OKANAGAN COLLEGE CENTRE OF EXCELLENCE IN SUSTAINABLE BUILDING TECHNOLOGIES AND RENEWABLE ENERGY CONSERVATION

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INTRODUCTION

The Centre of Excellence at Okanagan College in Penticton, British Columbia is being designed as one of the most innovative and sustainable post-secondary facilities in the world. On schedule for design and construction to be complete by April 2011, the two-storey multi-purpose facility has a mandate to provide trades and technology training and professional development to students from the province of British Columbia and beyond. It is aimed at attaining the highest standard of sustainable building design, the Living Building Challenge.

The building will support a syllabus with a focus on the design, installation, and support of sustainable building technologies and processes, and the development and application of alternative and renewable energy. The building itself will become an essential element of the educational programs that will reside there, a teaching tool for education on building trades and engineering technologies. In addition, the Okanagan Research Innovation Centre will be incorporated into the building, providing opportunities for start-up companies to develop and prototype new green technologies in a supportive and synergistic environment.

This article will demonstrate that a project with this level of sustainable objectives is achievable at a cost comparable to conventional building design. It will address how this can be attained through an integrated design process, along with the numerous innovative features that have been incorporated into the building design to help it function with a small environmental impact, and a large educational one.

KEYWORDS

holistic design, college sustainability, stormwater management, solar power, green roofs, living building challenge, net zero water, net zero energy

INTEGRATED DESIGN

The project design and construction teams embraced a truly integrated approach, in order to achieve the energy and resource efficiency needed to realize its sustainable objectives. The process started with a design charrette involving the client, architect, full consultant team, and several college and community stakeholders, whose initial input and insights led to a workable model, which was further elaborated over the following months.

Post-secondary facilities provide ideal opportunities for bold sustainable ambitions. Colleges and universities are where new ideas are proposed and experiments embraced, where innovation is given a place to thrive. Furthermore, educational institutions allow several disciplines to interact and overlap, providing opportunity for interdisciplinary growth. The Centre of Excellence is a testament to this thinking, as the pursuit of such a sustainable agenda would not have been possible without broad support from various contributors, including the school's administration and faculty, city officials, the local community, and a diverse range of design, engineering, and construction specialists.

Bringing a Living Building to life requires complete integration of building systems, which in turn relies on a cohesive, integrated design team. CEI Architecture was selected for the project in part because of the reputation of the firm's design charrette. By their very nature, post-secondary projects involve diverse stakeholders—different academic departments, staff, students and faculty, administrators, facility

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managers, and more. The charrette, which took place over three days in June 2009, involved over 40 participants. The process resulted in a workable model for the layout of the building on the site, which became more fully realized as design progressed.

The integrated design team recognized that achieving a facility with net-zero energy and water consumption, as required for Living Building Challenge certification, required a three-pronged approach: conserve, capture, and create.[3] Additionally, the design has to be highly adaptable, so that as time passes, new technologies will easily replace old, ensuring relevance and currency with the changing curriculum. All project features have been designed around these realities.

A TEACHING TOOL

From the outset, Okanagan College was motivated to pursue an ambitious sustainable agenda, based on the thinking that there is no better way to teach and encourage sustainable building practices than to feature the facility itself as part of the curriculum. In this way, the building will practice what the faculty will teach: an integrated, site-specific approach to sustainable building that aims to reduce energy use, conserve water, and mitigate its impact on the surrounding environment.

To enhance the learning experience for its occupants, the building is designed so that all building systems and elements will be easily observed, accessed, and monitored. As a result, the building is a working model of the technologies that will be taught. Its achievement of “net-zero energy, and water” will be confirmed after a thorough audit of one year’s operation under the International Living Building Institute’s (ILBI) Living Building Challenge (LBC) program. To attain this result, architects and designers have taken a multi-faceted approach, as will be seen later in this document.

As an agent for change in green building design, the COE will have two important features. It will be highly adaptable, so that as time passes, new technologies will easily replace old; ensuring that it will remain relevant to and current with what is being taught. The COE building will also promote innovation in green building design and development. An innovation centre, or technology incubator, is included in the COE for entrepreneurs with new ideas for green buildings to test and develop those ideas in cooperation with the faculty and students. The innovation centre will have access to the building for use as a test bed.

CONTEXT

The COE is situated in Penticton, British Columbia, on an existing campus of Okanagan College; itself a geographically distributed learning institution that operates under the direction of the Province of British Columbia within the Thompson-Okanagan Region. In Penticton, the COE will experience a climate that has typically low levels of precipitation, high average temperatures, comfortable humidity levels, short winters, and early spring seasons. Mean daily temperatures range from –1.7°C to 20.4°C, with mean daily minimum and maximum of –4.3°C and 28.1°C, respectively. The area receives an average of 1956 hours of sunshine per year, with 8.9 hours per day between May and August. Penticton experiences an average of 33.3 cm of precipitation and winds are light, ranging from zero to 10 or 15 km/h.[4] The site is located within the City of Penticton, which is situated in a wide valley between two large bodies of clean water, the Okanagan Lake and Skaha Lake.

For environmental management within the building, the location and environmental characteristics afford opportunities for the COE to exploit several green building technologies, including a high performance building envelope, passive solar gain, green roofs, extensive use of natural ventilation and daylighting, enhanced with solar ventilation chimneys glulam-concrete composite radiant wall panels, and prototype sun-tracking light pipes. Energy will be created by open loop geothermal, solar hot water, and a large photo-voltaic array.

