



**2019-2024  
MOHAWK COLLEGE  
CONSERVATION & DEMAND  
MANAGEMENT PLAN**

Date: July 1, 2019

To: Ministry of Energy, Northern Development and Mines

From: Henry Colyn  
Chief Building & Facilities Officer, Mohawk College

Subject: Mohawk College's 2019-2024 Energy Conservation & Demand Management Plan

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The following report is Mohawk College's 2019-2024 Energy Conservation & Demand Management Plan (CDM). This Plan is in accordance with Ontario Regulation 507/18, under the Electricity Act, 1998.

This Plan outlines:

- Information on the College's energy consumption and its demand for energy
- The College's goals and objectives for conserving and otherwise reducing energy consumption
- The College's proposed measures to reduce its energy consumption
- Sources of renewable energy operated at the College
- Cost and savings estimates for the major proposed energy efficiency measures

This plan will act as a roadmap, along with other College guiding documents, to achieve meaningful and significant reductions in the College's energy consumption and demand over the next five year period and beyond.

This CDM Plan has been approved by Mohawk College's senior management team.

Sincerely,

Henry Colyn

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# 1.0 Executive Summary

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This Energy Conservation and Demand Management (CDM) Plan is in accordance with Ontario Regulation 507/18, under the Electricity Act, 1998. This CDM plan will guide Mohawk College's efforts to reduce the College's demand for energy over the next five years.

This CDM plan is supported by the Campus Master Plan and Mohawk College's Environmental Management Plan (EMP) 2.0.

Mohawk College is an industry leader in sustainability and continues to set ambitious sustainability targets. Mohawk's previous 2014-2019 CDM Plan set a target to reduce Mohawk's overall energy use intensity (EUI) (ekWh/m<sup>2</sup>) by 6% by 2020, using calendar year 2012 as the baseline year. As of the end of calendar year 2018, Mohawk has successfully reduced its energy use intensity (ekWh/m<sup>2</sup>/HDD)<sup>1</sup> by 7.44%, bettering our 2014-2019 CDM Plan target by 24%.

With this new 2019-2024 CDM plan, Mohawk's goal is to reduce our overall energy use intensity (ekWh/m<sup>2</sup>/HDD) by 10% over the next five years (January 2019 through January 2024)<sup>2</sup>, using calendar year 2018 as the baseline year.

This goal will be accomplished through a number of strategies including:

- Stakeholder engagement, awareness and participation
- On-site energy generation through renewable energy sources
- Facility and operational improvements
- Efficiencies through future development and renovations
- Effective space planning
- Forming of a new Energy Conservation Committee to lead energy conservation initiatives throughout our campuses

In implementation, Mohawk's focus will be on continuing to build a culture of sustainability at Mohawk College. Guided by this CDM plan, the Facility Services team will apply an "energy conservation lens" on all new capital and maintenance projects. The Sustainability team will continue to promote engagement and education opportunities to create awareness of sound energy conservation habits. The Energy Conservation Committee will support innovative initiatives to help promote collaboration on cross-campus energy initiatives.

This CDM plan is a living document that will be updated by Facility Services staff as new opportunities become available.

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<sup>1</sup> Mohawk's target for the previous 2014-2019 CDM Plan was a 6% reduction in "ekWh/m<sup>2</sup>" energy use intensity (EUI). The EUI metric "ekWh/m<sup>2</sup>/HDD" is being used instead of "ekWh/m<sup>2</sup>" in this analysis. HDD stands for "heating degree days", which provides a means to indicate how the weather impacts energy use in a particular timeframe. When used along with building area (and the changes to building area over time), this ensures a fair comparison of energy usage year-over-year.

<sup>2</sup> Energy use intensity as measured in ekWh/m<sup>2</sup>/HDD – equivalent kilowatt-hours per square metre of building area per annual heating degree days with a balance point temperature of 18 degrees Celsius

## 2.0 Introduction and Reporting Requirements

Mohawk College is widely regarded as a leader in sustainability. Since 2008, Mohawk has undertaken hundreds of initiatives to reduce the College's impact on the environment and in turn, its energy consumption. In September 2018, Mohawk opened the region's first and Canada's largest institutional net zero building, The Joyce Centre for Partnership and Innovation. In spring 2019, Mohawk became the first college in Ontario to receive the AASHE STARS Gold rating in recognition of its achievements in sustainability.

In order to quantify its environmental impact, Mohawk has been measuring its greenhouse gas (GHG) emissions since 2007. Reported GHG emissions act as a consistent, measurable indicator of the College's environmental impact. Mohawk's current goal is to reduce GHG emissions by 30% by 2020 (2007 baseline year). To reduce its GHG emissions, Mohawk has set reduction targets that require effort and cooperation from all areas of the College. This plan will focus on Mohawk's energy reduction targets, under O. Reg. 507/18, which are necessary to achieve operational efficiencies and comply with provincial legislation.



