

LED Lighting: A Review of This Green Technology



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In recent years, LED lighting has taken off at a quick pace as incandescent lamps fade out. This is due to the absence of dangerous chemicals like mercury, and minerals in LED lighting and, depending on the application, a significant reduction in energy consumption.

LED is a "green" lighting source. In the next 5-10 years, it is expected that the world, including Malaysia, will make the transition from incandescent and fluorescent lighting fixtures to LED technology which is definitely superior in terms of a long lifecycle, operating costs and energy consumption.

The introduction of LED luminaire technology to replace incandescent bulb is in line with Malaysia's commitment to saving energy. This forward-looking initiative has opened up great opportunities for us to be a player in the global LED lighting industry which received a boost when a number of countries affirmed their commitment to ban the use of incandescent bulb (Figure 1).

- Europe banned the traditional 100 watt light bulbs from September 2008 and all incandescent bulbs from September 1, 2012.
- America started the incandescent light bulb phase-out on January 1, 2012.
- Japan called for the halt in production and sales of incandescent bulbs in 2012.
- The Chinese incandescent bulb phase-out policy started in October 1, 2012.

Malaysia, in line with its policy to upgrade itself to be an R&D based and high tech manufacturing country, has grasped the opportunity to ride this boom wave of the global LED luminaire business. The government has made great effort to support the local industry to be more competitive in the LED luminaire market here and on a global level.

An effective strategy to drive the development of the LED luminaire market is through enforcement of legislations that include

- Restriction of Hazardous Substances (RoHS)
- Reducing waste from Electrical and Electronic Equipment (WEEE)
- Phasing out of incandescent lights by January 2014
- Energy Performance of Buildings Directive (EPBD) as a Green Technology initiative
- Enforcing the anti-dumping of light bulbs by manufacturers
- Energy Star certification for appliances.

But despite the advantages from supportive legislations and efforts by the government to boost the competitiveness of local LED luminaire manufacturers, the industry still faces great challenges such as:

1.0 THE COST OF LED LUMINAIRE MANUFACTURING KEEPS INCREASING STEEPLY:

At present, most of the raw and intermediate materials used in the assembly and packaging of LED luminaire are imported because of the following:

- The materials are not available locally, for example, epoxy, silicone and the wafer.
- Locally purchased materials can be more expensive because most of these are brought from outside the principal custom areas (PCAs) in which the local companies are located.
- Prices charged by local suppliers are not competitive, possibly due to the fact that raw materials are imported, with local value added processing accounting for only a minor part.
- Another explanation for the non-competitive pricing of materials from local suppliers is that local companies impose substantial profit margins.
- Most of the imported materials are subject to import duties. Local companies may apply for exemption but with the extensive and time-consuming documentation, there is added cost involved.

