ENERGY CONSERVATION & DEMAND MANAGEMENT PLAN

2024-2028

Lambton College

Executive Summary

Lambton College's 2024-2028 Energy Conservation and Demand Management (ECDM) Plan follows the new Ontario Regulation 25/23 (O. Reg. 25/23): Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans under the Government of Ontario's Electricity Act, 1998. This new Ontario Regulation replaces O. Reg. 507/18: Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans which fell under the previous 2018-2024 ECDM Plan. This regulation requires all Broader Public Sector (BPS) organizations to report their annual energy use to the Ministry of Energy and develop ECDM plans every 5-years. This new ECDM plan is posted on the lambtoncollege.ca website.

Throughout the last 5 years, there has been an eager commitment by international governments (including the Government of Canada), institutions, private sector organizations, non-profits, and not-for-profits to lower their greenhouse gas (GHG) emissions and energy consumption. This has led them to generate goal(s) that will guide in achieving net-zero carbon emissions by the year 2050.

With concerns surrounding global climate change and energy supply and demand, the College has implemented a long-term forty-year plan to lower its energy consumption and carbon emissions which starts in year 2011 (which acts as the energy and carbon emitting baseline) and ending by year 2050. Otherwise known as its Greenhouse Gas Reduction Roadmap & Action Plan (GHG RRAP) or its Roadmap to Net-Zero Carbon this plan acts as the overall monitoring and reporting template for all energy & sustainability-led initiatives taking place at Lambton College.

This ECDM Plan and GHG RRAP will fulfill the College's:

- Strategic Plans (including but not limited to):
  - 2019-2024 Strategic Plan
- Strategies (including but not limited to):
  - EDI (Equity, Diversity & Inclusion)
  - Integrated Learning
- Mission
- Vision
- Values
- Policies & Procedures

Picture 1. Lambton College South (Main) Building Cafeteria

Our 2019-2024 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 2024-2028 and Beyond

Lambton College will strive to reduce energy consumption and intensity, greenhouse gas emissions, water consumption, and waste/ landfill generation. The 2019-2024 Strategic Plan will lay the foundation for getting us to move forward on our energy & sustainability goals. Future strategic plans (2025-2030 Strategic Plan for example) and strategies will allow our momentum to be sustained.

Roadmap to Net-Zero Carbon (GHG) Emissions

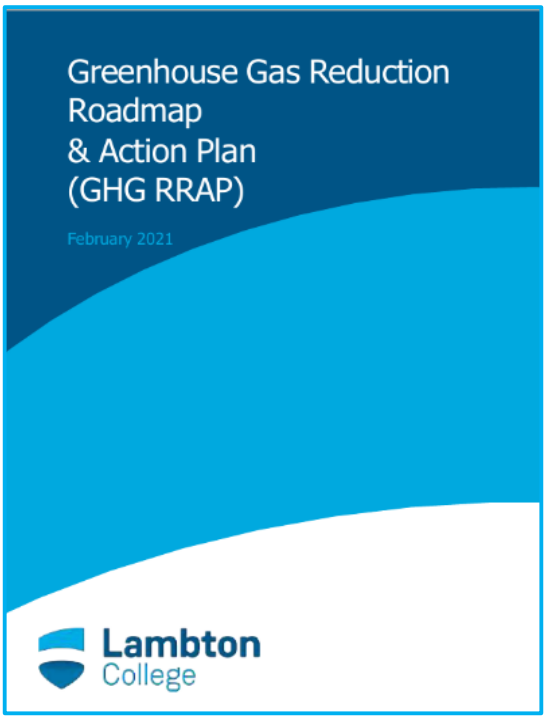
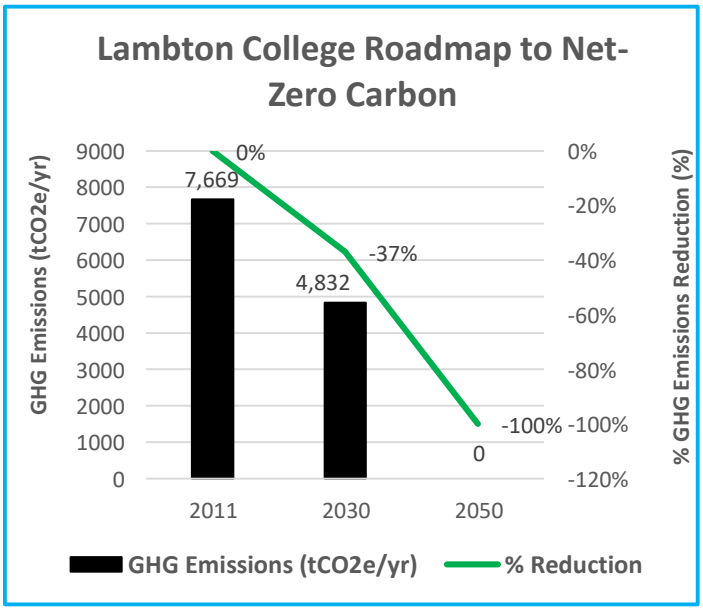


