## LEARNING. LIVING. LEADING.

State and a state

6 MILLY

# THE JOYCE CENTRE FOR PARTNERSHIP & INNOVATION

AN INSIDE LOOK AT MOHAWK'S NEW ZERO-CARBON BUILDING.

netzeromohawk.ca

In l.



COLLEGE



## **FROM THE PRESIDENT**

e are thrilled to celebrate the opening of The Joyce Centre for Partnership & Innovation at our Fennell Campus.

It was less than two years ago, in October 2016, that we broke ground on this one-of-a-kind net zero energy project, and just last week we welcomed new and returning students.

The Joyce Centre will bring learning and applied research together under one roof in a living lab. Students will have full access to all seven levels of this building, from the basement mechanics to the solar panels on the roof, so they can learn how to operate, maintain and monitor a zero carbon building. The real-time energy performance of The Joyce Centre will be visible on dashboards to all users and visitors.

They will work alongside our industry partners, who are developing new technologies, solutions and best practices for a future in which zero carbon buildings are the standard.

This building is the next step in Mohawk's commitment to and leadership in sustainability and it came out of the dedication of internal leaders and innovative external partners who brought an ambitious vision to life.

We look forward to welcoming more industry partners and the entire community to this record-setting and award-winning showcase of environmental sustainability.

Regards,

Ron J. McKerlie, President



# Learning. Living. Leading.

The Joyce Centre for Partnership & Innovation at Mohawk College incorporates leading-edge energy harvesting and conservation technologies and techniques. At 96,000 square feet, the award-winning \$54-million centre is Canada's largest, and Hamilton's first, zero carbon institutional building.

## Seven Storeys of Learning

Learning is not limited to the Centre's labs. Students will have access to every level of the building, from the solar thermal array on the roof to the mechanical room and the sub-basement water room. Students will get hands-on learning in how to operate, monitor and maintain a zero carbon building.

The Joyce Centre for Partnership & Innovation will also serve as a demonstration site for industry partners looking to adopt zero carbon technologies into commercial, industrial and residential buildings.

Partners will work alongside students and faculty on applied research projects, with a special focus on the generation, distribution and storage of renewable energies.



## **SUSTAINABLE** INNOVATIVE LOCAL

Net Zero design leadership rises from Hamilton's industrious roots at The Joyce Centre for Partnership & Innovation, Mohawk College

**mc**CallumSather ARCHITECTURE ENGINEERING INTERIORS

@mccallumsather | 905.526.6700 | mccallumsather.com

## We Build On Great Relationships

EllisDon is proud to be a part of the collaborative team delivering the Joyce Centre for Partnership & Innovation, Canada's largest zero carbon institutional building.

Over 1,900 solar panels installed across Mohawk Fennell Campus powering The Joyce Centre.

mcCallumSather's The Joyce Centre team, Kevin Van Hartingsveldt. Project Manager, Grant Taylor Construction Admin Lead, Joanne McCallum CEO

EllisDon



CHAMBRE DES COMMUNES CANADA

### Ottawa

648-S Centre Block Ottawa, Ontario K1A 0A6 Tel.: 613-992-1034 Fax: 613-992-1050

### Constituency 1686 Main St. W., Unit 4 Hamilton, Ontario L8S 0A2 Tel.: 905-529-5435

Fax: 905-529-4123



Filomena Tassi

Member of Parliament/ Députée Hamilton-West-Ancaster-Dundas

Ottawa 648-S Édifice du Centre Ottawa, Ontario K1A 0A6 Tél.: 613-992-1034 Téléc.: 613-992-1050

Circonscription 1686, rue Main ouest Unité 4 Hamilton, Ontario L8S 0A2 Tél.: 905-529-5435 Téléc, 905-529-4123

### Mohawk College,

Congratulations on your historic accomplishment with the completion of The Joyce Centre for Partnership & Innovation. I am proud that the largest net-zero energy use building in Canada lives right here in our hometown of Hamilton!

power source.

This exciting addition to our city will allow engineer and technology students to come together to create research support in health, energy and technology. I am eager to see how our community will continue to lead the charge on research and technology and with the resources in this Centre.

This facility will serve as inspiration for what can be achieved in science and technology through new solutions that will be created here at home.

Thank you Mohawk College for the innovative vision you are providing to our students, while making Hamilton an environmental leader.