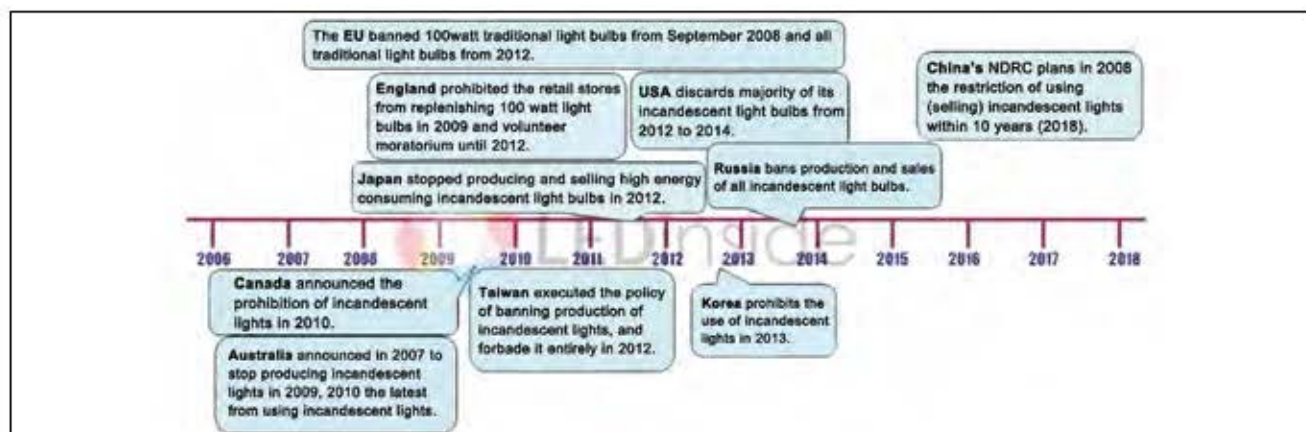


Figure 1: Timeline announced by countries to phase out the incandescent light bulb

- Materials supplied locally are often of poorer quality. Local technology is generally less advanced than the US, Japan or Taiwan. This has further prompted LED packaging companies to source from overseas.



Figure 2: The LED material supply chain

Figure 2 shows the supply chain in typical LED luminaire manufacturing.

2.0 LACK OF CAPABILITIES IN LOCAL MACHINERY AND AUTOMOTIVE MANUFACTURING:

Most of the machinery and equipment used by the local LED luminaire companies are imported. This has directly increased manufacturing costs.

- All the machines and equipment used in wafer fabrication and Front-of-Line process are imported. Examples of the latter are dicing machine, die attach and wire bonding machines.
- Locally-made machines and equipment are available for the End-of-Line process, especially those used for testing as well as tape and reel. Although locally-made machines and equipment are available, LED luminaire companies prefer to buy from abroad because:
 - Prices of locally-made machines are not competitive.
 - Locally-made machines are often of poorer quality. For example, ramping-up using imported machines and equipment is much faster than using locally-made ones.
- Figure 3 summarizes the LED luminaire manufacturing equipment supply chain.

3.0 TECHNICAL CHALLENGE AND RESOURCE CHALLENGE

- Local LED luminaire companies face difficulty in hiring technical people with the right skill sets and competency in LED and related technology. The shortage is especially acute in optic design engineering, thermal dynamic engineering, LED module design, luminaire system design and electrical designer for LED driver.
- The mismatch of technical competency between manpower supply and demand is a critical concern. This has become the "road stopper" to the local fast growing LED manufacturing and LED luminaire system integration and design industry.
- Companies require new employees to perform immediately. However, fresh graduates are not equipped with the know-how needed for their jobs. This situation must be addressed by local universities who need to design their curriculum to produce technically competent graduates who can meet the needs of the industry.

Local manufacturers face difficulty in finding trainers who can offer courses to upgrade their design and technical core staff. In the absence of

structured training, technical and design knowledge has to be picked up on the job or through trial and error. This is a limiting factor for the local LED industry to move ahead and grow to compete with multinational companies which have the resources to provide comprehensive technical training, by drawing on technical expertise from their headquarters overseas.

