

**Western University  
Results of Energy Conservation and Demand Management (CDM) plan 2014- 2018  
Energy Conservation and Demand Management (CDM) plan 2019 – 2024**

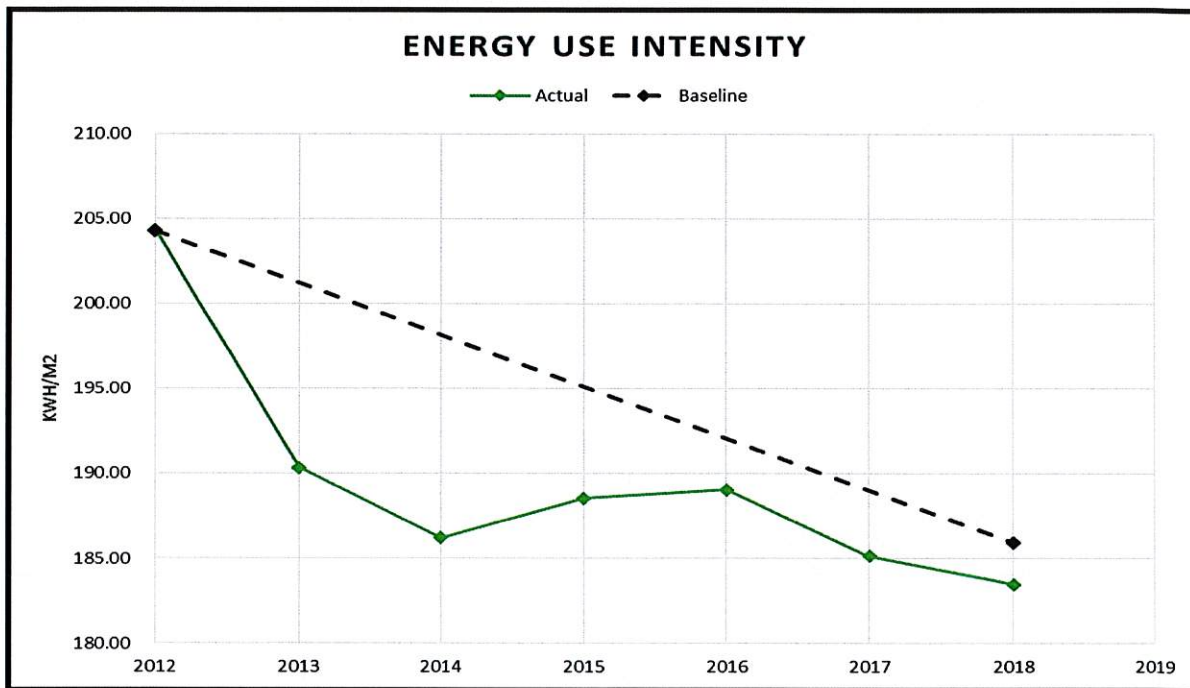
**Results of CDM Plan January 2014 to December 2018**

In 2014 Western submitted its energy conservation and demand management plan for the period 2014 to 2018. The plan was to do the following:

- 1) Reduce electricity intensity per square meter use by 9% below 2012 levels
- 2) Reduce Greenhouse Gas (GHG) emissions below 2009 baseline
- 3) Reduce water intensity (m<sup>3</sup>/m<sup>2</sup>) by 8% below 2012 levels
- 4) Reduce overall energy use by 4% below 2012 levels

**1) Reduce electricity use 9% below 2012 levels.**

- a. Actual results Western reduced energy used per square meter by 10.2% below 2012 levels
- b. Space at Western increased by 10.6% over the 6 years from our 2012 benchmark
- c. Electricity usage on campus increased 0.25% during the same time period mainly due to the increase in space



**Goal:** Reducing energy use intensity (kWh/m<sup>2</sup>) by 9% below 2012 levels – 185.94 kWh/m<sup>2</sup>  
**Actual:** Reduced by 10.2% below 2012 levels