Congratulations!

filmere Tim

Filomena Tassi

This state of the art building is Hamilton's newest and most innovative structure, generating its own clean-reusable energy, while using it's own main

## LEADERSHIP

In May 2018, EllisDon published 'The Journey to Net-Zero', an industry report detailing lessons learned during construction of The Joyce Centre for Partnership & Innovation. EllisDon is the world-leading construction and building services company behind the construction of The Joyce Centre for Partnership & Innovation, Canada's largest, and Hamilton's first, zero carbon institutional building. Following is an excerpt from 'The Journey to Net-Zero'.

Mohawk College's The Joyce Centre for Partnership & Innovation was selected by the Canada Green Building Council (CaGBC) as a national pilot project to demonstrate its new net zero energy carbon standard and validation process.



Within this standard, a zero carbon building is defined as one that is highly energy-efficient and produces onsite, or procures carbon-free, renewable energy in an amount sufficient to offset the annual carbon emissions associated with operations.

### **Requirements for achieving the Zero Carbon Building** Standard certification are:

- **1.** Demonstrate zero carbon balance
- 2. Provide zero carbon transition plan where fuels other than zero emissions biofuels are used onsite
- **3.** Install minimum of 5% onsite renewable energy
- 4. Achieve thermal energy demand intensity target
- **5.** Report energy use intensity
- 6. Report peak demand
- 7. Report embodied carbon

In May 2017, Canada Green Building Council was the first Green Building Council to launch a dedicated Zero Carbon Building Standard, making carbon emissions the key indicator for building performance. Developed through extensive consultation with representatives from over 50 industry organizations, utilities, governments and companies across Canada. CaGBC is also working with 16 of Canada's most sustainable projects in the Zero Carbon Building Pilot Program, which will inform further development of the standard and accompanying resources and education.

Over the past 15 years, interest in green building design has gone mainstream, in part due to the effectiveness of rating systems such as LEED that have educated the market and guided building processes. Industry-leading construction companies now have the experience and expertise needed to deliver a green building to clients, on time and on budget.

The market is about to change as we find our way in the emerging low-carbon economy. We are at a crucial time in the global energy efficiency market where designers, developers, and property owners are being challenged to do more as Canada strives to meet the United Nations' goal of reducing GHG emissions by 80% (below 1990 levels) by 2050.

New buildings and infrastructure projects will need to find ways to meet these targets, but there is no single solution. Most recently, the CaGBC has expanded its portfolio beyond LEED, launching its Zero Carbon Building Standard.

We are now moving to design and build projects that can generate as much energy on-site as they consume annually. These "Net Zero Energy" buildings are not meant to be a one-size-fits-all solution for the market, but they do offer a leadership target for the market to aspire. For example, a tall office tower in downtown Toronto would find it very difficult to achieve net zero energy (there is just not enough space for on-site energy generation), but the design principles used to achieve net zero energy on projects, such as Mohawk College's The Joyce Centre for Partnership & Innovation, can be used to influence design to meet hyper-efficiency targets for tall tower buildings.

All project proponents need to be brought to the table very early in the planning stages through an integrated design process. This process must include experts in intelligent building systems and facility management to prepare for operations and energy demands. This is especially true of buildings targeting aggressive levels of hyper-efficiency. The market has been discussing the need to adopt an integrated design model for years, but now we need to put these interests into practice.



Canada's first institutional project to earn CaGBC's Zero Carbon – Design certification!

Learn more about Canadian Zero Carbon innovation at cagbc.org/zerocarbon









### The Joyce Centre for Partnership & Innovation – Mohawk College

August 2018

It gives me great pleasure, on behalf of the City of Hamilton and members of council, to congratulate Mohawk College on the completion of the Joyce Centre for Partnership & Innovation, Canada's largest, and Hamilton's first, zero carbon emission institutional building.

The efforts taken to enhance the learning environment at the Joyce Centre are truly remarkable and will see both students and faculty learn and create in the facility for generations to come.

Hamilton is rapidly becoming a leader in utilizing green technology, and the opening of the Joyce Centre will see our city become an even bigger player in the field of sustainability, establishing a leading example for future buildings within our community.

