

# ENERGY CONSERVATION & DEMAND MANAGEMENT PLAN

**2019-2024**



**Lambton**  
College

# Executive Summary

This Energy Conservation and Demand Management (ECDM) Plan is written in accordance with sections 4, 5, and 6 of the recently amended Electricity Act, 1998, O. Reg. 507/18. As concerns surrounding energy availability and cost continue to rise, an ECDM Plan would be an effective way to strengthen the energy management initiatives of Lambton and contribute towards the fulfilment of our Strategic Plan.

## Our Strategic Plan



## Empowering Today. Shaping Tomorrow.

“We recognize the path forward is not a straight line. Our Strategic Plan establishes the direction we are headed and sets a clear vision of where Lambton College will be in 2024.”

## Our Goals & Commitments for 2019 - 2024

“Uncertainty is inevitable. Leveraging its past successes, Lambton College will continue to demonstrate the flexibility to adapt to unforeseen events and re-shape them as opportunities over the period of the 2019-2024 Strategic Plan.”



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# 1. Introduction

The purpose of Lambton’s Energy Conservation and Demand Management Plan (ECDM) is to promote sustainable stewardship of our environment and community resources. In keeping with our core values of system efficiency and financial responsibility, Lambton College’s energy management program would aim to increase energy conservation as outlined in 4, 5, and 6 of the recently amended Electricity Act, 1998, O. Reg. 507/18.

The results and the progress of the previous ECDM plan, and the projected impact of the new ECDM Plan is presented in the chart & tables below.

Figure 1. Campus-wide Energy Consumption Trends & Projections

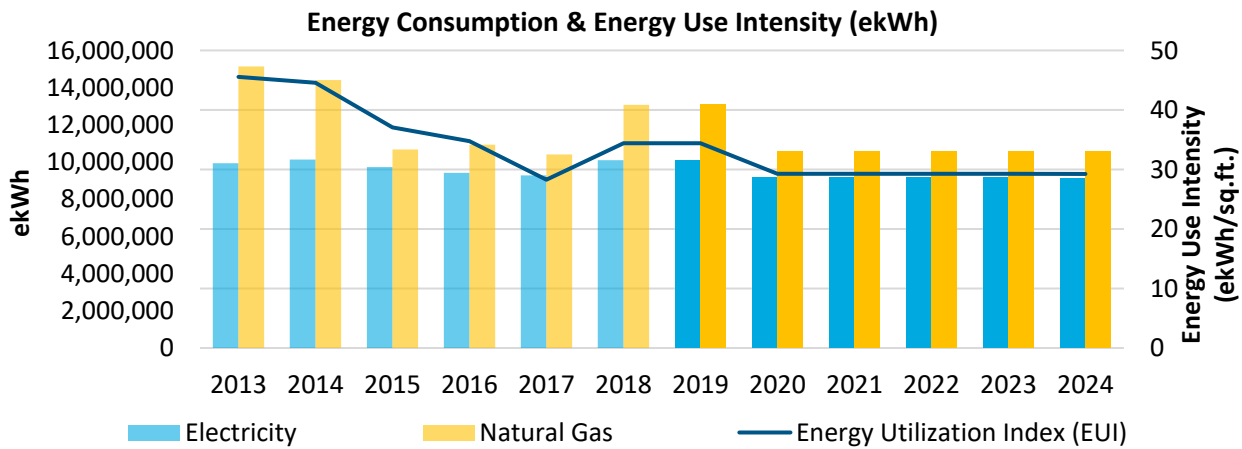


Table 1. Campus-wide Energy Consumption Trends & Projections

ECDM Program Summary	2013	2014	2015	2016	2017	2018
Electricity Consumption (ekWh)	9,937,512	10,130,610	9,730,842	9,418,820	9,283,876	10,102,982
Natural Gas Consumption (ekWh)	15,144,123	14,408,505	10,675,934	10,929,873	10,405,006	13,075,314
Electricity Savings(ekWh)	0	399,769	312,022	134,944	0	0
Natural Gas Savings (ekWh)	0	3,732,570	-253,939	524,866	0	1,260
Facility Size (Sq. Ft.)	550,557	550,557	550,557	585,609	696,286	673,768
Energy Utilization Index - EUI (ekWh/Sq. Ft)	46	45	37	35	28	34
ECDM Program Projections	2019	2020	2021	2022	2023	2024
Electricity Consumption (ekWh)	10,102,982	9,146,796	9,146,796	9,146,796	9,146,796	9,130,947
Natural Gas Consumption (ekWh)	13,074,054	10,581,373	10,581,373	10,581,373	10,581,373	10,581,373
Electricity Savings(ekWh)	0	956,186	956,186	956,186	956,186	972,035
Natural Gas Savings (ekWh)	1,260	2,493,941	2,493,941	2,493,941	2,493,941	2,493,941
Facility Size (Sq. Ft.)	673,768	673,768	673,768	673,768	673,768	673,768
Energy Utilization Index - EUI (ekWh/Sq. Ft)	34	29	29	29	29	29



The purpose of Lambton's Conservation and Demand Management Plan (ECDM) is to promote sustainable stewardship of our environment and community resources. To obtain full value from energy management activities, and to strengthen our conservation initiatives, a strategic approach would be taken. Our organization would strive to fully integrate energy management into our practices by considering indoor environmental quality, operational efficiency, and sustainably sourced resources into financial decision-making.

