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LED Lighting in India: Analysis on Progress

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Abstract:
An analysis of present state of LED lighting in India is done by using PEST (political, economic, social, technological) tool. The external macro-environment prevailing in India towards lighting is scanned to find out future trends in this direction. Many aspects like government of India initiatives, policies, energy savings, manufacturing and R&D, market size and trends have been mapped for understanding the nature of expected growth in LED lighting.

Keywords: *LED, PEST, CFL, lighting, energy saving/efficiency*

1. Introduction

India is showing tremendous growth in the area of LED[1] lighting. The drivers to this rapid growth are many including energy savings by LED lights, their long life, consumer thinking, government encouragement etc.

The lighting load in India is considered to be 17% of the total electricity consumption against a world average of 8% (Light sources – future trends). This shows great potential of energy savings in lighting consumption in India. As per the present consumption pattern in India; domestic households consume 10% of the total electricity produced (50-90% is consumed in lighting), industry consumes 49% of the total (4-5% is consumed in lighting[2]), commercial/public consumes 17% of the total (4-5% is consumed in lighting[3]) and others consume 24% of the total (2% is consumed in lighting) (Halpeth, Kumar, & Harikumar, 2004).

Lighting also contributes to greenhouse gases[4] (GHG) causing pollution to the environment. In the global GHG emissions of 30.6 billion tons of carbon dioxide (CO_2) in the the year 2010-2011, the lighting contributed 1.9 billion tons (6% of the total) (Jessup, Finighan, Walker, Curley, & Cai, 2012). In India too, there is a potential to reduce GHG emissions attributable to lighting, by determined efforts. As per the Climate Works Foundation report, the projected GHG reduction potential in residence households is 24.8 million tons CO_2 in the the year 2016 and 30 million tons CO_2 in the the year 2031 (pwc, 2011), by using LED lighting.

This paper attempts to do PEST[5] analysis of LED lighting in India. A PEST analysis does scan of the external macro-environment in terms of Political, Economic, Social and Technological (PEST) factors (www.quickmba.com/strategy/pest/).

- The political factors refer to government policies, regulations, tax/duty structures, and trade restrictions etc., which influence the growth of the business.
- The economic factors relate to the buying power of customers, money-interest rates, foreign exchange rates, inflation and other prevailing economic conditions. These indicate the growth of the products in the market.
- The social factors refer to the demographic and cultural outlook of the people, their interests based on age distribution, health and safety aspects. These factors impact the market size and customer demands.
- The technological factors relate to market entry barriers, technology incentives, research and development activities, production level efficiency etc.

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[1]Light emitting diode

[2] In some industries such as textiles, pharmaceuticals, electronics etc.; lighting may comprise of up to 15%.

[3]For information technology and certain types of commercial/ building sectors, lighting could be 40% of their total electricity consumption.

[4]The gases like carbon dioxide, Methane, Nitrous oxide, Fluorinated gases that trap heat in the atmosphere are called greenhouse gases (www.epa.gov).

[5] Harvard professor Francis J. Aguilar is thought to be the creator of PEST Analysis in his 1967 book 'scanning the business environment'.He included a scanning tool called ETPS in this book;the name was later tweaked to create the currentacronym PEST (www.mindtools.com/pages/article/newTMC_09.htm).

The PEST analysis is useful to spot business opportunities, direction of business environment change and entry into new market, by developing an objective view of scenario. The changes in the macro environment can create lot of opportunities as well as threats for any organization/product. New technologies, government policies, funding options, consumer trends etc.; they all affect the market (www.mindtools.com/pages/article/newTMC_09.htm). For example, few the years back we were seeing compact florescent tubes (CFL) as the future of the lighting. But the technologies change for improvement and it seems that CFL revolution could be now overtaken by LED lights.

2. PEST Analysis of LED lighting in India

LED lighting PEST analysis has been done by reviewing the literature for current market premises, government policies, consumer trends and technology enhancements.

2.1. Political Factors

'PM launches scheme for LED bulb distribution in Delhi'- on 5th January 2015, Indian Prime Minister, Sri Narendra Modi launched a 'Prakash Path' scheme for LED bulb distribution under the domestic efficient lighting programme in Delhi; and a national programme for LED-based home and street Lighting. This shows commitment of the Indian government at the highest level (http://pmindia.gov.in/, 2015).