Figure 1. Campus-Wide GHG Emissions and 2030 & 2050 Goals



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1. Introduction

The purpose of Lambton's Energy Conservation and Demand Management (ECDM) Plan 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 under O. Reg. 25/23: Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans which recently amended O. Reg. 507/18: Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans under the Electricity Act, 1998.

The results and the progress of the previous ECDM plan (2019-2024), and the projected impact of the new ECDM Plan is presented in the chart & tables below.

Figure 2. Campus-Wide Energy Consumption Trends & Projections

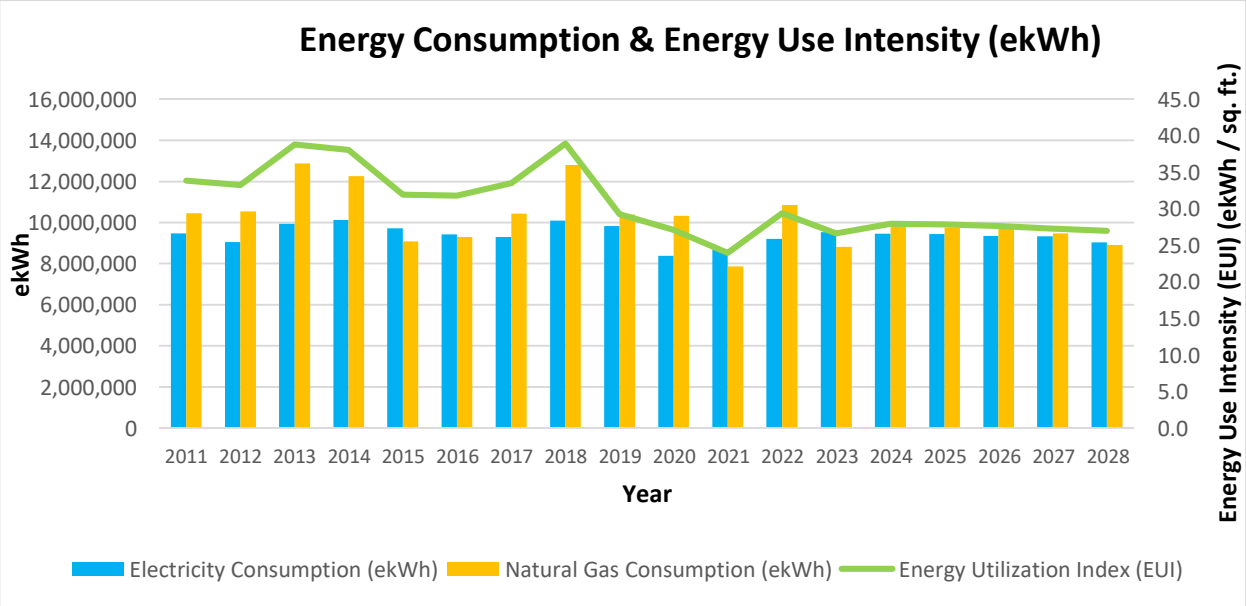


Table 1. Campus-Wide Energy Consumption Trends & Projections (2024-2028 ECDM Plan)

