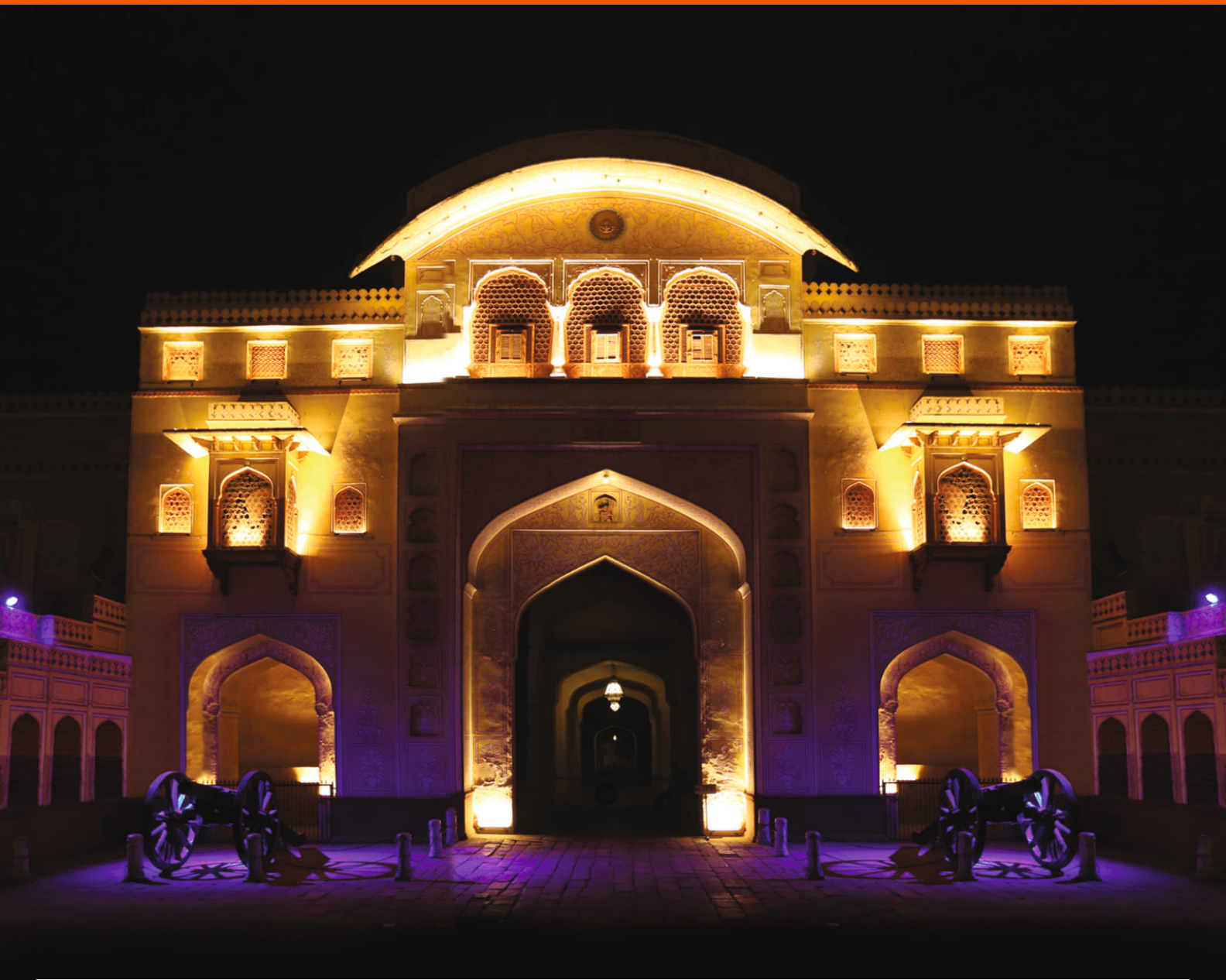

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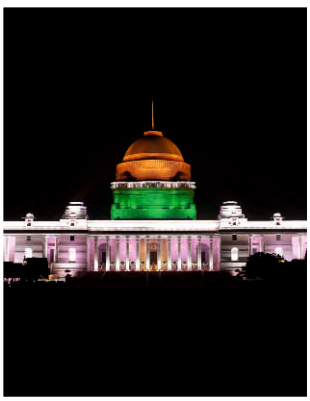

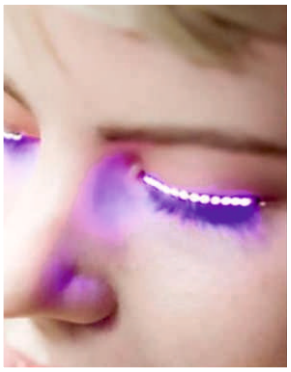

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ILLUMINATING THE WAY

I am much pleased to inform you all that our inaugural issue of 'IllumiNation' was a great success and well appreciated by the readers. We printed 10,000 copies out of which more than 6000 copies were distributed at Light India exhibition in October 2018 and the remaining were distributed to ELCOMA members, lighting manufacturers, government officials, architects, designers and many other stakeholders who matter in the lighting business. To attract international readers, we have also distributed hundreds of copies to associations and contacts in Australia, Japan, China, Taiwan, Korea, Europe, USA, South Africa, Russia and Brazil among others.

This next issue of 'IllumiNation' which is in your hands has undergone some significant changes in terms of format and specifically in terms of content with sections dedicated to upcoming technologies in lighting, interviews with the movers and shakers in the industry, policy and industry news, a snapshot of worldwide lighting developments and much more. These changes were arrived at after intensive discussions internally and mostly from helpful suggestions received from ELCOMA members and readers. We have also decided to highlight a lighting project covering a heritage building, monument or a place of public or national interest in the cover page and also as cover story inside the magazine.

We would like to incorporate news, views, information and new concepts related to the lighting industry and welcome articles from experts in technology, innovators of new applications or products and any other information relevant to our industry.

Through this magazine we are also trying to cover medium and small manufacturers to provide them a platform to reach and interact with larger audience and help them grow and be able to serve large manufacturers as co-makers or exporters. We are always looking to improve and better ourselves and create a magazine that remains relevant and interesting to all sections of readers. So please keep sending us your emails with comments, queries, criticisms and suggestions to help us become better.

And lastly, the year 2019 will mark the 50th year of ELCOMA's foundation. On this occasion I would like to thank all the office bearers, the governing body members, past presidents, vice-presidents, treasurers and support staff without whose contributions this association would not have reached where it is today. As we celebrate this momentous occasion, please join me in applauding these industry stalwarts that have helped mould and shape this most dynamic and proactive industry.

SHYAM SUJAN
Secretary General, ELCOMA

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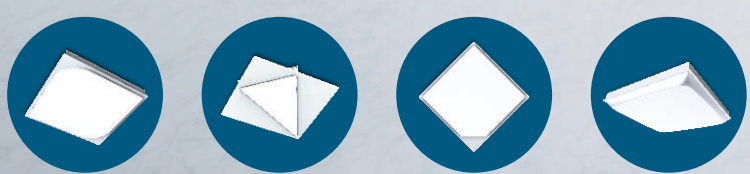

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MOVING TOWARDS INTELLIGENT LED LIGHTING

For many of us, our enthusiastic embrace of the latest technological developments has moved from 'Smart LED Lighting' to 'Intelligent LED Lighting'. This futuristic technology will soon be transformed from a novelty into an indispensable daily companion that will be an essential part of security and safety in household appliances that along with artificial intelligence is set to play an important part in our day to day lives.

As we know, new technology has always propelled and shaped society. However, new technological innovations used to take ages to develop in the Lighting Industry. The Incandescent Lamp continued to be the only light source for more than 100 years before CFL emerged as an alternate to these inefficient lamps. In the last one and half decade, technology has been changing at a very fast pace and today this change is measured not in decades or years but in six-month bites of history. Computer-based technology and its applications, I feel are the greatest offering to human kind in the recent past. Our awareness of fast speed technological developments and the electronic options they offer magnifies both our unending fascination of and our insatiable desire for each succeeding innovation.

I am glad that the Lighting Industry in India has adopted new technologies much faster than many other countries that are still in the CFL age. I know I, along with few large manufacturers are not alone in bringing this new technology in our products, but we have also seen a few new entrepreneurs in this sector who are creating value by bringing in their innovations across the value chain.

Introduction of every new technology needs to be supported by skills development and training of existing workers as well new entrants in the sector. ELCOMA is preparing itself to impart new training skills through government approved bodies such as Electronic Sector Skills Council of India. These trainings are envisaged to cover three important aspects of our industry namely manufacturing, after sales service and front-end sales product knowledge.

ELCOMA will continue to organize conference presentations on new technologies, as it has been doing in the past to help create awareness and enable knowledge sharing on emerging technologies and new innovations.

I wish the entire Lighting Industry a great future ahead.

Raju

RAJU BISTA
President, ELCOMA

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ELCOMA PRESENTS RECOMMENDATIONS FOR THE UNION BUDGET 2019-20

The Indian lighting industry awaits the budget of 2019-20 with great expectations. ELCOMA, as an apex body of lighting manufacturers in India has been facilitating communication between the Indian Lighting Industry and the government. ELCOMA has put forward certain recommendations for the upcoming budget, which could boost the Indian Lighting industry in the coming years and also make LED Lighting products more affordable.

The Honorable Prime Minister's *Prakash Path* initiative has shown remarkable progress and has already exceeded budgeted targets in public distribution of LED retrofit lamps, installation of LED street lights and now LED tube lights. These LED products reduce energy consumption between 50% to 90% as compared to conventional lighting products. As per the program, 770 million LED Lamps were planned to be distributed in Indian domestic sector by year 2019 and 30 million street lights by 2020. The lighting industry, in association with EESL, a government of India undertaking for public distribution and state procurement for energy efficient products, has already distributed one billion LED lamps and replaced more than 12 million street lights across the country. With these programs, the energy consumption would reduce from present 18% of total power produced to less than 13% in light sector by the year 2019. With the push given by government through Energy Efficiency Services Limited (EESL), LED lights are expected to witness a surge in demand and the Indian market for LED lighting is projected to grow at 40% CAGR (2015-2020). With this initiative, more than 27,000 MW power will be saved, besides financial saving, by 2020.

To support this massive green push, domestic manufacturers were relying on cheap imports as small local manufacturers did not have the wherewithal to meet this demand locally. Over the past one year, India has established manufacturing of most of the components of LED products in India. To support the government initiative of large quantities of LED Lamps and street lights for public distribution, the industry has jointly reduced the prices of LED bulbs to affordable levels.

RECOMMENDATIONS BY ELCOMA

- The present GST on LED Lighting products is 12%. Looking at our initiative of providing more efficient lighting sources that help us save a very significant amount of energy due to higher efficiency lighting products and to make LED Lighting products more affordable to replace CFL and incandescent lamps, it is proposed to reduce the GST on all LED Lighting products to 5%.

- The Customs duty on LED finished products is 20%. To encourage “Make in India” and save the industry from cheap imports, it is proposed to increase customs duty on all LED Lighting finished goods to 30%.

- To encourage production in India, Components imported for manufacturing LED products attract 5% duty as concessional benefit. However, the of getting the concessional certificate is cumbersome and lots of documentation adherence is required leading to red tapism and delays. To mitigate these problems and to promote ease of doing business, we would like to recommend to allow imports of these components at 5% custom duty under automatic route without the requirement of concessional benefit procedures as per Customs notifications.

- The input GST on components used for manufacturing LED finished products varies between 12% and 28%. This disturbs the complete manufacturing system and accumulates into a large amount of GST credit for long periods for adjustment/refund. To simplify the system, all input components used for LED products should also be reduced to 5%.