THE LIVING BUILDING CHALLENGE

The Living Building Challenge (LBC) was developed by Cascadia Region Green Building Council in 2006 in the Pacific Northwest region of the United States and Canada, and is overseen by the International Living Building Institute. The LBC takes green construction beyond LEED (Leadership in Energy and Environmental Design), and is considered one of the most progressive sustainability standards for buildings today. The Centre of Excellence is registered in the LBC 1.0, which requires the building design to address six “petals”: site, energy, materials, water, indoor quality, and beauty. (The current LBC standard, version 2.0, has slightly adjusted its requirements, and now includes seven categories.) In its ultimate form, a building meeting the LBC will be fully sustainable in all aspects, and have essentially no negative impact on the environment where it is constructed, both during construction and in actual use. The following sections demonstrate how each petal will be addressed.

Site

The site is located within the city centre of Penticton, between industrial/commercial uses to the north and south, and residential to the east. The site is directly in line with the runway of the regional airport 2 km to the south; a 40 m high navigation beacon is located immediately adjacent to the site to the east. To the west is a major highway, with a river channel beyond. The site was previously used as a timber mill. It is a brownfield, located away from all sensitive habitats, and not within the 100-year flood plain. The College is currently negotiating for an equivalent area of land to be set aside for permanent habitat exchange.

The two existing 1980s single-storey buildings on the site prevent the conventional east-west orientation to maximise the benefits of solar gain in the heating season and the control of the same during the summer months. Instead, a north-south

FIGURE 1. Aerial view.

axis is used with a series of classroom/lab/office blocks projecting to the west to maximise the use of north and south light. The articulation of the plan provides a series of semi-public external courtyards that are sheltered from the prevailing north-south winds. This extends the season for their use as outdoor study spaces and provides protection from the prevailing wind and dust for open windows.

The entrance wing to the south forms a gateway to the whole campus, and responds to the other two buildings. It is important that the COE does not unnecessarily dominate the other two existing buildings, thereby making them less desirable to use, and, if this is drawn to its full conclusion, ultimately wasting the materials and energy embedded within the existing building stock. To the north is the gymnasium and human kinetics/fitness suite, with the Okanagan Research Innovation Centre above. This is intentionally located so it may be isolated from the rest of the COE, thereby creating greater flexibility for use by outside groups and better use of the built resources.

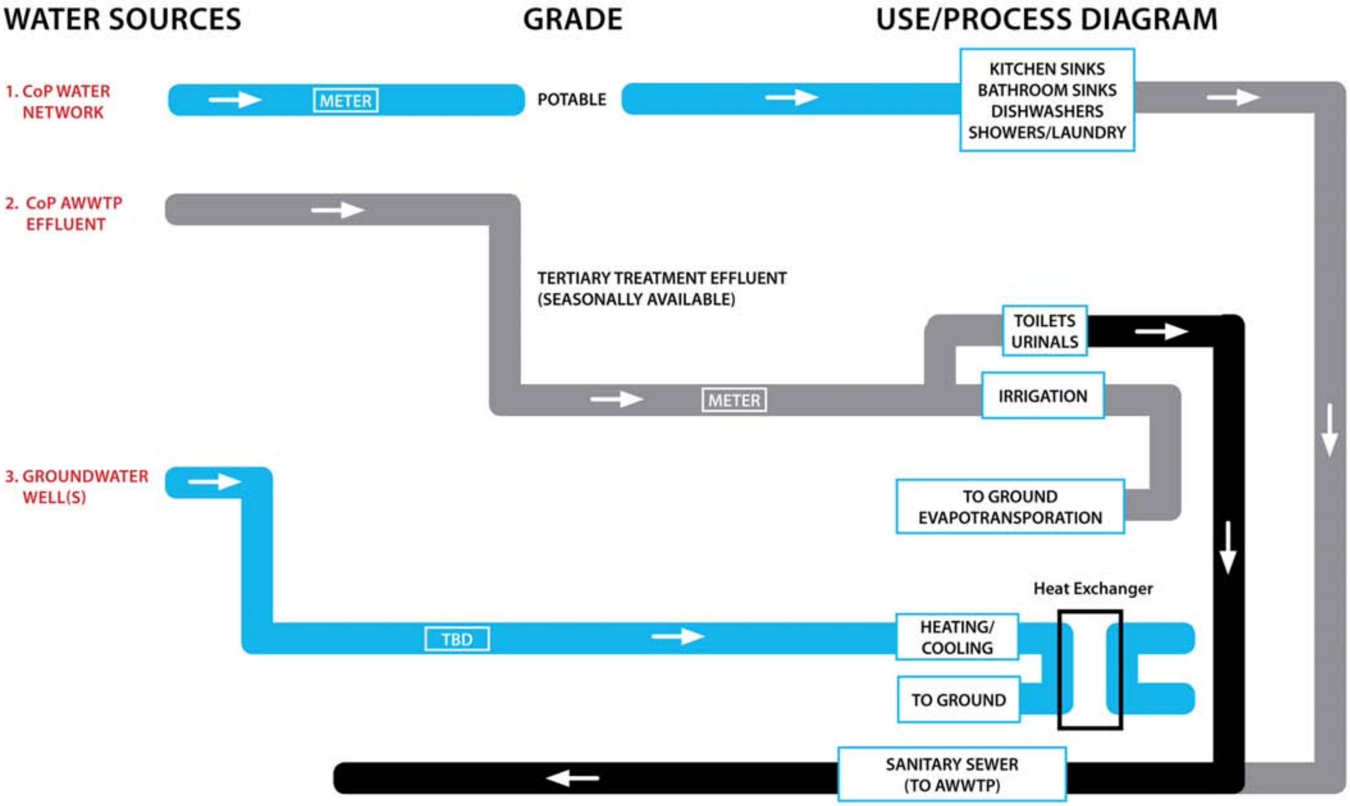
Poor ground conditions exist on site due to layers of peat and fine silt. As the tight timeline for the project does not allow the site to be preloaded, piling is required. Timber piles were originally considered; however, the lack of a suitable preservative treatment compliant with LBC made them an impractical choice, and locally sourced steel piles were selected. To minimise the number of piles used, a lightweight construction is required, which precludes the more traditional solution of using high thermal mass masonry construction to moderate the internal temperature swings.