ECDM Program Summary[1]	2011 [2]	2012	2013	2014	2015	2016
Electricity Consumption (ekWh)	9,459,296	9,033,072	9,937,512	10,130,610	9,730,842	9,418,820
Natural Gas Consumption (ekWh)[3]	10,452,838	10,540,784	12,880,185	12,253,027	9,070,789	9,287,286
Electricity Savings(ekWh)[4]	N/A	-426,224	478,216	671,314	271,546	-40,476
Natural Gas Savings (ekWh)[5]	N/A	87,946	2,427,348	1,800,190	-1,382,048	-1,165,552
Facility Size (Sq. Ft.)	588,289	588,289	588,289	588,289	588,289	588,289
Energy Utilization Index - EUI (ekWh/Sq. Ft)	33.8	33.3	38.8	38.0	32.0	31.8
ECDM Program Summary[1]	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Electricity Consumption (ekWh)	9,283,876	10,103,006	9,835,093	8,367,083	8,680,883	9,190,184
Natural Gas Consumption (ekWh)[3]	10,436,344	12,806,599	10,389,485	10,328,376	7,855,948	10,851,890
Electricity Savings(ekWh)[4]	-175,420	643,710	375,797	-1,092,213	-778,413	-269,112
Natural Gas Savings (ekWh)[5]	-16,494	2,353,762	-63,352	-124,462	-2,596,890	399,053
Facility Size (Sq. Ft.)	588,289	588,289	690,738	690,738	690,738	681,696
Energy Utilization Index - EUI (ekWh/Sq. Ft)	33.5	38.9	29.3	27.1	23.9	29.4
ECDM Program Summary and Projections[6]	**2023**	**2024**	**2025**	**2026**	**2027**	**2028 [7]**
Electricity Consumption (ekWh)	9,514,936	9,437,324	9,435,634	9,332,658	9,322,917	9,017,530
Natural Gas Consumption (ekWh)	8,801,506	9,810,356	9,760,935	9,700,946	9,456,389	8,894,514
Electricity Savings(ekWh)[3]	55,640	-21,972	-23,662	-126,638	-136,379	-441,766
Natural Gas Savings (ekWh)[4]	-1,651,332	-642,481	-691,903	-751,891	-996,448	-1,558,323
Facility Size (Sq. Ft.)	688,190	688,190	688,534	688,534	688,534	665,209
Energy Utilization Index - EUI (ekWh/Sq. Ft)	26.6	28.0	27.9	27.6	27.3	26.9

[1] The ECDM (Energy Conservation and Demand Management) Plan Summary lists out historical energy data.

[2] Greenhouse Gas (GHG) Emissions reporting baseline (y2011) based on Lambton College's Greenhouse Gas Reduction Roadmap & Action Plan (GHG RRAP) (February 2021 Version), otherwise known as the College's Roadmap to Net-Zero Carbon. Each subsequent year (2012-2028) will calculate savings based on the baseline year 2011.

[3] 1 m3 of natural gas consumption equates to 0.0373 gigajoules (GJ).
1 GJ equates to 277.7778 kWh of electricity (ekWh).
1 m3 natural gas = 10.36111194 ekWh of electricity production.
For example, 2011 natural gas consumption was 1,008,852.87 m3. This equates to 10,452,837.52 ekWh.
Source: https://apps.cer-rec.gc.ca/Conversion/conversion-tables.aspx#s1ss2.

[4] The Electricity Consumption Savings (ekWh) are a calculation by taking the difference of the existing year to the baseline (2011) year. Savings in negative values are considered savings. Savings in positive values are not savings and are assumed to be years using increased amounts of electricity relative to year 2011.

[5] The Natural Gas Consumption Savings (ekWh) are a calculation by taking the difference of the existing year to the baseline (2011) year. Savings in negative values are considered savings. Savings in positive values are not savings and are assumed to be years using increased amounts of natural gas relative to year 2011.

[6] The ECDM (Energy Conservation and Demand Management) Program Summary and Projections lists out historical data in combination with projected data. Historical data is recorded for years 2011-2023. Projected (Forecasted) data is for years 2024-2028.

[7] Approximately 1/3 of the North Building will be remaining after the majority being demolished. Those previously occupied spaces will be moved to the Main South Building Campus [I.e., ECE (Early Childhood Education) classrooms, Marketing, Communications & Recruitment].

Table 2. *Campus-Wide Energy Consumption Trends & Projections (2019-2024 ECDM Plan)*