I would like to recognize the entire planning committee that made this building possible, including college staff, architects, contractors and suppliers, all of whom worked tirelessly to bring this incredible facility to completion. You are to be commended for your collaboration and leadership which made your vision of creating a building of the future a reality.

Yours Sincerely,

Fred Eisenberger Mayor





BOB BRATINA, MP HAMILTON EAST-STONEY CREEK

The Joyce Centre has further elevated Hamilton's reputation in Canada for the quality we offer to students seeking post-secondary education. I'm personally proud that so much of this project was imagined, developed and carried out by so many of our own people and local companies.

I'm also proud that our Government made the single largest federal infrastructure funding contribution in the 50-year history of Mohawk, a \$20 million investment.

Not only will students benefit, the applied research activity will have a positive impact throughout Canada and indeed the entire world. Well done Mohawk!

Sincerely,

BB Bratina

Bob Bratina M.P. Hamilton East-Stoney Creek





## **A NET ZERO BUILDING AND POSITIVE TEACHING TOOL**

B+H is proud to contribute to Mohawk College's vision of becoming a leading environmentally, socially, and financially resilient institution.

A new paradigm for sustainable building and learning in North America, the Joyce Centre for Partnership & Innovation is not just a lab building, it is also a teaching tool for students, training them to deliver a more sustainable future.

To learn more visit www.bharchitects.com and www.mohawkcollege.ca



тонашк

Congratulations to Mohawk College on the opening of Canada's largest zero carbon institutional building.

Contract Glaziers Corp. is incredibly proud to be part of The Joyce Centre for Partnership & Innovation team.



The leader in custom building envelope solutions. www.contractglaziers.com

CONTRACT GLAZIERS CORP. 620 SPRUCEWOOD AVE. WINDSOR, ON N9C 0B2 P: + 519,969,1740





Xarina Aould Member of Parliament

Burlington

I am honoured to recognize one of Canada's institutional leaders in reusable energy, Mohawk College, in the opening of The Joyce Centre for Partnership & Innovation - Canada's largest and Hamilton's first zero carbon institutional building.

The Government of Canada is adamant on protecting and conserving our natural heritage, and ensuring a clean, safe and sustainable environment for present and future generations. We are working towards managing and reducing waste by managing the chemicals in our homes and workplaces in order to reduce environmental and health risks.

The Joyce Centre for Partnership & Innovation provides leading-edge energy harvesting and conservation technologies and techniques such as: their unique envelope design - designed to minimize energy use; their new geothermal wells which is one of the cleanest renewable energy sources available in storing waste heat in the summer for use in the winter, accessing natural light and using sunlight to produce power and adopting a rainwater harvesting system that collects, stores and re-uses rainwater on site.

It is through groundbreaking initiatives such as The Joyce Centre for Partnership & Innovation's net zero carbon achievement we are able to make large strides towards a safer and cleaner Canada.

Congratulations on being an exemplary leader in engaging future generations to continue to research and develop on the generation, distribution and storage of renewable energies.

Sincerely,

in fuld

Honourable Karina Gould Member of Parliament for Burlington Minister of Democratic Institution

## JOURNEY TO COMPLETION































## WHAT'S INSIDE

## Atrium & Gallery

### **Digital Creativity Centre** Lecture Halls | Gallery

The heart of The Joyce Centre is The Digital Creativity Centre supported by Mohawk Students' Association — a makerspace open to all students, featuring 3D printers, a virtual and augmented reality testing area, media and production editing suites, a green screen and a visualization wall for creating interactive storytelling. The main floor open space — The Marinucci Foundation Gallery — provides access to the lecture hall. The ArcelorMittal Dofasco Theatre and a café with indoor and outdoor seating. This space will be used to host college, community and industry events.

## Labs & Classrooms

### **Avionics Lab**

Through instruction and hands-on learning, students in Mohawk's Transport Canada approved Aviation Technician program will gain the skills to maintain and repair the hundreds of complex electronic systems in cockpits and cabins that ensure the safety, reliability and efficiency of modern aircraft.

### **Digital Health User Experience Testing Lab**

Part of Mohawk's IDEAWORKS and its internationally recognized mHealth and eHealth Development and Innovation Centre, the lab will bring students, staff, faculty and college partners together with patients, families and health-care providers to participate in applied research, testing and evaluation of global health solutions.