Water

The project benefits from wide support from students, staff, and the community at large. The City of Penticton has been particularly supportive, and fortunately, the city is currently constructing a state-of-the-art chemical-free wastewater treatment facility (WWTF) in close proximity to the COE. The facility treats wastewater to a higher standard than we might hope to achieve with a standalone facility on our site that is within our budget and without the use of PVC or other red-listed materials. Therefore, all blackwater from the COE is exported to the WWTF, and an equivalent volume of greywater is imported back for toilet flushing, irrigation, etc., as shown in Figure 2.

In addition, a corresponding volume of bio-mass is imported for use as fertiliser on the landscaping within the site, and an equivalent volume of bio-gas is imported, for which we are currently reviewing potential uses. To complete the balance, a quantity of electricity is generated on-site and exported

FIGURE 2. Schematic of Water Use System.



to the grid, to offset the energy used to treat the quantity of blackwater in the WWTF. The use of the municipal WWTF does not meet the LBC's specific requirements for on-site water treatment; however, this does meet the wider mandate for wise use of local resources and avoiding unnecessary duplication, and is therefore considered a pragmatic and acceptable solution by the International Living Building Institute.

Water use for landscape irrigation typically represents 50% of all non-agricultural water use in the Okanagan.[5] For the COE, this is mitigated by the extensive use of xeriscaping: landscaping that uses dry climate plants particularly well suited to the local environment, where little or no irrigation is required. Areas of landscaping with greater water requirements, such as lawns, are limited to specific areas where their use can be maximised and irrigation is done by high efficiency below-ground systems.

The areas of green roof on the COE have shallow soil depths to minimise the load on the roof, and, because they are fully exposed, are prone to drying out. These are exactly the growing conditions experienced in the hills surrounding Penticton: thin, dry soils. The green roofs will therefore be planted with flora indigenous to the area, rather than the more conventional selection of green roof plant material: sedums, aliums, delospermas, etc. This greatly improves the biodiversity benefits of these roofs.

Energy

The target of net zero energy use is a requirement of the Living Building Challenge. Our approach to achieve it is three pronged: conserve, capture, and create.[3] Although located in a semi-arid climate with an average daily temperature of 9°C, there is still a net heating load on the building. Therefore, a high performance envelope is used to conserve heat within the building. Insulation values of R28 and R40 are provided on the walls and roof respectively, and a maximum air leakage rate of 5 $m^3/hr/m^2$ required. Higher values for insulation in the walls and roof could have been targeted, but the design team chose to set realistic modelling targets that allowed for possible cold bridges and air leakage, and to conserve the limited budget for use in more vulnerable areas where a greater return might be achieved.

Since doors are prone to poor air leakage and poor insulation values, the number of external doors in the COE is minimised and, where possible, only single-leaf. All entrance doors have vestibules. Heat loss through the windows accounts for 50% of all heat loss through the external envelope of the COE.[6] To help offset some of this heat loss, all windows and curtain walling are to use argon-filled triple-glazing. High efficiency heat recovery systems will capture heat from the exhausted air to pre-heat incoming fresh air before it is distributed to the building in winter and can be used to pre-condition the air in summer. The building ventilation heat load can be reduced by as much as 80% in the winter.[7]

The uncontrolled growth of plug loads, or parasitic loads, has been a major hurdle for other buildings seeking to achieve net-zero energy use. Fortunately, the aspirations for this building to become an "agent for change" enjoy widespread support from students and staff. It is hoped, therefore, that as a teaching institute using full and detailed energy use monitoring, plug load energy use may be adapted and reduced through ongoing education and competition.

The building will have an extensive metering system in addition to the basic requirements of LEED. The building will be metered at the classroom/shop/office level. Each space is allocated a value for energy use (combining lighting, mechanical, and plug loads), and the users have to manage their own uses to ensure they do not exceed the allocated loads. User behaviour is therefore tied into the way the building functions, with the goal of altering use patterns, and ultimately will help toward the goal of net-zero energy.[8] In addition, a weather station is installed on the existing building on campus to monitor the local micro-climate. The data gathered is used to establish the parameters for the electrical and mechanical systems.[9]

While the heavily articulated building form increases the area of the external envelope, with a related increase in heat loss, by allowing the building to capture winter solar gain, daylight, and natural ventilation, the result is a net benefit to the overall energy equation.

The south orientation of the glazed entrance wing and some of the classrooms allow low-level winter solar gain to be captured, reducing the heating loads on the building. Summer solar gain is shaded by large overhanging roofs and a brise soleil. The capture of daylight and natural ventilation, discussed in more detail below, reduces lighting and ventilation requirements, further reducing the energy demands of the building.

