

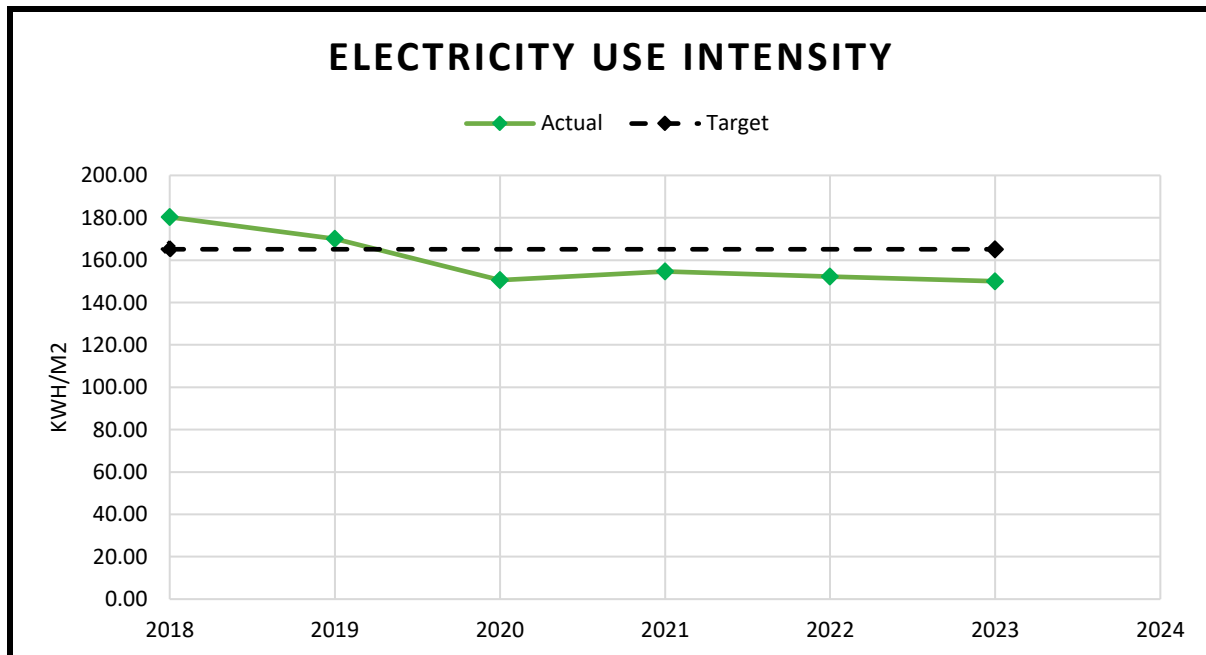
Western University
Results of Energy Conservation and Demand Management (CDM) plan 2019- 2024
Energy Conservation and Demand Management (CDM) plan 2024 – 2029

Results of CDM Plan January 2019 to December 2024

In 2019 Western submitted its energy conservation and demand management plan for the period 2019 to 2024. The plan was to do the following:

- 1) Reduce Electricity intensity (kWh/m²) by 10% from 2018 levels over the next five (5) years
- 2) Reduce Greenhouse Emissions (GHG/m²) by 8% below 2018 levels
- 3) Reduce Water intensity (m³/m²) by 10% from 2018 levels
- 4) Reduce overall energy usage by 3% from 2018 levels

- 1) **Reduce Electricity intensity (kWh/m²) by 10% from 2018 levels over the next five (5) years**
 - a. Actual results Western reduced energy used per square meter by 16.8% below 2018 levels
 - b. Space at Western increased by 5.91% from our 2018 benchmark
 - c. Electricity usage on campus decreased by 11.9% during the same period



Goal: Reducing electricity use intensity (kWh/m²) by 10% below 2018 levels – 162.25 kWh/m²

