Panel Discussion: Opportunities and Challenges for Lighting Manufacturers in Canada

Summary by Sharon McFadden (CNC/CIE Delegate to Division 1)

The panel was composed of representatives from three Canadian lighting manufacturers – Shirley Coyle, from CREE Canada, Tung Yung Wang from OSRAM SYLVANIA, and Howard Yaphe from Axis Lighting. The three panelists represent different areas of lighting manufacturing in Canada. Cree manufactures LED components and lighting systems, primarily high-powered LEDS. Osram Sylvania is a large multinational company that designs and manufacturers a wide range of lighting products. Axis Lighting is a privately owned Canadian company that focuses on the design, engineering, and manufacture of energy efficient lighting solutions for business and industry. The moderator was Dr. Jennifer Veitch from the National Research Council Construction Portfolio. To start, each panel member spoke about the challenges and opportunities from his or her company's perspective. This was followed by questions from the audience to which the panelists responded. Since all three panelists addressed many of the same issues, the following is a collation of the challenges and opportunities they discussed. Additional detail can be found in the presentations from CREE and Axis.

Panelists' Views

Role of Government

A challenge raised by all three panelists was the role of government. In Canada, incentive programs for energy efficient lighting are limited. In fact, by keeping energy rates low, provincial governments effectively discourage industry and consumers from moving to the more energy efficient lighting solutions that LEDs make possible. In the US, the Department of Energy (DoE) has taken an active role in the use of energy efficient lighting. It has invested millions to determine what is achievable in lumens per watt (lm/W) and their incentive program has resulted in many projects to explore the use of LED lighting particularly for street and roadway lighting. The success of these projects means that LED use in these types of applications, particularly in roadway and street lighting, is more advanced than in Canada.

The challenge for government then is to establish a road map for the introduction of energy efficient lighting even if it is only the validation of the DoE standards. If the requirement exists to provide greater lighting efficiency, LEDs will increasingly be the best solution. However, government should also support investigations into what kind of incentive programs will lead to the most effective use of energy efficient lighting, more research on the potential of different concepts in energy efficient lighting, and projects that demonstrate that the efficiencies of LED luminaries are real. A few such projects have already been undertaken especially under LEED. With additional support through incentives and standardization, it was felt that the implementation of LED lighting could really take off.

Manufacturing Changes

Both a challenge and an opportunity is the change to the lighting manufacturing model that is likely with the growth of LED lighting. Existing light technologies are relatively simple. Most lamps are composed of only three components. Success comes from volume. Consequently, lighting production is controlled by a small number of large companies. The modular nature of LEDs together with the wide range of available components and the continuing evolution of those components allows small companies to produce innovative lighting solutions that meet niche markets. The ever evolving nature of LED lighting systems means that manufacturers need to store components and build systems as required. For traditional manufacturers, these changes means they have to develop a new manufacturing model that does not necessarily include large volume factories. The successful companies will be those who can provide solutions for industry – the best combination of cost and performance. This change in manufacturing could benefit Canadian lighting companies. Storing components and building systems just in time gives local manufacturers the flexibility to meet customers' requirements effectively and efficiently and better compete with overseas manufacturers.

In the longer term, this new manufacturing model will probably lead to a revolution in lighting design and installation. Although LED manufacturing in the near term will probably focus on retrofitting existing installations with LEDs, in the long run it will involve rethinking how lighting is delivered. With solid state lighting (SSL) technology, it is possible to integrate a lighting system with digital technology allowing greater flexibility – e.g., colour, intensity and temporal control both locally and remotely.

Testing and Standardization

The scale of testing required for LEDs counterbalances the benefits arising from the modular nature of LEDs. Current experience is that SSL technology is held to a higher standard than traditional lighting, which increases manufacturers' costs and time to market. The more stringent requirements arise in part from the modular nature of LEDs. Manufacturers are dealing with the possibility of multiple drive currents, colour temperatures, form factors, and light engines. Every time a component changes, it is necessary to repeat the tests. The range of tests is much wider as well. Since electronics are a large component of LED fixtures, it is necessary to carry out thermal and optical tests along with photometric. To overcome this limitation, companies are exploring methods to reduce the number of tests per unit as well as the need to test every unique combination of components.

Growth Potential

A major opportunity with LEDs is the potential for growth. Currently, LEDs form a very small portion of the lighting market. This is expected to change especially as the requirement for more energy efficient buildings increases. The market drivers are IES lighting practices, standards, LEED, and Net-Zero building. For example, the average building today consumes 400 kW/m^2. LEED buildings use about 200 kW/m^2. In the future, commercial and manufacturing buildings will have to be net zero, i.e., energy expended equals energy created. To achieve this requires reducing energy expenditure to less than 100 kW/m^2. Currently, fluorescent fixtures are about 55 lm/W and that is not likely to change as fluorescent lighting represents a mature technology. The same holds true for other traditional technologies. LEDs, on the other hand, are expected to achieve upwards of 200 lm/W by 2020. In addition, LED lighting is generally dimmable, allowing designers to optimize lighting output as a function of time and location.