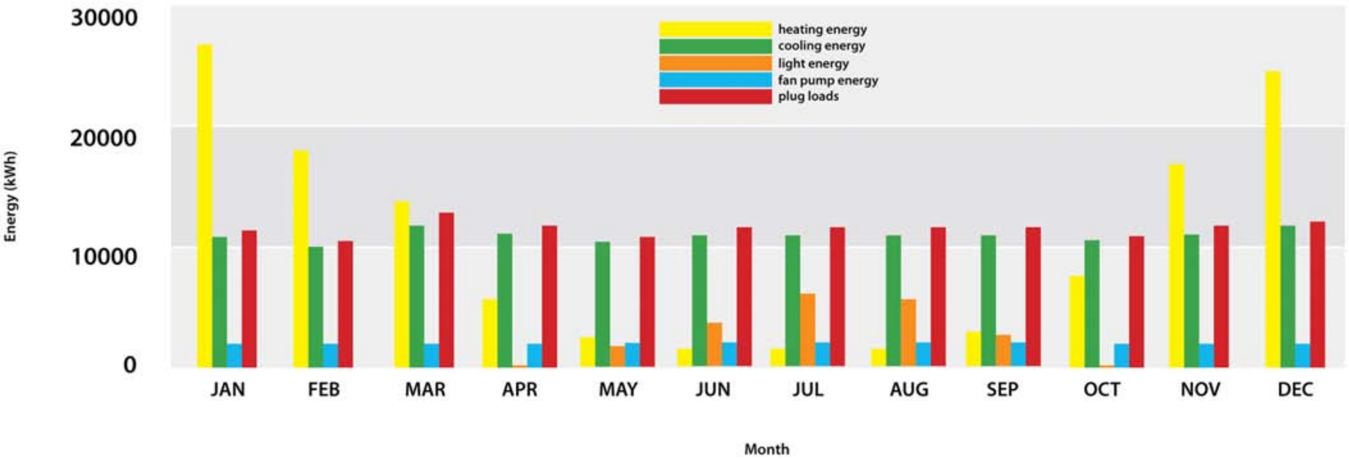
By applying these tried and tested principles in combination with a high performance envelope, winter solar gain, and efficient heat recovery, the peak heating load density for the building is reduced to 30 W/m^2. Using the latest version of IES VE 6.1, including the Beta version of the Vista Pro module, the AME Consulting Group has estimated the annual energy consumption to be 62.6 kWh/m^2, compared to 345.3 kWh/m^2 for a similar conventional building.[10] This very low energy consumption achievement is significant, and allows the building to achieve the zero net energy requirement. The total yearly energy consumption is calculated to be 424,680 kWh per annum. The energy requirements are divided as follows: heating requirements are 28.1%, cooling requirements are 4.1%, fan and pump requirements are 4.6%, lighting requirements are 30.6%, and plug loads are 32.6%. See Figure 3 for division by month.

To balance the net-zero equation, energy for the building is captured from two sources: geothermal and solar. While the strong south-north winds often seem to dominate the flat site, they are not consistent or strong enough to justify the use of wind turbines based on current technology efficiencies. However, the long hours of sunlight Penticton receives do make solar technology suitable.

A large, first phase 258 kW photovoltaic array on the roof will generate an estimated 310 kWh per annum. When there is insufficient light to generate power, typically at night or during the winter, electricity will be imported from the local utility, the City of Penticton. Surplus energy generated during the summer months will be exported to the local grid to achieve net zero or net export balance over the course of a year. This approach avoids the use of batteries, which are not sustainable, as they need to be replaced every three to five years, and require conditioning.

Vacuum tube solar panels are used to provide domestic hot water for the building. This is boosted by electrical power as necessary.

FIGURE 3. Annual Energy Components (kWh).



The basic source of heat for the building is a central ground-coupled heat pump loop. The design employs an open-loop system using groundwater production and injection wells for heat extraction and injection. When surplus heat is available from the vacuum tube solar hot water, it is used to supplement the ground-source heat pump system, further reducing electrical load. Heat recovery from the greywater system, successfully used at the Okanagan College Kelowna campus, is also being considered.

Space heating is provided by radiant heating from in-slab PEX piping. In the summer, the cooler groundwater (close to its natural temperature of 12°C) is circulated through this system to provide free cooling.[11] Thus, the COE uses the thermal mass of the ground as a heat sink, rather than the thermal mass of masonry construction, to moderate the internal temperature.

Indoor Quality

The heavily articulated plan allows daylight and natural ventilation to penetrate deep into the building, thereby minimising lighting and ventilation loads. High ceilings and tall windows maximise light penetration into offices and classrooms. North- and south-facing windows are used, with only small punctured windows facing west where necessary to bring light into darker corners. The west light is problematic for afternoon summertime solar heat gain and wintertime glare. South-facing glazing is more easily controlled with the use of conventional brise soleil, while internal high-level light shelves are used to bounce the light deep into the plan. High clerestory windows throw light into the larger volumes of the gymnasium and workshops. All occupied workspaces within the building are within 9 m of a window offering daylight, views, and natural ventilation.

Where natural illumination is not easily achieved, light pipes bring daylight deep into these spaces. Further to this, the Human Kinetics suite and Innovation Centre use a prototype system (Figure 4) developed by the University of British Columbia that actively tracks and collects sunlight, and ducts it into the deep plan spaces.

FIGURE 4. Sun-tracking light pipes.