Actual: Reduced by 16.8% below 2018 levels

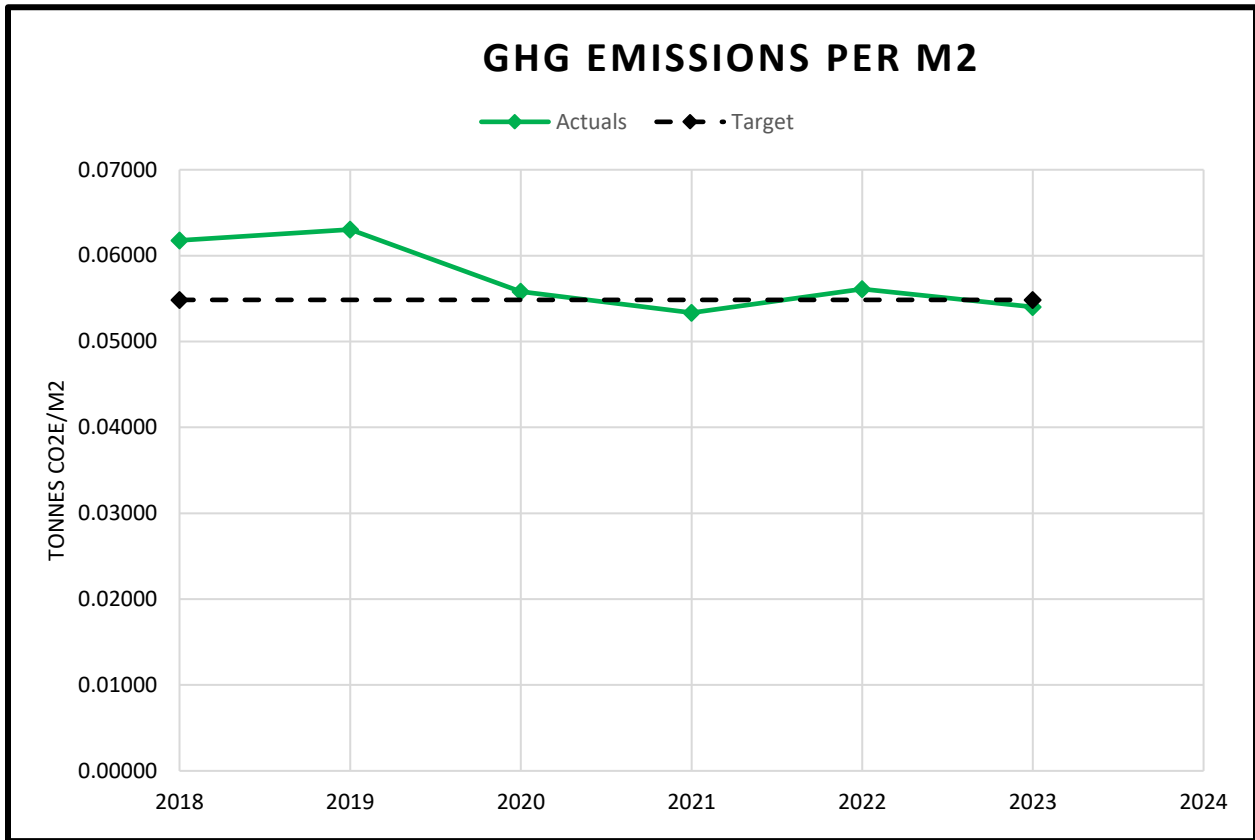
Calendar Year	Yearly Usage ¹		Western Buildings ²	
	kWh	kWh/m ²	Sq. Ft	Sq. M
2018	154,018,932	180.28	9,195,914	854,328
2019	146,166,854	170.12	9,248,324	859,197
2020	134,038,207	150.62	9,578,948	889,913
2021	138,353,134	154.71	9,625,986	894,283
2022	137,425,070	152.23	9,717,221	902,759
2023	135,759,692	150.04	9,739,147	904,796

¹ Electricity usage is taken from an internal summary of electricity usage derived from electricity bills from London Hydro and Hydro One

² Western building area is taken from Capital Budget Planning documents posted on the Office of Institutional Planning & Budgeting website: <https://www.ipb.uwo.ca/budget-planning/capital-budget-documents/index.html>

2) Reduce Greenhouse Emissions (GHG/m²) by 8% below 2018 levels

- a. Actual GHG emissions decreased by 8.6% from 2018
- b. Space at Western increased by 5.91% from 2018



Goal: Reduce Greenhouse Emissions (GHG/m²) by 8% below 2018 levels – 0.05484 tonnes CO₂e/m²