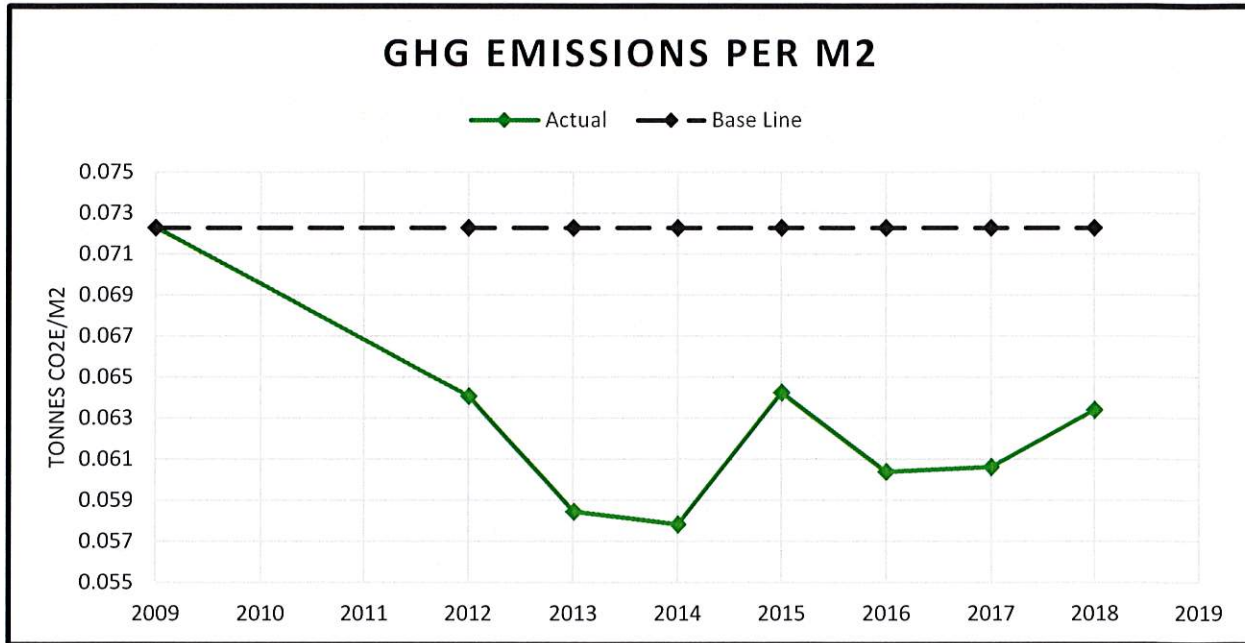
Calendar Year	Yearly Usage		Western Buildings	
	kWh	kWh/m <sup>2</sup>	Sq. Ft	Sq. M
2012	152,368,905.00	204.33	8,026,769	745,711
2013	154,156,053.00	190.34	8,717,732	809,903
2014	152,518,443.00	186.21	8,816,431	819,073
2015	154,441,656.00	188.56	8,816,431	819,073
2016	154,927,743.00	189.04	8,821,431	819,537
2017	151,742,427.00	185.16	8,821,431	819,537
2018	152,746,298.00	183.49	8,960,471	832,455

**A number of measures were introduced at Western including the following:**

- a. Technical Measure – Optimization of chilled water distribution in chiller plant south reducing 1,000 kWh per hour when the plant is running. Savings of 3,600,000 kWh per year
- b. Technical Measure – Improve controls in laboratories fume hoods to alert users of fume hoods being left open when no work was being done. Number of fume hoods modified: 63 in Chemistry and Medical Science buildings.
- c. Organization Measure – Energy dashboard with real-time energy use as well as historical data for all Western buildings – Dashboard allows for early detection of problems and allows building occupants to reduce energy use
- d. Technical Measure – New building and major renovations include energy savings in various systems designed to use less electricity including LED lights; replacement of 34 ultra-low freezers with new energy efficient models
- e. Behavioural Measure – Introduction of Demand management during summer time when chillers are used to help modify users demand for chilled water by closing windows, blinds; reducing lighting and increasing the set point in buildings; fan-shedding
- f. Technical Measure - Introduction of sensors to residence rooms which automatically shuts off air-condition units when windows or doors are left open
- g. Behavioural/ Organization Measure – Hired an energy manager to look for ways to reduce energy use across campus and assist design and engineering teams in selecting energy savings lights, HVAC, motors and other equipment.
- h. Organization Measure – modeled the campus using RETScreen by NRCAN to track trends in energy use over longer time spans

**2) Reduction of Greenhouse Gases (GHG) below 2009 base line**

- a. Actual GHG base line of 54,000 tonnes in 2009 base reducing to 52,771 tonnes in 2018 a reduction of 2.1% over the nine (9) years.
- b. Space at Western increased by 15.9% from our 2009 benchmark space of 718,304 square meters