BEE[6] India has taken policy initiatives to promote energy efficient lighting. One such example is launching of a nationwide village campaign, in which a demonstration village will be converted from existing incandescent bulbs and street lights to LED lights. This is to showcase the energy savings potential for replication of such projects in other areas. BEE has also prepared Indian standards on LEDs to ensure quality of the products (Garnaik, 2012).

Frost & Sullivan hosted 4th annual executive congress on LED lighting titled 'leading India's green energy revolution in Delhi. This interactive event brought together industry stakeholders, thought leaders and decision makers to understand relevant issues, patterns of LED industry and help devise collaborative solutions (Frost & Sullivan, 2014).

Indian power ministry released an official statement that BEE and EESL[7] will be working collaboratively with electricity distribution companies (DISCOMs) to supply LED lights at subsidized rates to households. In Andhra Pradesh state, EESL procured two million LEDs under memorandum of understanding with the state, to provide them to 3.7 million households at a subsidized cost of INR 10. In Pondhuchery state, EESL undertook several projects to install LED street lights and 750,000 LED bulb replacements for households (http://www.theclimategroup.org/, 2014).

There are many ESCO[8] companies now operating in India. The ESCO business model is a delivery mechanism to promote energy savings potential. ESCO does the assessment of energy savings potential and the risks, and provides upfront capital to fund the project. The payments to ESCO are done based on the achieved energy savings. BEE has empanelled over thirty ESCOs through an accreditation process carried out by CRISIL[9] and ICRA[10]. This procedure gives grading to the ESCO for their technical and financial capability (CRISIL, ICRA, 2008). Indian government has also setup EESL[11], to work as ESCO as well as resource centre for energy savings projects in India, including lighting.

For promoting LED manufacturing facilities in India, the government has reduced import duties and state governments have reduced value added tax (VAT). The Indian government is encouraged in LED direction after successful implementation of the bachat lamp yojana (BLY) for CFL started in the year 2009. Under the BLY scheme, 192 million households were targeted to replace incandescent lamps with energy saving CFL in 400 million light connection points. With an electricity saving potential of 20,000 MW (by 2011), BLY is the largest CO_2 reduction 'programme of activity' registered till date with CDM[12] (clean development mechanism) (Vasudevan, Cherail, Bhatia, & Jayaram, 2011).

2.2. Economical Factors

In India, there are around 2 billion lamp sockets in domestic households (distribution of lamps is as per figure 1); out of which, compact florescent tube (CFL) are 500 million. If additional 500 million CFL are put, 1500 MW energy can be saved (ELCOMA, 2012).

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[6]Bureau of energy efficiency

[7]Energy efficiency services limited

[8]Energy service company

[9]CRISIL is a global analytical company providing ratings, research, and risk and policy advisory services.

[10]Formerly investment information and credit rating agency of India limited

[11]A joint venture of national thermal power corporation (NTPC), power finance corporation (PFC), rural electrification corporation (REC) and POWERGRID

[12]Under CDM (clean development mechanism), emission-reduction projects in developing countries can earn certified emission reduction credits (Clean development mechanism (CDM)).

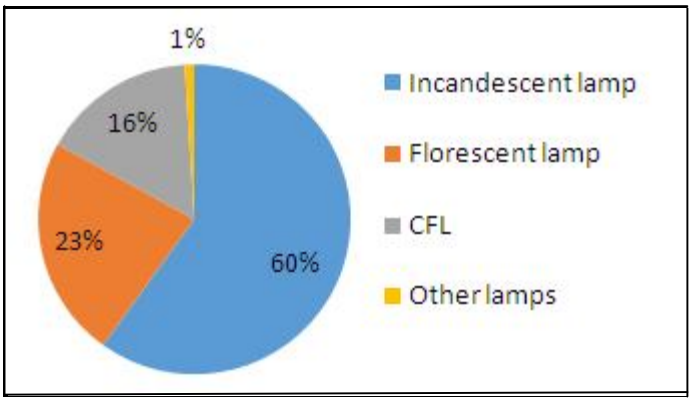

Figure 1

The Indian lighting market has increased from Rs. 4500 crore in the year 2005 to Rs. 7994 crore in the year 2010. The LED lighting is showing phenomenal growth in India and expected to reach Rs. 5000 crore by the year 2016 (table 1) (ELCOMA, 2013).