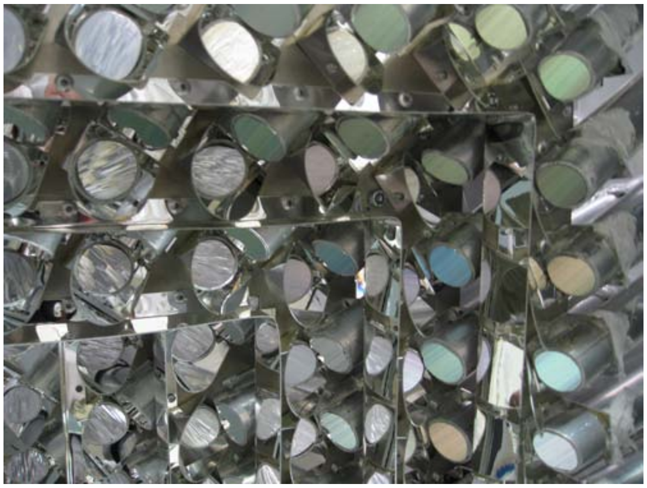
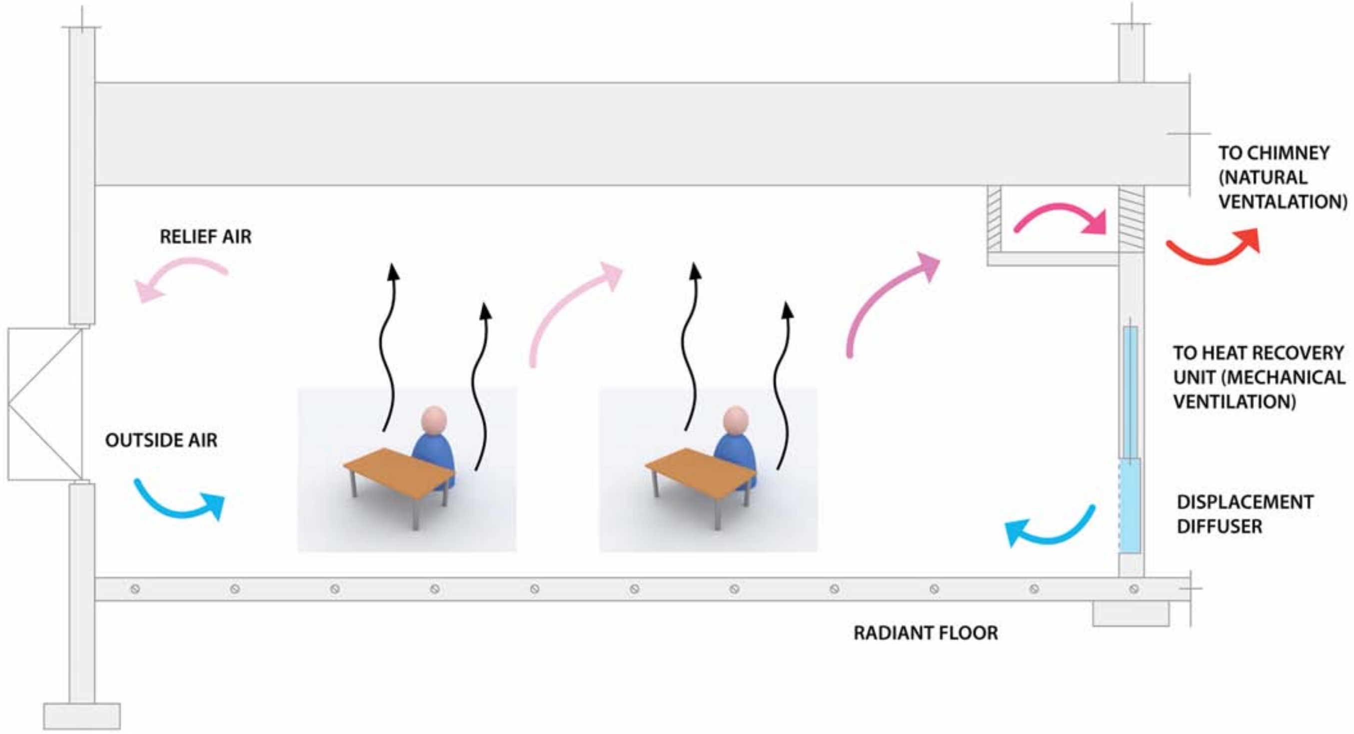


FIGURE 5. Mixed mode ventilation with radiant floor heating and cooling.