Actual: Reduced GHG/m² by 13.7% below 2018 baseline

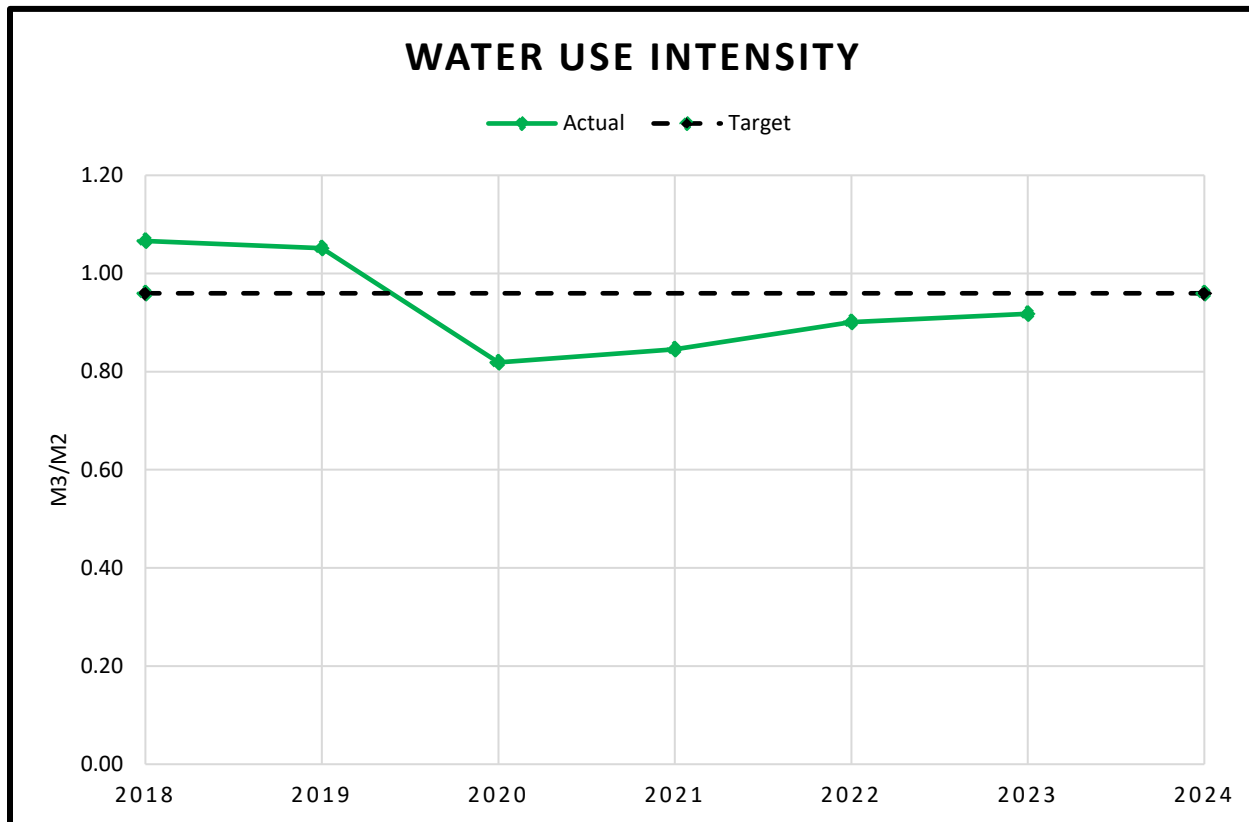
GHG Emissions³

	tonnes CO ₂ e	tonnes CO ₂ e/m ²
2018	50,929	0.05961
2019	49,880	0.05805
2020	44,979	0.05054
2021	46,981	0.05253
2022	50,172	0.05558
2023	46,574	0.05147

³ GHG emissions from natural gas and electricity, excluding steam production for University Hospital

3) Reduce Water intensity (m³/m²) by 10% from 2018 levels

- a. Actual results water intensity(m³/m²) reduced 13.9% below 2018 levels
- b. Space at Western increased by 5.91% from our 2018 benchmark
- c. Water use on campus reduced 80,302 m³ or 8.8% from 2018 levels