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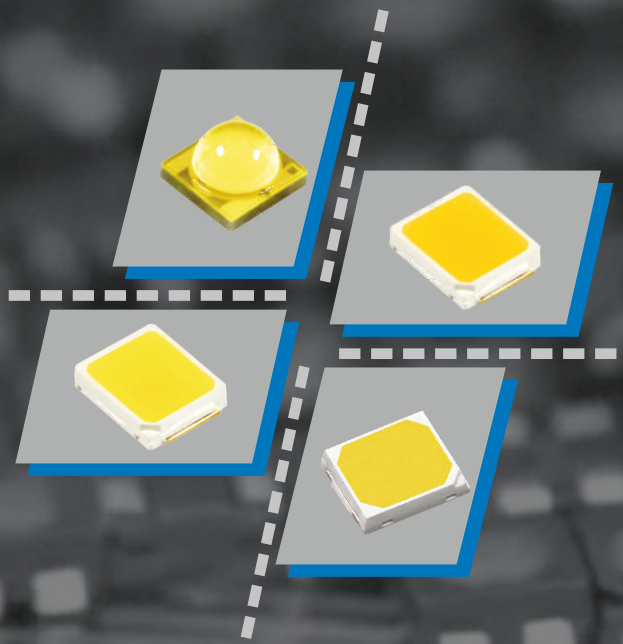

MLS is the largest manufacturer of SMD LEDs in the world. Headquartered in Zhongshan China, MLS has a capacity of over 3 billion LED packages per day.

MLS has a comprehensive product portfolio consisting of High, Mid and Low Power LEDs, SMD LEDs, LED Lighting Modules, LED Filaments, LED Digital Displays and many other products and components for lighting applications.

In India, MLS provides a wide choice of certified LEDs that are available in all standard CCTs and are used by our customers in products for trade, projects and tenders. MLS also has a wide range of color LEDs available in different LED packages.

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SIGNIFY CREATES A NEW SPARKLE FOR RASHTRAPATI BHAVAN IN NEW DELHI

Architectural LED lighting system lights up the iconic first address in the country

Signify Innovations India Limited (formerly known as Philips Lighting India Limited) announced the illumination of the Rashtrapati Bhavan building in New Delhi using its Philips Color Kinetics dynamic façade lighting, as the country celebrated its 69th Republic Day on 26th January, 2018. This iconic building is the official home of the President of India and is located at the western end of Rajpath in New Delhi, India. This illumination project follows the recent installation of dynamic façade LED lighting for the North and South Block buildings of the Central Secretariat, that was completed by the company in October 2017.

In the modern architectural world, facades have become an important showcase of technology, branding and identity. Especially when lighting up a monument of both historical and political significance, such as the Rashtrapati Bhavan, it is important to keep in mind the legacy of the building and its relevance to the nation at large.

The majestic Rashtrapati Bhavan building was built in 1929 as the official residence of the Viceroy of India and was later christened as the official residence of the President of India, when India gained its independence in 1947.

It is a strong emblem of Indian democracy and its secular, plural and inclusive traditions. The H-shaped building occupies 5 acres of the 330-acre Presidential estate, consisting of four floors and 340 rooms with a floor area of 200,000 square feet. The building is surrounded by the grand presidential gardens called Mughal Gardens and is one of the largest residences of a head of state in the world, in terms of area.

Hence the lighting for the monument was designed carefully keeping in mind its rich legacy.

PROJECT AT A GLANCE

A total of 628 light fittings have been installed for illuminating the building. The light fittings are equipped with lenses of both narrow and wide range, with a narrow beam lens highlighting specific objects such as the lotus on the Jaipur Column and a wider beam lens used to spread light over a larger area. Special focus has been given to structures such as the Jaipur Column, the dome of the main building, the Chattris, fountains at the terrace and ground level, as well as the Loggia columns. The façade LED lighting was officially inaugurated by President Ram Nath Kovind, in the presence of the Union Minister of State of Housing and Urban Affairs Hardeep Singh Puri, just ahead of the Republic Day celebrations in January 2018.

The monument was lit up with Philips Color Kinetics lighting systems from Signify and utilizes the latest advancements in LED technology to create themes and customized light recipes that can be used for important national festivals and celebrations. These special lighting themes can create unforgettable visual experiences, increase pride of residents, attract tourists and drive commerce.

"As the most prestigious address in the country, the iconic Rashtrapati Bhavan deserved attractive and dynamic lighting that emphasizes its architectural splendor and rich cultural heritage. We are proud to illuminate this historic landmark building with our dynamic Philips Color Kinetics LED façade lighting using a palette of 16 million colors" said Sumit Padmakar Joshi, Vice Chairman and Managing Director, Signify Innovations India Limited.

Around the world, many large buildings and monuments are being impressively lit in creative and artistic ways to stand out, building unique and strong identities for them. Making these structures dynamic helps them become part of our lives and can define a location, a city, a brand. It can also influence how we respond to a place and our emotional connection to it. And now with the flexibility of remote programming, this lighting can change almost instantaneously.

Philips Color Kinetics lighting system backs its LED lighting solutions with industry knowledge, years of experience, and an impressive track record. Lighting systems from Philips Color Kinetics are in use in over 34,000 high-profile lighting installations of varying sizes, environments, and levels of control in more than 100 countries around the globe - many specified by the world's most renowned lighting designers and architects.

PHILIPS TO SIGNIFY

Founded in 1997, Philips Color Kinetics virtually invented intelligent LED illumination, and was one of the first manufacturers dedicated to designing dynamic LED lighting systems and bringing them to market. Their lighting systems have been illuminating signature façades, landmarks, and interiors around the globe for over 20 years. Some of the installations have been running continuously, 24 hours a day, seven days a week, for more than a decade.

The company's commitment to cutting edge research and development is reflected in its extensive contributions to the Philips intellectual property portfolio in the area of LED lighting. As of 2011, innovations by Philips Color Kinetics engineers and researchers resulted in 135 issued U.S. patents, covering a range of LED products and technologies for various lighting applications.

Signify continues to invent new solutions for delivering energy-efficient LED light. Its latest innovation in this space is the new Interact Landmark platform that can enable users to monitor, manage and program dynamic architectural lighting using Interact Landmark software and system architecture. This system makes it easy to create and trigger light shows from anywhere, while simplifying maintenance to protect customers' investment. Their best-in-class energy efficient LED lighting systems also ensure maximum energy efficiency.

Signify became the new company name of Philips Lighting as of May 16, 2018. The legal name of Signify will be adapted in India in the beginning of 2019.

Author: SIGNIFY INNOVATIONS INDIA LIMITED
(Formerly known as Philips Lighting India Limited)

"As the most prestigious address in the country, the iconic Rashtrapati Bhavan deserved attractive and dynamic lighting that emphasizes its architectural splendor and rich cultural heritage. We are proud to illuminate this historic landmark building with our dynamic Philips Color Kinetics LED façade lighting using a palette of 16 million colors."

Sumit Padmakar Joshi, Vice Chairman and Managing Director, Signify Innovations India Limited (formerly known as Philips Lighting India Limited)

FACILITATING THE INDIAN LIGHTING INDUSTRY: THE ELCOMA STORY

Excerpts from a Speech by Shekhar Bajaj, CMD, Bajaj Electricals on 12 October, 2018 at ELCOMA Lighting Conference

Electric Lamp and Component Manufacturers Association of India (ELCOMA), the apex body of lighting manufacturers, was formed on 29th June 1970. Since then it has been liaising with government regulatory authorities, government officials, policy makers, various government agencies and has been supporting the lighting industry admirably.

Over last 48 years, India, ELCOMA and ELCOMA members have seen many changes in terms of various lighting technology platforms, modifications in lighting standards, revolution in taxation policies, new and improved import export policies, policies tailored to support small scale local manufacturers, policies that promote Make in India etc. And each and every time, with support from the government, this body has been successful in keeping the interest of the industry alive.

BEGINNING OF THE JOURNEY

The Indian lighting industry is an interesting space and it has constantly been evolving. ELCOMA saw the beginning of manufacturing in India with the incandescent light source based products which were energy guzzlers. Then came the fluorescent lamps - FTL which was a totally different technology platform with a much better efficacy and life. This was followed by the era of compact fluorescent lamps (CFLs) and then an improved version of FTL which was the T5 family. ELCOMA has also seen the evolution of copper ballast to high frequency electronic ballasts.

High power light sources, which were meant for outdoor usage, were introduced through high pressure mercury vapour lamps, followed by more energy efficient and best visual acuity light source called low pressure sodium vapour lamps and high pressure sodium vapour lamps and finally the improved version of mercury vapour lamps doped with metal halides for a high CRI called the high pressure metal halide lamps.

With the advancement of technologies came the challenges of re-evaluating existing lighting standards and rewriting and publishing newer and more improved lighting standards. ELCOMA has played a major role in essaying such standards in coordination with BIS.

The industry as usual was evolving, improving and always moving forward with new innovations and better and more efficient products. With development of more and more energy efficient sources came the challenges of effectively distributing light through various glare controller optical devices like mirrors, lenses, baffles and diffusers of different shapes and sizes. ELCOMA as always, was up to the task and was very active in aligning with latest developments and thereby bring the latest technologies to India.

Finally, to have the right light at the right place and at the right time, to have mood lighting, to create dynamic lighting ambiance and to save further energy and have more flexibility in lighting design, the industry experienced the introduction of lighting controls.

A PARADIGM SHIFT

With the advent of solid state lighting through LEDs, lighting industry is undergoing a paradigm shift. It is an ever evolving space and we are now migrating from energy saving to smart, intelligent and connected lighting by means of which we not only can save energy but also control, monitor and analyze the health of lighting installations. This way we can proactively do preventive maintenance and thus improve customer satisfaction.

Since lighting is omnipresent wherever there is human life, we can use lighting as an architecture to control other peripherals. Thus the normally dormant and innocuous streetlight poles and fixtures are now becoming smart and communicable. They can not only light up the roads but also intelligently control real time traffic, do city surveillance, reduce lighting levels based on traffic density, control parking, provide real time updates and alarms to municipal corporations when smart garbage bins are full, generate local wi-fi hot spots for public usage, make weather forecasts and so many other such uses. The applications are ever increasing and the utility of these kind of public infrastructure installations keeps growing each day.

We now use both, wired protocols like DALI (Digital Addressable Lighting Interface) and PLC (Power Line Communication) as well as wireless protocols like Wi-Fi, Zigbee, Li-Fi, M2M and Ultra Narrowband Frequency, etc to have redundancy in architectures.

Through its tenure of almost 50 years, ELCOMA has been playing a major role in supporting the industry, introducing newer and more efficient technologies when necessary, creating awareness about upcoming trends in global lighting, representing the industry in international and global forums, setting up standards and frameworks for certifications, and also driving policy and representing the industry in all government forums as the lighting industry's mouthpiece.

I am sure that the government will take adequate measures to allow organized and long-time reputable players with proper technology back-up, to enter into a healthy competition so that we, as Indians, can set the highest standard of smart lighting market to the entire world.

I wish all ELCOMA members a great success in a new era that is not only dynamic and challenging but also forces us to develop an innovative outlook on manufacturing and design a complete new portfolio of human centric Lighting products.

Best wishes for the coming 50 years of ELCOMA in India.