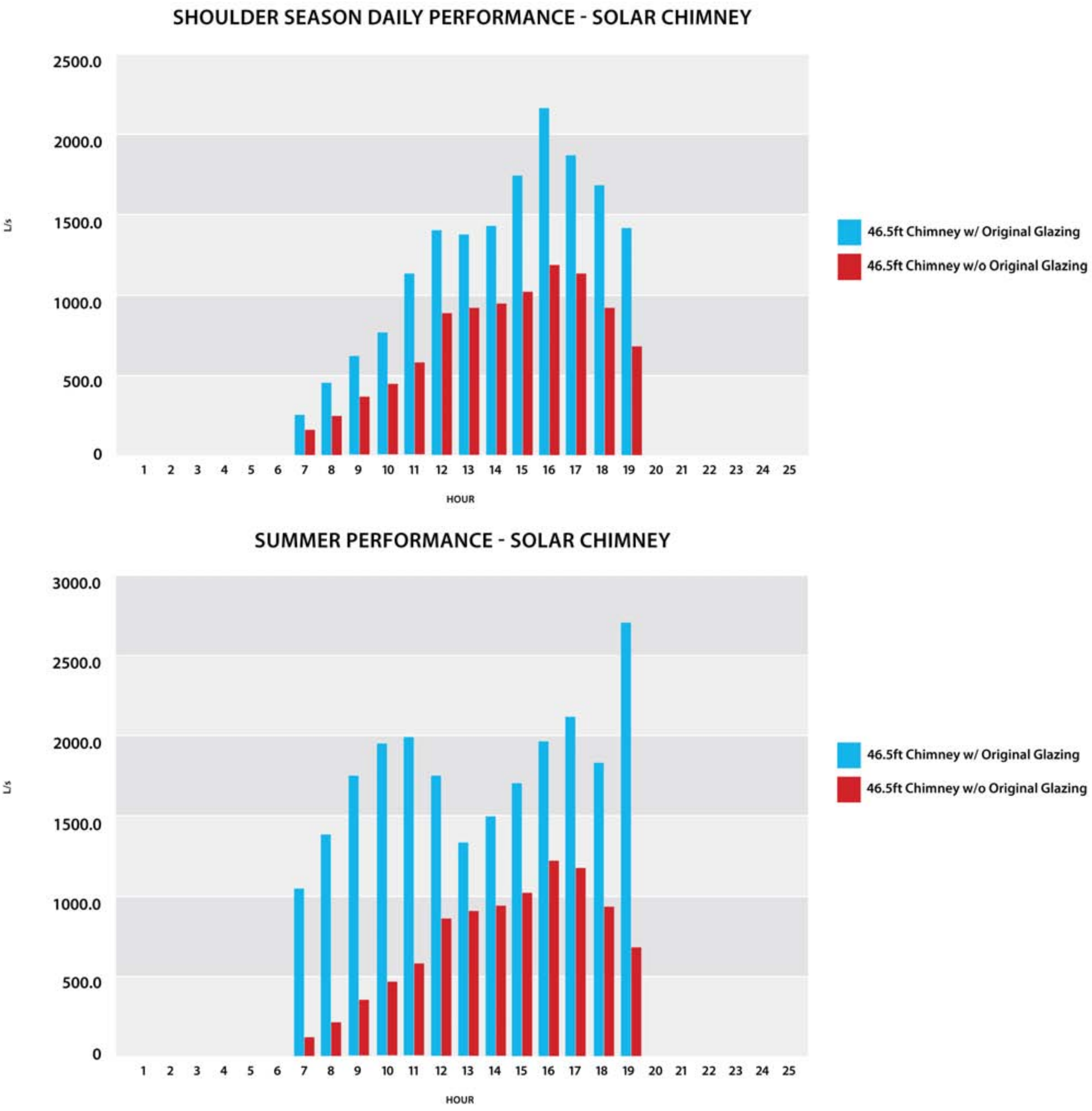


Typically, single aspect opening windows provide natural ventilation to a depth of 6 m into any space, before the air starts to warm and rise above head height. The articulated plan increases the penetration of natural ventilation further into the building, thereby reducing the mechanical ventilation and cooling loads.

A series of five 14 m high ventilation chimneys along the spine of the building are used to boost the natural ventilation. These chimneys use the natural stack effect of warm buoyant air to draw air through the building, creating an estimated natural flow rate of 1000 l/s per chimney at peak conditions (see Figure 5). Optimal periods for the solar chimneys are shoulder seasons (spring and fall) and in the morning and late afternoon during the summer. This ventilation is made possible by the orientation of the chimneys to the prevailing south-north winds, and by the use of glazed panels at low level to utilise solar gain to heat the rising air. At peak conditions the glazed panels alone increase chimney ventilation by as much as 100% during the peak summer months. Figure 6 shows the natural ventilation trends for spring-fall and summer seasons compared to the required ventilation.[12]

When winter and peak summer temperatures make it inefficient to use un-tempered air for natural ventilation, the building will operate in "closed mode." In order to maintain

FIGURE 6. Solar chimney performance.



simple operating systems and reduce costs, all windows are manually operated. Closed mode will be indicated to building occupants by a system of simple red and green lights throughout, as has been successfully used elsewhere.

When the building operates in closed mode, low-level displacement ventilation provides the acceptable background levels of fresh air (in accordance with the requirements of California Title 24, as per ILBI). The displacement ventilation is aided by the higher ceilings and resulting stratification, reducing the heating load on the incoming air.

Displacement ventilation is an able complement to the use of radiant heating and cooling. Both systems provide low level heat and ventilation directly to the occupied zones where they are needed, compared to the more general, larger volume, higher heat of forced air or similar conventional solutions. Furthermore, when the slab is cooled, incoming natural ventilation stays cooler and close to the slab, penetrating further into the building before rising as shown in Figure 7.

Materials

British Columbia is currently facing a major pine beetle epidemic. This small beetle, spreading unchecked due to mild winters, attacks pine trees and kills them by introducing a fungal infection, leaving vast areas of red forest. After two or three years the needles drop and the trees turn grey. In this grey-attack stage the structural value of the lumber significantly reduces. If left un-harvested, the beetle-killed forests will eventually burn, releasing the carbon that has been sequestered over decades back into the atmosphere.

It is estimated that 14.5 million hectares in BC are either red- or grey-stage infected; in some areas over 80% of all pines are beetle killed.[14] So in addition to the widespread environmental havoc this infestation has wreaked, many small BC communities are facing serious economic hardship in the coming years. If left unharvested, the dead trees burn, releasing the sequestered carbon back into the atmosphere. It was therefore clear from the outset that this building needed to respond to the socio-economic and environmental factors of the immediate availability of large volumes of lumber from beetle-kill forests. The project design team has established with the ILBI acceptable parameters for the use of wood harvested from beetle-killed forests.

Once it was decided to use timber-framed construction, BC Code requirements, and the proximity of the airport, dictate that the building be no more than two storeys. The decision to use wood construction results in a relatively low embodied carbon footprint, calculated at 1770 tonnes compared to 2235 tonnes or 3360 tonnes for an equivalent steel- or concrete-framed building, respectively.[15]

Within the gymnasium, the sprung timber floor is not suitable for use with a radiant heating/cooling system in the floor slab beneath, as used elsewhere in the building.

