50 shades of green

The Algonquin Centre for Construction Excellence at Algonquin College in Ottawa is a showcase of sustainable design where real-time monitoring of the building's operations is on display for students and the public. Images: Tom Arban

Located across three campuses in the Ottawa region of Canada, Algonquin College is guided by a lofty mission: "To transform hopes and dreams into skills and knowledge, leading to lifelong career success".

In order to back this up the college provides its student body with world-class facilities. In recent years an ambitious expansion program has seen a number of new buildings appear across three campuses.

One of these is the striking Algonquin Centre for Construction Excellence (ACCE), which explores innovative new environments in skilled trades education. The five-storey 18,020 sq m building (the sixth floor is a green roof) is a hybrid, combining construction trades and technical design programs under one roof.

Like the college itself, there are worthy aims for the building: that it is able to educate and to inspire.

A SHOWCASE OF SUSTAINABLE DESIGN

Designed by Diamond Schmitt Architects in joint venture with Edward J. Cuhaci and Associates Architects, the ACCE is intended as a showcase of sustainable design, where real-time monitoring of the building's operations are on display for students and the public.

"As a living laboratory, the design of ACCE assumes that the building itself is a teaching tool," says Michael Leckman, principal at Diamond Schmitt Architects. "The exuberant expression of green design transforms a trades shop and classroom into a celebration of sustainability."

The landmark building consolidates under one sizable green roof the college's building, design and construction technology programs for 2,600 full-time students. The facility acts as a new gateway for the campus, which is linked by pedestrian overpass to a major transit hub.

'The exuberant expression of green design transforms a trades shop and classroom into a celebration of sustainability'

The ACCE has earned LEED Platinum status, the equivalent of 6 star Green Star.

The building has two principle program and acoustic zones: flexible double-height bays for woodworking, welding, electrical,

Two study pods float over the great hall. Air quality is enhanced through the use of a decoupled ventilation system.

plumbing and other trades teaching, and a five-storey tower with learning labs, laptop classrooms and academic offices configured around an atrium with a 22m high biofilter living wall.

> We imagined the building as a green roof, with a college under it

The two are separated by a student hub space with a café and food court, two hanging-pod study areas suspended over the main entry hall, and a lounge with terraced seating for informal study. A 50mm gap between the two distinct program areas ensures no noise transmission into the academic tower.

Additional unstructured meeting areas that encourage interdisciplinary interaction include a grass-covered amphitheatre on the roof.

The glazed two-storey lobby and main entrance connects pedestrians arriving from different directions, and both are focused on the large second-floor café.

"As students progress with their studies here, we look forward to entering into an exchange with them about the design of the building and the choices that went into creating ACCE," says project architect Michael Leckman, principal at Diamond Schmitt Architects.

"I can't imagine a more appropriate or inspired setting in which to learn the building trades than this facility."

ENERGY

The building is designed to use 68 per cent less energy in operation as compared to Canada's Model National Energy Code for Buildings (roughly the equivalent of Australia's National Construction Code).

Heating and cooling are delivered primarily through a hybrid hydronic heat-pump system. A make-up air unit with heat recovery serves an independent CO_2 sensor-controlled ventilation system.

Hybrid heat pumps are able to take the advantages of a distributed heat pump system in cooling mode, as well as the advantages of fan coils in heating mode, yielding higher seasonal efficiency, as compared to either system on its own.

Other energy-reduction strategies include a high-efficiency building envelope, radiant heating, extensive green roof and reflective surfaces to reduce the heat island effect, innovative daylighting solutions, solar shading, solar thermal energy, the biofilter wall, high-efficient LED and compact florescent lighting fixtures and a building automation system.

INDOOR ENVIRONMENT QUALITY

The biofilter wall is a focus of the atrium, and part of the experience of the common spaces. It also plays an active role in the air system, filtering undesirable VOCs and CO_2, improving indoor air quality.

This ecosystem cleanses inside air through a natural processing of airborne contaminants through the exposed root system of a mass of tropical plants. It produces no toxic waste, and reduces energy consumption by recycling inside air rather than drawing air from the outside, which has to be heated or cooled depending on the season.

The biofilter is connected directly into the air handler for distribution throughout the building.

A return bypass is provided to allow regeneration or servicing of the biofilter wall, as well as the management of humidification.

Materials and finishes were selected to limit the impacts on the indoor environment. Only low-emitting wood, carpet, paints, adhesives and sealants have been used.

More than 85 per cent of the roof surface is covered by sedum that has self-irrigating felts, to create a broad extensive green roof.

