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– Roy Hughes, Energy Management Engineer, BC Hydro

Project

BC Hydro, Vancouver, BC

Challenge

Utility looking to showcase state-of-the-art energy efficient lighting in new building, and in so doing to demonstrate potential savings to hydro customers.

Solution

EL1 luminaires with integral Ergolight Controls by Ledalite.

Results

Monthly savings ranging from 65 percent to 80 percent compared with 2x4 troffers; power density at 0.5 watt per square foot; estimated payback 1.5 years.

Utility Showcases Ergolight

Demand-side management, through a program called Power Smart, is a top priority for BC Hydro, an electric utility serving more than 1.5 million customers in British Columbia, Canada. Aside from the paramount efficiency and environmental benefits for the customer and the province, helping local electricity customers conserve energy assists in delaying and, possibly, reducing the need for new generation resources.

BC Hydro's Power Smart division recently moved to four floors in a new office building, providing an opportunity for the utility to install, compare and evaluate a variety of different lighting solutions, including an Ergolight intelligent office lighting system. With up to 30 percent of a typical office building's electricity use being consumed by lighting, the potential for reducing the monthly electricity bill is considerable.

Ergolight, from lighting manufacturer Ledalite Architectural Products, integrates network controls, occupancy sensors, personal dimming and daylight dimming to deliver up to 87 percent proven energy savings. Its sophisticated software provides up-to-the-minute data on energy usage on a system-wide basis. A robust, market-tested technology, the product already has 5,000 users and was awarded the prestigious Energy Award at LightFair 2001, North America's premier lighting trade show.

“We were moving our marketing department and were looking for state-of-the-art technology to showcase in the building, with the additional benefit of saving energy,” said Roy Hughes, energy management engineer in the technology solutions department of BC Hydro's Power Smart division. “With Ergolight, we decided to conduct a case study on ourselves and do a complete cost-benefit analysis to see if the product could work economically.”

Economics are top of mind with Ergolight. Given the up-front costs of the technology, it is vital the product deliver substantial savings over a reasonable payback period. Underpinning these concerns is the belief among utility experts worldwide that the 50 percent-plus energy savings that were achievable a few years ago are no longer available. BC Hydro's Ergolight evaluation demonstrates that this is not the case at all.

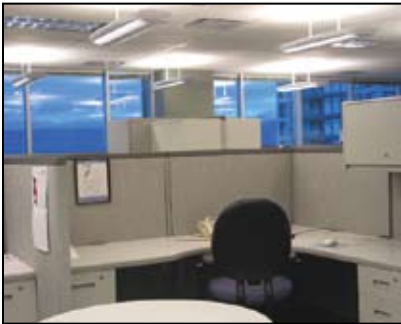
System delivers up to 80 percent energy savings

The core of BC Hydro's evaluation was a comparison of Ergolight's costs and energy savings with three other typical office lighting setups. These were: a baseline, lowest-cost system with standard 2x4 recessed troffers with parabolic louvers; the utility's higher office standard using better-quality parabolics; and that same Hydro standard with daylight dimming for window areas. Over the four floors, where 525 two-lamp 2x4 troffers would normally be needed in the three other systems, 195 Ergolights were installed. The findings were impressive.

The new Ergolight system is delivering monthly savings ranging from 65 percent to 80 percent in comparison to the baseline (i.e., the lighting system most often installed in office projects) system. The power density was reduced from 1.0 watt per square foot to 0.5.

The savings came in well above the conservative estimate of 60 percent. The utility attributed the additional savings to the amount of extra flex-time that people take away from their offices, and the fact that the lights turn on and off automatically based on workspace occupancy. The estimated payback period of the new system's extra cost over and above the base system cost is only 1.5 years, in contrast to the three years projected before the installation. This is an excellent result for a market that charges only US\$.035 per kilowatt-hour, making it one of the lowest-priced jurisdictions in North America.

The results would be even more impressive in markets where electricity charges are much higher than in British Columbia. For example, had this installation been built in the U.S. Northeast, where the rates range between 12 and 16 cents per kilowatt-hour, the incremental payback period would have been about five months, while the full cost payback would have taken around 17 months. Similar payback results would be obtained in the Midwest (6-10 cents) and U.S. West (8-13 cents), where electricity charges are more than double the B.C. rates (see Table 1 below).



BC Hydro's Ergolight installation has already exceeded expectations with 65-80% monthly energy savings.



