Northwest Community College – Conservation Minded Institution

Northwest Community College (NWCC) is a vital educational link for the Northern Interior / North Coast of the province of BC. With a main campus in Terrace and several satellite campuses in neighboring towns and outlying communities, NWCC has established themselves as the major trades-oriented educational institution in the area.

With their prominence in the area and with the local communities, NWCC has also endeavored to be a leader in environmental awareness and conservation. To this end, NWCC has initiated or is initiating several conservation, recycling and sustainability initiatives on their campuses.

Recognizing that lighting systems in an institutional environment represents a significant electrical energy use, NWCC embarked on a study and upgrade of their lighting systems at the Terrace campus. Although their on-site staff have in-depth knowledge of their facilities, the college recognized that the review, design and implementation of such a major overhaul would be better served by employing the use of specialists in the energy saving and lighting fields.

This article details the steps taken by NWCC, the results and benefits of this endeavor, including annual energy savings of over $27,000.

Terrace Campus

Constructed in the mid 1970s, the Terrace Campus facilities of the Northwest Community College consist of 11 buildings, comprising a total floor area of 204,298 ft2. The campus is located on 30 acres of land on a hillside in a residential / rural area above the town of Terrace.

While there had been various minor modifications to the base lighting systems, as well as some energy saving actions taken in the early 1980s, the majority of the lighting systems had remained unchanged since its original installation. As such, failure rates of existing systems were increasing and maintenance costs were escalating.

In addition, the majority of the buildings were constructed prior to the advent of tasks being computerized; as such, many of the lighting systems no longer met the occupant needs.

Energy Conserving Lighting Study and Upgrade

Working in conjunction with the local BC Hydro representative, NWCC entered into an energy study agreement under the Power Smart program.

NWCC sought out a consulting engineering to complete a study of their facilities; including audit of existing systems, design and analysis of energy saving options.

Prism Engineering Limited - a BC based, Canadian owned company specializing in Energy Management - was retained to perform an audit of lighting systems, assess the performance of the existing systems and identify opportunities for improvement throughout the campus facilities.

Detailed lighting audits were carried out that consisted of on-site physical evaluation and systematic review of systems in use in each of the buildings, determination of the various uses and illumination performance against standards, and evaluation of buildings systems performance in terms of energy usage versus various energy saving options. The audits included indoor and outdoor lighting systems for all buildings including dormitories, trades

workshop building, storage and outbuildings, daycare, cafeteria, administration and classroom buildings, and parking / site lighting.

The audit information was then used to determine existing energy consumption, analyze existing lighting systems, review various retrofit or replacement options, design and recommend cost-effective retrofits and carry out controls upgrades. A report detailing the findings of the audit results was presented to NWCC.

Study Findings, Recommendations and Implementation

Lighting systems in use at NWCC Terrace Campus consisted of a wide range of lighting types. These systems varied from recessed or surface mounted fluorescent luminaires using old technology T12 lamps and ballasts in classrooms, offices and administration areas, to Metal Halide "highbay" and industrial fluorescent lighting in trades building training shops and storage areas. In addition, there were incandescent downlights and wall mounted lights in the dormitories.

Exterior lighting also had a range of light sources in use, from old style high wattage Mercury Vapour "cobrahead" lighting in the parking areas, a mixture of High Pressure Sodium and Mercury Vapour buildings perimeter lighting, to incandescent lighting on the centre walkway and along dormitory building entrances and perimeters.

Some interior spaces had been renovated with newer fluorescent lighting systems that used newer technology T8 lamps and in most instances electronic ballasts. However, in several of these renovated areas, luminaires had too many lamps and the areas were overlit.

For the most part, the existing lighting systems were found to be in good physical condition, while the internal electrical components were dated. Many of the ballasts in fluorescent and High Intensity Discharge systems were nearing end-of-life or had exceeded the expected serviceable life.

Improvements recommended included installing controls where lighting is presently operating longer than required, such as in washrooms, lunch rooms, and storage areas; upgrading lighting sources, lamps and ballasts to newer technology options, and retrofitting existing luminaires with more efficient T8 lamps and ballasts.
Fluorescent lamps were replaced with high CRI (Colour Rendering Index) T8 lamps to improve lighting quality and new electronic ballasts were installed to improve energy efficiency. Common retrofits included delamping four lamp luminaires to two lamps and delamping three lamp deep cell parabolic systems to two lamps with use of a reflector to ensure that all cells within the louvre remained evenly illuminated. In some instances, the layout of lighting system was revised to better optimize the systems and to improve the lighting distribution and eliminating low light areas within rooms.