### **Clean and Renewable Energy Testing Lab**

Students will collaborate with industry partners on applied research projects, focusing on how to safely integrate renewable energy systems into micro-grids, smart grids and the existing electrical system. Students will also have access to a weather station and wind turbine for real-time monitoring and testing.

### Sustainable Design Lab

Within a showcase of net zero design in The Joyce Centre, students will have a fully immersive experience in how to design and build environmentally sustainable buildings. Students will develop in-demand skills by using leadingedge technology, including virtual and augmented reality, drones and 3D scanners.

With dozens of applied research and capstone projects underway at any time within The Joyce Centre, the studio will be a popular meeting place and collaborative space for students, faculty, staff and industry partners. The studio can be used for pitches, presentations, brainstorming sessions, project updates, meetings and special events.

## **Technology Automation Lab (IIOT)**

## Physics and Metrology Lab

Students from five Engineering Technology programs will use the Physics and Metrology Lab to get hands-on experience in quality control, which is critical to the competitiveness and profitability of advanced manufacturers. The lab features precision equipment for the measuring, scanning and testing of parts. Mohawk is the first postsecondary institution in Canada to partner with Mitutoyo Canada, the world's largest metrology company.

## **Energy and Power Management Lab**

## Hands On Learning

The Joyce Centre for Partnership & Innovation will be a learning lab and demonstration site for what is possible in a zero carbon institutional building. Student learning will extend well beyond the labs and classrooms to the basement mechanical rooms, where heat pumps manage the heating and cooling power of 28 geothermal wells, all the way to the roof, where solar panel arrays will generate the building's energy needs.

## **Partnering Studio**

## Cyber Security Testing Lab

Teams of students will plan, launch, thwart and defend in realtime cyber-attack simulations played out on giant wall monitors that will teach them how to prevent, detect, predict and respond to threats against computer systems, networks and data. The lab will also deliver customized training for industry partners.

Students will use Industrial Internet of Things (IIOT) technology to prepare for in-demand careers at the forefront of Industry 4.0. Through training and applied research projects, students will study the development and applications of sensors for machineto-machine communication, including robotics, motor controllers, power protection systems, and residential, commercial and industrial automation systems.

Part of the IDEAWORKS' Energy & Power Innovation Centre, students will work with real-time data from multiple locations including The Joyce Centre, a micro-grid at Mohawk's Stoney Creek campus, and the college's Energy and Power Utilities Lab in a decommissioned electrical substation in downtown Hamilton. Students will collaborate with industry partners on energy storage technologies, power protection, the control of grid systems and the development of new energy monitoring and control systems.

## TECHNOLOGY

# What is a zero carbon building?

The Joyce Centre showcases leading-edge environmental technologies that significantly reduce the building's carbon emissions. The building's technology includes:

- A high-performance building envelope that maximizes natural light in the building and also reduces the building's heating and cooling loads
- Solar photovoltaic panel arrays generating 721,000 kWh of clean, renewable electricity per year
- A solar thermal array
- 28 geothermal wells
- A variable refrigerant flow heat pump system
- Storm water harvesting of up to 228,000 litres
- Sensor-controlled LED lighting
- A green roof with extensive planted areas
- High-efficiency plumbing fixtures

Buildings account for nearly 40 per cent of greenhouse gas

Taken together, these technologies make The Joyce Centre the country's largest net zero energy institutional building. The Joyce Centre will also serve as a living lab for students. Students will have access to every part of the building, from the penthouse to the basement. Students will monitor and get real-time data on the energy being generated and consumed by The Joyce Centre.

## Water

Large institutional buildings provide an opportunity to save thousands of litres of water every year through rainwater harvesting systems that collect, store and re-use rainwater on site.

The Joyce Centre's rainwater harvesting system is designed to collect 228,000 litres of rainwater runoff for reuse. Two cisterns are located below ground will store water that will be re-used for plumbing purposes, such as low-flush toilets, urinals, and landscaping needs.

On average, an individual Canadian uses 329 litres of water per day, mainly for things like toilet flushing and showering. Very little potable water is actually used for drinking. Installing a rainwater harvesting system can help to reduce the use and waste of the drinkable water supply.

## **Understanding Mohawk's** new geothermal wells

Geothermal energy is one of the cleanest renewable energy sources available, emitting close to zero greenhouse gases, storing waste heat in the summer for use in the winter, and generating no sound pollution.