**Goal:** Reducing direct GHG emissions below 2009 baseline

**Actual:** Reduced GHG/m<sup>2</sup> by 12.0% below 2009 baseline

**From GHG Report (O.Reg 452)**

	tonnes CO2e	tonnes CO2e/m <sup>2</sup>
2009	53,901	0.07228
2012	47,767	0.06406
2013	47,326	0.05843
2014	47,360	0.05782
2015	52,615	0.06424
2016	49,486	0.06038
2017	49,674	0.06061
2018	52,771	0.06339
<b>tonnes CO2e</b>		
1990	33,099	
2030	20,852	

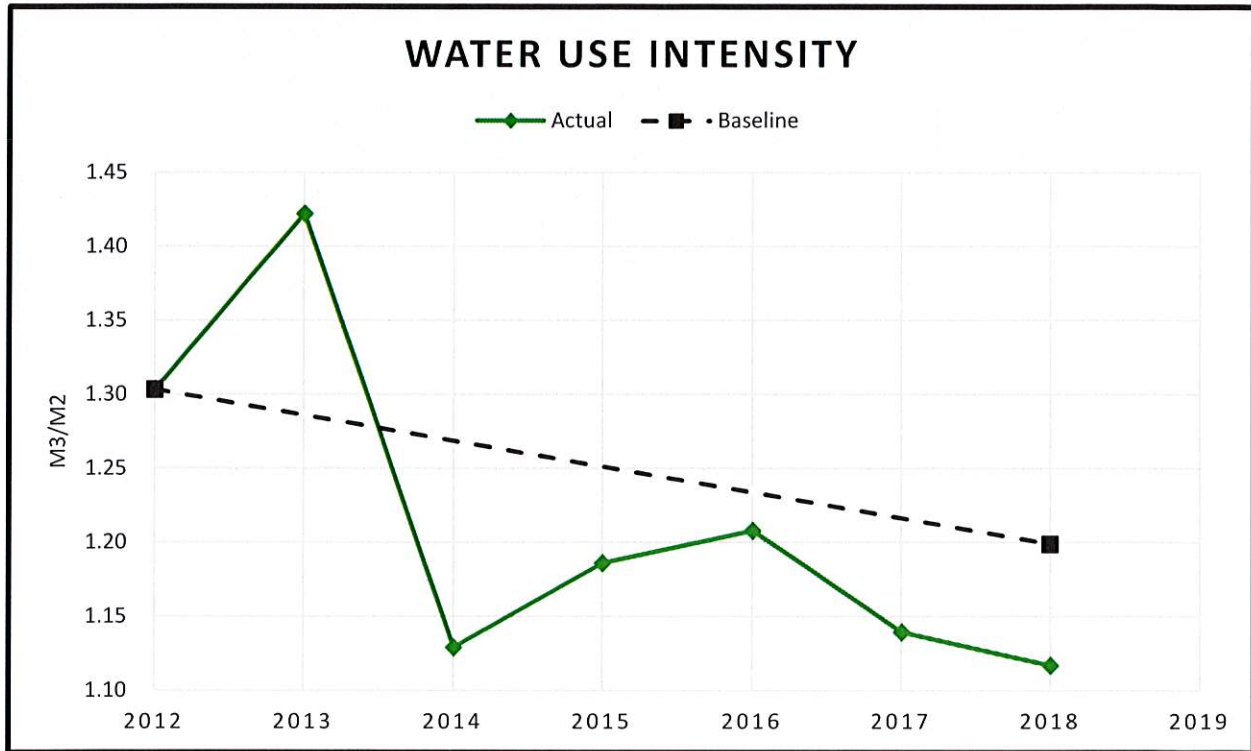
**A number of measures were introduced at Western including the following:**

- a. Technical Measure – Steam pipe insulation – saving 2,048,158 lbs CO<sub>2</sub>e per year
- b. Organization Measure – Energy Dashboard measuring steam and gas usage at each building on campus
- c. Technical Measure – the upgrade of 43 boilers in a number of standalone buildings across campus reducing GHG over the past five (5) years.
- d. Technical Measure – Residence rooms were equipped with sensors to detect when windows are open shutting down heat to the space
- e. Technical Measure – Improve controls in laboratories fume hoods to alert users of fume hoods being left open when no work was being done. Number of fume hoods modified: 63
- f. Technical Measure – leaks in the steam and condensate lines were repaired reducing the heat loss to the boilers and reducing the amount of gas required to make steam.
- g. Behavioural/ Organization Measure – Hired an energy manager to look for ways to reduce energy use across campus and assist design and engineering teams in selecting energy savings lights, HVAC, motors and other equipment.
- h. Organization Measure – modeled the campus using RETScreen by NRCAN to track trends in energy use over longer time spans