"Through its tenure of almost 50 years, ELCOMA has been playing a major role in supporting the industry."
Shekhar Bajaj,
CMD, Bajaj Electricals

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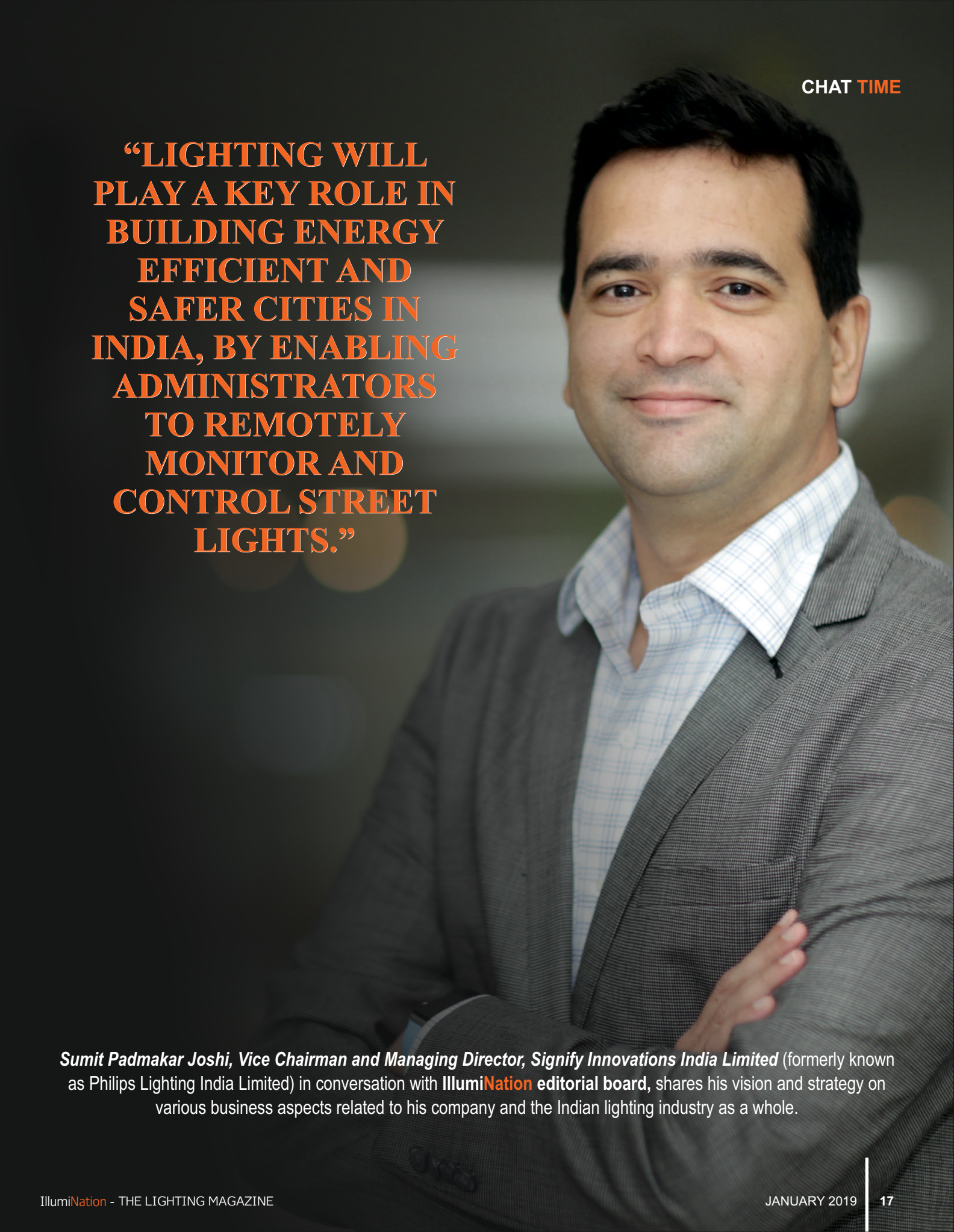

"LIGHTING WILL PLAY A KEY ROLE IN BUILDING ENERGY EFFICIENT AND SAFER CITIES IN INDIA, BY ENABLING ADMINISTRATORS TO REMOTELY MONITOR AND CONTROL STREET LIGHTS."

Sumit Padmakar Joshi, Vice Chairman and Managing Director, Signify Innovations India Limited (formerly known as Philips Lighting India Limited) in conversation with **IllumiNation editorial board,** shares his vision and strategy on various business aspects related to his company and the Indian lighting industry as a whole.

Q. You quit your job at Whirlpool to join Philips Lighting in September 2011. Did you find Lighting more challenging than the consumer durables business or was it just a matter of new challenges that you look forward to?

In my two-decade long career, I have had the opportunity to work across diverse sectors such as consumer durables, FMCG and healthcare, amongst others. What has been common amongst all these companies and roles has been the constant drive to face new challenges with optimism and deliver results, while building successful teams and grooming young talent. Lighting is a very interesting field which has undergone multiple transformations even in the last 7 years that I have been at Philips Lighting. It has been a very exciting yet fulfilling journey to be part of the market leader in the lighting industry, witnessing new cutting-edge lighting technologies like Li-Fi being introduced by our company. In India as well, we have been the market leader since the last 90 years we have been in the country and we continue to deliver innovations every year.

Q. As you have said that there is a great future in Connected Lighting or Intelligent Lighting, how are you preparing Philips for new products to adopt the new technology?

We have been talking about connected lighting even before the industry started seeing its potential. The Internet of Things (IoT) is driving transformation in every industry and lighting is no different. With the introduction of solid-state technology of LED's, lighting has become smart and can deliver much more value than just illumination. Lighting can help make cities safer, buildings more energy efficient and your home more personal while connected lighting has the potential to make our world even more energy efficient, as it can deliver up to 80% energy savings and also enables benefits beyond illumination. At Philips Lighting, we are driving this new wave of transformation with our Interact systems for lighting up offices, industries, stadiums, landmarks and cities. Our connected lighting solutions will enable safer cities, productive offices and everyday great home experiences. In a nutshell, we will deliver on our company promise of creating "Brighter Lives and a Better World".

"At Philips Lighting, we are driving this new wave of transformation with our Interact systems for lighting up offices, industries, stadiums, landmarks and cities. Our connected lighting solutions will enable safer cities, productive offices and everyday great home experiences."

Sumit Padmakar Joshi,
Vice Chairman and Managing Signify Innovations India Limited
(formerly known as Philips Lighting India Limited)

Q. Do you think the Lighting Industry in India will continue to grow double digit in next 4 to 5 years?

The Indian Lighting market has grown to become a INR 22,000 crore industry today, with LED's constituting more than 50% of the overall lighting products sold. Owing to the government's push towards adoption of LEDs and their general consumer popularity, LED lighting has pervaded every corner of the country. With rapid urbanization and growing construction activity in both metros and sub-metros, we believe the lighting industry will continue to grow in the country. Rising consumer awareness has also led to the growth of new LED product categories such as downlights and LED strips.

Q. Has eroding consumer prices affected the gross profits of brands like yours?

While volumes will grow, eroding prices do impact value growth and any business or industry undergoing such a shift offers opportunities for serious and strong players like us to extend our leadership. We need to strive to deliver better outcomes for our customers and work harder to ensure we have sustainable profitable growth and we believe we have done exactly that so far.

Q. Few new entrants have joined the Lighting Industry and are a challenge to present famous brands including Philips. Do you see any threat to your brand from some of them? How do you plan to face this challenge?

While we have been the global market leader in lighting since our company's inception 127 years ago, we continue to extend our leadership position in every country we operate in. We are not living on past laurels and we continue to respect competition as they make us work harder and keep us on our toes. We welcome competition, but over the past few years we have witnessed the entry of several spurious and non-compliant lighting brands. Even though these non-compliant products flout government safety regulations like BIS, they are being openly sold in marketplaces around the country. This has led to an increase of unsafe and illegal products being used in households and offices by Indian consumers, endangering many. The government must act against these spurious and non-branded products for safeguarding consumer safety and protecting their tax revenues.

Q. Your recent assignment at Philips Lighting Amsterdam as Global Head of Marketing Excellence was for a duration of two years. Was it to prepare you for the top job in India or to upgrade your technical skills? Can your share your experience working in International environment. Are areas like horticulture lighting in poultry etc on area of focus in India for Philips?

My stint at the Philips Lighting Headquarters in Amsterdam was a great learning opportunity, as it exposed me to multiple countries and business environments we operate in globally. Leading the global marketing excellence program, I had the opportunity to interact with our marketing teams spread across the globe and understand our business even deeper. It was exciting to see our product leadership in different geographies and build on them even further with strong local teams. It was an enriching experience that has helped me immensely in my current stint as the CEO of the Indian and South Asia operations of Philips Lighting.

Q. What are the new areas of growth identified by Philips Lighting India?

With rapid urbanization and growing consumer awareness, we foresee a growing demand for smart lighting solutions in Indian homes. Having a 'Smart Home' has become the latest urban dream and choosing the right smart products can transform your in-home experience dramatically. Our Philips Hue smart lighting system enables consumers to customize their lighting as per their lifestyle and daily tasks. It has a wide range of light fixtures to suit various design requirements such as Bulbs, light strips, pendants, table and floor lamps and downlighters. The system has pre-set light recipes to help users relax, read, concentrate and energize. It can gently wake you up in the morning, get you energized for the day ahead, and even give you a warm welcome when you arrive home.

Additionally, we also see a growing potential for connected lighting solutions for offices and commercial buildings. In large offices, our Interact Office system enables employees to personalize the intensity and color of light at their workstation, thereby enhancing their productivity. Building managers get updated information about the efficiency and usage of the real-estate and energy on an hourly basis, wirelessly. Offices can also choose circadian lighting in their premises, that can mimic the natural daylight and boost employee productivity.

City street lights have now become intelligent and can serve as a vital backbone for the city administrators. Our Interact City system enables them to remotely monitor and control lights across the city from the control room itself. Faulty lights can be detected accurately through the GPS technology in the pole, hence repair can be carried out immediately, thereby reducing downtime. Lights can also monitor air quality, traffic, temperature and noise and feed these to the city administration for analysis.

Q. What is the vision for Philips Lighting in India for the next - 5 years? Where do you see the industry headed?

Over the next five years, we expect that the lighting industry will rapidly transform towards smart and connected lighting. The digital nature of LED technology has also brought illumination and IT together, allowing lighting systems to participate in the Internet of Things. This has further led to the emergence of connected lighting, marking a significant shift and transforming lighting from a commodity product to a fully integrated lighting system that can seamlessly connect with a wireless network or Ethernet, allowing users to remotely control and monitor their lighting systems. The new LED lighting systems can now connect and interact seamlessly with smart controls, networks, devices as well as apps to offer a customizable and tech-enabled lighting experience, paving the way for a fully digital world.

Philips Lighting foresees that this technology will significantly enhance a consumer's lighting experience at home and drive new business value for professional users. This year we also introduced Light Fidelity (LiFi), a technology in which high quality LED lighting provides a broadband Internet connection through light waves, thereby reducing exposure to an electromagnetic environment, currently caused by radio waves and Wi-Fi. As the lighting company for the

"Having a 'Smart Home' has become the latest urban dream and choosing the right smart products can transform your in-home experience dramatically."

Sumit Padmakar Joshi,
Vice Chairman and Managing Director,
Signify Innovations India Limited
(formerly known as Philips Lighting
India Limited)

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(formerly known as Philips Lighting India Limited)

Internet of Things, we are the first global lighting company to offer Li Fi-enabled luminaires from our existing office lighting portfolio. It will have great applicability in environments that require secure connections such as Banks, government offices etc.

Q. What has been the impact of large government program like UJALA/DELP, SLNP etc on the industry and Philips in particular?

Over the past 4-5 years, government initiatives like the Ujala Scheme and Smart Cities Mission have created significant awareness about LED's and their advantages in terms of energy efficiency. These initiatives provided critical mass for the industry by aggregating demand, which in turn enabled the industry to lower the prices owing to economies of scale. As a result, there has been a rapid adoption of LED lighting across homes, offices, public spaces and cities.