FIGURE 7. Thermal Modelling of Cooling of Classroom Spaces.[14]

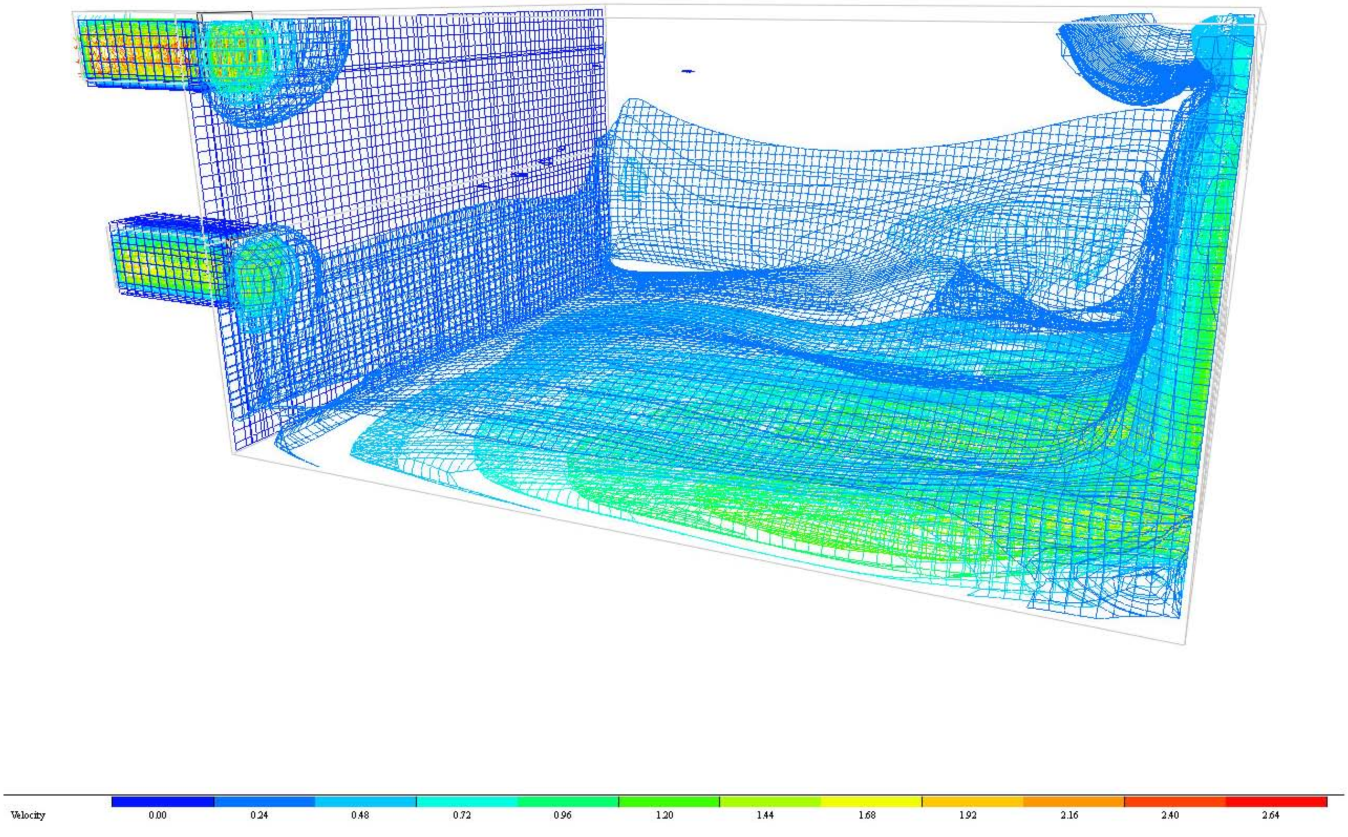


FIGURE 8. Timber-framed construction.

FIGURE 9. Composite Panel Mock-up.

In heating mode, the void beneath the timber floor would form an insulating layer above the radiant system; in cooling mode, the risk of interstitial condensation causing rot within the sprung floor is too great. Instead, a system of pre-manufactured composite wall panels is used.

A 75 mm thick, reinforced concrete panel provides the thermal mass for a radiant heating/cooling system, as shown in Figure 9. The PEX piping is cast, while pressurised, into the concrete panel under factory conditions, and upon delivery each panel is simply plugged into the radiant heating/cooling supply system on-site, and is ready for use. The 3.6 m wide and up to 7.9 m high concrete panels are cast between 175 mm × 266 mm glulam columns, with additional 80 mm × 190 mm glulam reinforcement to the rear face. The composite action of the fixings between the two elements reduces both the structural size of the glulams and the thickness of concrete, thereby reducing the volume of materials used, as well as the weight on the piles. The typical panel will incorporate 2 m^3 of concrete and have an overall weight of 5 tonnes. An equivalent pre-cast concrete panel would be 185 mm thick and use 14 tonnes of concrete, an increase of 280% in the overall weight.[16]

This panel provides an innovative, integrated design solution for the COE, and is believed to be the first use of a composite concrete/glulam system in North America. It may ultimately offer an alternative to tilt-up or pre-cast concrete construction that utilises less material.

The LBC contains a Red List of prohibited chemicals that are commonly found in building materials and known to pose serious health risks. This and the requirements and source materials from within an appropriate radius according to their densities are particularly onerous on the design team. Located in a relatively unpopulated region of North America, many construction products are shipped from the manufacturing belt on the Eastern seaboard or from overseas, both outside of the permitted radii. The presence of Red List substances in many common construction materials further compounds the difficulties of sourcing acceptable products, as does sourcing alternatives to achieve competitive tender prices. Several other projects pursuing the LBC in this region have already chosen not to pursue this petal for this reason. While the design team is still currently chasing these prerequisites, they remain challenging targets.