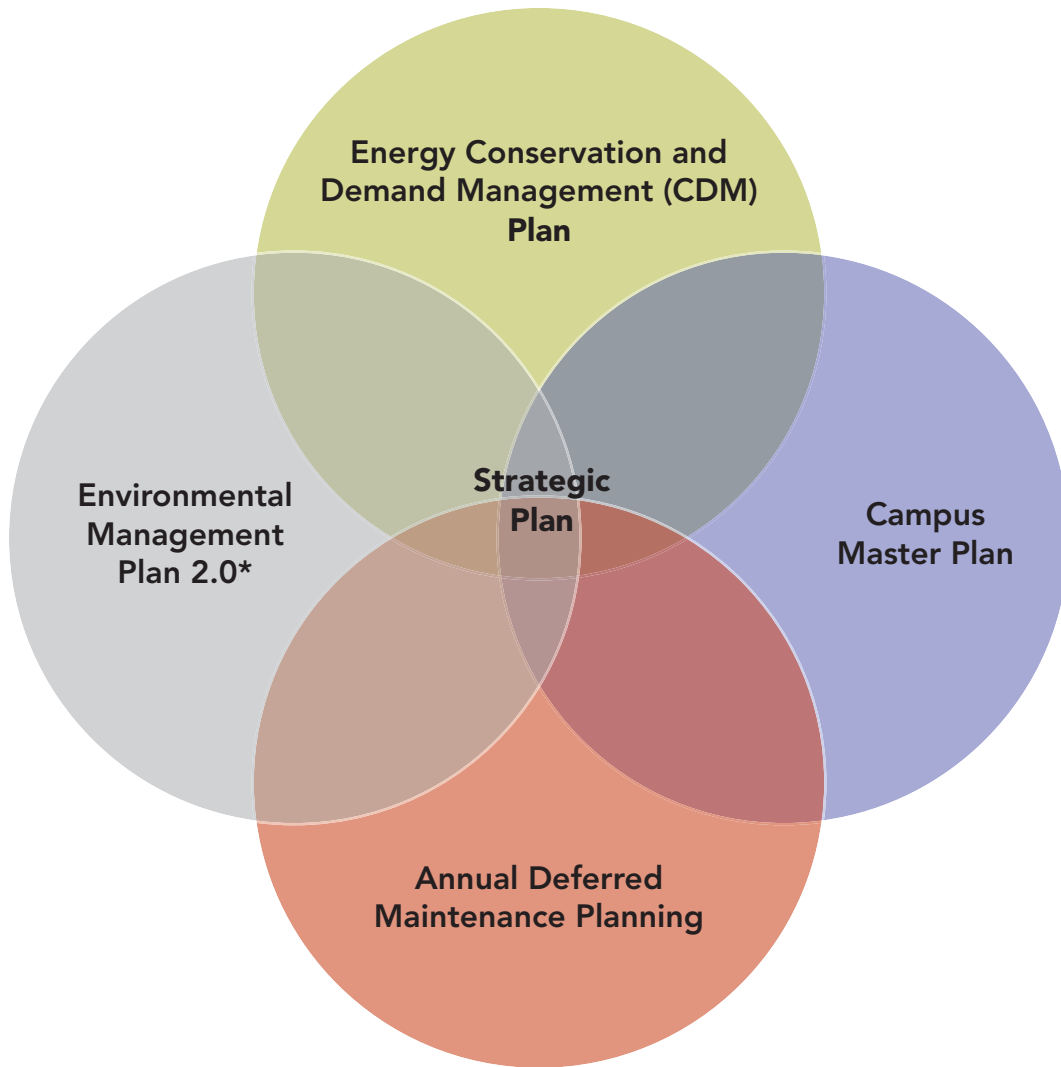
Under the Electricity Act of 1998, O. Reg. 507/18 requires public agencies, such as municipalities, municipal service boards, school boards, universities, colleges and hospitals, to report their energy consumption and direct GHG emissions annually. The regulation also requires institutions to develop and implement an Energy Conservation and Demand Management (CDM) plan every five years, starting in 2014. This new CDM plan covers the 2019-2024 period.

This CDM Plan outlines:

- Information on the College's energy consumption and its demand for energy
- The College's goals and objectives for conserving and otherwise reducing energy consumption
- Cost and savings estimates for the proposed measures

To reduce the College's demand for energy and its environmental impact, this CDM plan aligns with Mohawk College's Strategic Plan, Campus Master Plan, Environmental Management Plan 2.0, and Essential Deferred Maintenance Plan. Each of these plans applies an "energy conservation and sustainability lens" to capital planning, space management and engagement programs that help to a create culture of sustainability on campus.

Table 1.0 Campus plans supporting energy conservation and demand management on campus



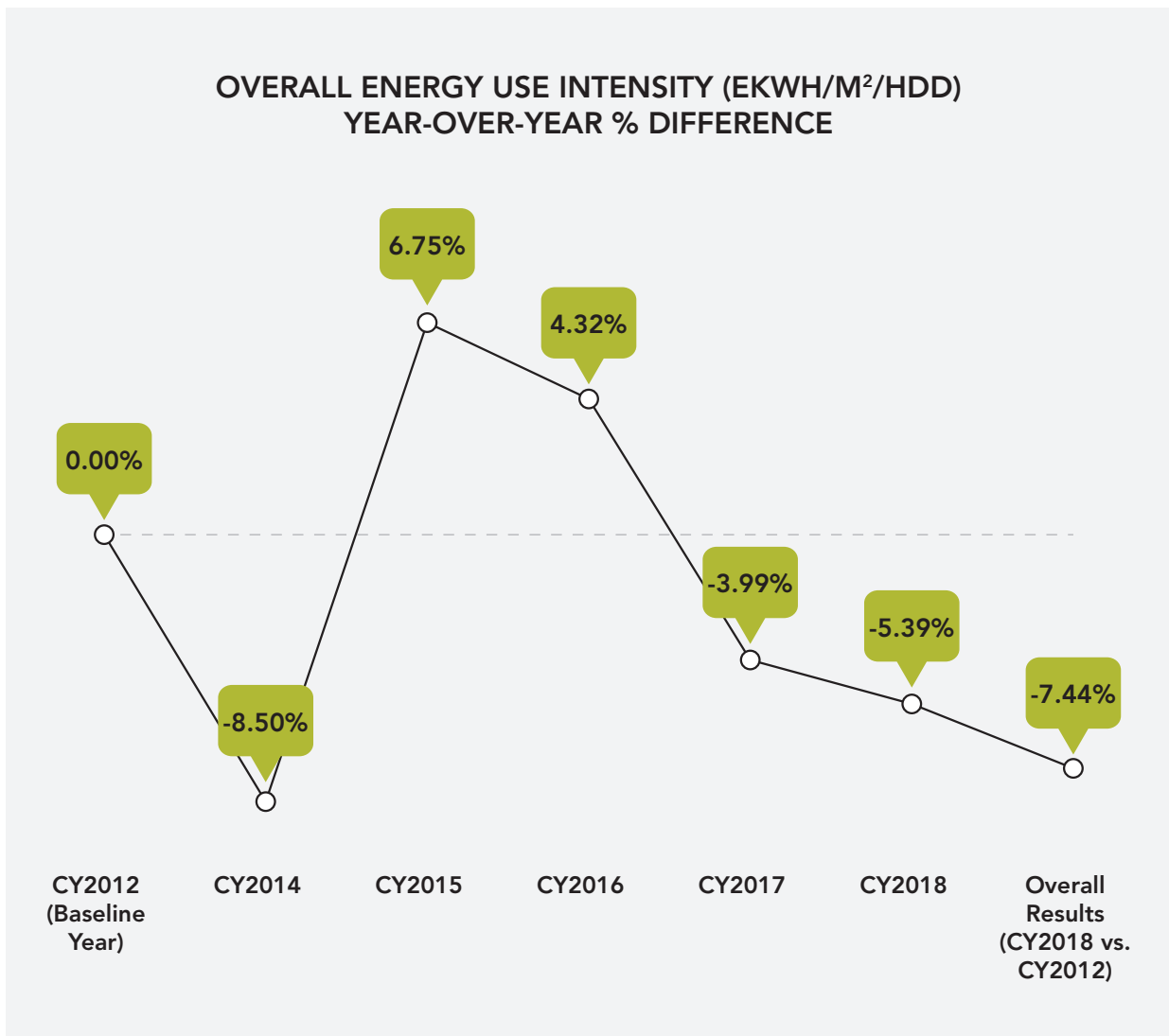
\*A new sustainability plan will replace the EMP 2.0 in 2020.