### *Our Mission*

Lambton is committed to student and community success.

### *Our Vision*

To foster innovation and entrepreneurship among the faculty, staff, and students – and in the local and global communities and rise as a leader in education and applied research by challenging boundaries in a world shaped by the Fourth Industrial Revolution.

### *Our Values*

#### *Innovation*

We are creative leaders in a rapidly changing society.

#### *Caring*

We respect the dignity and uniqueness of every individual.

#### *Quality*

We are committed to the highest standards in academics, applied research and service delivery.

#### *Vitality*

We bring life to new opportunities.

#### *Diversity*

We champion equity, accessibility and inclusivity.



## 2. Regulatory Update

**O. Reg. 397/11: Conservation and Demand Management Plans** was introduced in 2013, under which public agencies were required to report on energy consumption and greenhouse gas (GHG) emissions and develop Conservation and Demand Management (CDM) the following year. Until recently, O. Reg. 397/11 was housed under the Green Energy Act, 2009 (GEA).

On December 7, 2018, the Ontario government passed Bill 34, Green Energy Repeal Act, 2018. The Bill repealed the GEA and all its underlying Regulations, including O. Reg. 397/11. However, it re-enacted various provisions of the GEA under the Electricity Act, 1998.

Thus, the conservation and energy efficiency initiatives, namely CDM plans and broader public sector energy reporting were re-introduced as amendments to the Electricity Act. The new regulation is now called **O. Reg. 507/18: Broader Public Sector: Energy Conservation and Demand Management Plans (ECDM)**.

Thus, as of January 1, 2019, O. Reg. 397/11 was replaced by O. Reg. 507/18, and BPS reporting and ECDM plans are under the Electricity Act, 1998 rather than the Green Energy Act, 2009.

Further, this just reinforces that conserving energy would not only save money for families and businesses, but it would also lower the demand on the electricity system and would help reduce greenhouse gas emissions.

Through conservation, Ontario homeowners, businesses and industry have saved more than 1,900 megawatts of peak demand electricity since 2005 – the equivalent of more than 600,000 homes being taken off the grid.



### 3. About Lambton College

Lambton College is an integrated network of facilities with programs serving the communities of Ontario in education, preparation, and providing the opportunity for success. And supporting prosperity in our local community through research, innovation and entrepreneurships.

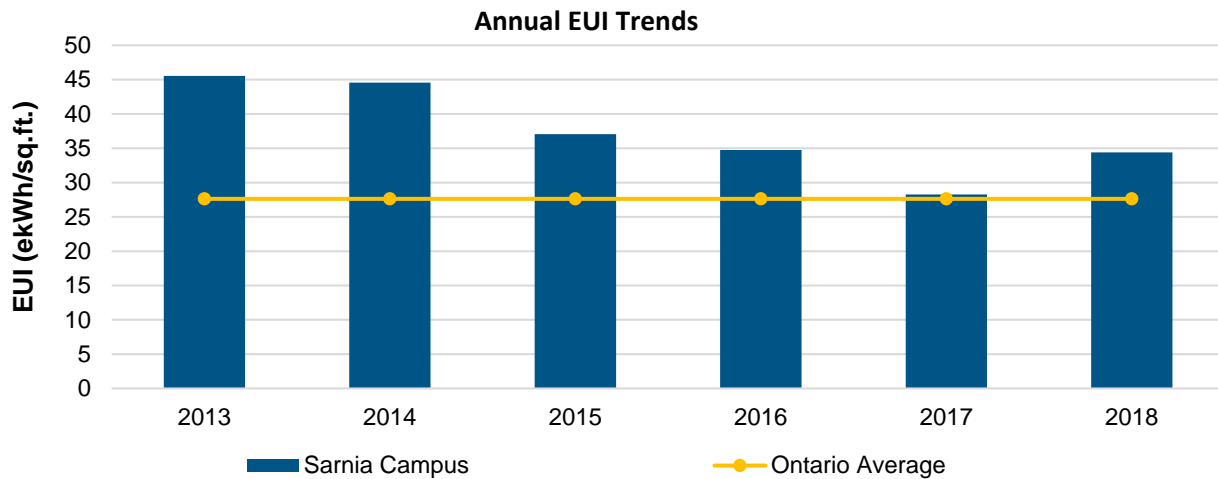
#### 3.1. Historical Energy Intensity

Energy Utilization Index is a measure of how much energy a facility uses per square foot. Breaking down a facility’s energy consumption on a per-square-foot-basis allows facilities of different sizes to be compared with ease. In this case, we are comparing our facility to the industry average for Ontario colleges, derived from Natural Resources Canada’s Commercial and Institutional Consumption of Energy Survey which was found to be 27.63 ekWh/Sq. Ft.

