

The LED Advantage

BY ADAM FRANKLIN

Office lighting has improved drastically over the last 25 years. Gone are the days of flickering fluorescent lighting systems that contain tar, mercury and polychlorinated biphenyls (PCBs), all of which are harmful to human health.

As our work environments have evolved, so too have our lighting requirements and expectations. Today the emphasis is on energy efficiency, flexibility, personal control, and the promoting of human health and wellbeing. As a result, lighting designers must now be able to meet a wide range of requests when it comes to office lighting and address a set of stringent national and local building code requirements aimed at energy savings. One set of standards being adopted by many jurisdictions across Canada, ASHRAE 90.1, defines minimum building efficiency requirements and requirements for lighting controls for different spaces and areas within a building.

The advent of LED lighting makes achieving, and surpassing these requirements much simpler than with more traditional light sources. Today's lighting designers should have a good understanding of the opportunities associated with LED lighting in terms of comfort, control and energy savings.

Comfort and Control

LED lighting boasts a number of benefits. Unlike CFL and fluorescent sources, LED technology can be switched on and off frequently without reducing the life of the system. LEDs also offer more dynamic dimming and adjustability options including brightness, colour temperature and hue — which can be used to mimic our natural light expectations based on circadian rhythms of the human body. These inherent characteristics of LED lighting allow for more advanced control strategies which, when properly implemented, reduce energy consumption and improve employee comfort. In an office setting, where employees spend the majority of their workday indoors, it is important that artificial light feels natural for the hour of day and provides flexibility for different preferences or sensitivities.

A Case Study of Open Office Lighting

At Prism Engineering, we use our office as a living laboratory to test new technologies. A recent expansion at our offices in Burnaby offered us the opportunity to conduct a lighting improvement project in the new space and explore a variety of LED technologies and applications.

The renovation included new LED recessed troffer luminaires uniquely sized at 20" x 24" and complete with wireless dimming controls that



interfaced with each user's personal computer in the open office areas. Set at 50 per cent dimmed, these luminaires achieve a lighting power density of 0.18 watts per square foot, exceeding ASHRAE 90.1/2010 LPD requirements by 80 per cent, while still meeting industry target illumination levels.

A survey of the office's lighting control system revealed that a majority of staff set their lighting levels between 30 and 60 per cent of total lighting capacity. No one in our office was found to have their default light setting above 80 per cent, demonstrating a general preference for moderate lighting levels but allowing the freedom to adjust lighting based on need. Providing employees with personal control allows individuals to optimize their comfort level, while generating considerable energy savings. At the 50 per cent dimmed setting, the recessed LED luminaires consume 75 per cent less power than a similar luminaire that utilizes long CFL lamps, and 80 per cent less than the standard 2'x4' fluorescent luminaires used in the building.

Taking advantage of the capacity of LED lighting to be switched on and off with frequently, we also installed occupancy sensor, which automatically switch off the lighting in each 'pod' of four workstations when no one is in the area. Meeting lighting requirements on an "as needed" basis ensures that entire floors or departments don't remain fully lit when there are only a few employees left working in an area. Compared to a scenario where the lights are turned on by the first person to arrive and turned off by the last person to leave, this zoning strategy has proven to reduce lighting operating hours by 25 to 30 per cent.

Meeting Room Lighting

The adjacent private office and meeting room spaces were fitted with 8' LED pendant luminaires

that utilize cutting edge light distribution and optical control technology that delivers over 75 lumens per watt and virtually eliminates glare. These luminaires meet target illumination levels, while using 60 per cent less energy compared to pendant luminaires that utilize high output T5 (T5HO) fluorescent lamps. Pairing this technology with dimmable wall switch vacancy sensors, which operate as "Manual-On Auto-Off", ensures that lights are only on when needed and function at maximum efficiency and effectiveness.

Key Features of the Lighting Improvement Project:

- All new LED luminaires are fully dimmable and can be adjusted to suit personal preferences
- Occupancy / Vacancy sensors automatically switch off lighting when not required.
- Reduced lighting power density from 0.93 to 0.20 Watts/ft²

Although not all LED products are created equal and must be closely evaluated for a number of different metrics, the performance of LED luminaires has now reached, and in many cases exceeds, the level of fluorescent lighting that we've become accustomed to. It is now a viable option for most general office lighting applications that offers far more options for controls.

Properly designed LED lighting systems easily meet ASHRAE 90.1 requirements (both 2010 and 2013 versions) and even surpass the more stringent requirements of ASHRAE 189.1 2014. At the same time these systems can meet target illumination levels set by IESNA without compromising office comfort or control. **CB**

Adam Franklin, EIT, LEED Green Assoc., is an electrical engineer with Prism Engineering Ltd.