## 3.0 Measured Success: 2014-2019

### 3.1 HOW IS SUCCESS MEASURED?

Mohawk College is an industry leader in sustainability and continues to set ambitious sustainability targets. Mohawk's previous 2014-2019 CDM Plan target was to reduce Mohawk's overall energy use intensity (EUI) (ekWh/m<sup>2</sup>) by 6% by 2020, using calendar year 2012 as the baseline year. As of the end of calendar year 2018, Mohawk has successfully reduced its energy use intensity (ekWh/m<sup>2</sup>/HDD)<sup>3</sup> by 7.44%, bettering our 2014-2019 CDM Plan target by 24%.

**Graph 1. Mohawk College 2014-2019 Overall Energy Use Intensity Year-Over-Year % Difference (2012 Baseline Year)**



<sup>3</sup> Mohawk's target for the previous 2014-2019 CDM Plan was a 6% reduction in "ekWh/m<sup>2</sup>" energy use intensity (EUI). The EUI metric "ekWh/m<sup>2</sup>/HDD" is being used instead of "ekWh/m<sup>2</sup>" in this analysis. HDD stands for "heating degree days", which provides a means to indicate how the weather impacts energy use in a particular timeframe. When used along with building area (and the changes in building area over time), this ensures a fair comparison of energy usage year-over-year.

Table 1. Mohawk College 2014-2019 Overall Energy Use Intensity Data (2012 Baseline Year)

Calendar Year	Building Area (m <sup>2</sup> )	Electricity Consumption (kWh)	Electricity Use Intensity (kWh/m <sup>2</sup> )	Natural Gas Consumption (m <sup>3</sup> )	Natural Gas Use Intensity (ekWh/m <sup>2</sup> )	Overall Energy Use Intensity (ekWh/m <sup>2</sup> )	Overall Energy Use Intensity (ekWh/m <sup>2</sup> ) Year-Over-Year % Difference	Annual Heating Degree Days (HDD) with Balance Point of 18 deg C taken from NASA weather database for Hamilton ON (deg C-d)	Overall Energy Use Intensity (ekWh/m <sup>2</sup> /HDD)	Overall Energy Use Intensity (ekWh/m <sup>2</sup> /HDD) Year-Over-Year % Difference
CY2012 (Baseline Year)	111,928	17,305,662	154.61	1,270,983	118.04	272.65		3,236	0.08425	0.00%
CY2014	118,589	18,381,101	155.00	1,864,653	163.45	318.45	16.80%	4,131	0.07709	-8.50%
CY2015	104,527	17,676,446	169.11	1,440,785	143.28	312.39	-1.90%	3,796	0.08230	6.75%
CY2016	105,112	17,714,482	168.53	1,317,562	130.30	298.83	-4.34%	3,481	0.08585	4.32%
CY2017	106,675	17,311,884	162.29	1,290,163	125.72	288.01	-3.62%	3,494	0.08243	-3.99%
CY2018	116,399	18,123,287	155.70	1,543,921	137.88	293.58	1.93%	3,765	0.07798	-5.39%
<b>Overall Results (CY2018 vs. CY2012)</b>							<b>7.68%</b>			<b>-7.44%</b>



Mohawk measures the success of its sustainability initiatives by evaluating reductions in GHG emissions and energy consumption. When measuring GHG emissions, Mohawk College abides by the Greenhouse Gas Protocol. Mohawk includes both direct (Scope 1) and indirect emissions (Scopes 2 and 3) in its GHG reporting.

Currently, Mohawk is one of only a few colleges in Ontario that measures all three scopes in their GHG emissions reporting. Mohawk measures and reports on all of their scopes to better evaluate the College's environmental impact. This also informs evidence-based sustainability solutions that aim to reduce both direct and indirect emissions.

### Mohawk College Greenhouse Gas Emissions Tracking

- In 2010, the College created a baseline for its GHG emissions based on the 2007 calendar year.
- From this baseline the College created its first Environmental Management Plan (EMP) and then, in 2013 replaced the first EMP with the EMP 2.0, which set a target of a 30% reduction in 2007 baseline GHG emissions by 2020.
- In 2017, Mohawk College performed its third comprehensive GHG emission inventory showing a total 26% reduction in GHG emissions.
- In August 2018, Mohawk College opened The Joyce Centre for Partnership and Innovation (JCPI) – a 96,000 square foot net zero carbon building. Highly energy efficient, JCPI's solar photovoltaic system is designed to generate 721,000 kWh of clean, renewable electricity annually. A geothermal system heats and cools the building. The addition of this building supports a growing student population but does not add any corporate carbon emissions.
- In 2019, Mohawk installed a solar photovoltaic carport system capable of generating 505,000 kWh annually, upgraded the central campus boiler system at the Fennell Campus with highly-efficient condensing boilers and variable-speed distribution pumps, and added 1 MWh of battery energy storage. With the addition of more efficient boilers and renewable energy systems, Mohawk is predicting an additional 6% reduction in greenhouse gas emissions by late 2019.

Mohawk continues to measure and report on its Scope 1 and 2 GHG emissions annually. However, Scope 3 emissions are measured every five years. Reporting for Scope 3 is only done every five years because of the time-consuming and data-intensive nature of Scope 3 emissions.

A comparison of Mohawk's GHG emissions for the period of January 2012 through January 2019 is shown below. The chart below indicates that a reduction in overall greenhouse gas emissions intensity ( $\text{tCO}_2\text{e}/\text{m}^2/\text{HDD}$ ) of 11.75% was achieved during this period.

Graph 1. Mohawk College 2012-2019 Overall Greenhouse Gas Emissions Intensity  
Year-Over-Year % Difference