ECDM Program Summary Projections (2019-2023 ECDM Plan)	2019	2020	2021	2022	2023
Electricity Consumption (ekWh)	10,102,982	9,146,796	9,146,796	9,146,796	9,146,796
Natural Gas Consumption (ekWh)[3]	13,074,054	10,581,373	10,581,373	10,581,373	10,581,373
Electricity Savings(ekWh)[4]	0	956,186	956,186	956,186	956,186
Natural Gas Savings (ekWh)[5]	1,260	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
Energy Utilization Index - EUI (ekWh/Sq. Ft)	34.0	29.0	29.0	29.0	29.0
ECDM Program Summary Actuals (2024-2028 ECDM Plan)	**2019**	**2020**	**2021**	**2022**	**2023**
Electricity Consumption (ekWh)	9,835,093	8,367,083	8,680,883	9,190,184	9,514,936
Natural Gas Consumption (ekWh)	10,389,485	10,328,376	7,855,948	10,851,890	8,801,506
Electricity Savings(ekWh)[4]	375,797	-1,092,213	-778,413	-269,112	55,640
Natural Gas Savings (ekWh)[6]	-63,352	-124,462	-2,596,890	399,053	-1,651,332
Facility Size (Sq. Ft.)	681,696	681,696	681,696	681,696	688,190
Energy Utilization Index - EUI (ekWh/Sq. Ft)	29.7	27.4	24.3	29.4	26.6
ECDM Program Summary Projections (2019-2023 ECDM Plan) - ECDM Program Summary Actuals (2024-2028 ECDM Plan)	**2019 Projections - 2019 Actuals**	**2020 Projections - 2020 Actuals**	**2021 Projections - 2021 Actuals**	**2022 Projections - 2022 Actuals**	**2023 Projections - 2023 Actuals**
Electricity Consumption (ekWh)	267,889	779,713	465,913	-43,388	-368,140
Natural Gas Consumption (ekWh)	2,684,569	252,997	2,725,425	-270,517	1,779,867
Electricity Savings(ekWh)[3]	-375,797	2,048,399	1,734,599	1,225,298	900,546
Natural Gas Savings (ekWh)[4]	64,612	2,618,403	5,090,831	2,094,888	4,145,273
Facility Size (Sq. Ft.)	-7,928	-7,928	-7,928	-7,928	-14,422
Energy Utilization Index - EUI (ekWh/Sq. Ft)	4.3	1.6	4.7	-0.4	2.4

Notes:
- Negative values represent an underestimation.
- Positive values represent an overestimation.

Under Table 2 we can see that there is a mixture of over and under estimations between 2019-2023 projections (estimated) and actuals.

Table 3. Campus-Wide Greenhouse Gas Emissions Trends & Projections (2011-2028)

ECDM Program Summary	2011	2012	2013	2014	2015	2016
Greenhouse Gas (GHG) Emissions (tCO2e) (electricity and natural gas consumption only)	2,658	2,659	3,204	3,076	2,369	2,080
Greenhouse Gas (GHG) Emissions (tCO2e) Savings	0	2	547	418	-289	-577
Facility Size (Sq. Ft.)	588,289	588,289	588,289	588,289	588,289	588,289
Greenhouse Gas (GHG) Utilization Index - GHGUI (tCO2e/Sq. Ft)	0.00452	0.00452	0.00545	0.00523	0.00403	0.00354
ECDM Program Summary	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Greenhouse Gas (GHG) Emissions (tCO2e) (electricity and natural gas consumption only)	2,284	2,750	2,298	2,227	1,789	2,356
Greenhouse Gas (GHG) Emissions (tCO2e) Savings	-373	93	-359	-431	-869	-301
Facility Size (Sq. Ft.)	588,289	588,289	690,738	690,738	690,738	681,696
Greenhouse Gas (GHG) Utilization Index - GHGUI (tCO2e/Sq. Ft)	0.00388	0.00468	0.00333	0.00322	0.00259	0.00346
ECDM Program Summary and Projections	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Greenhouse Gas (GHG) Emissions (tCO2e) (electricity and natural gas consumption only)	1,996	2,176	2,167	2,152	2,107	1,992
Greenhouse Gas (GHG) Emissions (tCO2e) Savings	-662	-481	-490	-506	-551	-666
Facility Size (Sq. Ft.)	688,190	688,190	688,534	688,534	688,534	665,209
Greenhouse Gas (GHG) Utilization Index - GHGUI (tCO2e/Sq. Ft)	0.00290	0.00316	0.00315	0.00313	0.00306	0.00299

Notes:
- Negative values represent a reduction in GHG emissions.
- Positive values represent an increase in GHG emissions.

Starting in 2015, except for 2018, GHG emissions are less than baseline year 2011. These reductions in GHG emissions are forecasted to rise after 2024, representing a greater percentage to move the College towards its first GHG reduction goal -> a 37% reduction in GHG emissions by 2030, relative to 2011 baseline levels.

Land Acknowledgement

At Lambton College, we are always very grateful for the land we live on, for the land we teach and work on, for the land we play and compete on and for the land we learn on.

It is with this gratitude in our hearts that we are always very proud to acknowledge that Lambton College is located on the beautiful homeland that is the traditional territory of the Ojibwe, Potawatomi and Odawa First Nations. These three individual Nations make up the traditional Three Fires Confederacy. We acknowledge the grace and the welcome they have offered to all students, staff and guests at Lambton College.

(Placed within Lambton College's Equity, Diversity and Inclusion Strategy 2022-2027)

Picture 2. New Future Indigenous Outdoor Gathering Space at Sarnia (Main) Campus.