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Table 1: BC Hydro Ergolight Controls payback under U.S. electricity rates

	BC Hydro	U.S. Northeast	U.S. Midsouth	U.S. West
Electricity charge per kWh*	3.5 cents	12-16 ¢	6-10 ¢	8-13 ¢
Conservative multiplier over BC Hydro rate	N/A	3.5X	2X	2.5X
(a) Incremental payback	1.5 yrs	0.4 yrs	0.8 yrs	0.6 yrs
(b) Full-cost payback	5.0 yrs	1.4 yrs	2.5 yrs	2.0 yrs

* Rates in effect around the time of the study.

“We received dramatic immediate reductions in lighting electricity consumption in the range of 77 to 83 percent, and we haven’t even tried to bring the electricity usage down yet using the software-based load-shedding controls. This kind of result far surpasses what many in the energy conservation field thought was impossible in lighting,” commented Hughes. “Ergolight brings the days of 50 percent-plus energy savings back. It’s very impressive.”

One of Ergolight’s intriguing features is that it has been designed to put light only where it’s needed. Termed workspace-specific, this design strategy sees a suspended fixture placed over each employee’s cubicle or private-office desk. The energy-savings technologies then work according to the criteria set by the building manager and the occupant. For example, a few minutes after the fixture-integrated occupancy sensor detects no movement within the workspace, the downlight is automatically and gradually dimmed to off. One lamp in each fixture that projects light up to the ceiling is left on to maintain ambient illumination in the space. Outside regular office hours, the occupancy sensors in the open office are scheduled by the manager to control both the uplighting and the downlighting, thereby ensuring that uplights are not left on in vacant workspaces.

For most companies, with employees working on flex-time or taking sick days off, or with many inside meetings or outside sales calls that take people away from their desks, much energy is wasted lighting unoccupied workspaces. Occupancy sensors allow the organization to save the electricity that would normally be wasted for this purpose. In the Hydro case, an estimated 50 percent of all the savings were generated directly by occupancy sensors.

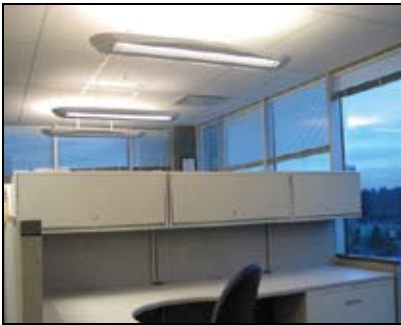
“Occupancy sensors contributed more savings than we had projected,” notes Cristian Suvagau, the BC Hydro lighting engineer who managed the Ergolight implementation project. “This is due mainly to the fact that we don’t really know how much time people spend away from their desks. This software tells us.”



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Ergolight's personal dimming capabilities allow employees to maintain their workspace illumination levels within their own individual comfort zone.

Personal dimming enhances employee visual comfort

Each Ergolight is connected to the employee's computer through the corporate LAN system. Using an icon on their computer screen, staff members are able to control the light level directly overhead and adjust it (usually downward) to deliver the optimum illumination level. Hughes notes that during the summer most of the Hydro staff set their lighting at 50 percent, providing additional savings.

Although personal dimming delivers less than five percent of the overall energy savings, its importance should not be underestimated. A recent study conducted by the National Research Council in Canada found that every person has a personal preference for how they want their desktop to be illuminated. They also found that these preferences vary widely. Due to this variation, the study found that today's standard of fixing the illumination levels at one particular setting, no matter where it is, will leave at least half of the staff uncomfortable with light levels. The study concluded that "the best way to maximize the benefits would be to provide employees with individual control over their lighting".¹

"Our employees have been quite happy with the controls and the new system. We found that personal dimming was a valuable benefit that they continue to appreciate," said Suvagau. "Normally, when you change the lighting it can be a big deal for people. That was the issue — would they like it? There have been only positive comments on the new system."

Installed-cost comparison: Ergolight surprises as second-lowest-cost

In lighting, a major issue in new construction and retrofit budgets is the upfront, or "first cost," of the lighting. This concern is especially true with Ergolight, which, due to its on-board technologies, can cost several times as much per fixture as the standard parabolic troffers.

However, due to Ergolight's ease of installation and the reduced number of fixtures to be installed, comparing the systems by purchase price per fixture results in an inaccurate comparison. Instead, labor installation costs must be considered with the purchase price (a lighting industry metric called the installed cost) to arrive at the most accurate comparative measure. BC Hydro evaluated all four systems on this basis and found some surprising results.