As not all lighting designs are created equal, innovation through the use of available electronic ballast technology allowed for "light tuning" using differing ballast factors. Ballast factor, not to be confused with power factor, is related to the relative light output of the lamp, either raising or lowering the light output by these factors. The result of "light tuning" is that an area with excessive light levels can have lighting levels reduced, with a corresponding increase in savings, and areas with deficient lighting levels can have levels increased; all without replacing the lighting systems, just the internal electronic components. These changes are accomplished without any damaging affect to or any reduction in life expectancy of the lamps.

Existing Metal Halide systems were retrofitted with newer technology Pulse Start Metal Halide (PSMH) lamps and ballasts. The (PSMH) systems have several advantages over older technology standard Metal Halide systems. Complaints with Metal Halide systems is the warm-up time when the lighting is turned on, re-strike time in event of a momentary power failure or brownout condition, and the shift of lamp colours as the lamps age (shifting from white to green to pink). PSMH warm-up time of about three minutes and re-strike times of five to seven minutes are approximately 50% faster than standard Metal Halide, while colour shift over life of the lamp is not normally noticeable to the average viewer. As well, PSMH does all of this with approximately a 20% energy savings.

All Mercury Vapour systems were replaced new PSMH lighting systems or retrofitted with High Pressure Sodium (HPS) lamps and ballasts. To create a consistent appearance around the campus, all exterior lighting on perimeters were retrofitted with HPS light sources, while building entrance light and walkways were converted to PSMH to take advantage of the "white light" source and the increase seeability associated with this type of lighting.

Incandescent lighting systems throughout campus were retrofitted with compact fluorescent lamps and electronic ballasts to avoid the annoying flicker typically associated with the use low cost and low power factor magnetic ballasts.

Occupancy sensors, digital timers, high / low level switching and other controls were installed throughout campus. Existing photocell controls for exterior lighting were checked, repaired or replaced as needed.

Lighting Upgrade Project Benefits

Working with NWCC VP of Finance, Diane Ready, and Manager of Facilities & Maintenance, Cindy Harmel, Prism Engineering produced a specification and the project was tendered in December of 2003. Implementation of the lighting upgrade project began in March of 2004 and was completed in September 2004.

According to Andrew Munro, the lighting designer from Prism Engineering, "there have been many benefits of the lighting upgrades including energy savings, enhanced building aesthetics, improved security, increased occupant comfort and productivity, and reduced operating and maintenance costs".

As the majority of the lighting systems in use are fluorescent light source, the upgrade from the older technology systems has been the most noticeable difference. The higher quality of light output has enhanced "seeability" and created a more pleasant visual environment for occupants. Audible "hum" from older systems have been eliminated.

Occupants generally expressed appreciation of the new lighting.

The new and retrofitted systems installation has a one year all inclusive warranty; as well, many of the new electrical components have product warranties of two to five years. Life expectancy of these renewed systems is upwards of 20 years for major components like ballasts. As a result, NWCC's facilities maintenance personnel and budget can be focused on other systems throughout campus.

As for the “bottom line” – the figures are impressive and speak for themselves.

Pre-retrofit lighting operation represented slightly less than 50% of the electrical energy usage for the campus. Following completion of the lighting retrofit, the annual energy consumption of the lighting systems was reduced from 1,050,000 kWh to 512,000 kWh; a consumption savings of 538,000 kWh – over 50%! This translates into an annual energy savings of $27,323 in consumption and demand costs. In addition, electrical system capacity has been reduced, freeing up 125 kW for future use and expansion, without having to increase or replace existing electrical service.

With total project costs of approximately $276,000, the project payback for energy savings alone is approximately 10 years, with a rate of return (IRR) of 6.1%. If maintenance savings are included, the payback will be improved greatly.

Environmentally, the lighting retrofit has resulted in a reduction of green house gas emissions and the elimination of PCB materials that were present in many of the older magnetic ballasts.

The Future

NWCC is continuing their goal toward system renewal and environmental sustainability on their sites.

Future lighting designs and retrofits at Terrace Campus and other satellite campuses will adhere to a set of lighting standards and design guidelines developed for NWCC by Prism Engineering. These guidelines continue the use of T8 lighting technology and installation of controls.