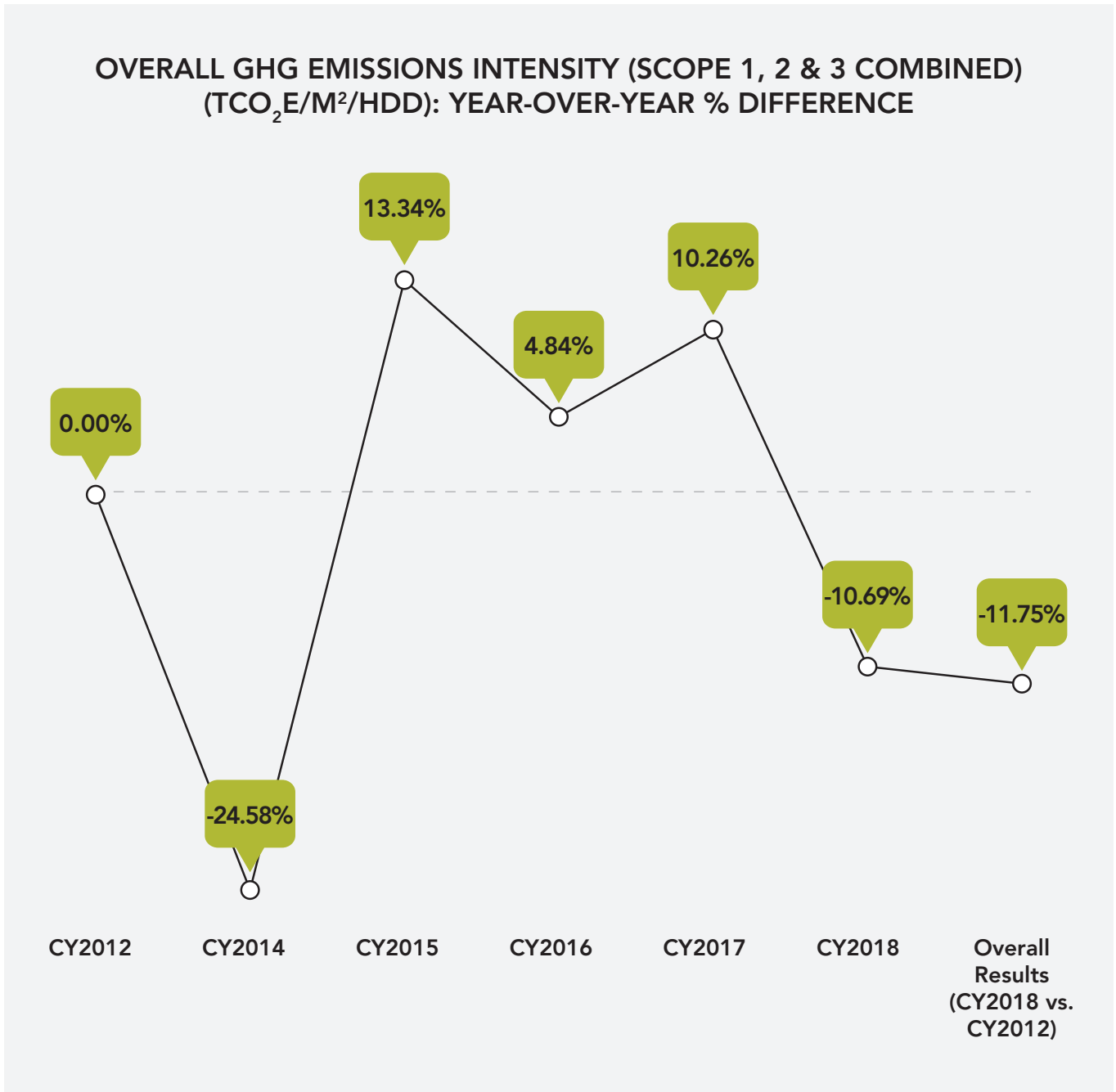


Table 2. Mohawk College 2014-2019 Overall Greenhouse Gas Emissions Data (2012 Baseline Year)

Calendar Year	Building Area (m <sup>2</sup> )	Natural Gas Consumption (m <sup>3</sup> )	Ontario Natural Gas Consumption GHG Emissions Factor (tCO <sub>2</sub> e/m <sup>3</sup> )	GHG Emissions Attributed to Natural Gas Consumption - Scope 1 (tCO <sub>2</sub> e/m <sup>3</sup> )	All Other Scope 1 GHG Emissions (tCO <sub>2</sub> e) (from 2012 GHG Emissions Inventory Report)	Electricity Consumption (kWh)	Ontario Electricity Consumption GHG Emissions Factor (tCO <sub>2</sub> e/kWh)	GHG Emissions Attributed to Electricity Consumption - Scope 2 (tCO <sub>2</sub> e)	Overall GHG Emissions Attributed to Natural Gas & Electricity Consumption (tCO <sub>2</sub> e)	Scope 3 GHG Emissions (tCO <sub>2</sub> e) (from 2012 GHG Emissions Inventory Report)	Overall GHG Emissions - Scope 1, 2 & 3 Combined (tCO <sub>2</sub> e)	Overall GHG Emissions - Scope 1, 2 & 3 Combined (tCO <sub>2</sub> e) - Year-Over-Year % Difference	Overall GHG Emissions - Scope 1, 2 & 3 Combined Intensity (tCO <sub>2</sub> e/m <sup>2</sup> )	Overall GHG Emissions - Scope 1, 2 & 3 Combined Intensity (tCO <sub>2</sub> e/m <sup>2</sup> ) - Year-Over-Year % Difference	Annual Heating Degree Days (HDD) with Balance Point of 18 deg C taken from NASA weather database for Hamilton ON (deg C-d)	Overall GHG Emissions - Scope 1, 2 & 3 Combined Intensity (tCO <sub>2</sub> e/m <sup>2</sup> /HDD)	Overall GHG Emissions Intensity - (Scope 1, 2 & 3 Combined) (tCO <sub>2</sub> e/m <sup>2</sup> /HDD) - Year-Over-Year % Difference
CY2012	111,928	1,270,983	0.001888	2,400	114	17,305,662	0.000095	1,644	4,044	5,535	9,693	0.00%	0.08659722	0.00%	3236	0.00002676	0.00%
CY2014	118,589	1,864,653	0.001888	3,520	114	18,381,101	0.000039	717	4,237	5,535	9,886	2.00%	0.08336631	-3.73%	4131	0.00002018	-24.58%
CY2015	104,527	1,440,785	0.001888	2,720	114	17,676,446	0.000040	707	3,427	5,535	9,076	-8.19%	0.08683173	4.16%	3796	0.00002288	13.34%
CY2016	105,112	1,317,562	0.001888	2,488	114	17,714,482	0.000036	638	3,125	5,535	8,774	-3.33%	0.08347552	-3.87%	3481	0.00002398	4.84%
CY2017	106,675	1,290,163	0.001888	2,436	58	17,311,884	0.000017	294	2,730	7,068	9,856	12.33%	0.09239400	10.68%	3494	0.00002644	10.26%
CY2018	116,399	1,543,921	0.001888	2,915	58	18,123,287	0.000017	308	3,223	7,068	10,349	5.00%	0.08890986	-3.77%	3765	0.00002362	-10.69%
<b>Overall Results (CY2018 vs. CY2012)</b>												<b>6.77%</b>		<b>2.67%</b>			<b>-11.75%</b>

## 3.2 HOW WERE THESE REDUCTIONS ACHIEVED?

The success of these carbon and energy reductions is due in large part to the commitment of the Facility Services team to drive energy reduction and sustainability interventions. Mohawk is also dedicated to increasing the culture of sustainability among Mohawk College students and staff through sustainability programs and services. Some examples of the previous initiatives are given below.