*Table 2. Historic Annual Energy Utilization Indices*

Annual Consumption (EUI)						
Year	2013	2014	2015	2016	2017	2018
Lambton College	46	45	37	35	28	29

*Figure 2. Historic Annual Energy Utilization Indices*

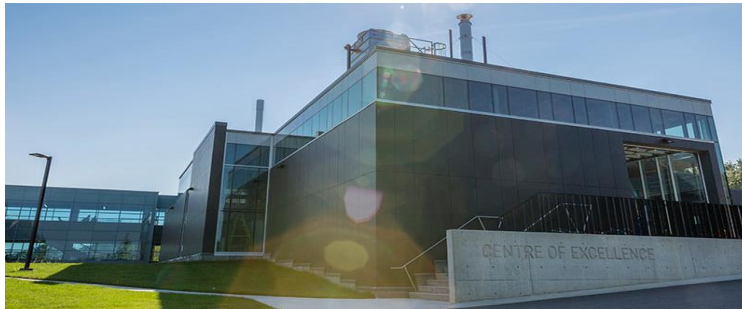


## 3.2. Sustainability at Lambton College

As an institute of learning Lambton College has strong and broad reaching operational, academic and communication connections. These use these connections, their values and their knowledge to improve ecological, economic, social, health and cultural conditions for students, employees and the community. Lambton has expressed its commitment to sustainability and maximizing their contributions towards a sustainable future and recognize that is a path that is ever changing.

Lambton College strives for a culture of sustainability that can be seen through academic activity and campus involvement. Such success included:

- Lambton has a strong focus on sustainability through academics. They offer a wide variety of programs that focus on sustainable development, green energy, sustainable food, just to name a few.
- Participating in 1 Day Stand Against Smoking to promote health and the environment
- Making the entire campus-wide property smoke free since May 1, 2019
- The newly opened Centre of Excellence in Energy & Bio-Industrial Technologies
  - A place to showcase the collaborative research projects currently happening within the centre of excellence. Some current projects include:
    - Optimization of Energy Use in the Mine Water Reclamation Modular Plant
    - Artificial Intelligence, Diagnostic and Recommender System for Energy Efficiency and Performance Optimization of Industrial Process Equipment
    - Use of AI Algorithms to Reduce Energy Consumption in Temperature Controlled Devices
    - Design, Fabrication and Optimization of a Green, High-Temperature Thermal Energy Storage System Using Nanostructured Zeolite Composites



*Picture 1. Centre of Excellence in Energy & Bio-Industrial Technologies*

- Annual Research day
  - An opportunity to explore the various exhibits and speak with students about their projects and research taking place on campus
  - Project areas include information technology, advanced manufacturing, energy water and wastewater, social sciences, and health
- Participate in Annual Green Energy Doors Open showcase
  - Gives the community the opportunity to look at the sustainable energy projects and sustainability initiatives taking place on campus



## 4. Site Analysis

The following section will outline our site and provide a brief description about the building and its operations, energy & greenhouse gas (GHG) emissions trends, and specific conservation measures.



*Picture 2. Lambton College*

Lambton College's Main Campus is located in Sarnia, Ontario and the main building on-site is the South Building where the majority of the classrooms and staff and faculty offices are located. In addition to the South Building, the main campus is also home to the Suncor Sustainability Centre, the Lambton College Residence and Event Centre, the Sustainable Smart Home, the Skilled Trades Training Centre and the North Building.

*Table 3. Facility Information*

Facility Information	
Facility Name	<b>Lambton College</b>
Address	1457 London Road, Sarnia, ON
Gross Area (Sq. Ft)	673,768
Type of Operation	Post-Secondary Education Institution