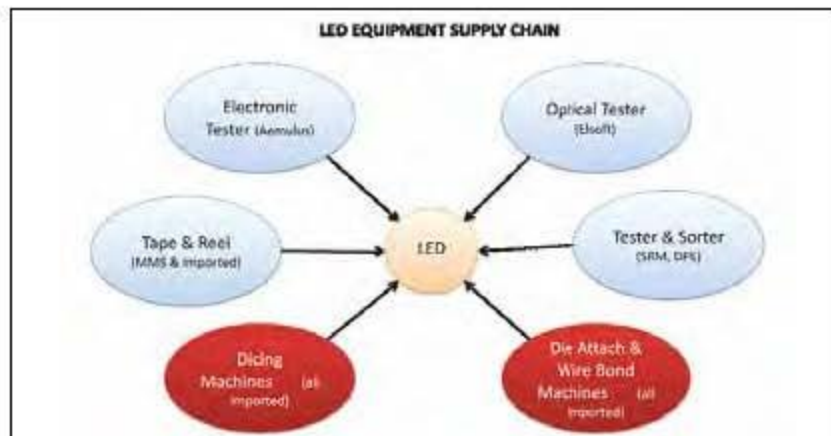


Figure 3: The LED luminaire equipment supply chain

4.0 SLOW LOCAL LED LUMINAIRE PRODUCT ADOPTION

- The adoption rate of LED products by local consumers is very slow. Although the Malaysian government has announced the ban on the use of incandescent bulbs by 2014, there is no legislation yet (currently still in progress) and no organised campaigns to aggressively promote the advantages of LED luminaire products.
- Prices of LED lighting products are much higher than comparable compact fluorescent lamps (CFLs) which are already established in the market. This is due to several factors as discussed earlier.
- The ban on use of incandescent bulbs may well lead to an increase in the use of CFLs rather than LED lightings. This is due to a lack of information to educate the public on the advantages of LED luminaire products.
- Although the government has taken the first step to phase out incandescent lights, the market continues to favour traditional lighting which is well-established.

5.0 LOW LEVEL OF LOCAL INDUSTRIAL INVOLVEMENT IN LED LUMINAIRE DESIGN AND SYSTEM INTEGRATION

- In Malaysia the LED lighting industry is dominated by large foreign firms. Only a few local companies are involved and these have limited roles such as the low value added process of packaging. No local companies are involved in upstream activities like wafer fabrication.
- We also have very few local companies moving into LED luminaire driver, system design and application. What most of them do is to merely import luminaire products and market them locally. Limited to trading activities, these companies are not able to build up their competitiveness based on development of indigenous technology in LED. There are no unique features in the products to distinguish one company from another as their LED products are all purchased from overseas. Such unrestricted importing of LED luminaire products invariably leads to increased competition and price wars. The case for promoting LED luminaires as the advantageous alternative is lost in the fight over the price advantage.
- The lack of home-grown technology also means that local LED luminaire companies are unable to come up with product designs to compete with imported lighting or to make to the requirements of customers. Big overseas companies, however, are able to provide design services to meet specific needs or requests. This scenario has further slowed down

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the growth of the local LED industry and hindered the quick and widespread public acceptance of this green technology.

- There are some big foreign companies operating in Penang which are involved in LED luminaire system integration. However, almost all their products are sold in the US, Europe and elsewhere in Asia. Less than 1% of these is sold in the local market. Again, this has contributed to the slow pace of local use of LED products as what is available here is expensive, imported LED lighting.

RECOMMENDATIONS

For local LED luminaire manufacturing to play a major role in getting Malaysia to adopt this green technology, it is important that this sector be sustained by government initiatives. These include doing more to educate the public and promote its use, spawning and developing SME into optoelectronics module and system integrators, and skill capacity building among lighting designers and architects in the application of lighting retrofit, lighting fixture, lighting module and lighting system using LED luminaire to replace conventional lighting.

Local companies must be given incentives to move into LED integration in particular in the application of LED lighting. This range of activities can generate better profit margins compared to LED packaging which is the focus of Malaysian companies in this industry. LED integration

companies have mushroomed in countries like Taiwan and China. Major companies that have positioned themselves in LED integration include giants like Foxconn, Delta Electronics, Chimei and AUO from Taiwan and Midea and TCL from China.

The government should capitalize on the availability of expertise in design at the system integration level to provide training for local technopreneurs in promoting and developing the LED integration industry. Local institutions and universities should include in their curriculum more courses that are in line with the country's economic transformation plan that cater to high tech and green technology industries.

Incentives from the government should benefit local companies and encourage them to get involved in the LED industry, for example provide support on infrastructure, land and building, offer subsidy for high tech equipment for the manufacture of core LED components, abolish hiring restrictions on foreign knowledge workers and ease entry of expertise from overseas, exempt tax import duty for core raw materials and exempt on domestic sales of advanced LED products. ■

Goh Boon Chin is the current Vice President of Operation QAV Technologies Group of Companies. He built the test standard for LED and Luminaire testing for Malaysia and collaborated with Energy Commission, JKR, Sirim, GreenTech, to ensure all Luminaire entering Malaysia are of high standard. He obtained ANSI certification for luminaire and Led modules and qualified QAV into DOE/EPA to become 1st lab in South East Asia to have such accreditation. He has also worked with TÜV Germany to get certification for automotive and medical products.