The year	Traditional lighting	The year-over-the year growth	LED lighting	The year-over-the year growth
2010	7950		500	
2011	9290	17%	850	70%
2012	10469	13%	1250	47%
2013	11679	12%	1825	46%

Table 1: All figures are in Rs. crore

In India, the public (street) lighting demand is growing at a faster rate as compared to other sectors. The public lighting demand expectations are as per figure 2 (Energy efficiency services limited (EESL), 2013).

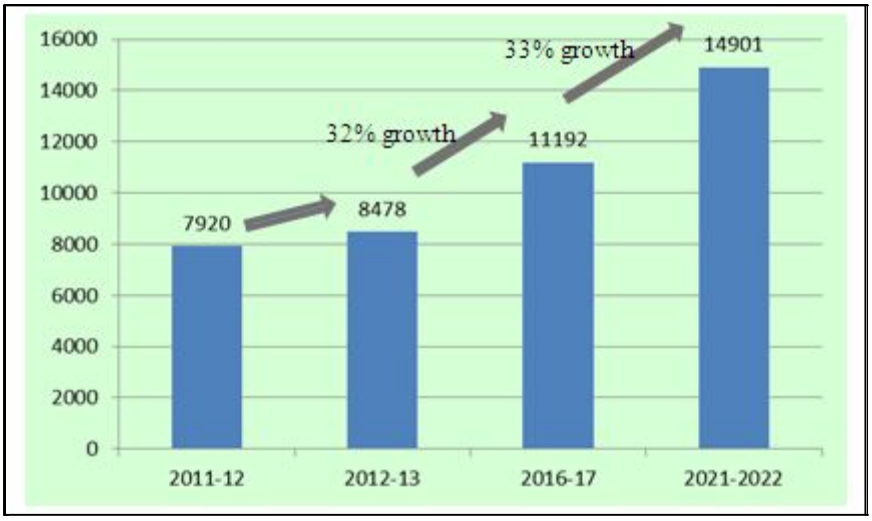

Figure 2: All figures are in million KWh

It is estimated if all the conventional street lights are replaced by LED lights, there is a potential to save 4,300 million KWh energy, which is 50% of the total consumption in the year 2012-13. Further, twilight controls, dimming, voltage optimization of LED lights could save additional 15-20% of energy. Therefore, there is a potential of Rs. 2,500 crore energy savings (@ Rs. 5 per KWh) in public lighting alone in India (Energy efficiency services limited (EESL), 2013).

Philips Lumileds, one of the big manufacturers of LED lights, foresee that the LED demand in India will continue to increase by more than 40% on the year-over-the year basis for the next few the years. LED is expected to take a lead position in three the years as compared to the present traditional products like CFL and HID[13] lamps (Electronics maker, 2014). Philips expects that the LED lighting price will drop by 10 times by the year 2020 and its' market share will become 75% (Borovkov, 2011).

[13] High intensity discharge

2.3. Social Factors

A well illuminated retail outlet encourages people entry, increases ambience, uplifts mood, and plays a pivotal role in generating higher sales. New lighting trends are emerging with LED technology and their usage keeps running and maintenance cost low (Khan, 2014).

Opple lighting, a Rs. 30 billion Chinese lighting company, having presence in 50 countries, employing 6,000 people, have entered into Indian market in the year 2014. Targeting to achieve the leading position in the Indian market, Opple considers that Indian customers are open to new technology, looking for energy efficient solutions, hassle free value for money products (Electronicsb2b, 2014).

'Philips lighting signs RanbirKapoor as brand ambassador', declared in a press event by Philips India. This celebrity endorsement is a clear strategy to woo the mass consumers, increase their awareness and preference for LED lights (Philips, 2013).

The consumers are becoming aware that the LED lighting saves energy as compared to traditional lights (table 2), therefore the market size is increasing at a growing rate (Energy efficiency services limited (EESL), 2013).

Present lighting system	**Approx. equivalent upgrade system (LED/control)**	**Potential saving in energy consumption**
Fluorescent lamp TL[14] 40W	LED 16W	61%
Sodium vapour 70W	LED 30W	61%
Sodium 150W	LED 60W	63%
Sodium/Metal halide 250W	LED 120W	56%
Sodium 400W	LED 240W	46%
Manual switching	Lighting control management system	10 – 25%

Table 2

The expectancy of LED lamp is 50,000 hours, which is very high as compared to 8,000 hours of CFL expected life and 1,200 hours of incandescent lamp expected life (Samal, 2013).