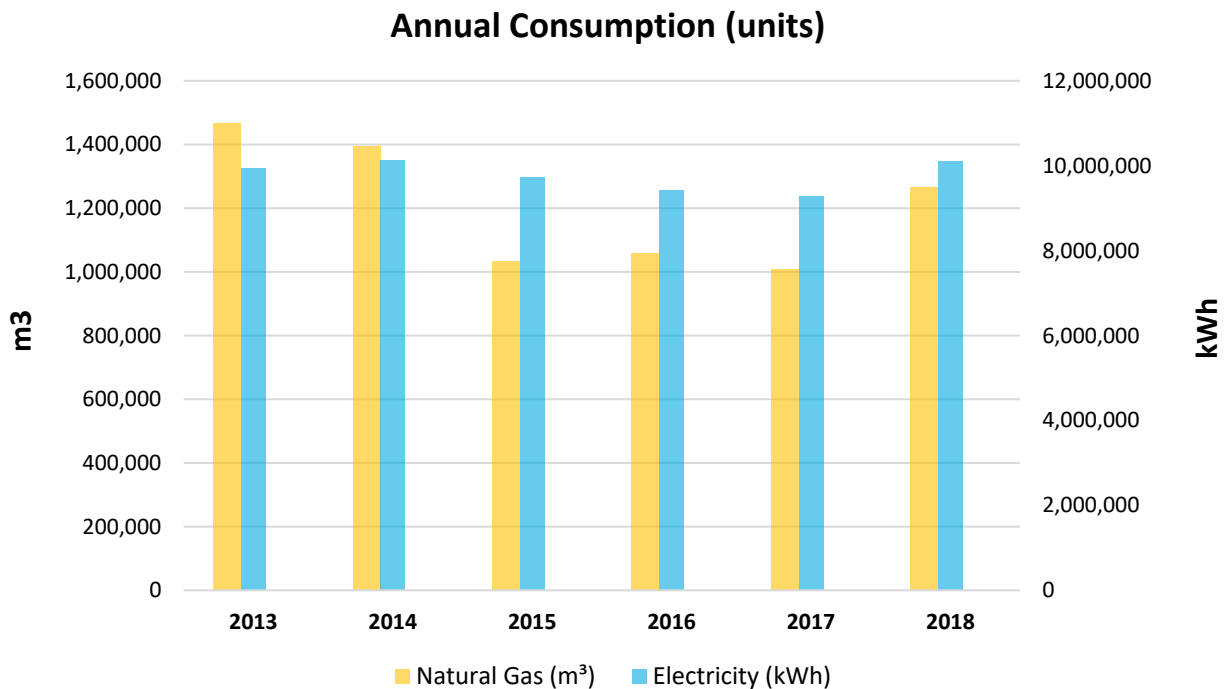
## 4.1. Historic Utility Data

Utilities to the site are electricity, natural gas and water. The following table summarizes the accounts for each utility (except water). Utility consumption for each respective utility has been adjusted to fit a regular calendar year (365 days).

**Table 4.** Historic Annual Utility Consumption

Annual Consumption (units)						
Utility	2013	2014	2015	2016	2017	2018
Electricity (kWh)	9,937,512	10,130,610	9,730,842	9,418,820	9,283,876	10,102,982
Natural Gas (m <sup>3</sup> )	1,466,033	1,394,821	1,033,488	1,058,071	1,007,261	1,265,761

**Figure 3.** Historic Annual Utility Consumption



## 4.2. Historic GHG Emissions

Greenhouse Gas (GHG) emissions are expressed in terms of equivalent tonnes of Carbon Dioxide (tCO<sub>2</sub>e). The GHG emissions associated with a facility are dependent on the fuel source—hydroelectricity produces fewer greenhouse gases than coal-fired plants, or light fuel oil produces fewer GHGs than heavy oil.

Electricity from the grid in Ontario is relatively ‘clean’ as the majority is derived from low-GHG hydroelectricity, and coal-fired plants have been phased out. Scope 1 (natural gas) and Scope 2 (electricity) consumptions have been converted to their equivalent tons of greenhouse gas emissions in the table below. Scope 1 representing the direct emissions from sources owned or controlled by the institution, and Scope 2 being the indirect emissions from the consumption of purchased energy generated upstream from the institution.

Figure 4. Examples of Scope 1 and 2

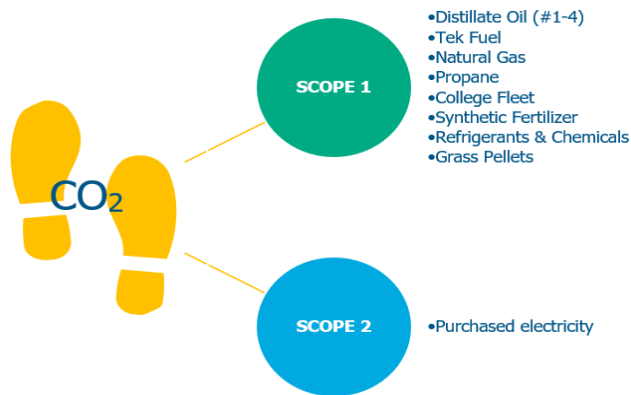
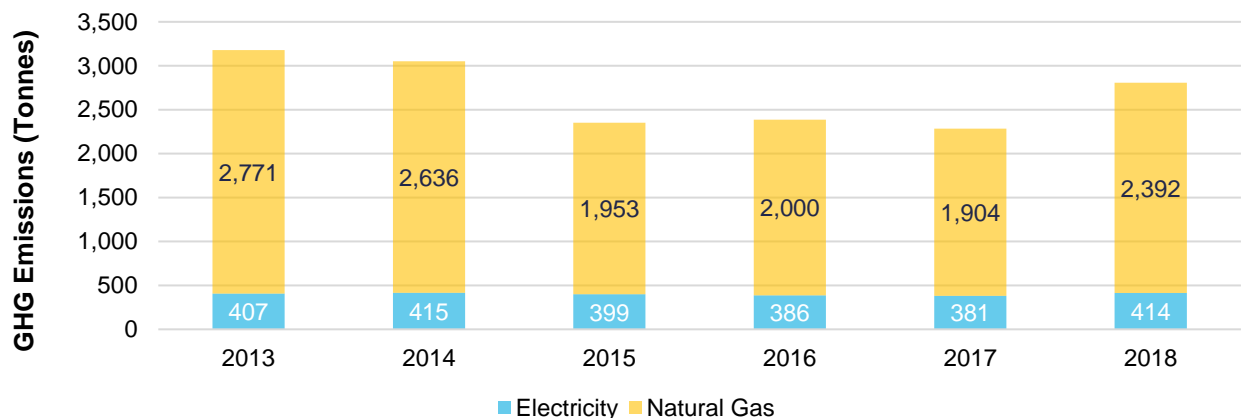


Table 5. Historic Annual Greenhouse Gas Emissions

GHG Emissions (tCO <sub>2</sub> 3)						
Utility Source	2013	2014	2015	2016	2017	2018
Electricity	407	415	399	386	381	414
Natural Gas	2,771	2,636	1,953	2,000	1,904	2,392
<b>Totals</b>	<b>3,178</b>	<b>3,052</b>	<b>2,352</b>	<b>2,386</b>	<b>2,284</b>	<b>2,807</b>

Figure 5. Historic Annual Greenhouse Gas Emissions



### 4.3 Conservation Strategies to Date

Lambton has completed a significant amount of energy conservation measures. The college is continuously looking for ways to improve its operations. Energy and water saving initiatives that were previously implemented are summarized in the table below.