### SPACE PLANNING

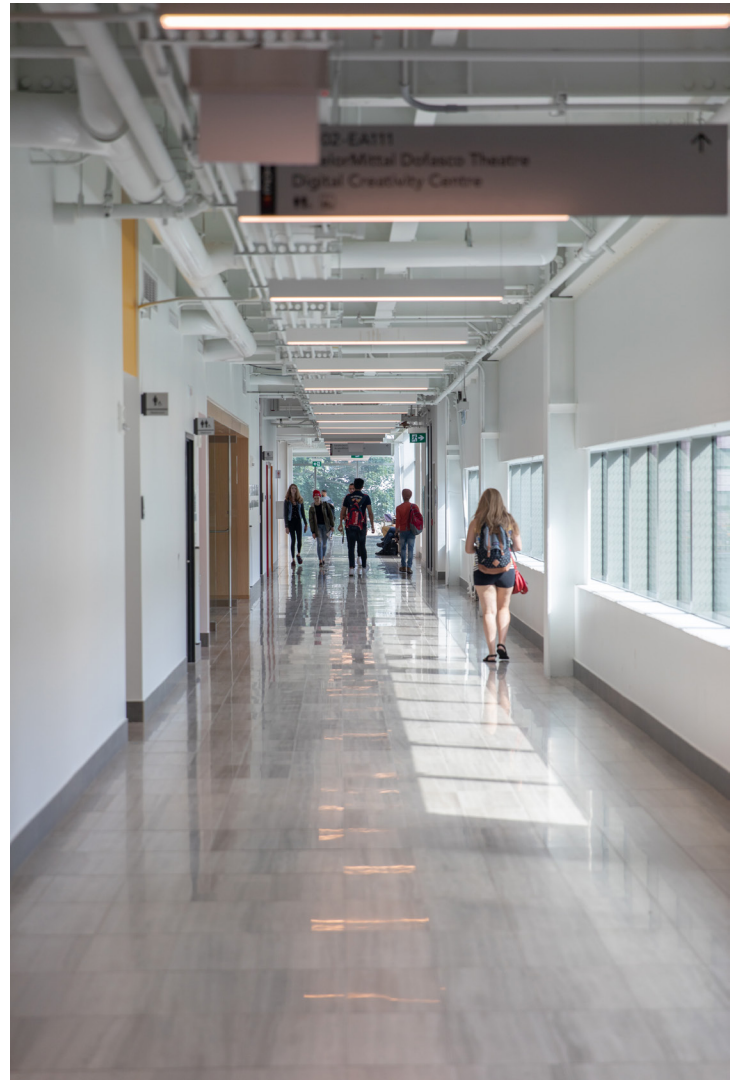
Effective space planning is a means through which Mohawk continues to reduce energy use intensity while serving a growing student population. Campus spaces are carefully designed and managed to maximize efficiency. Increasingly, space is designed with flexible furniture and technology to allow increased use. In March 2019, the Board of Governors approved a new Campus Master Plan that will guide efficient space and capital planning.

### ZERO CARBON AND LEED® DEVELOPMENT

Mohawk has been a leader in sustainable building design since it embarked on its Fennell Renewal Project in 2009 with sustainability as one of its guiding principles.

The new Joyce Centre for Partnership and Innovation is located at Mohawk's Fennell Campus. At 96,000 square feet, it is the region's first and Canada's largest Net Zero building. The building is designed to be highly energy efficient. The building envelope and triple-paned glazed windows provide powerful insulation while still allowing the building to take advantage of passive solar energy and shading. An advanced building automation system (BAS) ensures optimal operation of the HVAC system and lighting system. Heating and cooling is supplied by a geothermal system.

Additionally, Mohawk has two LEED® Gold buildings at the Fennell campus – the David Braley Athletic & Recreation Centre and the Learning Exchange & Cummings Library.



## **FACILITY AND INFRASTRUCTURE UPGRADES**

A long-standing commitment from the facility services team has allowed Mohawk to implement many infrastructure upgrades aimed at reducing the College's demand for energy. By replacing or upgrading older, inefficient equipment, the college was able to increase its energy efficiency and reduce its environmental impact. Some of the major facility upgrades are listed below.

- Efficient lighting upgrades across all campuses
- Extension of Building Automation System (BAS) and addition of control sensors throughout campus
- Addition of a 330 kW-ac-peak solar carport
- Addition of a 1 MWh battery energy storage system
- Replacing boilers and generators with more efficient and cleaner natural gas burning equipment
- Replacement of one natural gas boiler with a 1 MW electric boiler
- Updated HVAC equipment

### **3.3 ENHANCED CULTURE OF SUSTAINABILITY**

With the support of leaders from all levels within the College including the Board of Governors, Mohawk Students Association and the Mohawk Executive Group, a strong culture of sustainability has been established. This culture of sustainability has been accomplished through the following:

- Educating individuals on their environmental impact
- Events and incentives that encourage sustainable habits and decision making in everyday life
- Creating a social shift towards sustainability both at the College and in the surrounding community
- Enhanced programs and services
- Hosting the Centre for Climate Change Management at Mohawk College, which acts as a catalyst to support climate change action in the cities of Hamilton and Burlington

Mohawk is also on track to achieve a 30% reduction in GHG emissions (from 2007 baseline) by the year 2020. In anticipation of this achievement, Mohawk is currently developing a new sustainability plan. The new plan will re-affirm Mohawk's commitment to sustainability and broaden efforts to grow sustainability learning opportunities, move towards a net zero campus, and continue to lead in sustainability initiatives – in the sector and in the community.

## 4.0 2018 Energy Consumption Data (Baseline Year)

Mohawk College will use the 2018 calendar year as the baseline year for our 2019-2024 energy use intensity (EUI) reduction target.

The following is a summary of energy consumption, in both natural gas and electricity, for the baseline 2018 calendar year.

The data below is reported on a total consumption basis by campus, as well as consumption per m<sup>2</sup> of building space and, finally, consumption per m<sup>2</sup> of building space per heating degree day. Calculating the consumption data on a per m<sup>2</sup> per heating degree day basis provides the most meaningful indication of our energy conservation progress from year to year, as this metric accounts for changes to building area and changes in weather and climate from year to year. The resulting year-over-year EUI numbers then reflect the decrease or increase in energy use intensity based solely on actions by our staff and students. Using this metric helps the College to better understand the operational efficiencies of each campus and create targeted interventions to continue to create demand management and efficiency strategies.