Q. How has the GST regime impacted your company in India in the 1 year?

The GST regime has been advantageous for organized companies like ours, as it has helped us drive synergies and efficiencies in our supply chain and distribution system. We have consolidated some of our warehouses spread across multiple states to enhance efficiencies and reduce infrastructure costs. Moreover, it has also inhibited the role of non-compliant players by ensuring that retailers are covered under the new tax regime. This has to some extent curbed the supply of spurious and non-compliant lighting products.

Q. How do you see Lighting Industry in India in the 5 years from now?

Over the next five years, we expect the lighting industry in India will rapidly transform towards smart and connected lighting, with more and more offices, public buildings, cities and homes using smart lighting. Lighting will play a key role in building energy efficient and safer cities in India, by enabling administrators to remotely monitor and control street lights.

Offices will also adopt connected lighting to enable energy efficiency and drive employee productivity. We will also see a rapid growth in smart homes with connected lighting, driven by the entry of smart home assistants like Google Home and Amazon Alexa.

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LED TO LEAD THE INDIAN MARKET

LED lighting boom is to stay long in India, on account of ever-increasingneed for smart, connected lifestyle and energy efficiency measures. Let's catch the pulse of the industry.

The lighting infrastructure in India is evolving rapidly through the replacement of conventional products by LEDs driven by increasing government initiatives for energy conservation, rising consumer awareness for energy efficient products and innovative products offered by the industry in sync with the mega trend of digitization of information. In this discourse, we try to provide insights about India's LED lighting ecosystem, focussing primarily on market size, opportunities, major demand generating applications, hindrances that impact growth, emerging technology trends and the impact of goods and service tax (GST).

MARKET AT A GLANCE

India, being the second most populous country and fifth major electricity consumer, has been witnessing ever widening demand vs. supply gap in electricity. Consequently, the market for energy efficient products such as LED lighting products is bound to grow riding on the initiatives encouraging use of LED lights and increasing focus on smart city projects, efficient public distribution system and ever increasing need for smart, connected lifestyle and energy efficiency measures. The Electric Lamp and Component Manufacturers Association of India (ELCOMA) predicts that the LED market will grow to Rs 261 billion (26.1k Cr) by 2020 making the LED market ~80% of the total lighting industry.

According to a TechSci (a global research-based consulting firm) report, the LED lighting market in India is projected to register a CAGR of over 24%, during 2016-2021. The Indian LED lighting market stood at $ 918.70 million in 2016, and is projected to grow at a CAGR of 24.66%, in value terms, during 2016-2022, to reach $ 3,758.74 million by 2022, on account of increasing government initiatives to boost LED adoption and growing awareness regarding lower power consumption of LED lighting products. Moreover, easy availability at affordable prices

coupled with distribution of LED bulbs by Indian government at affordable rates to promote the use of LED bulbs and streetlights over halogens and incandescent lighting products is augmenting demand for LEDs in the country, through EESL's ESCO model.

OPPORTUNITIES GALORE

LEDs, being versatile products, can be used for residential lighting, street lighting, down lights, landscaping, monument lighting, signage, traffic signals, security lights, industrial lighting, office space lighting, automotive lighting and much more. Low energy consumption, low costs, modular designs and ease of use have made LED lighting the first choice in industrial, commercial and domestic applications.

The major demand generating application areas would be

1. Street lighting
2. Residential lighting
3. Office space lighting
4. Industrial lighting

Increasing demand of LED for industrial areas including warehouse, manufacturing floors etc. is a new trend. In the hazardous work areas across industries, too, most of the new lighting requirements are for LED lighting.

The demand for LED lighting in India is still mostly driven by metro cities due to affordability, awareness and socio-economic growth. However, the demand from Tier-II cities is expected to grow on account of the potential applications for street lighting and industrial lighting. The demand for LED lighting from rural India is also going to increase significantly soon due to the government initiatives for electrification in rural India under the Street Lighting National Project (SLNP). EESL is offering long term payment projects to Gram Panchayats. Further expansion of such initiatives across the country will open up new market areas for the LED lighting industry. Retrofit installations are mostly in demand across all kind of application areas.

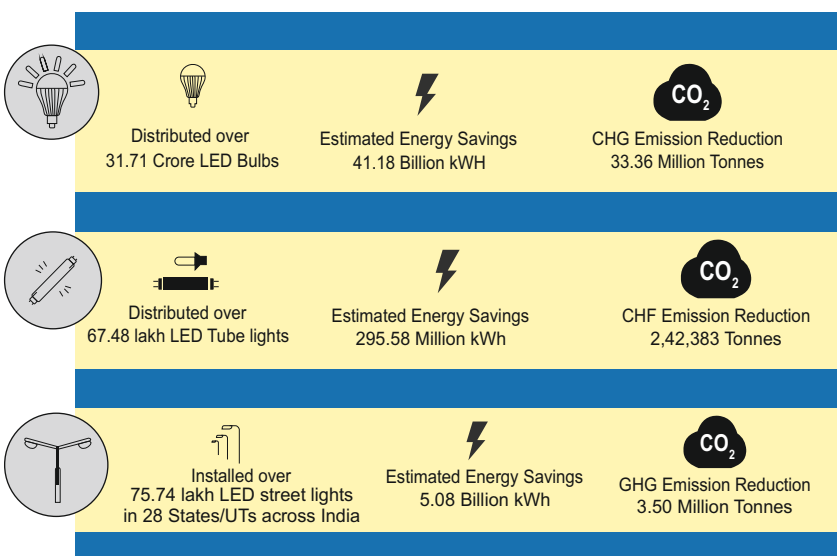


Figure 1: Outcome of EESL initiatives in 2018 to boost LED lighting adoption in the country (Source: EESL Tweet)

SMART LIGHTING PAVES THE WAY

Smart connected LED lights is going to be the next big thing. Lighting systems are getting smarter as a vision of autonomous, self-commissioning illumination systems is emerging. With the advent of LED lighting, the industry has transformed from analogue to digital as LED lighting allows users to control, monitor and measure lighting output. This transformation is taking place across public, home and professional lighting and the smart connected LED Lights will emerge as the largest segment of IoT device within the next five to ten years. Control devices, dimmers and wireless lighting with advanced sensors will cater to various needs of modern consumers.

Ever increasing demand for smart homes, smart workspaces and other smart applications are also going to enhance demand for smart lighting. According to a study by Nielsen, lighting control is the most frequently used daily home automation feature. Smart lights appear on a short list of technologies beginning to appear on many buyers' must-have lists because of its ability to improve security and comfort and cut electricity costs. According to Gartner, smart lighting applications are expected to continue growing to reach 2.54 billion units installed by 2020 globally.

Leading brands are paving the way with smart LED bulbs and switches that connect to Wi-Fi and offer app, button and voice controls over the positioning,

brightness, warmth and colour of connected bulbs. Currently, smart lighting technology has been adapting to seamlessly integrate into smart home systems. Bluetooth-enabled systems that don't rely on the internet need only the app and the fixture to operate. Even light switches and bulbs may look completely different in 10 to 15 years as consumers are looking for clean and sleek designs.

EMERGING 'TECH' TRENDS

The advent of much more efficient, smarter and seamlessly connected/integrated LEDs LEDs will transform the way we see lighting. LED lighting is going to open up immense possibilities not only by lowering energy consumption levels but also enhancing the overall lighting experience through a tectonic shift in technology. The emerging technologies that are going to shape the LED lighting industry of the future could be:

- **Change in 'on board technology'** through the use of IC based drivers to support touch based technology which is the need of the hour for smart lighting systems. This in turn will also reduce the number of components in the drivers as compared to those used in traditional drivers. Use of lesser number of components can reduce cost while enhancing efficiency of the final product.

- **Use of Chip Scale Packaging (CSP) or 'Flip Chip' packaging technology** to enhance lumen output while increasing reliability of the final product. Use of CSP eliminates the traditional submount to directly attach the LED die to the PCB, allowing for overall system cost reductions.

- **Introduction of driverless low voltage direct current (LVDC) operated products** will enable energy saving by reducing AC-DC current conversion loss. This will also make the products compatible with solar photovoltaic and can run as LED-solar hybrid system which is quite effective for India.

- **Shift in manufacturing techniques from through hole to Surface Mount Technology (SMT)** will enhance efficiency while reducing operational cost. This is turn will help to achieve break-even point (BEP) quickly in spite of relatively higher Capex investment.

CHALLENGES TO BE ADDRESSED

- Mushrooming of low quality unauthorized production units producing substandard products and low cost of cheap imports with poor quality result in low consumer confidence.

- Lack of awareness among consumers as well as institutional buyers including Government bodies about efficiency of the final products with respect to Lux and wattage, life expectancy etc. often results in use of products with higher wattage but lesser efficiency.

- Due to inability to produce wafers, chips and LED packages domestically, the country is still totally dependent on import of LED packages, the country is still totally dependent on import of chip. This in turn also puts constraints in developing a wider variety LED lights with more colour options and compatible to the Indian condition.

- Use of inefficient drivers results in more energy usage as well as product failures.

Author: ILLUMINATION EDITORIAL BOARD

IMPROVING UPON THE SUN: LED LIGHTS FUEL PLANT GROWTH IN SPACE

Among the environmental variables that optimize plant production, the most powerful in determining plant growth is lighting. With the ever-increasing intensity and efficiency, LEDs can now be considered as sole (or single) source of lighting for plants.

As a result of extensive research spanning several decades, NASA has determined that LED lights are the best single source lights for growing plants on Earth as well as in space. According to NASA scientists, LED lights provide the best source of lighting for plants cultivated indoors.

Some of the factors that led to the research team making this decision include:

- LED lights do not require ballasts like fluorescent and other older lights do.
- LED lighting offers the flexibility of opting for monochromatic lights or a mix of different wavelengths.
- Since LEDs emit little to no heat, they can be mounted closer to plants than other lights, which makes LEDs the optimal choice for lighting in small contained places.

Researchers at Controlled Environment Systems Research Facility (CESRF) at the University of Guelph have also been investigating controlled-environment plant production and how best to get the most out of plants in terms of food, oxygen, fresh water and carbon dioxide scrubbing for human life support since the mid-1990s as part of the Space and Advanced Life Support Agriculture (SALSA) program.

As part of their research activities in the niche field of space exploration known as “biological life support” or plants in space CESRF is trying to refine and perfect LED technology and use LEDs as a source of photosynthetic energy to grow high-density production of a range of crops

IMPROVING UPON THE SUN

Among the environmental variables that optimize plant production, the most powerful in determining plant growth is lighting. With the ever-increasing intensity and efficiency, LEDs can now be considered as sole (or single) source, lighting for plants. LEDs have a unique narrow wave band of light that represents a small sub-section of the solar spectrum. LEDs offer the opportunity to design a spectrum and assess the responses of plants to some very unusual colour combinations.

Early research concerning the effects of different light spectra on plants found that red and blue lights offer the best support for photosynthesis, which is the process used by plants to transform light into the energy needed for growth and flowering. Further investigation pinpointed more specific effects of different light wavelengths on plants grown indoors. The findings of these studies provide the basis of LED light recipes.

Some examples of the NASA research findings include the following:

- Red Light (630 - 660 nm) is essential for the growth of stems, as well as the expansion of leaves. This wavelength also regulates flowering, dormancy periods, and seed germination.
- Blue Light (400 - 520 nm) needs to be carefully mixed with light in other spectra since overexposure to light in this wavelength may stunt the growth of certain plant species. Light in the blue range also affects the chlorophyll content present in the plant as well as leaf thickness.
- Green Light (500-600 nm) was once thought not to be necessary for plants, but recent

Pic 1: Results of lettuce plants grown under the three different light spectra showing differences in accumulated biomass and expressions of anthocyanin (pigment) in the leaves. These plants also tasted different, indicating additional secondary metabolite responses to the colour of the light. University of Guelph, CESRF.

studies have discovered this wavelength penetrates through thick top canopies to support the leaves in the lower canopy.