**3) Water intensity use reduced 8% below 2012 levels**

- a. Actual results water intensity( $m^3/m^2$ ) reduced 14% below 2012 levels
- b. Space at Western increased by 10.6% over the 6 years from our 2012 benchmark
- c. Water use on campus reduced 42,242  $m^3$  or 4.4% from 2012 levels



**Goal:** Reducing water use intensity ( $m^3/m^2$ ) by 8% below 2012 levels – 1.20  $m^3/m^2$

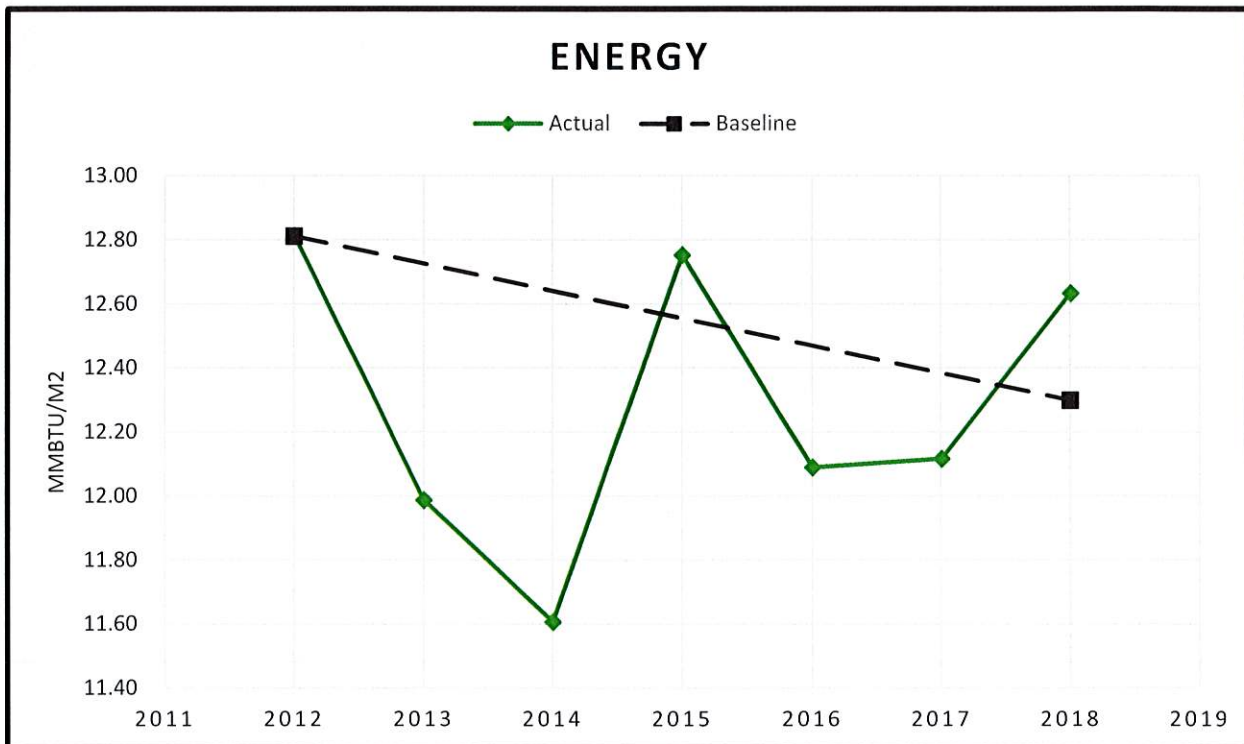
**Actual:** Reduced by 14% below 2012 levels

	Water Usage	
	$m^3$	$m^3/m^2$
<b>2012</b>	971,907	1.30
<b>2013</b>	1,151,812	1.42
<b>2014</b>	924,686	1.13
<b>2015</b>	971,327	1.19
<b>2016</b>	989,825	1.21
<b>2017</b>	933,800	1.14
<b>2018</b>	929,665	1.12

