Canadian Consulting Engineering Awards 2021
STEM Building – University of Ottawa
Bouthillette Parizeau

Synopsis

The University of Ottawa's goal for the STEM building was to create an innovative space that fosters collaboration and creativity between disciplines expertly designed to offer research, teaching and entrepreneurial development. For this project, energy efficiency was at the heart of every design decision. The mechanical and architectural design innovations lead to the achievement of LEED® Gold certification. Despite very tight deadlines, the building is now the standard for high-performing buildings, satisfying the University's requirements.

8580 de l'Esplanade Avenue, office 200, Montreal (Quebec) H2P 2R8 | (514) 383-3747 | (514) 383-8760_fax | www.bpa.ca

Q. 1 Innovation

The appeal of the STEM complex is in the way that it supports modern and innovative education. It applies integrated and interdisciplinary approaches through the use of flexible classrooms, and 18 state-of-the-art laboratories covering the entire spectrum of science and engineering — always with an emphasis on collaboration between departments.

The building, now the largest on campus, covers an area of approximately 30,200 m^2 spread over nine levels. For this building, the University wanted the mechanical and architectural concepts to reflect the latest innovations in educational institutions. These innovations became the most illustrious features used by the University to promote a new kind of research and way of teaching.
The mechanical system designs were based on the latest developments in energy efficiency. The heating water and chilled water were designed to be supplied by the University's central plant, not by its steam network, as it was found to be aging and inefficient. The leading-edge mechanical systems used in this building allow an annual energy savings of approximately 37,400 GJ (or 53%) compared to ASHRAE standards. Futhermore, natural gas consumption is reduced by 30,970 GJ, which represents approximately 1,550 tCO2e / year, or the equivalent of 457 vehicles taken off the road.

Occupancy detectors were implemented to modulate the lighting during unoccupied periods, despite the installation of already very low intensity lighting of 0.4 W / ft^2. The installed heat recovery chillers significantly reduce heating consumption by offsetting the energy drawn from the University's central plant.
The installation of an independent controls system that allows the precise control of fresh air intake provided significant energy savings since it accurately controls the amount of air circulating throughout the building and reduces it based on occupancy. This system uses an innovative dual-duct terminal units with, on one side, the conditioned air controlled by the thermostat, and on the other side, the outside air controlled by CO_2 sensor and occupancy sensor. This system supplies the precise amount of air required in each room and superior air quality while significantly reducing energy consumption.

Lastly, an adiabatic humidification system significantly reduces consumption since the water is introduced directly into the air, without producing steam.

On the architectural side, large open and bright spaces combined with a highly energy efficient building envelope, provide increased comfort for the occupants.

Q. 2 Complexity

The uOttawa STEM project was quite a challenge, as it needed to integrate eco-friendly systems in a complex that includes various modern spaces each with their own function and use — such as classrooms, offices, laboratories, common rooms and collaborative areas. The design team rose to the challenge achieving LEED® Gold certification, which is quite an achievement for such a large-scale building with several state-of-the-art laboratories and multi-purpose spaces.

The foremost challenge of this project was designing a complex that made sustainable development its highest priority, with every decision centered on the latest innovations in green buildings. The central concept is an innovative new-type dual-duct ventilation system that allows precise control of fresh air intake in high occupancy spaces.

With this system, the first duct provides air conditioning (like a single-duct system), while the second is used only to introduce outside air into the rooms based on actual occupancy rates, as monitored by presence detectors and CO_2 probes. Finally, recovery chillers heat the various spaces using advanced control sequences and programing. By not heating or cooling unoccupied spaces, the energy savings are also substantial.

The other challenge in bringing this building to life was the accelerated project schedule. The design of the entire state-of-the-art facility had to be completed within nine months. Having to connect both the chilled water and heat recovery chiller to the existing central network without interrupting operations presented significant challenges in terms of engineering and work planning, making the timely delivery of this fast-track project quite a feat.

Q. 3 Social and/or Economic Benefits

The University of Ottawa is unique for its proximity to Canada's parliament buildings as well as its involvement in research and development with other Canadian institutions. The goal of the new Science, Technology, Engineering and Mathematics (STEM) building is to transform graduate and post-graduate education by combining several faculties within technologically advanced collaborative spaces.

There are five major open-concept spaces where students, faculty and researchers can come together to invent, explore and design. They foster brainstorming, experimentation, prototyping and commercialization. Classrooms with interchangeable layouts, leading-edge laboratories and modern spaces are only some of the features that promote learning for the 11,000 attending students. The exceptional energy efficiency of this building not only reduces the University's carbon footprint, which will have long-lasting impacts, it also significantly reduces its operating costs, allowing the University to further invest in research and education.

The benefits of the STEM complex extend far beyond the University of Ottawa. This building brings together under one roof several science and engineering faculties, making this interdisciplinary approach the very source of innovation and knowledge-sharing. The campus wants to promote partnerships with industry leaders as well as marketing through the Entrepreneurship Hub. This will transform research discoveries into innovations for the public, and will provide advantages to businesses in the region.

4 Environmental Benefits

The project qualifies for a LEED® Gold Canada-NC certification, a program that recognizes a building's environmental performance. To achieve this, the project was designed using a sustainable development approach, paying particular attention to material choices, construction waste management, pollution prevention, air quality, as well as water and energy consumption reduction throughout the life of the building.

The building was designed to be modular and compact, to not only ensure its longevity but also to make sure it can be repurposed for many different uses throughout its lifecycle. The building envelope itself is very high performing and provides both optimal comfort for the occupants as well as exceptional energy efficiency.

The energy recovery strategy developed for this building was optimized to reduce fossil fuel consumption to a minimum. When the building produces excess heat, the energy is released into the campus' heating network, increasing the campus' overall efficiency.

The indoor air quality is constantly measured and controlled using a dedicated fresh air supply system, thus promoting high-energy performance while maintaining a healthy environment for the occupants.

The project connects to the City of Ottawa's public transportation network through outdoor walking paths, but also through a corridor connecting to the Marion Building and to Ottawa's new light rail transit system.

Q. 5 Meeting Client's Needs

The University of Ottawa is a renowned educational and research institution overlooking the Rideau Canal in the heart of Canada's Capital. The University's objective with the construction of the STEM building was to take advantage of the unprecedented growth of its science and engineering faculties by freeing up obsolete and end-of-life spaces and grouping them together in a multidisciplinary research, teaching and entrepreneurial development centre. The complex therefore integrates the faculties of science, technology, mathematics and engineering under one roof to provide an environment that fosters exchange and interaction.

Positioning itself as a leader in the country in terms of sustainable development, the University aimed for and achieved LEED® Gold certification. As energy efficiency was a priority on this project, all opportunities for energy recovery were exploited in order to reduce the carbon footprint.

To meet the federal government's funding requirements, the entire project — from planning and design to construction and close-out — was completed in just under 24 months. This was an extremely tight timeframe considering the size of the project. The design had to proceed at the same time as the construction, but the challenge was met with overwhelming success by all!