*Table 6. CDM Measures from 2014-2018 ECDM Plan*

Building	Energy Management Actions	Implemented	Year Implemented	Comments
Multiple Buildings	Annual Reporting	Yes	2019	Project tracking sheet provided by energy contractor in relation to the college's greenhouse gas reduction roadmap and action plan (GHG RRAP) from 2011 baseline data to 2050.
Multiple Buildings	Future Energy Projects	Yes	2018	Energy curtailment plan (during Ontario peak demand periods to reduce global adjustment fees and GHG emissions). Continuously evolving.
Multiple Buildings	Renewable Energy	No	Pending	Renewable energy projects have been incorporated into the college's GHG RRAP (reporting/ forecasting on 2011-2050 energy and GHG emissions data).
Multiple Buildings	Purchasing Practices	Yes	2017	Since approximately 2017, all new lighting upgrades and additions will be LEDs. Lambton College also took advantage of the previous Ontario government funding by the Liberals as part of the GGCRP (Greenhouse Gas Campus Retrofits) - NPF (Non-Participants Fund) when Ontario was still part of the Cap-And-Trade program. This resulted in the installment of a 96% efficient lead condensing boiler and BAS upgrades. Lighting upgrades are seeking funding through the IESO SaveOnEnergy Retrofit program.
Multiple Buildings	Energy Management and Information Systems (EMIS)	Yes	2019	An EMIS software was recently installed on the college's existing BAS. Careful monitoring, managing and documenting of energy will soon be implemented using this software.
Multiple Buildings	Building Re-Commissioning	Yes	2019	
Multiple Buildings	Energy and Resource Awareness (ERA) Programs	Yes	2019	Potential Student Watt Challenge during student residence orientation week September 2019. Public notices (i.e. social media, awareness-run events, stickers, etc.) will be produced.



Multiple Buildings	Energy Management Team	Yes	2018	In May 2018, an Energy & Sustainability Project Coordinator was hired on to expand on the sustainability-led initiatives brought on by the department of facilities. The Energy Management team now encompasses three internal facilities staff: 1) Director, Facilities Management; 2) Manager, Facilities Management; and 3) Energy & Sustainability Project Coordinator, Facilities Management. All other facilities staff, external staff, faculty and students contribute indirectly to the facilities energy and sustainability goals and objectives.
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#### 4.4. Renewable Energy Generation at Lambton

In addition to the measures above, Lambton has also been proactively pursuing the following renewable energy generation on-site, at the Sustainable Smart House.

*Table 7. Renewable Energy Generation Operated by Lambton*

Building	Renewable Energy Description	In Operation	Utility
Sustainable Smart House	fixed PV system Rated for ~2.5kW of power	No	Electricity
Sustainable Smart House	tracking PV system gives a total power rating of 9kW	No	Electricity
Sustainable Smart House	wind turbine will provide a rated 3.5kW of wind power	No	Electricity
Sustainable Smart House	roof top PV system - 1.6kW	No	Electricity
Sustainable Smart House	solar Thermal Unit	Yes	Electricity
Sustainable Smart House	Hydrogen Fuel Cell Technology	No	Electricity
Sustainable Smart House	Geothermal Loop (3,000 sq. ft.)	Yes	Gas



## 4.5. Proposed Conservation Measures

The energy analysis has revealed several conservation strategies for the facility. Sarnia Campus' proposed energy and water saving initiatives are summarized in the table below outlining the targeted utilities. These measures will remain in place until another, more efficient and cost-effective technology is found.

These measures have replaced the original energy management actions set forth in the first five-year 2014-2018 CDM plan. Also, conservation measures from previous 2015 Level 2 energy audits that have not been implemented at the facility have been incorporated in this section.

*Table 8. Targeted Utilities and Proposed Conservation Measures*

Building	Measure	Impacted Utility		Expected Year of Implementation
		Electricity	Natural Gas	
North Building	Combine/Consolidate ECE Centre Refrigerators	X		2020
North Building	Water Conservation: Ultra Low Faucet Aerators		X	2020
North Building	Reduce Thermostat Settings - Occupied Areas		X	2020
North Building	Repair/Replace Weather Stripping		X	2020
North Building	Lighting Upgrade: Incandescent to LED	X		2020
North Building	Insulate DHW Piping: ECE Centre		X	2020
North Building	Schedule AHUs	X	X	2020
North Building	Schedule Exhaust Fans	X	X	2020
North Building	DHW Plant Upgrade		X	2020
South Building	Water Conservation: Ultra Low Faucet Aerators		X	2020
South Building	Lighting Controls: Recommission Photocells	X		2020
South Building	Summer Shut Down of Heating Plant	X	X	2020
South Building	Lighting Upgrade: LED Retrofit Lamps	X	X	2020
South Building	Greenhouse Heating Conversion: Electric to Natural Gas	X	X	2020
South Building	Lighting Controls: Occupancy Sensors	X		2020
South Building	BAS Controls: Individually Schedule AHUs	X	X	2020
South Building	BAS Recommissioning	X	X	2020