- Far Red Light (720-740 nm) also passes through dense upper canopies to support the growth of leaves located lower on the plants. In addition, exposure to IR light reduces the time a plant needs to flower. Another benefit of far red light is that plants exposed to this wavelength tend to produce larger leaves than those not exposed to light in this spectrum.

The scientists also found that mixing white LED light in arrays ensures that plants cultivated indoors receive all the photosynthetically active radiation needed to optimize their health, growth, and yield.

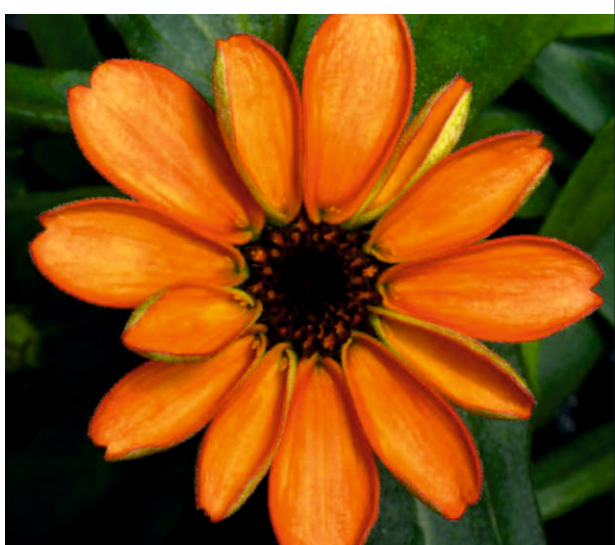
With the new attributes of LED lights, researchers can almost improve upon the sun in the production of various plants.

The latest research findings on various spectral qualities colours, in other words provide details on specific responses in some plants related to the plant's size, shape and photosynthetic efficiency. We can even modify the content of metabolic compounds that influence the colour, taste and medicinal properties of a plant.

These medicinal properties have attracted the scientific and industry communities in the evolving phyto-pharmaceutical (medicines from Plants) sector. Low-cost production of reproducible, high-quality medicinal compounds is the main focus of the sector, and the range of commodities is growing rapidly. They include cancer drugs, vaccines for a range of viral pathogens, antibodies and, of course, cannabis or marijuana.

THE RESULTS OF USING LED GROW LIGHTS IN SPACE

Today NASA uses LED lighting to grow a variety of plants on the International Space Station. Initially, experiments focused on cultivating green leafy vegetables, such as cabbage. Current studies involve growing flowering plants like zinnias.



Pic 2: The first zinnia blooms on the International Space Station. Source: NASA

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Author: ILLUMINATION EDITORIAL BOARD

HERALDING ENERGY EFFICIENCY REVOLUTION IN INDIA

India's energy efficiency programs have saved approximately 13 GW of annual generation capacity, translating to savings of over USD 10 billion in the form of avoided capacity generation and reduced energy bills.

Energy efficiency is a crucial component in India's concerted efforts towards energy security & climate action. An important pillar of the nation's efforts towards energy security, it is estimated that increasing energy efficiency could reduce global carbon emissions by nearly 70%. In fact, India has set a new benchmark in energy efficiency and today its programs are being replicated worldwide. India's energy efficiency programs have saved approximately 13 GW of annual generation capacity, translating to savings of over USD 10 billion in the form of avoided capacity generation and reduced energy bills.

In line with the Indian government's vision to encourage energy conservation and sustainability by increasing the use of energy-efficient appliances at the residential level, Hon'ble Prime Minister Shri Narendra Modi launched the National Programme for Energy Efficient Appliances UJALA (Unnat Jyoti by Affordable LEDs for All) in January 2015. With a vision to replace 77 crore incandescent lamps with LED bulbs by 2019, resulting in the reduction of 20,000 MW load, energy savings of 10,000 crore kWh, and greenhouse gas (GHG) reduction of 8 crore tonnes of CO_2 every year, the program has been a stupendous success.

As the implementing agency of the UJALA programme, within a period of over three years, EESL has distributed more than 31 crores LED bulbs across the country, enabling INR 16,000 crores of savings annually, and reduction in carbon dioxide emissions by 3.3 crore tonnes per year, till December 2018. The UJALA scheme has been able to percolate to the grassroot level under the Gram Swarajya Abhiyan, wherein a significantly large number of low-income households were able to buy LED bulbs for a special price of Rs. 50 under the Unnat Jyoti By Affordable LEDs for All (UJALA) programme. The LED bulbs have equipped homes with energy-efficient, cost-effective lighting, and higher lumen output than conventional incandescent bulbs. This not only translated into higher monetary savings for the end-consumer, but also improved their quality of life, thereby contributed to India's economic growth and prosperity.

The UJALA programme has also provided an impetus to domestic manufacturing creating favorable market conditions for the development of new and allied industries. The Indian LED market has grown 10 times in five years and annual domestic production increased from approximately 30 lakh LED bulbs in 2013 to 6.0 crore in 2018. EESL's approach of bulk procurement attracted tremendous interest and participation from industry. According to estimates of ELCOMA, the apex body of lighting manufacturers in India, the LED industry is projected to grow dramatically on the back of these initiatives. By 2020 it is expected to be approximately 85 per cent of the overall lighting industry.

Affordability and accessibility, along with a three-year warranty enabling easy replacement were the key drivers for the success of the UJALA programme. Furthermore, EESL's innovative business model of zero-subsidy, zero-capex and pay-as-you-save which obviates the need for any upfront capital investment has also played an instrumental role in its success.

Thus, UJALA has created an ecosystem for high quality products, while enabling LED manufacturers to build a business that will potentially be able to compete at an international level. By generating awareness on the need to embrace energy efficiency, this programme has also been successful in bringing about a behavioural change among consumers.

The LED success story did not remain confined to households but has spread its wings to every nook and corner of the country through the Street Light National Programme (SLNP). As an implementing agency of the programme, EESL has replaced over 78 lakh streetlights with LED lights, leading to an annual energy saving of more than 5279 million units, and reducing over 3.6 million tonnes of CO_2 emissions and peak demand of over 880 MW, as of December 2018.

The program is being implemented across 23 states and union territories; replacement of conventional street lights with smart LED street lights have already been completed in seven states including Himachal Pradesh, Tripura, Rajasthan, Andhra Pradesh, Telangana, Gujarat and Jharkhand. Besides the savings, there has been an enhanced illumination leading to better visual comfort, enhanced safety and security of people. In addition, EESL is also implementing a special heritage lighting project, wherein over 4000 LED street lights have been installed in Kashi region of Uttar Pradesh, making the heritage city more vibrant.

To bring in mass-scale transformation, EESL has adopted a unique strategy of partnering with states, municipal bodies and ULBs. Under the program, EESL replaces conventional street lights with LEDs at its own costs with no upfront investment by the municipalities, thereby making LED adoption even more attractive. The investment is recovered over time through monetized savings accrued from the consequent reduction in energy and maintenance cost of the municipality.

A seven-year contract with the local bodies guarantees a minimum energy saving of typically 45-50 percent and provides free replacement and maintenance of lights at no additional cost to the civic partners. EESL's business model has enabled a new paradigm that is attractive, scalable and has overcome barriers that prevented the replacement of street lights. For instance, the Centralised Control and Monitoring System (CCMS) for remote operation and supervising has mitigated the lack of monitoring mechanism and warranties against technical defects.

Today, both these programs are the world's largest; as households and municipalities saved over 40 billion kWh of energy by LEDs for domestic, commercial and street lighting annually. Overall, the energy intensity in India declined by 58 percent between 2005-06 and 2015-16 and is projected to decline by a further 37 percent in the next 20 years.

At the moment, India has only realised the potential of just a fraction of its total energy efficiency market, which is valued at an annual USD 12 billion. Energy efficiency policies need to go beyond industries and enter our kitchen, buildings and transport. Energy policy will also need to focus much more on rural regions that are the future drivers of growth.

Though, energy-efficiency planning is prevalent globally, there is considerable scope for quality of targets and specifications. A series of policy initiatives such as green mortgage, green bonds, tax incentives, credit lines with banks for energy efficiency activities, and public private partnerships in energy sector investments will go a long way in accelerating the transition towards a sustainable future.

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Views expressed in this article are those of the author and do not necessarily reflect those of the editor or publisher.

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REDUCING FAILURES OF STREETLIGHT DRIVERS

Designing a long lasting, error free and efficient LED driver is not as easy as it seems. Selection of high quality components that meet the highest standards coupled with an efficient and optimal design by experienced engineers are some of the key factors to achieving this.

The stupendous growth of outdoor LED Lighting in India in the last 18 months coupled with install-and-maintain models and 7 year replacement warranty are forcing manufacturers to revisit their driver designs to ensure longevity and error free performance. Outdoor lights, especially street lights, tunnel lights, etc are difficult and expensive to repair, so the LED drivers for such applications not only need long term reliability and high levels of protection, but also long life.

The electrolytic capacitor and potting material are two of the most important and critical parts of any LED Driver. In a series of articles, we will analyze these two and other components and their effect on LED driver reliability and look at ways of improving LED driver life.

A typical failure analysis (Figure 1) of recent lighting systems shows that drivers are the primary cause of system failures.

The operating environment in India throws up challenges that are very different from the rest of the world. Our power distribution system is inefficient and plagued by problems like very low (<90V) and very high voltage (>440V), missing ground or failed ground errors and power surges of over 5kV which are coupled with frequent spikes in supply. All connected devices, especially outdoor public street lights and floodlights also have to operate in very hot ambient temperatures in the summer and also face continuous periods of very high humidity.

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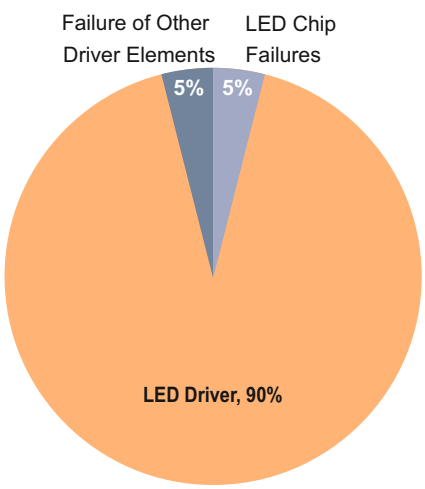

Figure 1: Typical Failure Analysis of LED Lighting System

INDIAN OPERATING ENVIRONMENT

- Operating temperature of upto 60~70°C
- Exposure to the elements - sun, rain, snow, humidity and wind
- Sudden surges and spikes in input power
- Frequent line distribution failures and wrong input supply
- No grounding or non-functioning earthing LED driver is composed of hundreds of components like semiconductors, capacitors, potting materials, PCBs and magnetics etc., but the electrolytic capacitor is regarded as the weakest link in this entire conflagration.

ENSURING LED DRIVER RELIABILITY

Reliability of LED drivers can be ensured by:

- **Minimizing operating temperature**: The failure rates of semiconductor devices are largely dependent on the operating temperature of the device. Typically the failure rate of an LED driver increases by approximately 25-40% for every 10°C increase in the case temperature and of its internal components. It is also critical to minimize the operating temperature of the electrolytic capacitors. This can be ensured by using potting solution in drivers. This potting solution plays an important role (apart from Ingress Protection) in lowering the

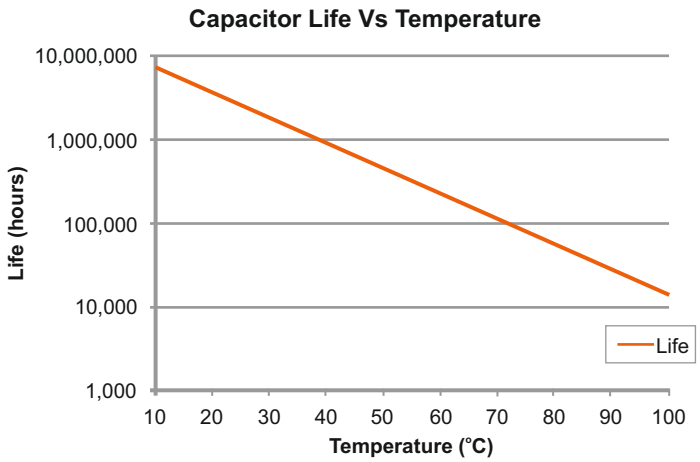

Figure 2: Typical Failure Analysis of LED Lighting System

internal temperature of the driver and also ensures uniform distribution of temperature within the driver.