The Institute of Applied Health Sciences (IAHS) campus is not included in this CDM plan. This is because the IAHS is located at the McMaster University campus in Hamilton. It is understood that McMaster includes the IAHS in its own O. Reg. 507/18 reporting, and therefore is excluded here. However, the Sustainability Office and the Energy Conservation Committee will still encourage energy conservation and demand management practices as part of Mohawk's larger sustainability mission.



Table 3. 2018 Energy Use Data by Campus (2019-2024 CDM Plan Baseline Year)

Campus	CY2018 Building Area (m <sup>2</sup> )	CY2018 Electricity Consumption (kWh)	CY2018 Electricity Use Intensity (kWh/m <sup>2</sup> )	CY2018 Natural Gas Consumption (m <sup>3</sup> )
Fennell	91,554	15,126,437	165.22	1,193,299
Stoney Creek	24,845	2,996,850	120.62	350,622
<b>TOTAL</b>	<b>116,399</b>	<b>18,123,287</b>	<b>155.70</b>	<b>1,543,921</b>

Campus	CY2018 Natural Gas Use Intensity (ekWh/m <sup>2</sup> )	CY2018 Overall Energy Use Intensity (ekWh/m <sup>2</sup> )	Annual Heating Degree Days (HDD) with Balance Point of 18 deg C taken from NASA weather database for Hamilton ON (deg C-d)	CY2018 Overall Energy Intensity (ekWh/m <sup>2</sup> /HDD)
Fennell	135.49	300.71	3,765	0.07987
Stoney Creek	146.70	267.32	3,765	0.07100
<b>TOTAL</b>	<b>137.88</b>	<b>293.58</b>	<b>3,765</b>	<b>0.07798</b>

## 5.0 Energy Use Intensity Reduction Target for 2019-2024

Mohawk College's target for the period from January 2019 through January 2024 will be to reduce the College's overall energy use intensity (ekWh/m<sup>2</sup>/HDD) by 10%, as measured against the calendar year 2018 baseline.<sup>4</sup> This goal will support Mohawk's sustainability and climate change management goals.

**Note: This target is contingent upon the approval of a 5-year LED Campus-wide Retrofit Plan that will be presented to the Board of Governors in fall 2019.**

**10% REDUCTION IN ENERGY USE INTENSITY  
(ekWh/m<sup>2</sup>/HDD) OVER THE 2019-2024 PERIOD  
(2018 BASELINE)**



<sup>4</sup> Energy intensity will be measured in ekWh/m<sup>2</sup>/HDD – equivalent kilowatt-hours per square metre of building area per annual heating degree days, using a balance point temperature of 18 degrees Celsius



## 6.0 Current & Proposed Energy Efficiency Measures

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To further reduce the College's energy use intensity, Mohawk will focus its energy conservation strategies on weaving energy conservation and demand management strategies into operational efficiencies, future development, and investments in renewable energy. To meet our targets, college staff will have to apply an "energy conservation lens" to every day operations and future planning. Mohawk must also respond to rising energy and operational costs to ensure long-term environmental, social and fiscal resiliency.

### 6.1 HOW WILL WE DO IT?

In order to achieve these goals the College will use a set of supporting strategies. These strategies will be implemented through a set of actions that will help to reduce the College's demand for energy.

Over the past five years (January 2014 through January 2019), Mohawk focused on building staff capacity, upgrading facilities, and looking at new opportunities to invest in renewable energy systems. The combination of these strategies has led to a 7.44% reduction in Mohawk's overall energy use intensity (ekWh/m<sup>2</sup>/HDD) during that period.

Over the next five year period (January 2019 through January 2024), Mohawk will continue to focus on building staff capacity, upgrading current facilities to increase efficiency, and investing in smart technologies and renewable energy systems. This will maximize gains and resource use.



## CLASS A GLOBAL ADJUSTMENT SYSTEM

In response to rising energy costs, in 2018, Mohawk became an Industrial Conservation Initiative (ICI) Program Class A customer with Alectra Utilities. As a Class A customer, the College's annual Global Adjustment costs are based on Mohawk's electricity consumption during the top five peak demand hours in Ontario during the year. Global Adjustment costs can represent up to 70% of annual total electricity costs. This means that if Mohawk is able to reduce its demand for grid-supplied electricity during these top five peak demand hours, the College's annual cost of electricity can be substantially decreased.

The Global Adjustment Class A system encourages industrial and institutional customers to reduce their energy consumption on days when the demand on Ontario's electricity grid is very high. Peak demand days usually happen on the hottest or coldest days of the year. This kind of demand strains the electrical grid and increases the chances of service disruptions like "brown-outs" or "black-outs". Therefore, by becoming a Class A customer, Mohawk College is not only able to avoid energy costs through better energy demand management, but it can also help increase our community's resilience.

Being a Class A customer, it is particularly important for Mohawk to manage energy demand consciously. During peak times, Mohawk is planning on using solar energy from The Joyce Centre and the Fennell Campus P4 parking lot solar carport, the battery storage system and HVAC equipment demand curtailment strategies to help manage our electrical demand at Fennell Campus. Facilities staff will also use the BAS system to reduce our grid-provided electricity demand on campus and reduce the power load in offices, classrooms and other essential spaces. Additional opportunities for using space optimization in the summer months will also be pursued as time goes on.



## SUPPORTING PLANS

To reduce the College's demand for energy and its environmental impact, this CDM plan aligns with the Campus Master Plan, the Environmental Management Plan 2.0, and the Essential Deferred Maintenance Plan. Each of these plans applies an "energy conservation and sustainability lens" to capital planning, space management and engagement programs that help to create a culture of sustainability on campus.

## STAFF CAPACITY BUILDING

This plan also focuses on growing staff capacity in energy conservation. Over the last five years, Mohawk Facility Services staff have been growing their expertise in our building automation system and developing strategies that enable staff to identify and correct energy waste and inefficiencies.

The following is a work plan that provides a list of actions that Mohawk plans to undertake to achieve, and hopefully surpass, its target of a 10% reduction in energy use intensity (ekWh/m<sup>2</sup>/HDD) by January 2024.