South Building	Install VFDs & 2-Way Control Valves on Hot and Chilled Water Pumps and Coils	X		2020
South Building	Install Variable Speed Kitchen Hood Exhaust System	X	X	2020
South Building	Lighting Upgrade: Exterior Parking LED	X		2020
South Building	BAS Upgrade: Install Wireless Occupancy Sensing Thermostats in Rooms	X	X	2020
South Building	Install Lead Condensing Boilers		X	2020
Suncor Centre	Tighten AHU Schedules	X	X	2020
Suncor Centre	Lighting Controls: Occupancy Sensors	X		2020
Suncor Centre	Fuel Conversion: Install Instantaneous Gas Fired Water Heater	X	X	2020
Suncor Centre	HVC Controls: Expand BAS at Suncor Centre	X	X	2020
Skilled Trades Learning Centre	Water Conservation: Ultra Low Faucet Aerators		X	2020
Skilled Trades Learning Centre	Tighten Occupancy Schedules		X	2020
Skilled Trades Learning Centre	Building Envelope: Repair/Replace Weather Stripping		X	2019
Skilled Trades Learning Centre	Lighting Upgrade: LED Retrofit Lamps	X	X	2020
Skilled Trades Learning Centre	Lighting Controls: Occupancy Sensors	X		2024
Skilled Trades Learning Centre	Building Envelope: Interlock RTUs with Overhead Doors	X	X	2020
Skilled Trades Learning Centre	HVAC Controls: Install Occupancy Sensing Thermostats	X	X	2020
Skilled Trades Learning Centre	Lighting Upgrade: Exterior LED Fixtures	X		2020
Skilled Trades Learning Centre	Expand BAS: Control Rooftop Units, Implement CO2 Control	X	X	2020
Skilled Trades Learning Centre	Install High Efficiency DHW Heater		X	2020
Fire College	Lighting Upgrade: Halogen to LED	X	X	2020



Fire College	Maximize Use of Reservoir for Fire Fighting	X		2020
Fire College	Lighting Controls: Occupancy Sensors	X		2020
Fire College	Lighting Controls: Photocells	X		2020
Fire College	Install a VFD on Fire Pump	X		2020
Fire College	Re-Commission Solar DHW System		X	2020
Fire College	Interlock Overhead Doors with Heaters		X	2020
Fire College	Reset / Limit Vestibule Temperature		X	2020
Multiple Buildings	Variable Air Volume System with Demand Control Ventilation	X	X	2020
Sarnia Campus	Lighting Control	X		2020
Sarnia Campus	Lighting Fixture Retrofit	X		2020
Sarnia Campus	Convert Pumps from CV to VV	X		2020
Sarnia Campus	Recommissioning/Upgrade Controls and Adjust Schedule	X		2020
Sarnia Campus	Lighting Fixture Replacement	X		2020
Sarnia Campus	Kitchen Demand Ventilation	X	X	2020
Sarnia Campus	Boiler System Upgrades	X	X	2020
Sarnia Campus	Relamp & Reballast	X		2020
Sarnia Campus	Expand BAS	X	X	2020
Sarnia Campus	Piping Insulation	X		2020
Sarnia Campus	Weather stripping Doors and Windows	X		2020
Sarnia Campus	Upgrade AHUs	X	X	2020
Sarnia Campus	Ground Source Heat pumps (250 ton)	X	X	2020
Sarnia Campus	Roof Replacement		X	2020
Sarnia Campus	Window Upgrades			2020
Sarnia Campus	360kW Rooftop Solar	X		2020
Sarnia Campus	3095 kW Carport Solar	X		2020
South Building	Installment of EMIS (Energy Management Information System) - Kaizen FDD and Kaizen Energy	X	X	2020
South Building	Energy Curtailment Plan (during Ontario Peak Demand Periods to Reduce Global Adjustment Fees and GHG Emissions)	X		2018