Goal: Reducing water use intensity (m³/m²) by 10% below 2018 levels – 0.96 m³/m²

Actual: Reduced by 13.9% below 2018 levels

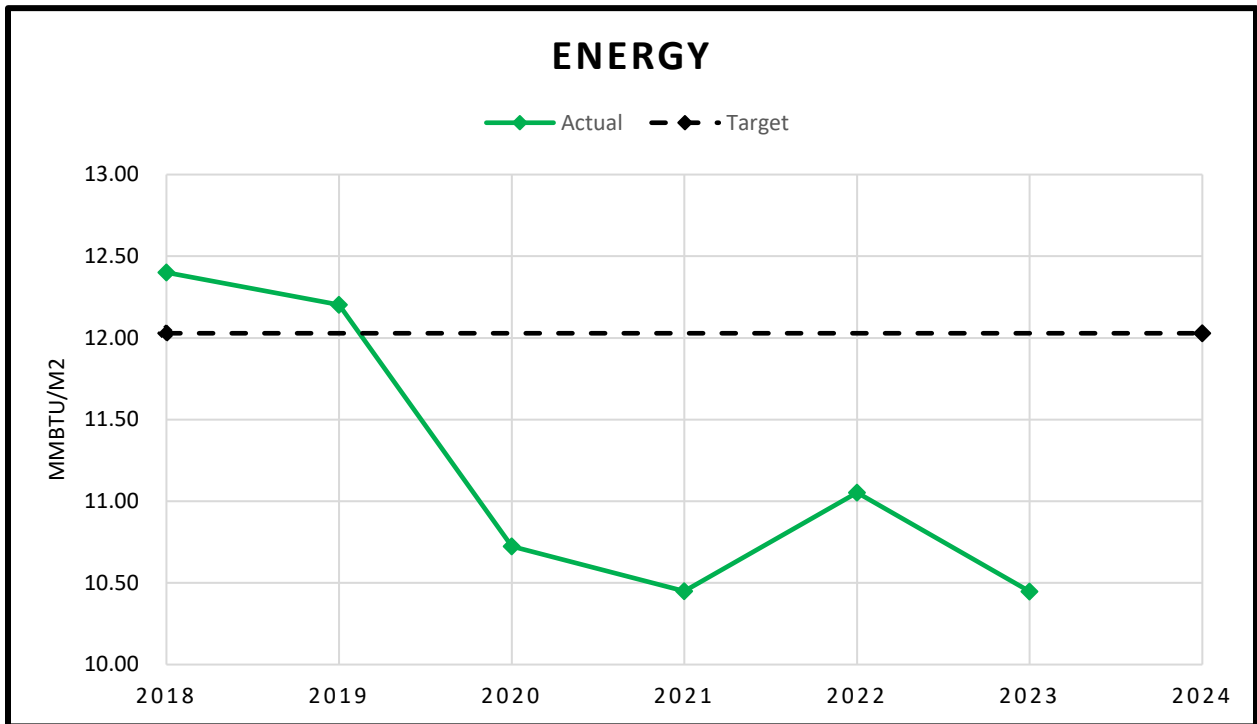
Water Usage⁴

	m ³	m ³ /m ²
2018	910,913	1.07
2019	903,575	1.05
2020	728,633	0.82
2021	756,289	0.85
2022	813,491	0.90
2023	830,611	0.92

⁴ Water usage is taken from an internal summary of water usage derived from water bills from London Hydro

4) Reduce overall energy usage by 3% from 2018 levels

- a. Actual results energy usage reduced by 1,141,101 MMBTU 10.77% below 2018 levels
- b. Natural gas usage decreased by 3,039,380 m3 or 10.7% from 2018 levels
- c. Electricity usage decreased by 18,259,239 kWh of 11.9% from 2018 levels
- d. Energy use intensity (MMBTU/m²) decreased by 15.75% from 2018 levels



Goal: Reducing overall energy use by 3% below 2018 levels - 12.03 MMBTU/m²

Actual: Reduced by 15.75% below 2018 levels

	Natural Gas + Electricity ⁵	
	MMBTU	MMBTU/m ²
2018	10,593,978	12.40
2019	10,484,251	12.20
2020	9,543,757	10.72
2021	9,344,908	10.45
2022	9,978,909	11.05
2023	9,452,877	10.45

⁵ The energy content of 1 m³ of natural gas is assumed to be 0.35494 MMBTU

From 2019-2024, a number of measures were introduced at Western including the following:

- Technical Measure: Install a Flue gas recovery unit on Boiler # 1 and introduce the recovered heat to
 - o Heat the air being brought into the combustion chamber of boiler #1 reducing the loss heat required to heat the air
 - o Introduce the excess low temperature hot heat in the winter months into the Energy Loop connected to all on-campus buildings where electric heat pumps will pull in the heat for the buildings.
 - o The combination of these two uses for heat, which would have normally gone up the stack, will be used to reduce the gas consumption of the boilers.
- Technical Measure: Install electric heat pumps in on-campus buildings to collect and share excess heat between buildings on campus.
 - o Low temperature hot water will be shared via the energy loop during winter months reducing the amount of natural gas which will need to be burnt and reduce the GHG emissions on campus
 - o Projects completed during this time include CMLP, SEB, and WSRC
- Technical Measure: Deep energy retrofit for buildings on campus which include the installation of electric heat pumps attached to the energy loop.
 - o Excess heat from buildings will be first shared within the building before being added to the energy loop to be shared with other buildings on-campus
 - o All major retrofits on campus will include deep energy retrofits which include the installation of electric heat pumps capable of taking or giving low temperature hot water to the energy loop during the winter months.
 - o Lighting in these buildings are also switched to LED lighting resulting in electricity savings and all HVAC systems and controllers switched to variable speed drives and controllers switched to digital from pneumatic controls to allow better centrally from our BAS system
- Technical Measure: North Chiller Plant will be optimized in the same way the south plant was reducing electricity usage to run the chillers and increase the flow of chilled water out of the north plant.
 - o Replace cooling tower and optimize chillers in the North Plant to run the most efficient chillers first and to reduce the pumping power required to get the chilled water out of the plant.