- **Using long life aluminum capacitors and other semi conductor devices:** Life of an LED driver can also be determined by the components having the shortest life. Therefore the life of and LED driver is normally determined by the life of the aluminum capacitors used in the driver. Long life capacitors need to be designed into the system to ensure their long life. Failure rates of LED drivers are also dominated by the failures of semiconductor devices which include the main MOSFETs, diodes, control ICs, and opto-couplers, so designers also need to ensure they "design in" the longest life devices, based on their cost-performance factors driver.

FACTORS DETERMINING LED DRIVER RELIABILITY OR FAILURE RATE

- The failure rates of semiconductor devices are largely dependent on the operating temperature.
- Failure rates of LED drivers increases by approximately 25-40% for every 10°C increase in the case temperature.
- Long life capacitors need to be employed to ensure long life of the LED drivers.
- Critical to minimize the operating temperature of the electrolytic capacitors.
- Potting in drivers lowers internal temperature and ensures uniform distribution of internal temperature within the Driver.
- Failure rates of drivers are dominated by the semiconductor devices including MOSFETs, diodes, control ICs, and opto-couplers.
- The typical life of driver is increased by about 2.5 times as the driver efficiency is increased from 85% to 93%.
- Reduce the RMS ripple current of capacitors and operating voltage as per rating.
- Reduce operating temperature by improving efficiency.

Author: DEEPAK GUPTA
CO-FOUNDER, JUST ABOUT POWER

Reliability Tests Suggested For Led Drivers & Led Complete Outdoor Lighting Systems*

1. *Power and Temperature Cycling*
2. *High Temperature Test*
3. *Thermal Shock*
4. *Surge*
5. *Switching (On-Off)*
6. *Under Voltage Operation*
7. *Over Voltage Operation*
8. *Short Output*

** Based on standards globally used in semiconductor/ electronic industry.*

SMART LIGHTING WITH Li-Fi

Li-Fi or Light Fidelity transfers data at a rapid pace using visible light from LED bulbs. It is much faster than radio wave-based Wi-Fi

Light is always an interesting area of study for physicist because of its wave particle nature, i.e two formats of existence - a flood of particles known as photons or propagation of electromagnetic waves in a range of frequencies. Due to the wave nature, light can be used as a medium for wireless communication. Li-Fi (Light Fidelity) is a wireless communication technology that uses the infrared and visible light spectrum for high speed data communication. In its present state only LED lamps can be used for the transmission of visible light.

LI-FI TECHNOLOGY - AT A GLANCE

Li-Fi or Light Fidelity is a technology for wireless communication between devices using light to transmit data at high speeds over the visible light spectrum, ultraviolet and infrared radiation. The term was first introduced by Harald Haas during a 2011 TEDGlobal talk in Edinburgh.

The key technical difference between the Li-Fi and Wi-Fi is that Wi-Fi uses radio frequency to transmit data while Li-Fi uses light to transmit data.

Using light to transmit data allows Li-Fi to offer several advantages such as being able to work across higher bandwidth, working in areas susceptible to electromagnetic interference and offering higher transmission speeds.

HOW IT WORKS

Li-Fi which is an optical wireless communications (OWC) technology uses light from light-emitting diodes (LEDs) as a medium to deliver networked, mobile, high-speed communication in a similar manner to Wi-Fi. Visible light communications (VLC) works by switching the current to the LEDs off and on at a very high rate, too quick to be noticed by the human eye. Although Li-Fi LEDs would require to be switched on at all times to transmit data, it is possible to dim them to below human visibility levels while still emitting enough light to carry data. Since light waves cannot penetrate walls, it makes this technology a much shorter range technology, though it is much more secure from hacking as compared to Wi-Fi. Direct line of sight is not absolutely necessary for Li-Fi to transmit a signal - even light reflected off the walls can achieve about data transfer rates of 70 Mbit/s.

ADVANTAGES OF Li-Fi OVER Wi-Fi

Li-Fi has the advantage of being useful in electromagnetic sensitive areas such as in aircraft cabins, hospitals and nuclear power plants without causing electromagnetic interference. Both Wi-Fi and Li-Fi transmit data over the electromagnetic spectrum, but while Wi-Fi utilizes radio waves, Li-Fi uses visible light, ultraviolet and infrared for the same purpose. While the US Federal Communications Commission has warned of a potential spectrum crisis because Wi-Fi is close to full capacity, Li-Fi has almost no limitations on capacity. The visible light spectrum is 10,000 times larger than the entire radio frequency spectrum. Even as early as 2013 researchers have reached data rates

of over 224 Gbit/s which was much faster than typical fast broadband networks. Though Li-Fi is expected to be ten times cheaper than Wi-Fi however it does have some potential downsides such as short range, low reliability and high installation costs.

Li-Fi - A COMPLETE COMMUNICATION SOLUTION

Li-Fi is a complete wireless networking system, offering bidirectional multi-user communication, within a wireless network of very small optical cells, therefore a very high spatial connection density, and with seamless handover. Each Li-Fi luminaire acts as an Access Point (AP). Optical OFDM (Orthogonal frequency division multiplexing or OFDM is a modulation technique which is now used in most new and emerging broadband wired and wireless communication systems) provides natively a multiple access technique called OFDMA which is also the method of access for the new WiFi-ax standard, where users of data broadcasted by a given luminaire are separated by a number of orthogonal subcarriers.

For a complete Li-Fi communication system, duplex communication is required, i.e. an uplink connection from the mobile terminals to the optical AP (access point) must be provided. RF duplex techniques where the downlink and the uplink are separated by different time slots, or different frequency bands, could be used.

However, emitting intense white light by the receiver terminal is not acceptable in practice. A solution to this has been implemented by Lucibel and PureLiFi who use Wavelength Division Duplexing (WDD) which uses visible light modulation for the downlink and the modulation of an IR LED for the uplink communication channel. Using RF communication for the uplink is also an option in certain configurations since there is often a traffic imbalance in current wireless communication systems that makes the uplink channel considerably less congested.

In RF wireless communications, the network is distributed over areas called cells, each served by at least one fixed-location base station. In 4G LTE, in order to improve user access, the network is densified by the addition of cells of different sizes referred to as macro-, micro-, pico- and femto-cells in order of decreasing base station power. Inter-cell and intra-cell interference avoidance is one of the most critical challenges for the concurrent operation of these cells. 5G wireless network should see the incorporation of unlicensed networks such as Wi-Fi into so called heterogeneous networks.

The concept of cell is easily transposed to LiFi and the optical AP associated to a LiFi luminaire is frequently called an “attocell” because of its small size. Because of the density of luminaires and the nearly uniform illuminance, optical attocell can drastically improve coverage and data density.

In an hybrid Li-Fi/Wi-Fi deployment, Li-Fi offloads some of the traffic from Wi-Fi to maintain the broadband user experience. With Li-Fi, each user benefits from the bandwidth available under each luminaire, without sharing it with users under other luminaires. This idea of ”connection densification” is a key point in favor of Li-Fi with respect to Wi-Fi, as much as the high data rate. Moreover, whereas complex beamforming techniques are developed for next generation RF wireless systems to increase capacity, beamforming is native for light based communications.

It is worth noting that, similar to conventional RF based communication systems, Multiple Input-Multiple Output (MIMO) schemes in Li-Fi and more generally VLC are capable of bringing data transmission speed enhancements. All these characteristics make Li-Fi a crucial enabler of mobility indoor with as yet unmatched quality of service, improving substantially the user experience. A Study Group of the IEEE Standards Association is exploring adding light communication protocols to the 802.11 Wi-Fi standards for communications. This standardisation effort is an important factor towards large scale deployments of Li-Fi and Lucibel is a contributor to the work being performed.

Author: NISHIKANT DWIVEDI
TECHNICAL MARKETING HEAD, COMPONIX INDIA

TRAINING PROGRAM FOR DOMESTIC ELECTRICIAN: ELECTRICAL APPLIANCES INSTALLATION AND MAINTENANCE

A structured training programme covering proper and recommended installation, maintenance, commissioning, replacement and repairing procedures for electrical equipment, fittings and appliances

As an industry body, ELCOMA believes that electricians across the country need to be better trained on the various aspects of their job including safety and use of certified and branded components as spares. There is a definite need for imparting structured training covering proper and recommended installation and maintenance procedures for the commissioning, installation, maintenance and repair of electrical equipment, fittings and appliances and their replacement and repair as well.

- Most of the electricians in the field are experienced electricians but they may not be aware of the all the correct/proper procedures for repair and installation of all products.
- They may not be fully aware of the new/emerging technologies and their capabilities.
- This may lead to improper installation and therefore lead to failures in the field, etc.
- Some formal training must be imparted to such electricians to ensure that they are well trained in all aspects of installation and maintenance of electrical equipment and Appliances .

ELCOMA along with ESSCI has developed a Basic Electrician Training Program and is offering the same to ELCOMA Members for its targeted candidates (electricians at Dealer locations or within their manufacturing locations, etc) across India. ELCOMA has the capability to enable, execute and manage such a training and assessment program leading to a certification of these Electricians.

This same program can also be offered under CSR to such candidates since ECCSI can accept CSR funding for carrying out such programs covering the following modules.

INTRODUCTION AND BASICS OF ELECTRICAL SYSTEMS

- Basics of electricity
- History and Concept of Electricity
- Electricity in India
- Electrical Terminology

ELECTRICAL INSTRUMENT AND TOOLS

- Types of measuring instruments and their use
- Identifying tools for electrician

WIRING

- Input power supply and its distribution
- Two wiring system
- Cables & wiring materials
- Switches, plugs, sockets and circuit breakers
- Domestic wiring

EARTHING

- Types of Earthing
- Measuring ground resistance and test of insulation of wiring system

ADVANCED ELECTRICAL EQUIPMENT

- Transformers
- Parts, working and use of Transformers
- Troubleshoot & Repair of Transformers

MOTORS

- Types, parts, working & application
- Protection systems
- Installation and troubleshooting

CIRCUIT DIAGRAM AND WIRING DIAGRAM

- Circuit diagram and wiring diagram for house wiring

WIRING FOR HOUSEHOLD

- Plan wiring for house
- Input supply to distribution box to switch board to junction box

APPLIANCES & SAFETY; HANDS ON TRAINING, ASSESSMENT

- Safety and First Aid
- Occupational Hazards, On job safety precautions
- General Health and Safety
- Workplace Hazards and Risks
- Safe Working Practices
- Fire Safety
- Basic First Aid Procedures

APPLIANCES AND EQUIPMENT; HANDS ON TRAINING ON ACTUAL ELECTRICAL EQUIPMENT

- Installing, Maintenance and Ceiling Fan, Single tube light, wiring for corridor and staircase, etc
- Troubleshooting Ceiling Fan, Tube light, electric iron, Food Mixer, Geyser, etc

ASSESSMENT AND CERTIFICATION

Intelligent Street Light Solution

Smart Solutions for Smart Cities

Street light controlling with / without dimming

It utilizes 6LoWPAN communication standard over sub 1 GHz wireless communication helping to monitor and control every individual luminary. It supports multiple Broadband communication network connectivity over GSM / GPRS, Ethernet and Wi-Fi for server end connectivity