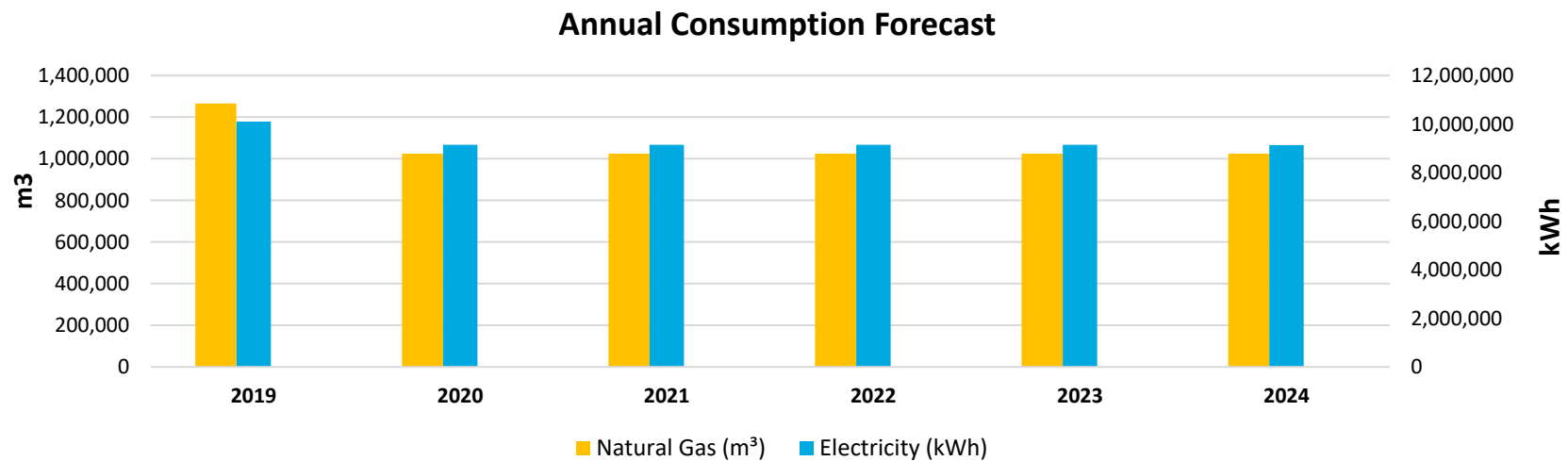
## 4.6. Utility Consumption Forecast

From implementing the energy conservation measures stated in the previous section, the forecasted electricity and natural gas use could be forecasted based on the utility savings generated from individual measures. The forecasted utility consumption is tabulated below:

*Table 9. Forecast of Annual Utility Consumption*

Annual Consumption												
	2019		2020		2021		2022		2023		2024	
	Units	% Change	Units	% Change	Units	% Change	Units	% Change	Units	% Change	Units	% Change
Electricity (kWh)	10,102,982	0%	9,146,796	9%	9,146,796	9%	9,146,796	9%	9,146,796	9%	9,130,947	10%
Natural Gas (m <sup>3</sup> )	1,265,639	0%	1,024,334	19%	1,024,334	19%	1,024,334	19%	1,024,334	19%	1,024,334	19%
Potential Savings	-		\$162,008		\$162,289		\$162,575		\$162,867		\$165,017	

*Figure 6. Forecast of Annual Utility Consumption*



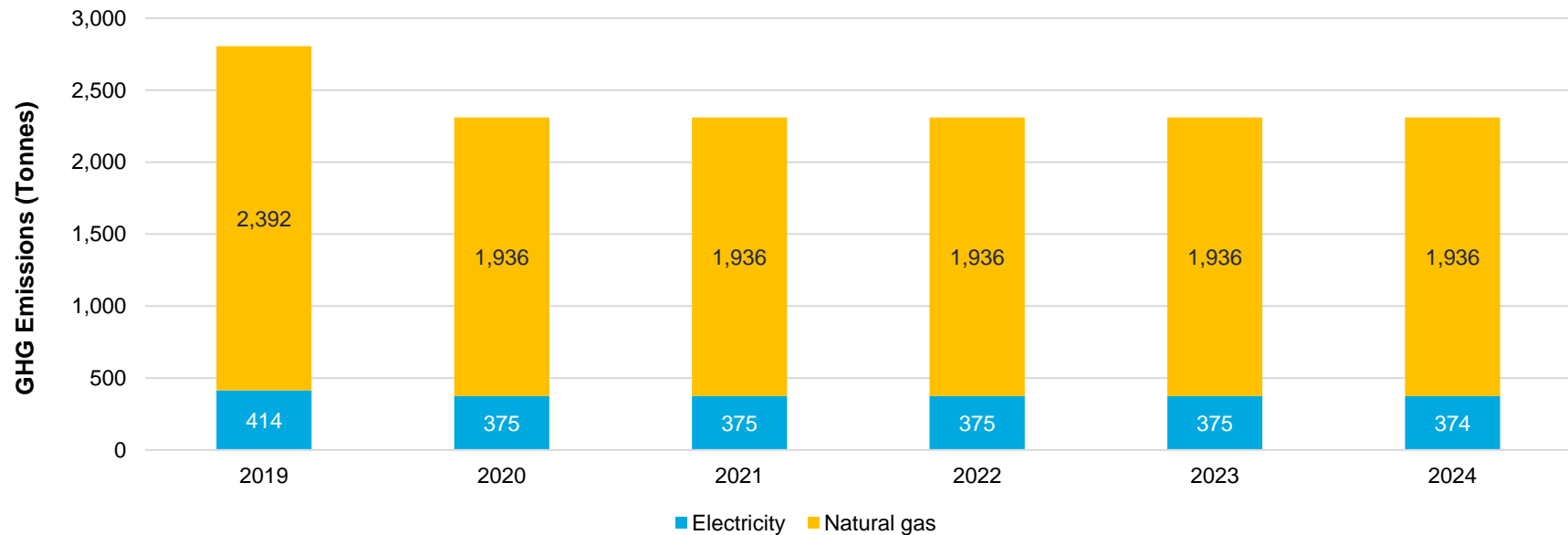
## 4.7. GHG Emissions Forecast

The forecasted greenhouse gas emissions for the Sarnia campus are calculated based on the forecasted energy consumption data analyzed in the previous section and are tabulated in the following table:

*Table 10. Forecast of Annual Greenhouse Gas Emissions*

GHG Emissions (tCO <sub>2</sub> e)						
Utility Source	2019	2020	2021	2022	2023	2024
Electricity	414	375	375	375	375	374
Natural Gas	2,392	1,936	1,936	1,936	1,936	1,936
<b>Totals</b>	<b>2,806</b>	<b>2,311</b>	<b>2,311</b>	<b>2,311</b>	<b>2,311</b>	<b>2,310</b>
<b>Reduction from Baseline Year (2018)</b>	<b>0%</b>	<b>18%</b>	<b>18%</b>	<b>18%</b>	<b>18%</b>	<b>18%</b>

*Figure 7. Forecast of Annual Greenhouse Gas Emissions*



## 5. Closing Comments

Thank you to all who contributed to Lambton College's Energy Conservation and Demand Management Plan. We consider our facility a primary source of education, and an integral part of the local community. Now being recognized as the number one applied Research College in Canada based on research income, Lambton strives to be a leader in innovation, applied research and bio industrial technologies. The key to this relationship is being able to use our facilities efficiently and effectively to maximize our ability to provide the highest quality education services while integrating environmental stewardship into all aspects of facility operations.

On behalf of the senior management team here at Lambton, we approve of this Energy Conservation and Demand Management Plan. We acknowledge that the execution of this plan is dependent on the funding available in the following years. And based on available funding, Lambton will aim to meet or exceed the energy conservation measures listed in this plan.



## 6. Appendix

### 6.1. Glossary of Terms

Word	Abbreviation	Meaning
Air Changes per Hour	ACH	Air changes per hour, or air change rate, is a measure of the air volume added to or removed from a space divided by the volume of the space
Air Leakage		Air leakage is the uncontrolled migration of conditioned air through the building envelope.
Baseline Year		A baseline is a benchmark that is used as a foundation for measuring or comparing current and past values.
Building Automation System	BAS	Building automation is the automatic centralized control of a building's heating, ventilation and air conditioning, lighting and other systems through a building management system or building automation system (BAS)
Business as Usual	BAU	The College does not add any new conservation measures or mitigation strategies to reduce emissions.
Carbon Dioxide	CO <sub>2</sub>	Carbon dioxide is a commonly referred to greenhouse gas that results, in part, from the combustion of fossil fuels.
Category 5 cable	CAT 5	Category 5 cable is a twisted pair cable for computer networks.
Climate Change Action Plan	CCAP	The Climate Change Action Plan is the environmental plan released by the Liberal government as a means to identify targets and strategies to reduce provincial greenhouse gas emissions.
Cooling Degree Day	CDD	A cooling degree day (CDD) is a measurement designed to quantify the demand for energy needed to cool a building.
Decentralized Micro Grid		A micro grid is a small network of electricity users with a local source of supply that is usually attached to a centralized national or provincial grid but is able to function independently.
Electric Vehicle	EV	An electric vehicle (EV), also referred to as an electric drive vehicle, is a vehicle which uses one or more electric motors for propulsion.
Energy Cost Intensity	ECI	Energy cost intensity means the cost of energy, or energy expense, relative to a buildings physical size typically measured in square feet.
Energy storage		Energy storage typically refers to energy stored by battery.
Energy Usage Intensity	EUI	Energy usage intensity means the amount of energy relative to a buildings physical size typically measured in square feet.
Equivalent Carbon Dioxide	CO <sub>2</sub> e	CO <sub>2</sub> e provides a common means of measurement when comparing different greenhouse gases.
Full Time Equivalent	FTE	Full-time equivalent (FTE) or whole time equivalent (WTE) is a unit that indicates the workload of an employed person (or student) in a way that makes workloads or class loads comparable across various contexts.
GHG Protocol		GHG Protocol refers to the recognized international standards used in the measurement and quantification of greenhouse gases.
Greenhouse Gas	GHG	Greenhouse gas means a gas that contributes to the greenhouse effect by absorbing infrared radiation, e.g., carbon dioxide and chlorofluorocarbons.
Heating Degree Day	HDD	A heating degree day (HDD) is a measurement designed to quantify the demand for energy needed to heat a building.
Marginal Abatement Cost Curve	MAC Curve	Marginal abatement costs are typically used on a marginal abatement cost curve (MACC) or MAC curve, which shows the marginal cost of additional reductions in pollution.
Metric Tonnes	t	Metric tonnes are a unit of measurement. 1 metric tonne = 1000 kilograms
Net Zero		A net-zero energy building, is a <a href="#">building</a> with zero net <a href="#">energy consumption</a> , meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of <a href="#">renewable energy</a> created on the site.
Sensible Heat		Sensible heat is <a href="#">heat</a> exchanged by a body or <a href="#">thermodynamic system</a> in which the exchange of heat changes the temperature of the body or system, and some macroscopic variables of the body or system, but leaves unchanged certain other macroscopic variables of the body or system, such as volume or pressure.
Variable Frequency Drive	VFD	A variable frequency drive is a device that allows for the modulation of an electrical or mechanical piece of equipment.



## 6.2. List of Tables, Figures and Pictures

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