LEDs have other advantages over fluorescent fixtures that will likely lead to greater market penetration in the near future. They offer a considerable range of output – low power for Christmas lights, middle power for general indoor lighting, high power for outdoor use and super or ultra high power for specialized applications such as theatre lighting. Individual LEDs are so inexpensive that one can use many of them in a single fixture. They are becoming much more efficient than other light sources, and are expected to have a longer life span. With many LEDs in a single fixture, it is simple to control colour temperature and adjust the output to meet specific requirements. Finally, LED technology allows the use of intelligent drivers. Thus, for example, it will soon be possible, to adjust the output of a fixture to achieve constant light levels across its life span. Today, lighting is designed to have 70% light output at the end of life. When an LED fixture is installed, the driver can run the lamps at about 70% of its maximum output. As the unit ages, the driver will run the lamp harder to maintain the same light output. As well as maintaining constant output, this approach means that fixtures will last longer since they are not always being driven at their maximum output. The intelligent electronics in the driver will be able to tell the operator the status of the lamps making it possible to optimize fixture replacement.

Overall, with LEDs one does not have to fit one system into multiple applications. They can be selected (low, medium, high power) and manipulated (row, rectangle, circle, etc.) to optimize lighting for each application. However, while it is simpler to get what one wants, one needs to know what is wanted. Designers need to understand that LEDs are not a single thing. Intelligent design is required to achieve optimal systems. As well, optimal systems will not necessarily look like today's lighting fixtures, which could lead, at least initially, to low acceptance in the user community. These latter two factors could negatively impact market penetration in the near future. Hence the requirement for research to explore effective design concepts that optimizes the potential energy savings of LEDs and government regulation to promote more energy efficient lighting.

Audience Discussion

Specification Challenges

Many of the issues raised by the panelists were echoed in the questions and discussion. Since the efficacy of LEDs has grown and continues to grow rapidly, designers are finding it difficult to specify the most energy efficient LED lighting solution for a building that will open in 2-3 years. The panelists offered a number of routes. One approach is to specify a minimum output. For example if 130 lm/W is achievable within the next year or two, specify it as a minimum. Alternatively, designers can use the DoE predictions. So far their predictions on achievable lm/W have proven extremely accurate. A third approach is to specify total lumens. The installers then put in the type of fixtures that meets that total lumen requirement at the time the building is finished. Alternatively they can choose higher power fixtures and run them at lower current to achieve a longer life span.

The complexity of LEDs was probably the most important issue for attendees. With fluorescent fixtures, ballasts are interchangeable. With LED drivers, designers find there are multiple options, which could lead to replacement problems. The response of the panelists was to recommend programmable drivers. Most manufacturers are moving to programmable drivers so that LED drivers will be interchangeable in the future just as ballasts are today. They also suggested that designers should not specify the driver. Instead specify a lighting solution and let the manufacturer provide the best solution. With LEDs, one is dealing with electronics and as with other types of electronics, it is necessary to think of the total unit and not the components of a unit. One does not specify the boards for a computer. Rather than specifying specific components, one should try to provide minimum performance specifications that the lighting solution must meet (e.g. life span, total lumens, end of life output, lm/m^2, etc.). As discussed above one of the advantages of LEDs is the ability to move away from the concept of lighting as holes in the ceiling. With LEDS it is possible to integrate lighting into a building.

The panelists also felt that the complexity of LEDs was in part at least due to the dynamics in the industry right now. As stated earlier, there are many more players in the SSL market than with traditional light sources, which favour large companies. Everyone is trying to find the ultimate solution. More efficient and effective components emerge almost daily. Manufacturers have not had the time to sit down and look for commonality.

Maintenance

Maintenance complexity is also an issue with LEDs. Currently with fluorescent lighting fixtures, a janitor can replace a burnt out fixture, but with LEDs it requires an electrician at about 5 times the cost. For that reason, some facilities managers feel that the savings associated with LED levels of efficiency are outweighed by maintenance costs.

Panelists agreed that maintenance costs were an issue today, but that this issue was likely to disappear in the future. To start, current experience suggests that the failure rate with LEDs is extremely low – 0.02% compared to 10% with HIDs. Secondly, given that LEDs are closer to electronics than traditional lighting, you will probably see the development of a maintenance philosophy similar to what you have today with TVs etc. Owners do not replace the components in their TV set themselves. They either take it to a repair shop or replace the device. In order to realize the efficiencies possible with LEDs, the market is unlikely to see the development of a "standard socket" as is the case with current types of lighting. When manufacturers try to standardize on something that works for everyone, they have to compromise and cost go up and efficiencies go down. Thus, they predicted that LEDs will continue to have many different form factors and if an LED fixture break down, an owner will take it to a shop to be repaired or replaced it as happens today with other types of electronics. A variant of this approach will be lighting installations that are composed of "plug and play" components that can be taken out and sent away for repairs. Maintenance will also likely be simplified and reduced through the use of distributed systems, e.g., a centralized driver that runs all the fixtures in a room or even on a floor. This driver could even contain spares making it possible to switch over to a working driver if the current one fails.

Cost

Not surprisingly cost was also a big issue. Most designers said that they could not currently justify the initial cost of LEDs on the basis of life cycle efficacy. As one attendee put it, how can LEDs compete against a $4, 62,000 hour rated fluorescent light. The panelists agreed that currently it is very difficult. However, if there is a requirement for dimming, LEDs quickly become the better option. In many applications, fluorescent lights perform very well. Thus, the drop off will likely be gradual, which will slow down market penetration of LEDs. However, government regulation could change that. For example if government imposes very restrictive mercury content, it will be the end of fluorescents.

Currently, the prediction is that by 2015, 50% of lighting sales will be LEDs and by 2020 – 80%. At the same time the number of lm/W is increasing. With higher efficacy, there is less of a requirement for heat sinks, which not only decreases production costs but also increases life expectancy. Both of these factors will result in a decrease in the cost of LEDs.

Conclusion

The session wrapped up with thanks from the organizers and audience to the panelists. All felt that it had been helpful to discuss the issues, and looked forward to further exchanges in future.