## CURRENTLY IMPLEMENTED ENERGY EFFICIENCY MEASURES TO HELP ACHIEVE MOHAWK'S ENERGY USE INTENSITY REDUCTION TARGET

- Upgrades to Fennell Campus Central Hot Water Heating System
  - In February 2019, upgrades to our Fennell Campus central hot water heating system were completed
- Upgrades to Stoney Creek Campus Hot Water Heating Systems
  - In May 2019, upgrades to our Stoney Creek Campus heating systems began and are scheduled to be completed by October 2019
- Opening Of New Net-Zero Joyce Centre for Partnership & Innovation Building
  - In September 2018, the new net-zero Joyce Centre for Partnership & Innovation building opened

## PROPOSED ENERGY EFFICIENCY MEASURES TO HELP ACHIEVE MOHAWK'S ENERGY USE INTENSITY REDUCTION TARGET

### Campus-Wide LED Lighting Retrofits

- Upgrade existing fluorescent lighting throughout our Fennell Campus and our Stoney Creek Campus to LED lighting
- Set a target to install this new LED lighting at a lighting density of 0.5 watts per square foot or better
- Upgrade controls for new LED lighting so all lighting is controlled via the existing central lighting control system; this will allow occupancy sensors from the central lighting control system to control HVAC system operation as well as the lighting

## Campus-Wide Thermal Comfort Guideline Policy

- Create a campus-wide thermal comfort guideline policy, which will result in consistently comfortable learning/working environments for our students and staff
- Policy will reduce energy consumption and carbon footprint, by eliminating overheating, overcooling and overventilation

## Thermal Energy Storage System

- Explore the opportunity to install a new thermal energy storage system at the Fennell Campus to shift campus energy demand from daytime to nighttime; this will help balance Mohawk's energy load profile
- Use 1 megawatt electric boiler in tandem with the thermal energy storage to maximize benefits and savings

## Completion of Campus-Wide Energy Management Information System (EMIS)

- Continue to install energy submeters to measure real-time consumption of electricity, natural gas and water in all areas across the campuses
- Full-coverage EMIS will allow access to our energy consumption at a granular level; this data granularity will allow building operators to uncover, investigate and correct consumption anomalies in real-time, which will ensure that energy consumption is as efficient as possible
- Connect EMIS real-time energy consumption to campus dashboard monitors, allowing students and staff access to the data



## Fennell Campus Central Chilled Water System Investigation & Optimization

- Perform an audit of Fennell Campus central chilled water system to uncover operational inefficiencies
- Put a plan in place to correct any uncovered system inefficiencies

## Ventilation Air Improvements

- Evaluate areas of the campuses which are currently over-ventilated; over-ventilation increases heating and cooling loads unnecessarily and can contribute to less than optimal space conditions
- Use space planning optimization methods and install new technologies to reduce wasted energy consumption due to conditioning of this excess ventilation air

## Expanded Installation of Smart Energy Control Valves

- Continue to install smart energy control valves across the Fennell Campus for both hot and chilled water system control valves.
- Enhanced data and insights into the operation of our hot water and chilled water systems from these smart energy control valves will allow facilities staff to correct inefficiencies (i.e., flow issues, temperature differential issues)

## Building Pressurization Improvements

- Develop a plan to identify and correct building pressurization issues that lead to unwanted infiltration and exfiltration of air through the building envelope, leading to wasted energy consumption and drafts

## Expanded Automation of Fennell Campus Electricity Demand Curtailment Strategy

- Automating electricity demand curtailment strategy via campus-wide building automation system will ensure that Mohawk is able to optimize demand curtailment during any potential top five Ontario provincial electricity demand hours

## Facility Operations

- Develop energy and water conservation targets
- Include sustainability and efficiency metrics into the capital planning process
- Continue to improve Building Automation System capabilities to optimize building operations
- Continue to employ an energy specialist to maintain focus on energy management and building automation systems initiatives
- Manage energy through monitoring, tracking, trending and reporting

## Future Development and Renovations

- Investigate opportunities to design new buildings and existing building renovations so that energy performance is 50% better than ASHRAE Standard 90.1-2004 (Energy Standard for Buildings Except Low-Rise Residential Buildings)
- Investigate opportunity to build all new buildings and deep retrofits with Passive House and/or Zero Carbon designation
- Use the campus as a living lab to provide students with on-site learning opportunities in renewable energy and energy conservation
- Align energy conservation goals with Deferred Maintenance Plan

## Stakeholder Engagement and Awareness

- Develop an Energy Conservation Committee that will advocate for and support energy conservation initiatives on campus
- Hold workshops, outreach events and information kiosks
- Give classroom presentations
- Develop digital, print and social media communication strategies
- Develop academic partnerships
- Hold on-campus events with local sustainability leaders, organizations and businesses
- Support student groups on campus such as the Zero Carbon Ambassadors, Enactus and other environmentally-conscious groups
- Develop staff leadership opportunities, committees and networks
- Enhance programs and services
- Develop co-curricular credits that encourage sustainable living

## Space Planning Optimization

- Increase the number of faculty, staff and students that can be served by existing areas through adaptive reuse of space
- Maintain effective and efficient space planning standards



## 7.0 Costs and Savings Estimates Of Proposed Energy Efficiency Measures

Under the current Deferred Maintenance budget, Mohawk will spend \$1,000,000 over the next five years to retrofit and upgrade existing lighting. This will result in an estimated annual cost savings of \$75,000 and save 425,000 kWh.

Estimated project costs = \$200,000 per year over five years (\$1,000,000 total)

Estimated annual cost savings = \$75,000

Estimated annual energy consumption savings = 425,000 kWh

### PROPOSED CAMPUS-WIDE LED RETROFITS

Given Mohawk's position in sustainability, potential cost savings, and co-benefits to our students and staff, Mohawk Facilities staff is proposing a complete 5-year LED campus-wide retrofit.

The proposed 5-year LED campus-wide retrofit project will cost \$6,000,000 over five years. This project will result in an annual cost savings of approximately \$375,000 annually in avoided costs for operations, maintenance and energy. This project will be proposed to the Board of Governors for implementation beginning in the 2020/21 budget year.