The price projections of various lighting technologies are as per table 3. This shows that more consumers could trend towards LED lighting in future (pwc, 2011).

The year	**LED**	**CFL**	**Incandescent**	**Florescent (T8 tube light)**
	Rs. per thousand lumen[15]			
2011	1500	166.67	19.23	12.76
2021	150	150	17.79	11.82
2031	15	135	16.45	10.93
Basis of reduction	Haitz law[16]	10%/ 10the year (PwC analysis[17])	7.5%/ 10the year (PwC analysis)	7.5%/ 10the year (PwC analysis)

Table 3

2.4. Technological Factors

This factor is clearly in favour of LED lighting. The biggest proof is that the Nobel prize in physics for the the year 2014 was awarded for the invention of efficient blue light-emitting diodes which has enabled bright and energy-saving white light sources (The Royal Swedish Academy of Sciences, 2014).

Bloomberg Business reported that incandescent light bulbs have bleak future in United States. The 100-watt incandescent bulb was phased out in January 2010, and to be followed by 75-watt, 60-watt and 40-watt. Their replacement with energy efficient bulbs is expected to mean 10 billion to 15 billion US$ worth of national energy savings per the year. Already, leading manufacturers such as General Electric (GE) and Royal Philips Electronics (PHG) have stopped manufacturing traditional 100-watt bulbs (Winter, 2012).

LEDs are emerging and complex technology and the major technology holders for chips, components, fixtures etc. are in U.S, Japan, Taiwan or Europe (Netherlands/ Germany). In India, there are around 12 large, 15 medium and 600 small manufacturers in LED business. However, now most of the global players have extended offices, packaging and manufacturing facilities in India (pwc, 2011).

Philips realized LED boom in the year 2005 and started investing in this segment. They acquired key companies like Lumileds, Color Kinetics, TIR Systems, Dynalite, Teletrol, Genlyte, etc. along with the key technology (Borovkov, 2011). Philips spends 3% of their

[14]Tubelight

[15]Lumen is a measure of the total amount of visible light emitted by a source.

[16]Haitz law postulates that 'every decade, the cost per lumen (unit of useful light emitted) falls by a factor of 10, the amount of light generated per LED package increases by a factor of 20, for a given wavelength (color) of light.'

[17] Analysis done by PwC (PricewaterhouseCoopers) (pwc, 2011)

turnover in research and development (R&D) and their Bangalore innovation campus supports global R&D. Philips India has 2 manufacturing facilities for CFL and general lighting source (GLS) in Mohali and Vadodara cities (Philips).

In India too, lighting firms like Bajaj Electricals, Philips, Toshiba, Havells are sensing good business growth. This is especially in view of Indian government's plan to develop 100 smart cities across the country. Havells is expanding their LED lights manufacturing capacity, Toshiba is investing in R&D and also plans to set up a manufacturing base in India (PTI, 2014).

ELCOMA[18] has initiated LED technology support from Japan for training, testing and preparation of the standards (India-Japan cooperation for technology exchange, 2014). TERI[19] has setup a high quality laboratory in Delhi, as per IEC 62257-9-5 standards to ensure quality and compliance of various parameters of solar lighting products (TERI's solar lighting laboratory first in India to receive NABL accreditation, 2014).

3. Conclusion

The PEST analysis tilts in favour of LED lighting in India in future. With more popularity of LED lights, price reduction would follow, resulting in more consumption. The technology will become mature and improve in quality.

With the Indian government supporting the LED initiative for energy savings, the industry is expected to pick-up at a rapid pace. With a growing market, many manufacturers will venture in and big players will consolidate their positions.

With the establishment of manufacturing facilities, laboratories and R&D centres in India, LED products could be designed suitable for Indian environment and conditions.

With time, ESCO companies will set-up and gear up to undertake and execute LED projects successfully.

The LED will be used in all sectors like domestic households, industry, commercial and public lighting. The consumers will have many options with LED lighting and there could be social trend in this direction.

Energy saved is energy generated – this will become true with LED lighting.

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