Air quality is enhanced through the use of a decoupled ventilation system. The ventilation system is controlled by levels of CO_2 in the air. It delivers outdoor air as required to maintain healthy levels, independent of the need for heating or cooling.

> It was a collaborative process, guided by the builder, and using 'triple bottom line principles' – that is to say, balancing social benefit, environmental benefit, and profit

CO_2 sensors cause variable air volume boxes to open and allow more outdoor air to be delivered when CO_2 levels are elevated.

A LIVING LABORATORY

The ACCE is meant to be an instructional tool in and of itself. Exposed structure, ductwork, plumbing, piping, electrical services and lighting, together with wall and floor assemblies are revealed in place, as well as in "cut-away" sections.

"The living laboratory features are experienced as central to the design concept, not just as peripheral elements," Leckman says.

"The structural, environmental and energy performance of the building is monitored and displayed on LCD screens, allowing students and the public to understand the invisible forces and processes at work in this precisely tuned instrument of technical and skilled trades education."

Ecolibrium chatted with Michael Leckman, principal at Diamond Schmitt Architects, which designed this arresting building.

Ecolibrium: Could you talk about the design process and concept for the ACCE – it's been described as s a "crossroads", but also as a living laboratory and an exuberant expression of green design.

Michael Leckman: ACCE is a crossroads in many ways. It is a node in the network of pedestrian bridges and student spaces at the intersection of the college with the transit systems.

It is a common social space and dining area between the trades and technical education. It is at the intersection of interior study spaces and exterior landscapes; and it signifies a major expansion of the college across a previously impassable eight-lane highway.

We combined all these elements by focusing on successful student spaces, connected to the outdoors and to nature, brightly lit, acoustically tuned, and with precisely orchestrated ranges of social interaction.

Eco: Is this a building where form follows function?

ML: Yes and no.

Once the general arrangement of spaces and volumes were understood, and the functional requirements met, we sought to express the college's higher-level objectives. The focus on triple-bottom-line sustainability in their curriculum, management practices and future planning was very clear, and inspiring.

In response, we imagined a large green roof to be a practical and symbolic element in the design.

We saw this ribbon taking the form of a continuous plane that could be seen in two ways: first, beginning near the entrance, tilting and terracing along the way, sloping up to the third floor and leaping up to the sixth-floor roof, a continuous landscape, fulfilling the biophilic principles aspired

The 22m high biofilter living wall is a focus of the atrium, shown here, and part of the experience of the common spaces.

The building is planned around social spaces that encourage interaction.

to in the brief; the second, subtle adjustments applied to a large form, done to allow the green roof to be seen from eye level. We imagined the building as a green roof, with a college under it.

> I can't imagine a more appropriate or inspired setting in which to learn the building trades than this facility

As we developed the roof in its context, we also discovered that it was visible from a prominent highway to the north; the shaping was adjusted to ensure the college was an unmistakeable presence from these long-distance views.

Eco: This seems to be a building that has eschewed "green bling", but has the fundamentals such as orientation, natural light and façade performance right.

ML: The site, offered to the college by the City of Ottawa was previously an artificial mound screening a large regional bus stop – a berm, in other words.

The client's program of 19,000 gross sq m and tall 9m-high trade shops nearly filled the entire site.

On the east of the site, and constructed as part of the project, is a tunnel for a future light-rail transit system. So orientation was a given. The site was filled to capacity.

In order to achieve the college's minimum requirement of 60 per cent better than the Model National Energy Code for Buildings, fundamentals were crucial.

This included using the site's given orientation in the best ways possible. First, to position a prominent entrance and drop-off, next to provide convenient servicing and loading, locate skylights and solar-shaded areas of generous glazing, and fine-tuning solar shading and natural ventilation.

Getting the fundamentals right demands the use of super-insulating the walls and roof, with R32 and R50 as well as using R8 triple glazing.

The glass itself has a very low solar heat gain coefficient, but in addition we managed cooling loads with sun shades and ceramic fritt.

Eco: How effective is the biofilter living wall?

ML: Biofilter walls treat air as a first step in the return-air system. Microbial life in the root systems filter-out pollutants and toxins.

Alan Darlington of Nedlaw Living Walls designed the system, and was previously contracted by the Canadian and European space agencies to develop air purifying systems for living in outer space.

Testing done on the biofilter wall has shown that up to 35 per cent of return air is filtered, and that fan energy is reduced by 21 per cent.

ACCE has, as part of its academic program, installed sensors in the Biofilter wall to validate the claims.