- Metallic / SMC Enclosure
- In built external > 20KA SPD
- Door Open Detection
- Ability to Control each light independently.
- Ability to monitor each light burning hours independently
- Powerful measurement module (energy consumption, active power, power factor, current and wattage)
- Monitoring lamp status (malfunction detection and reporting) – lower servicing cost
- Flexible and centralized network
- Structure – better functionality and reliability
- Installation at a lamp fixture

Electrical Design

Networking

Monitoring & Controlling

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EESL SLNP STREET LIGHT TRAINING DASHBOARD

45 programs between December 2016-December 2018
training 1200+ Streetlight across 29 cities

TRAINING DASHBOARD

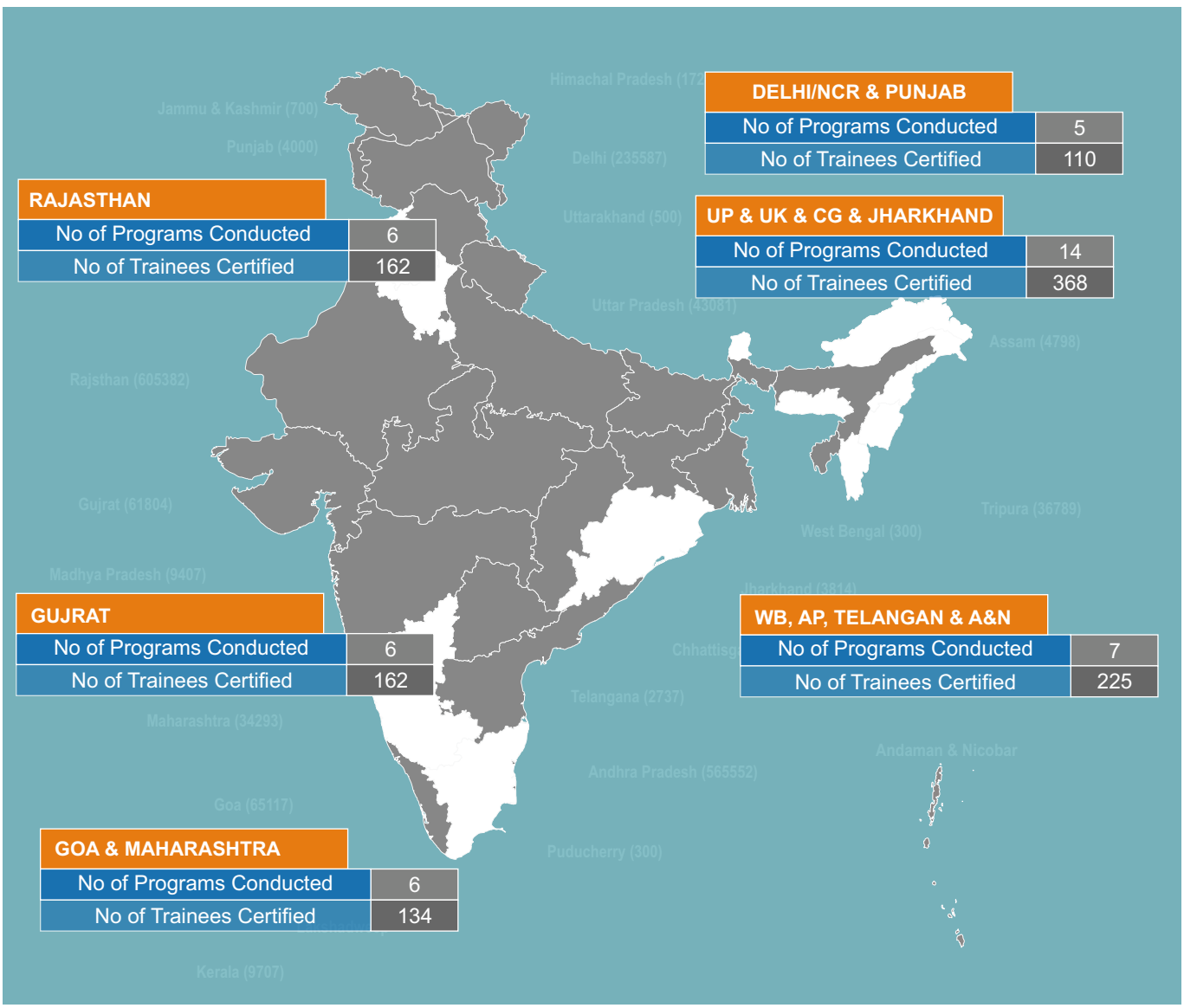
- Delhi/NCR (4)
- Jodhpur (1)
- Jaipur (1)
- Bikaner (1)
- Kota (1)
- Ajmer (1)

- Bharatpur (1)
- Rajkot (1)
- Gandhinagar (1)
- Jamnagar (1)
- Ahmedabad (1)
- Goa (3)

- Amravati (1)
- Allahabad (1)
- Lucknow (3)
- Agra (1)
- Bilaspur (1)
- Ranchi (1)

- Hyderabad (4)
- Chandigarh(1)
- Rajmundhry (1)
- Dehradun (1)
- Bareilly (1)
- Gorakhpur (1)

- Meerut (1)
- Aligarh (1)
- Osmanabad (1)
- Dehradun (1)
- Chandrpur (1)



WONDERFUL USES OF LED TECHNOLOGY

ARTIFICIAL SKY

Many times stuck in the four windowless walls of your office cabin we all have pined for the blue of the sky and the bright warmth of the sun to help us get though the work of the day. Well, Artificial Sky has solved this particular problem for us.

Based out of Plymouth, Michigan, USA, Artificial Sky (https://artificialsky.com) claim to manufacture the "world's Largest sky ceilings made from acoustic ceiling tiles, led skylights and virtual sky ceiling panels for windowless environments". Their Virtual Sky product uses LED lighting and artificial intelligence to create a ceiling that actually appears to be a blue sky with passing clouds overhead, birds flying and even sunrise and sunset effects. Virtual Sky remotely changes from overhead dimmable white task lighting to a blue sky with moving clouds.

Artificial Sky claims thata person reacts positively to natural surroundings like green trees, mountains, water and blue sky and that thousands of medical facilities have incorporated their LED skylights to help patients recover faster, lower blood

pressure, reduce stress and anxiety and even energize the staff. Using a proprietary technology developed with the help of NASA, they display larger-than-life images of nature that harness the healing properties of day-lighting into any spacewhile providing 135+ lumens per watt. They also claim that many academic institutions have started integrating acoustic ceiling tiles with a touch of nature to encourage and make classrooms more conducive to learning with ceiling art.

Artificial Sky has several Fortune 5000 companies as their clients that have begun to realize the benefits of biophilic day-lighting and use Artificial Sky to make their employees more productive in the corporate workplace as well as in their retail stores where Artificial Sky'sVirtual Sky ceiling systems entice their customers to stay longer. They also claim that their products can help to reduce stress & anxiety, overcome jet lag, combat afternoon fatigue and even speed-up decision making.

F.LASHES - FUN INTERACTIVE LED LASHES

Tired of the ordinary eyelashes? A Kick starter campaign dubbed 'F.Lashes' has introduced bright and unique light up lashes which is a product that combines fun and lashes. These are lightweight LED lashes that respond to head and body movements such as dancing and jumping, etc or even posing for selfies.

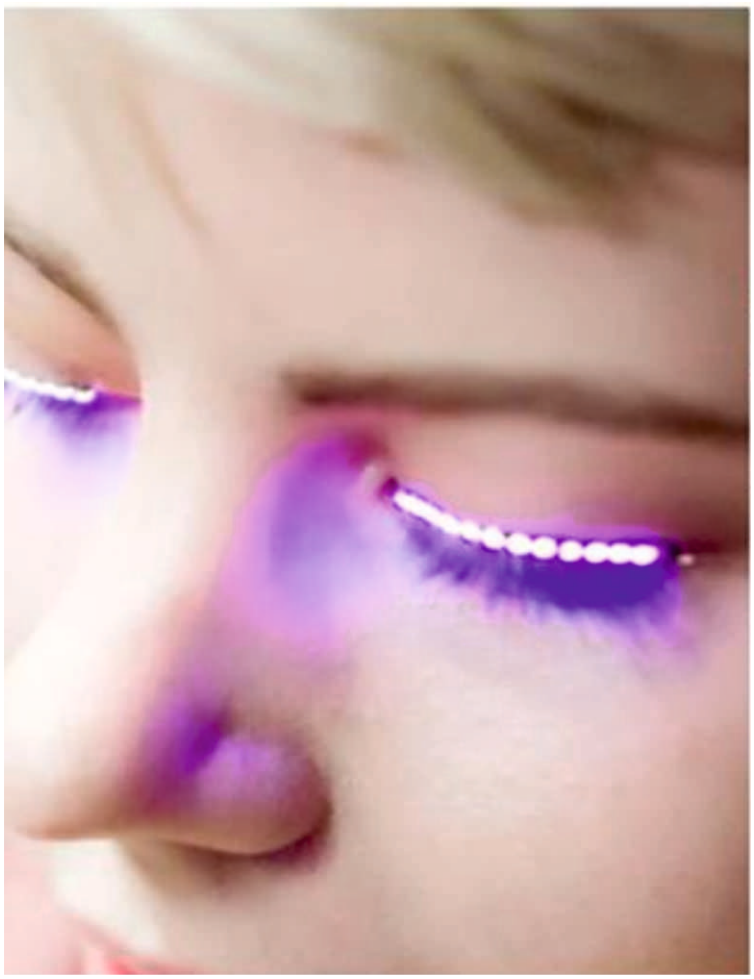
Tien Pham, co-inventor of f.lashes says that the product started off as a Halloween project with Davey Taylor, his co-inventor. They worked together at an electronics company, and one day he asked Davey if it was possible to somehow incorporate tiny LEDs into his costume - perhaps making them into LED Lashes. They formed Tavey Designs LLC so that they could bring their idea to market.

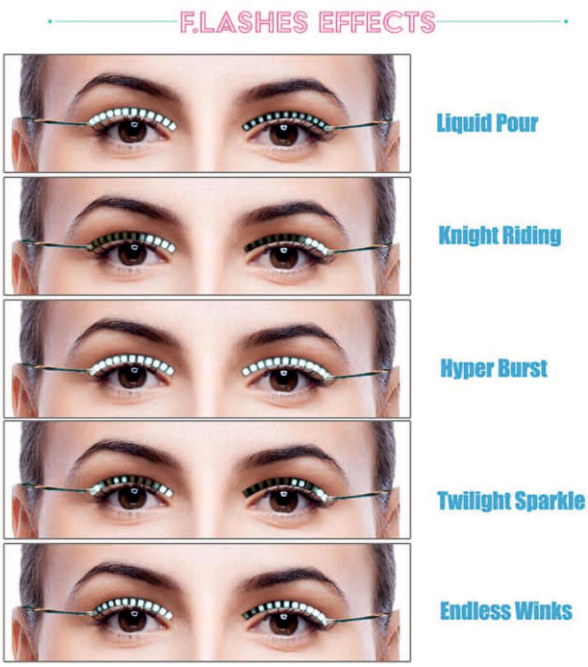
After a video of Tien wearing f.lashes during Maker Faire in San Mateo went viral, they realized their worldwide potential.

F.Lashes are Lightweight LED lashes that flash and sparkle and come with 5 effects - Liquid Pour, Twilight Sparkle, Hyper Burst, Knight Riding and Endless Winks.

They are available in 7 colors - Bright White, Light Pink, Bright Red, Bright Yellow, Light Green, Bright Blue and Light Blue.

Different effects are activated by different motions - some light up when you jump, some move faster when you tilt or nod your head and some get brighter as you move.