The Joyce Centre includes a whopping 28 geothermal wells that have been drilled into rock to a depth of 184.4 metres or 605 feet. These boreholes are, on average, 4 metres apart and the well field encompasses approximately 53,000 m<sup>3</sup> of volume below ground. This below-ground space is often referred to as a geoexchange well field and will be able to store heat in the summer for extraction during the winter months when heating is needed for the building.

Mohawk's wells are designed in a closed-loop system, which means heat transfer fluid is circulated through a continuous loop of pipe into heat pumps located in the building. The system has a life span of 100 years. Each drilled well for The Joyce Centre stores enough heat for a 2,000 square foot home each year and will help offset seven tonnes of greenhouse gases.







# Capturing sunlight and access to natural light

Two large steel structures on the roof of The Joyce Centre support PV arrays, with additional arrays installed on adjoining buildings at Mohawk's Fennell Campus to support the net zero performance of the building. Orientation of the building allows daylight to be captured and distributed to all levels of the building through the light well feature, located near the centre of the building.

Photovoltaic (PV) arrays, made up of solar cells, produce power when exposed to sunlight. That power can be used to charge batteries, operate motors, or power any number of electrical loads. The energy is free and renewable, and no noise pollution is created from operating these systems. As well, solar arrays have no moving parts, and are easily expandable and transportable.

The Joyce Centre will generate 100 per cent of the energy required to power it through the course of a year. This will be achieved by powering the building completely with electricity, generating the yearly total energy usage on-site.



# An envelope design to minimize energy use

Outside and inside, The Joyce Centre maximizes green building techniques and efficiencies to meet and exceed the goals of a net zero institutional building.

The outer envelope of the building regulates the interior climate by creating an air and vapour barrier, so that the HVAC systems work a minimal amount of time – if at all.

The Joyce Centre includes two wall system designs to keep the building as air tight as possible: a rain screen glass system and an insulated opaque assembly.

The laminated rain screen glass, installed on thermal clip supports, have a mineral wool cavity. The wall layers in this system are made up of an air and vapour barrier on exterior sheathing, structural steel studs, followed by spray foam in the stud cavity, and finishing with 16mm drywall.

The insulated opaque assembly is a precast panel in which extruded polystyrene insulation board is sandwiched between patterned concrete and board. On the interior, there is also spray foam insulation and drywall.

All windows in The Joyce Centre are triple glazed, which increases thermal performance. The roof surfaces are designed for increased thermal performance and will have a high reflective top surface.





## THE IMPACT

## Together we can deliver the future

The Joyce Centre for Partnership & Innovation builds on Mohawk's strengths in energy, health and technology, and encourages partnership to flourish leading to enriched curriculum. The building introduces cutting-edge technology to industry and gives students

real-world experience. Our vision is that by working together, we can ensure that students have the up-to-date digital skills and global competencies to succeed, and that industry has the highly-skilled workers it needs to participate in the competitive digital economy.

Together, we can deliver that future.

"Our team at ArcelorMittal Dofasco is 100% behind The Joyce Centre for Partnership & Innovation and everything that it will deliver for students, employers, the City of Hamilton and the Province. We are proud to join the Government of Canada and The Joyce Family Foundation in supporting this initiative."

> Sean Donnelly, President and CEO, Arcelor Mittal Dofasco

"The Joyce Family Foundation seeks to build a legacy for the future through ongoing leadership and innovative partnerships. This is why we are a great supporter of the education and training at Mohawk College and proud to invest in The Joyce Centre for Partnership & Innovation."

Ron Joyce, C.M. Advisor Trustee, The Joyce Family Foundation

THE ----JOYCE FAMILY FOUNDATION

"This infrastructure investment will increase Mohawk's capacity for applied research which will drive innovation and grow the economy in Hamilton. I am confident that the students and faculty who use this new infrastructure will launch startups and new businesses that will help to shape Hamilton's community and future prosperity."

### Hon. Filomena Tassi,

Minister for Seniors, MP Hamilton West - Ancaster - Dundas

the completion of The Joyce Centre for Partnership & Innovation. As Mohawk College continues to be a leader in environmental sustainability, our investment in this building was an investment in our students. This fall, we are looking forward to welcoming new students into this innovative space who will become the future ready graduates of tomorrow."