Beauty and Inspiration

It is not possible to quantify the LBC requirement for beauty and spirit in this paper, nor is it possible to record responses from the users, the wider community, or the architectural society for a building that is still under construction, so such judgment will be deferred to others at a later date.

It is worth noting that in many European countries the need to build sustainably is widely recognized and commonplace. As a result, the desire to make sustainability visually manifest in the architecture is often considered unnecessary. Sustainable architecture in North America still lacks the widespread acceptance it receives in Europe and elsewhere, and could be considered comparable to the European market perhaps 5–10 years ago. Therefore, to promote sustainability as part of its mandate, the COE exhibits its climate adaptations and green technologies in a very public manner.

In response to the desire to celebrate culture, spirit, and place, it was intentional from the outset that local First Nations (Native Americans) building vocabulary would not be directly replicated as a pastiche within the building form or interior design. However, it was also identified that many of their philosophies and design principles are intrinsic to those of the LBC and the building that has resulted. The groundwater heating and cooling makes use of the thermal mass of the ground, just as a recessed Kw'i'ci, a traditional En'owkin winter home, would do. This home would also be carefully located to maximise the warming benefits of the early spring sun. Ventilation chimneys make use of natural convection within the building, just as the traditional smoke vent in the Kw'i'ci would. Using only local materials and resources, and only the minimum necessary, is again inherent to the First Nations culture.

Furthermore, in local First Nations philosophy the four columns of the Kw'i'ci represent the Four Laws of the En'owkin Wheel. The centre of the columns forms a fulcrum between opposites. If stability is lost in one direction, the equilibrium must be restored. Such opposites may include the balance between change and tradition, or actions and their physical consequences or relationships.[17] The strong similarities with the aspirations of the LBC are clearly apparent.

In contrast to beauty and spirit, the requirement for the building to be used to inspire and educate can be clearly demonstrated, and as a primary mandate for the project, is one of the most exciting aspects of the project for the design team. Most sustainable buildings influence their respective societies by example, within the constraints of their primary building purpose. One of the main purposes of the COE is to train the next generation of construction professionals in sustainable technologies and renewable energy. The building will therefore have direct impact on the wider construction industry throughout the region for decades to come. Figure 8 highlights the entrance to the building, which makes a strong statement through its prominent use of glulam wood beams and solar shading elements.

To do so, the building and its systems must be transparent to both students and visitors. The building itself is to be used as a teaching tool. To remain relevant, the design makes generous provisions for experimentation and will be adaptable and flexible to accommodate the inevitable changes in building technology that will occur. The inclusion of the Innovation Centre as a vital link to industry is perceived as a crucial part of the equation.

As an example, the roof contains many of the innovative technologies for the building. Full access for students and visitors to the roof is afforded to the roof by stair and elevator to a viewing gallery that can be used for teaching during inclement weather. Immediately outside is the "Petri dish": an area dedicated to the future testing and study of innovative technologies as they arise both by students and start-up companies within the Innovation Centre. Beyond, a walkway running the length of the roof allows closer inspection of the ventilation chimneys, vacuum tube solar panels for domestic hot water, and photo-voltaic array. To the south a removable section of external envelope allows for the testing of alternate building constructions. All teaching areas of the roof are wheelchair accessible.

FIGURE 10. Main Entrance to COE.

COST

The project is currently under construction and forecast to be on schedule and budget. The estimated total construction cost (hard and soft) for the COE is $27.65 million. This equates to $4065/m^2, which, perhaps surprisingly, is directly comparable to another building recently completed in 2009 by the College, which achieved LEED Gold. Although the figures may be skewed by a depressed market, this is perhaps the most significant result: that a building can be constructed to be fully sustainable yet at no cost premium.

Further, through its design, the COE has many facets that are significant: the COE building will teach and learn, the Innovation Centre will allow for direct technology development and transfusion to influence both the COE and new sustainable design and construction, and the COE will create a learning and teaching environment that is both sustainable and synergistic. While each of these elements in and of themselves are laudable, having them all come together in a single project at reasonable cost will have far-reaching and positive implications for the College and the BC construction industry.

Furthermore, the LBC requirement for materials to be sourced responsibly and from an appropriate radius has generated significant work in the regional community and increased awareness within the construction industry of the lack of locally sourced or manufactured products and the widespread use of environmentally harmful products.

Perhaps the most significant to local economies was the recognition by the College of the devastating impact of the Western pine beetle on the BC lumber industry. Many small forestry communities have been badly affected both economically and socially, while others are threatened by forest fires generated within neighbouring unharvested dead forests.

CONCLUSIONS

The COE, currently under construction, is poised to meet all elements of the LBC, and be very comparable in cost to a conventional building design in the southern interior region of British Columbia. This is perhaps the most significant result, that a building can be constructed to be fully sustainable yet not at a cost premium. Further, the COE through its design has many facets that are significant: the COE building will teach and learn, the Innovation Centre will allow for direct technology development and transfusion to influence both the COE and new sustainable design and construction, and the COE will create a learning and teaching environment that is both sustainable and synergistic. While each of these elements in and of themselves is laudable, having them all come together in a single project will have far reaching and positive implications for the College and BC.

Website: www.alivingclassroom.com

DESIGN TEAM

Client: Okanagan College
Architect: CEI Architecture Planning Interiors
Mechanical engineer: AME Group Engineers
Electrical engineer: Applied Engineering Solutions
Structural engineer: Fast + Epp
Civil engineer: True Consulting
Landscape architect: Site 360
Sustainability consultant: Recollective Consulting
Interior design: CEI Architecture Planning Interiors
Quantity surveyor: Spiegel Skillen & Associates
Construction manager: PCL Constructors Westcoast Inc

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