Eco: How closely did you work with the mechanical engineers and ESD consultants on the project?

ML: As ACCE was designed during a three-month design-build competition, architects, engineers, energy modellers, landscape architect, schedulers, LEED consultants and builders met in the contractor's office for 10 hours every week to discuss and develop strategies that would meet the client's brief, meet the design objectives, achieve the energy goals, and work within the budget.

It was a collaborative process, guided by the builder, and using "triple bottom line principles" – that is to say, balancing social benefit, environmental benefit, and profit.

A green roof of at least 50 per cent of the roof area was mandated by the client's brief. It was our decision to increase that percentage and develop our design concept around the practical and symbolic importance of the roof.

The brief also discussed the need to visibly apply "biophilic" concepts. We understood these concepts as the seamless integration of landscape as a continuity of interior and exterior spaces.

ALGONQUIN CENTRE FOR CONSTRUCTION EXCELLENCE AT A GLANCE

The professionals

Architect: Diamond Schmitt Architects in joint venture with Edward J Cuhaci and Associates

Civil engineer: Delcan Corporation

Commissioning: Doug Cathcart

Electrical engineer: Goodkey Weedmark & Associates

Energy simulator: Halsall Associates

Facilitator: Halsall Associates

General contractor: EllisDon

Geotechnical engineer: Colin Alston

Landscape architect: Gino J. Aiello landscape architect

Mechanical: Goodkey Weedmark & Associates

Sustainable design: Halsall Associates

Structural engineer: Halsall Associates

Energy-conservation features

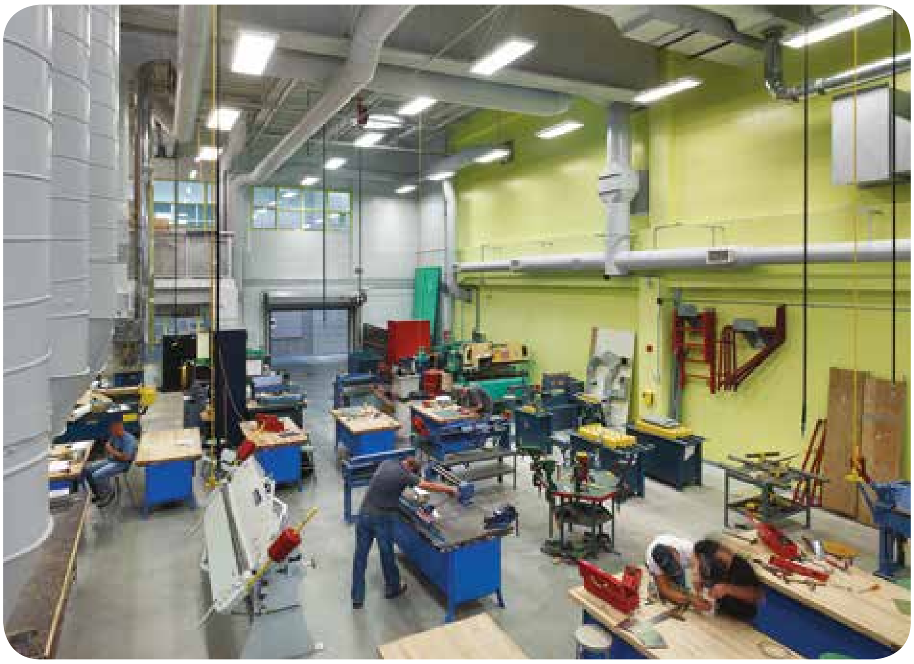
- Biofitter wall
- Demand-control ventilation
- Heat-recovery ventilation
- High-efficiency mechanical equipment
- High-performance building envelope
- Integrated control system for lighting, daylight and shading
- Siting and orientation
- Solar photovoltaics
- Solar hot-water collector

Exposed structure, ductwork, plumbing, piping and electrical services are revealed in place.

In our imagination, we saw the building as an extension of the ground plane and its landscape, sloping to the sixth-floor roof, and then extending downward and inside the building with the five-storey high biofilter wall.

Heat pumps were an interesting choice, as the space they occupy on a floor plan is significant, and they are usually associated with hotels and condos, not college buildings.

But as the mechanical engineer accurately predicted, and the energy model proved, heat pumps used every quantum of energy more effectively than any other system. With heat pumps, and 95 per cent efficient heat-recovery wheels, we targeted 60 per cent better than the Model National Energy Code Building, and actually achieved 68 per cent.



One of the workshops.