Andrew Pidsadny, President, Mohawk Students<sup>7</sup> Association



"The Mohawk Students' Association is thrilled to see





**Building Innovation** 



### 24 MOHAWK COLLEGE

# AT MOHAWK

The Joyce Centre for Partnership & Innovation will be a showcase to teach students, faculty, staff, and community partners about sustainability in real time every day.

SUSTAINABILITY

The Campus Sustainability and Climate Change team at Mohawk College is educating and engaging students about climate change, conservation, waste management and net zero energy. The Joyce Centre will be the ideal place to demonstrate net zero in action, says Kate Flynn, Manager of Campus Sustainability and Climate Change.

"It is a momentous occasion to be the first college in Ontario to have a building like this. There is a huge opportunity to engage and learn from the building and we are proud of that," she said.

"But it's important to remember that unless the humans inside the building act with sustainability in mind, the building can't accomplish the net zero targets set out for it. We want to help students understand the choices that were made in designing this building and how their behaviour impacts its operation."

With that in mind, the Sustainability team, which will be located in The Joyce Centre, is launching the Zero Carbon Ambassador program, a peer-to-peer student program focused on getting Mohawk students engaged in the net zero goal.

Zero Carbon Ambassadors will receive training in zero carbon building design and management from The Joyce Centre's architects, designers, and facility managers. Ambassadors then support outreach activities that encourage students, staff and faculty to learn about and use the building as a net zero environment.

Ambassadors will provide tours of The Joyce Centre during Orientation and will be on-site during peak hours to teach students, faculty, staff and visitors about the operation of the building. Ambassadors will also host sustainability challenges throughout the academic year.



**Kate Flynn,** Manager of Campus Sustainability and Climate Change "We are trying to encourage a culture of conservation so that people use the building while being mindful of the energy load they are putting on it," said Flynn. "If we can inspire people to be mindful of their use of The Joyce Centre in energy, waste and water, we hope it can inspire a new consciousness for them in all the buildings they use.

"Everything will be transparent about how the building works. Students will be able to see their impact on the building live. If it's a busy day, they will see increased water usage or if it's hot outside, they will see the energy needed to cool the building or how it impacts water levels because the landscaping needs watering. It's all visible in real time," said Flynn.

"I think what's exciting is that this building will prove it can still be net zero even when it's at maximum use. That would have been called impossible even just a few years ago."

The Zero Carbon Ambassadors will come from a wide variety of academic programs. Many students choose to study at Mohawk College because of its leadership on sustainability, says Flynn. It was the first college in Ontario to implement a campus Environmental Management Plan in 2011 and among the very first with a dedicated sustainability team.

The team leads more than 30 initiatives centered on transportation, energy, waste management, water conservation and local food.





Congratulations to Mohawk College on completing Canada's largest institutional Net Zero building.

A Net Zero building - one designed to generate as much energy as it uses - requires leadership collaboration and detailed work from the whole team.

RDH Building Science is proud to have been the Net Zero Energy Design Consultants for this groundbreaking project.

rdh.com | buildingsciencelabs.com

## AND THE AWARD GOES ΤΟ...

## The Joyce Centre for Partnership & Innovation

received 4 awards before it's opened!

**2017** Innovation in Sustainability Award, Canada Green **Building Council** 

2018 Sustainable Project of the Year, **Ontario Sustainable Energy Association** 

2018 Environmental Sustainability Award, Alectra Energy **Evolution Summit** 

2018 Engineering Project of the Year, **Ontario Society** of Professional

The Joyce Centre is the second Canadian building to receive the Zero Carbon **Building – Design** certification from the Canada Green **Building Council.** 



# **Conference Services** DISCOVER. SERVICE. EXCELLENCE.

Mohawk College Conference Services offers a distinctive and stimulating environment for any conference, meeting or event, with a variety of unique facilities at our Hamilton campus.

Visit our facility to discover how your next event can benefit from our service and excellence.

mohawkcollege.ca/conferenceservices

## понашк



Thinking of attending Mohawk? Join us for the Fennell Campus Fall **Open House** on Saturday, November 3<sup>rd</sup>, and tour The Joyce Centre for Partnership & Innovation.

Learn more at: mohawkcollege.ca/openhouse