Renewable Energy

- Western currently has one grid connected solar photovoltaic installation installed at Amit Chakma Engineering Building. This system was installed in 2018 and has a capacity of 127 kWp and generates around 165,000 kWh/year

Energy Conservation and Demand Management Plan for 2024 to 2029

Western is committed to reducing our emissions in line with the International Paris Accords of 2016, and Ontario's provincial goals, in an effort to prevent global temperature increase of 1.5°C. Specifically, our goals are:

- By 2030 - reduce greenhouse gas emissions by at least 45%, relative to 2005 levels
- By 2050 - achieve net-zero emissions for campus operations

Western's baseline emissions in 2005 was 65,209 tCO₂e, making the absolute emission target 35,865 tCO₂e by 2030.

The 2005 baseline is based on natural gas and electricity purchased by Western for use on Western owned and operated facilities.

Goals for 2024-2029 CDM:

- 1) Reduce greenhouse emissions (tCO₂e) from buildings by 45% below 2005 levels
- 2) Reduce natural gas consumption by 37% from 2023 levels (in order to achieve carbon emissions goals)

Measures being implemented or considered over the next five years for all the above goals:

- 1) Technical Measure: Install 10-12 MW of electric boilers in the central steam plant.
 - a. The electric boilers will be used for baseload steam generation and reduce natural gas consumption
 - b. Expected outcomes: 7-10 million m³ of natural gas and 13,500-19,300 tonnes of GHG emissions savings, an increase in electricity consumption of 65-89 GWh.
- 2) Technical Measure: Deep energy retrofit for buildings on campus which include the installation of electric heat pumps attached to the energy loop.
 - a. Excess heat from buildings will be first shared within the building before being added to the energy loop to be shared with other buildings on-campus
 - b. All major retrofits on campus will include deep energy retrofits which include the installation of electric heat pumps capable of taking or giving low temperature hot water to the energy loop during the winter months.
 - c. Lighting in these buildings are also switched to LED lighting resulting in electricity savings and all HVAC systems and controllers switched to variable speed drives and controllers switched to digital from pneumatic controls to allow better centrally from our BAS system
- 3) Technical Measure: All the necessary components for the energy loop to operate have been installed. The energy loop will continue to be optimized for energy efficiency and emissions reduction. A training program for power plant operations and other operations staff will be implemented.
- 4) Technical Measure: Interconnect standalone chillers with the North Chilling Plant loop allowing for the most efficient chiller to add chilled water to the loop thereby avoiding the investment in new capital assets and full utilized of existing assets to cool the north campus buildings
 - a. Delay of capital investment of \$15 M for 10-15 years.
 - b. Expected savings in electricity by better utilization 500,000 kWh per year.

- 5) Organizational Measure: Update sustainable design guidelines
 - a. Ensure that all new construction is net zero carbon/net zero carbon ready
 - b. Ensure that all new construction is evaluated for renewable energy opportunities, connection to the district energy loop
 - c. Include feedback from operations staff
- 6) Organizational Measure: Implement an intake process for the campus community to suggest energy efficiency and emission reduction projects.

Renewable Energy

- Western is currently installing its first commercial scale closed-loop ground source heat pump system at the Ronald D. Schmeichel Building for Entrepreneurship and Innovation. This system will have a peak capacity around 300kW in both heating and cooling modes

June 27, 2024

To: Ontario Ministry of Energy and Electrification

I hereby confirm Western University's commitment to energy conservation and demand management will be guided by this plan for the next five years. The plan will be revised and periodically updated, in order to remain relevant and current to Western's operations.

Sincerely,



Andrew Konowalchuk
Associate Vice-President Facilities Management
Western University