The different parts of the F.Lashes product are

1. Responsive Motion sensor programmed with several unique light effects

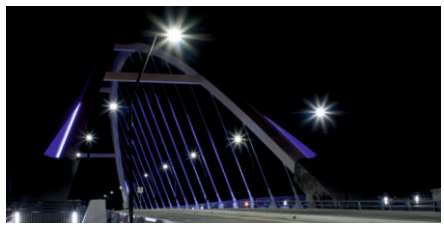
2. LED Lashes which are reusable, individually controlled LEDs connected with almost invisible wires.

F.Lashes is a patent pending technology that is powered by a coin battery similar to those found in watches. The inventors claim that these are completely safe since they use only a 3V battery and the LEDs do not emit any noticeable heat. They are weather resistant and normal perspiration and weather conditions do not affect their functionality. The only drawback is that a single CR2032 battery lasts only 4 hours!

Compiled by: ILLUMINATION EDITORIAL BOARD

14 MILLION STREET LIGHTS TO BE REPLACED BY ENERGY EFFICIENT LEDS IN INDIA

While speaking in an industry event in Delhi NCR , Shri Venkatesh Dwivedi, General Manager, EESL, Ministry of Power shared: " Under UJALA more than 31 crore LED bulbs have been distributed to the consumers in India by EESL and by June 2019 we expect almost 14 million street lights in the urban-local bodies across the country to be replaced by efficient LED lights. We see a potential for another two crore street lights in the country which will mainly target rural segment, national highway, court authorities, railways and the army segment of the business."



CONNECTED LED LIGHTING TO ILLUMINATE LONDON'S BRIDGES

The Illuminated River Foundation has chosen Signify as the connected lighting partner to illuminate up to 15 of London's iconic bridges by 2022. The aim of the project is to reinvigorate the city's River Thames bridges and help to differentiate London as one of the world's most attractive, leading capital cities. It will represent the longest public art commission in the world once completed, at 2.5 miles in length, equivalent to 44 football pitches laid end-to-end along 4.5 nautical miles of the River Thames. An estimated 50-70 per cent of the annual electricity consumption for architectural lighting will be saved by moving to LED connected technology'

100 PER CENT LED STREETLIGHTS IN ANDHRA PRADESH BY JANUARY 2019

EESL has retrofitted 10 lakh LED lights in different gram panchayats of Andhra Pradesh under the first phase and is preparing to install 13 lakh LED lights in the second phase. N Chandrababu Naidu, Chief Minister, Andhra Pradesh has directed officials to take steps to launch Alert Management System (AMS), a delivery mechanism with global standards to deal with complaints pertaining to LED streetlights, in all gram panchayats in the State. According to the CM, the State had already created a national record in LED street lighting project and that the Energy and Panchayat Raj department should focus on achieving world record. Expressing happiness over the information given by Panchayat Raj and Rural Development Minister Nara Lokesh that the first phase of LED street lighting project was almost completed, the Chief Minister directed officials that the entire project must be completed by the end of December.

POST OFFICES TO PROVIDE LED BULBS UNDER UJALA SCHEME IN HARYANA

With a view to facilitate the consumers, the LED (bulbs, tube lights) and energy efficient fans under Prime Minister's Unnat Jyoti by Affordable LEDs for All (UJALA) programme would now be provided through post offices under Postal Services Department across the state in a phased manner.

Recently, a Memorandum of Understanding has been signed between Nirmal Singh, Director, Postal Services Department, Haryana Circle and Energy Efficiency Services Ltd (EESL). In the first phase, the scheme has been launched from Ambala. As per the scheme, EESL would provide LED bulbs and fans at subsidised rates.

SMART LIGHTS SHINE BRIGHT AT LIGHT INDIA 2018

Light India 2018 brought high-tech products to lighting sectors for a smart future. Bringing the industry leaders together, 193 exhibitors from India, China, Hong Kong and the UAE participated in the country's most prominent exhibition on lighting, Light India continues to be a trusted platform for promoting brands and helping target new business opportunities.

KEY FACTS

Date : October 11-13, 2018

Venue : Pragati Maidan, New Delhi

Exhibitors : 193

Visitors : 10,000+

Bridging the gap between global industry giants and the serious buyers, Light India 2018 was organised from 11 to 13 October, 2018 at Pragati Maidan, New Delhi by Electric Lamp and Component Manufacturers (ELCOMA) in association with Messe Frankfurt. 4th in series 4th bi-annual event in the series, this exhibition had total focus on new technology, Intelligent Lighting and Connected Lighting products had total focus on new technology or Intelligent Lighting Connected Lighting products.

SHRI SURESH PRABHU, MINISTER OF COMMERCE & INDUSTRY AND CIVIL AVIATION AND DR. HARSH VARDHAN, MOS, EF & CC INAUGURATED LIGHT INDIA 2018

Light India 2018 was inaugurated by Shri Suresh Prabhu, Union Minister of Commerce & Industry and Civil Aviation, Government of India and Dr Harsh Vardhan, Minister of Science & Technology, Environment & Forest and Climate, Change Government of India at New Delhi on October 11, 2018.

Addressing the media and other delegates at the ceremony, Shri Suresh Prabhu, said that "This is a great occasion where excellent brands have displayed their products in the fast growing lighting industry. We promise to provide full support for the exports of these products and encourage the exhibitors to have more manufacturing not only for the domestic but also for the global markets. While we ensure environmental friendly lights aesthetics will be equally important so the industry has an opportunity of providing innovative solutions. We will build 100 airports in the next 15 years and for that we have invited experts and earmarked an investment of 65 billion dollars for this industry. This will be a big opportunity for the lighting industry and I hope Light India will truly 'Light India'."

Continuing the enthusiasm, Dr Harsh Vardhan, also said that: "We have discussed Lighting in India and have appreciated the industry's role as to how all the stakeholders help us reduce the price of LED lights from INR 380 to INR 50."

Standing out as a market having immense potential, India has gained the attention of many global investors and business leaders in the lighting and electrical building industry. The top-notch domestic and international leaders from lighting, building and automation market participated in the three-day exhibition seizing business opportunities and preparing the Indian market for a smart and tech-ready transformation in lights and building automation systems.

"We want the industry to manufacture in India not just for Indian markets but for global markets. We will build 100 airports in the next 15 years and for that we have invited experts and earmarked an investment of 65 billion dollars for this industry. This will be a big opportunity for the Lighting Industry and I hope Light India will truly 'Light India'."

Shri Suresh Prabhu,
Union Minister of
Commerce & Industry
and Civil Aviation,
Government of India

The grand inaugural ceremony also saw the presence of Lighting Lndustry giants and key association members including:

- Mr. J P Aggarwal, Chairman & Managing Director, Surya Roshni
- Mr. Raju Bista, President ELCOMA & Managing Director of Surya Roshni
- Mr. Raj Manek, Executive Director & Board Member of Messe Frankfurt Asia Holding Ltd
- Mr. Sunil Sikka, Advisor, ELCOMA
- Mr. Shyam Sujan, Secretary-General, ELCOMA

Light India 2018 hosted 193 companies from five different countries who displayed and introduced their unique and revolutionary technologies to the lighting and electrical building market.

"We have discussed Lighting in India and have appreciated the industry's role as to how the to involve all the stakeholders have and helped us reduce the price of LED lights from INR 380 to INR 50."

Dr Harsh Vardhan,
Minister of Science, EF & CC,
Government of India

Besides providing all the stakeholders in the industry with a one-to-one trading platform, one of the aims of Light India 2018 was to drive the growth and development of the industry by showcasing trusted and innovative brands with their premium products to the buyers from all around the country.

Looking at the zeal and energy of the show, Mr Shyam Sujan, Secretary General, ELCOMA (Electric Lamp and Component Manufacturers Association of India) said: "It is a proud occasion for me to present the fourth edition of Light India. During each exhibition we have successfully launched new technologies. Today we have reached a stage where all applications in lighting have been introduced in LED format. Our vision 2020 envisaged that we will bring power consumption for lighting down from 18% to less than 13% by year 2020. I am proud to say that we have crossed the 1 billion mark in LED lamps, about 12 million streetlights and more than 30 million down lights. A visitor to Light India 2018 has been able to witness a large plethora of impressive new smart and intelligent lighting products in all the applications."

ELCOMA CONFERENCE ON FUTURISTIC INTELLIGENT LIGHTING AT LIGHT INDIA 2018

This conference was attended by 200 strongly committed delegates from government departments like CPED, PWD, Railways, Metro Corporation, Airport Authority, Large corporates, Architects, Designers etc.

Intelligent Lighting is the most versatile technology that can be used in most of the LED lighting applications in the form of Internet of Things (IoT). IoT is a platform that is provisioned with multifarious capabilities like environmental monitoring and asset tracking, which can be scaled to innumerable real-time IoT applications. These applications can include energy management, remote asset monitoring, ready-to-deploy point solutions among others.

IoT enables you to control the entire outdoor or indoor lighting system through one console. Whether it is local street Lighting, highways, sports arenas, building facades or basement parking, it is possible to control the lighting operations from anywhere across the world. The remote switching, monitoring and control system provides most effective intelligent controls and provides high energy savings and proven ROI.

Considering the importance of intelligent lighting and to bring in awareness on new technology among stakeholders, ELCOMA organized a conference on 12 October, 2018 at LIGHT INDIA 2018. The inaugural session of the conference was graced by the presence of

- Shri. Santosh Kumar Gangwar, Minister of State (IC), Ministry of Labour & Employment, Govt. of India
- Mr. Shekhar Bajaj, CMD, Bajaj Electricals
- Mr. Sukanto Aich, CMO, Philips Lighting India
- Mr. Raju Bista, President, ELCOMA
- Mr. Rakesh Zutshi, Immediate Past President, ELCOMA
- Mr. Sunil Sikka, Advisor, ELCOMA
- Mr. Shyam Sujan, Secretary General, ELCOMA

GLIMPSES FROM ELCOMA CONFRENCE

Experts in new Intelligent Lighting technology, presented their papers on following topics.

- Connected Lighting for Indoor Spaces by Mr. Ajay Saraf, Havells India
- Human Centric Lighting by Mr. Satyabrata Chakraborty, Bajaj Electricals
- Building and Façade Lighting by Ms. Uma Lanka, Crompton Greaves
- Smart and Intelligent Lighting Systems by Mr. Mohit Sharma, Jaquar Lighting
- How will you LIVE in the Future!! Light elligence by Mr. Pruthwiraj Lenka, OSRAM Lighting
- Street Light National Program and scope beyond by Mr. Ashish Sharma, EESL
- Testing & Compliance with reference Futuristic Intelligent Lighting by Mr. Puneet Randeo, UL India
- Training Programs by ELCOMA, Mr. Krishan Sujan, Training Coordinator for ELCOMA.

This conference was attended by 200 strongly committed delegates from government departments like CPED, PWD, Railways, Metro Corporation, Airport Authority, Large corporates, Architects, Designers etc.

PRODUCT HIGHLIGHTS

Amongst many, some product highlights of the exhibition included

- India's first 5-star LED bulb that is low-glare, fixture-free and 30% brighter than 3-star LED by Orient Electric
- Launch of its latest copper chandelier finely crafted with Silver Plating that is equipped with intelligent lighting features which pull through the fluctuations of high/low voltage and high/low temperature by Jaquar
- Launch of High Performance Utility Retrofit EH80 solution to replace Incandescents that can be used in cooking area, food industry, cold storage, tunnel, mining industry, agriculture industry, construction industry and other hazardous areas
- App operated smart lights that includes bulb, downlights & striplights that gives a full spectrum of palette of 16 million colours by Svarochi

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NEO GOLD Series with better light spread!

Normal LED Lamp

The newly launched series comes with new design, aesthetics and covering a wider area for better light distribution.

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This Lamp which is worth GOLD.

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DMOV* TECHNOLOGY

SURYA LED

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