The standard office lighting system (2x4 recessed deep-cell parabolic louver fixtures with twelve three-inch-deep cells and two T8 lamps) was set as the baseline measurement, with its installed cost set at 100 percent. Surprisingly, Ergolight came next at 132 percent, followed by the Hydro standard (the same parabolic fixtures as above except each had 18 4.5-inch-deep cells) at 154 percent. The Hydro standard plus photocell dimming came in last, at 172 percent.



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1. "Lighting Quality Recommendations for VDT Offices: A New Method of Derivation." Dr. Guy Newsham, Dr. Jennifer Veitch, Research Officers, Institute for Research in Construction, National Research Council of Canada.

BC Hydro’s prime finding is that, without even discussing energy savings, Ergolight is price-competitive with parabolic troffer systems on an installed-cost basis, while providing better lighting quality and, of course, enormous energy savings over the system’s lifetime.

“People look at the sticker price but forget that, with Ergolight’s workspace-specific design, you need far fewer fixtures to deliver the same or better quality of illumination,” notes Suvagau. “Our finding was that, in combination with the product’s ease of installation, it’s less expensive without even taking energy savings into account.”

“The conclusion is that purchasers must look past the initial price to the installation costs. Those who purchase Ergolight end up getting far more features for their lighting budget, for a reasonable price. Also, the product is easier to install than standard suspended lighting systems and comes complete with T-bar hangers.”

Table 2: Lighting system comparison

	Baseline parabolics ¹	BC Hydro standard parabolics ²	BC Hydro standard plus photocells ³	Ergolight ⁴
Installed cost	100%	154%	172%	132%
Quantity of fixtures	525	525	525	195
Energy savings (%)	0	0	15%	80%
Power density (W/ft ²)	1.0	1.0	1.0	0.5
Energy cost (CAD per month)	\$700	\$700	\$590	\$70
Payback period: tenant improvement*	N/A	no payback	42 yrs	1.5 yrs
Payback period: retrofit (T12 to T8)**	N/A	no payback	120 yrs	5 yrs

* The amount of time needed for the recurring energy cost savings to offset the higher first cost of Ergolight compared to the baseline system – also called incremental cost.

** The amount of time needed for the recurring energy cost savings to offset the total installed cost of Ergolight, if the building has an existing lighting system with T12 lamps – also called full cost.

1. The baseline office lighting system composed of 2x4 recessed, deep-cell parabolic louver fixtures with 12, three-inch-deep cells and two T8 lamps.

2. BC Hydro’s corporate office lighting standard consists of 2x4 recessed, deep-cell parabolic louver fixtures with 18, 4.5-inch-deep cells and two T8 lamps.

3. This consists of BC Hydro’s corporate office lighting standard but includes energy-saving photocell sensors.

4. Ergolight is a fully controllable, three-lamp, direct/indirect lighting fixture that features personal dimming, occupancy sensors, daylight dimming, and centralized scheduling and load shedding controls.



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Greatly reduced long-term environmental and maintenance costs

Suvagau observes that Ergolight is environmentally friendly in more ways than one. By reducing the quantity of fixtures, it decreases the number of fluorescent lamps required for re-lamping over the twenty-year lifetime of the system. This, in turn, reduces the amount of maintenance labor time needed for re-lamping and fixture cleaning work. In the Hydro installation, the utility estimates the cost savings in this area at 50 percent. At the manufacturing stage, the reduced quantity of fixtures means fewer materials are required for the lighting system. This means a reduction of up to 75 percent at the manufacturer level in materials required for any particular lighting system. And, of course, the aggressive energy conservation reduces demand, and so lessens the pressure on electrical producers to build new power plants.

Quality luminous environment

Ergolight is a direct/indirect fixture distributing light downwards (direct) to the desktop for task lighting, and upwards (indirect) to the ceiling to reflect off the ceiling and provide a balanced luminous environment. This contrasts greatly with parabolic recessed (in the ceiling) lighting, which sends all of its light downward, leaving the ceiling dark and creating harsh shadows. The result is that the Ergolight fixture delivers higher vertical foot-candles and more uniform lighting throughout the space. According to Suvagau's review, the contrast factor ensures there are fewer glaring reflections on the computer screen. Overall, it's a better visual environment for the office.

BC Hydro's analysis confirms that Ergolight is an aggressive high-quality lighting product that is well suited for commercial office projects in which large-scale energy savings can be reaped. Judging from the utility's installation test, there are plenty of those available.

As Roy Hughes concludes, "Ergolight is an exciting leading-edge technology that delivers major energy savings and employee benefits."

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