Estimated project costs = \$6,000,000 over five years

Estimated annual cost savings = \$375,000

Estimated annual energy consumption savings = 2,125,000 kWh

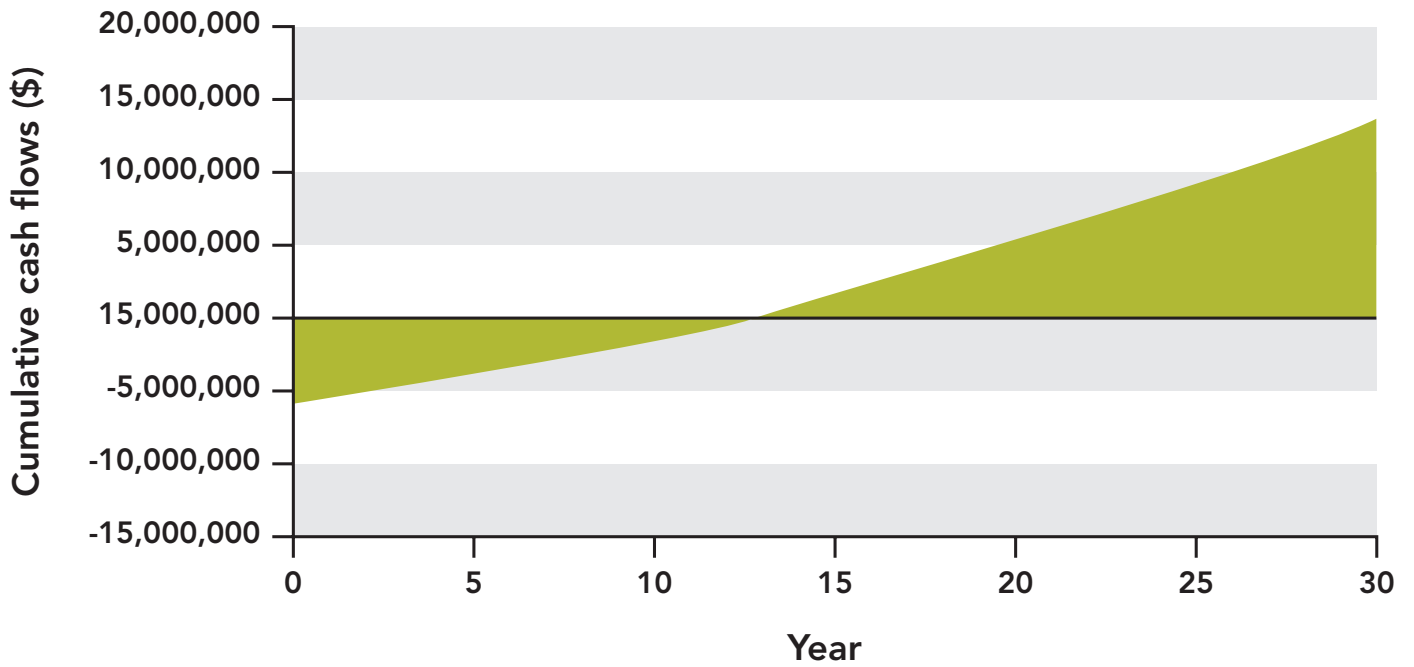
Project annual internal rate of return = 8.4%

Project net present value = \$8,800,000 (based on project lifespan of 30 years)

#### Project co-benefits

- Improved lighting quality
- Improved local controllability of lighting for occupants
- Data on occupancy patterns throughout all areas of Fennell Campus, which will be able to reveal insights regarding space utilization throughout each day
- Space occupancy data will also be able to be utilized to control Fennell Campus heating, ventilation and air conditioning equipment, resulting in further substantial energy consumption reductions
- Savings on operation & maintenance costs

Graph 2. Cumulative cash flow over Campus-Wide LED Lighting Retrofit Project Lifespan



Costs and savings estimates for other proposed energy efficiency measures will be added to this document throughout the CDM Plan's 5-year period as they are investigated and calculated.



## 8.0 Sources of Alternative Energy

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### SOLAR PHOTOVOLTAIC (PV) ENERGY SYSTEMS

Mohawk will continue to investigate opportunities to maximize the use of our existing solar PV systems and investigate opportunities to invest in more solar PV technologies.

The Joyce Centre for Partnership and Innovation's (JCPI) solar photovoltaic system at the Fennell Campus (including JCPI, A-Wing, J-Wing & H-Wing rooftop systems) consists of 1,980 solar panels, capable of generating roughly 721,000 kilowatt-hours (kWh) of clean, renewable electricity on an annual basis. The system is capable of generating up to 500 kilowatts (kW) of AC power.

The Fennell Campus P4 parking lot carport solar photovoltaic system consists of 1,316 solar panels, capable of generating roughly 505,000 kilowatt-hours (kWh) of clean, renewable electricity on an annual basis. The system is capable of generating up to 300 kilowatts (kW) of AC power.

The rooftop of the David Braley Athletic and Recreation Centre (DBARC) at our Fennell Campus is solar photovoltaic ready, allowing our campus solar photovoltaic system to be expanded without additional structural upgrades at that facility.

### SOLAR THERMAL WATER ENERGY SYSTEMS

The David Braley Athletic and Recreation Centre (DBARC) rooftop houses 14 flat-plate solar collectors that use collected energy to preheat domestic hot water for showers and sinks throughout the building, reducing the amount of non-renewable energy required.

The Joyce Centre has five solar collectors for heating of domestic hot water for the building.

### SOLAR THERMAL AIR ENERGY SYSTEMS

The ventilation air provided to the E-Wing is preheated in the winter months via a solar thermal air energy "solar wall" system. This system helps reduce Mohawk's natural gas consumption and GHG emissions by first using the sun's energy to heat the air.

### GROUND SOURCE HEAT PUMP SYSTEMS

JCPI has a ground source heat pump system, which provides heating and cooling to the building year-round. This system consists of 28 geothermal wells, which extend 185 metres below the ground surface. This system allows us to store heat in the ground when it is not required by the building, and draw that heat back when it is required by the building.

### DEMONSTRATION FACILITIES

The College is equipped with a renewable energy lab as a part of the Electrical Engineering Technology Department. This lab consists of thin film laminate PV, building integrated PV, and standard solar PV panels with micro inverters. The lab also has the latest in off-grid lighting technology featuring solar and wind powered LED street lighting.

## 9.0 Implementation & Next Steps

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Mohawk College's target for the 2019-2024 CDM Plan is to reduce our overall energy use intensity (ekWh/m<sup>2</sup>/HDD) by 10% over the next five years, from 2019 to 2024.<sup>5</sup> This will be measured by using Mohawk's energy use intensity for the 2018 calendar year as the baseline.

In implementation, the focus remains on continuing to build a culture of sustainability at Mohawk College. Guided by this CDM plan, the Facilities Services team will apply an "energy conservation lens" on all new capital and maintenance projects. The Sustainability team will continue to promote engagement and education opportunities to create awareness of sound energy conservation habits. The Energy Conservation Committee will support innovative initiatives to help promote collaboration on cross-campus energy initiatives.

This CDM plan is a living document that will be updated on an ongoing basis by Facility Services staff as new opportunities become available. This plan is also contingent on the approval of the Campus-wide LED Retrofit plan by the Mohawk Executive Group and the Board of Governors in fall/winter 2019.

This CDM plan is not just an opportunity to reduce energy waste and improve the efficiency of campus operations. All of the initiatives listed in this plan have co-benefits – improving the campus environment, reducing costs and investing in new technologies that will lead us to a cleaner, greener future.

Mohawk will continue to foster an environment where all students and staff are able to LEARN, LIVE, and LEAD in energy efficiency and sustainability. This CDM plan will support Mohawk's continued sustainability mission and leader in the college sector.



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<sup>5</sup> Energy intensity as measured in ekWh/m<sup>2</sup>/HDD – equivalent kilowatt-hours per square metre of building area per annual heating degree days with a balance point temperature of 18 degrees Celsius