**A number of measures were introduced at Western including the following:**

- a. Technical Measure – Installation of low flush toilets and urinals across campus
- b. Technical Measure – Installation of low flow shower heads in residences and gym change rooms
- c. Technical Measure – Better leak detection resulting in repair of water loops, cooling towers and steam systems
- d. Behaviour Measure – Conservation efforts to educate staff, students, and researchers on the use of water
- e. Organization Measure – Energy dashboard displaying water usage in each buildings
- f. Technical Measure – Installation of water meters
- g. Behavioural/ Organization Measure – Hired an energy manager to look for ways to reduce energy use across campus and assist design and engineering teams in selecting energy savings lights, HVAC, motors and other equipment.
- h. Organization Measure – modeled the campus using RETScreen by NRCAN to track trends in energy use over longer time spans

**4) Reduction of overall energy use by 4% below 2012 use**



<b>Goal:</b> Reducing overall energy use by 4% below 2012 use – 12.30 MMBTU/m <sup>2</sup>
<b>Actual:</b> Reduced by 1.4% below 2012 levels

	Natural Gas + Electricity	
	MMBTU	MMBTU/m <sup>2</sup>
<b>2012</b>	9,553,615.45	12.81
<b>2013</b>	9,707,974.38	11.99
<b>2014</b>	9,506,010.74	11.61
<b>2015</b>	10,444,694.08	12.75
<b>2016</b>	9,907,122.86	12.09
<b>2017</b>	9,929,723.53	12.12
<b>2018</b>	10,515,976.34	12.63

**A number of measures were introduced at Western including the following:**

- a. Technical Measure – Steam pipe insulation –saving 2,048,158 lbs CO<sub>2</sub>e per year
- b. Organization Measure – Energy Dashboard measuring steam and gas usage at each building on campus
- c. Technical Measure – the upgrade of 43 boilers in a number of standalone buildings across campus reducing GHG over the past five (5) years.
- d. Technical Measure – Residence rooms were equipped with sensors to detect when windows are open shutting down heat to the space
- e. Technical Measure – Improve controls in laboratories fume hoods to alert users of fume hoods being left open when no work was being done. Number of fume hoods modified: 63
- f. Technical Measure – leaks in the steam and condensate lines were repaired reducing the heat loss to the boilers and reducing the amount of gas required to make steam
- g. Technical measure - roof replacement on multiple buildings on campus
- h. Organization Measure – modeled the campus using RETScreen by NRCAN to track trends in energy use over longer time spans



## **Energy Conservation and Demand Management Plan for 2019 to 2024**

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

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

- 1) Technical Measure: Install a Flue gas recovery unit on Boiler # 1 and introduce the recovered heat to
  - a. Heat the air being brought in to the combustion chamber of boiler #1 reducing the loss heat required to heat the air
  - b. 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.
  - c. The combination of these two uses for heat, which would have normally gone up the stack, will be used to reduce the gas consumption and therefore the GHG emissions by 5,000 tonnes of GHG annually.
- 2) Technical Measure: Install electric heat pumps in on-campus buildings to collect and share excess heat between buildings on campus.
  - a. 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
  - b. Expected savings for CMLP and SEB: 1,061 tonnes annually (SEB: 795 MTCDE; CMLP: 266 MTCDE)
- 3) 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
- 4) 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.
  - a. 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.



- b. Expected savings 3,500,000 kWh per year when the north plant is running.
- 5) 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.
- 6) Behaviour Measure: Introduction of Green Lab program introduction of green measures to reduce waste and energy in labs:
  - a. Ultra-low freezer cleaning kits with instruction to keep freezers in top condition reducing the amount of energy required to keep freezers working and research material in good condition.
  - b. Information on how to reduce energy by turning off equipment when not in use and closing sash hoods when not in use stopping the 100% exchange in conditioned air in the lab.
  - c. Collection of single use plastics not contaminated which would have found the waste system which then are returned to be reused to make new products.
- 7) Behaviour Measure: Continuation of the Green Office Program where offices pledge to keep windows and blinds closed during hot and cold days saving energy required to heat or cool these locations.

July 17, 2019

To: Ontario Ministry of Energy


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,



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Elizabeth Krische  
Associate Vice-President Facilities Management  
Western University



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Lynn Logan  
Vice-President (Operations & Finance)  
Western University