Purpose

Lambton College's 5-year cyclical Energy Conservation and Demand Management (ECDM) Plan holds several attributes for our campus. Some of these include promoting 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

Our mission is to have student and community success.

Our Vision

A leader in education and applied research, challenging boundaries in a world shaped by the Four 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 inclusion.

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) Plans the following year. Until 2018, 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 second latest regulation was called O. Reg. 507/18: Broader Public Sector: Energy Conservation and Demand Management (ECDM) Plans.

From January 1, 2019 to January 31, 2023, O. Reg. 397/11 replaced O. Reg. 507/18, and BPS reporting and ECDM plans fell under the Electricity Act, 1998 rather than the Green Energy Act, 2009. By February 2023, O. Reg. 507/18 was then replaced by **O. Reg. 25/23 Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans**. This continues to fall under the Government of Ontario's Electricity Act, 1998.

This Ontario regulation reinforces that conserving energy will not only save money for families and organizations, but it would also lower the demand on the electricity system and help reduce greenhouse gas emissions.

Through conservation, Ontario homeowners, institutions, businesses, and industry have saved several megawatts of peak demand electricity since 2005 – lowering the risk to run backup natural gas fired generators which, in turn, increases accessibility and reliability for electricity consumers.

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. In addition, the College supports prosperity in our local community through research, innovation, and entrepreneurship.

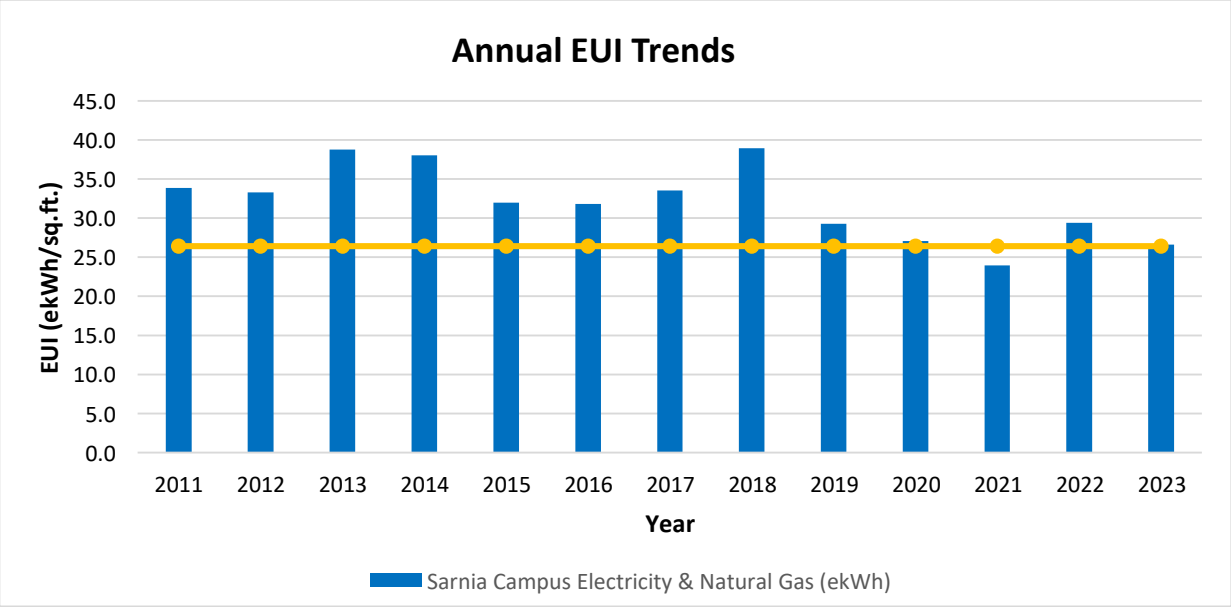
3.1. Historic Energy Intensity

The Energy Utilization Index (EUI) 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 median for Ontario colleges, derived from Climate Challenge Network's (CCN's) 2019 median value for 20 Ontario Public Colleges which was found to be 26.4 ekWh/Sq. Ft.

Table 4. Historical Annual Energy Utilization Indices (2011-2023)

Annual Energy Utilization Index (EUI) (ekWh Per Square Foot)						
Utility Source / Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Electricity & Natural Gas (ekWh)	33.8	33.3	38.8	38.0	32.0	31.8
Utility Source / Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Electricity & Natural Gas (ekWh)	33.5	38.9	29.3	27.1	23.9	29.4
Utility Source / Year	**2023**					
Electricity & Natural Gas (ekWh)	26.6					

Figure 3. Historical Annual Energy Utilization Indices

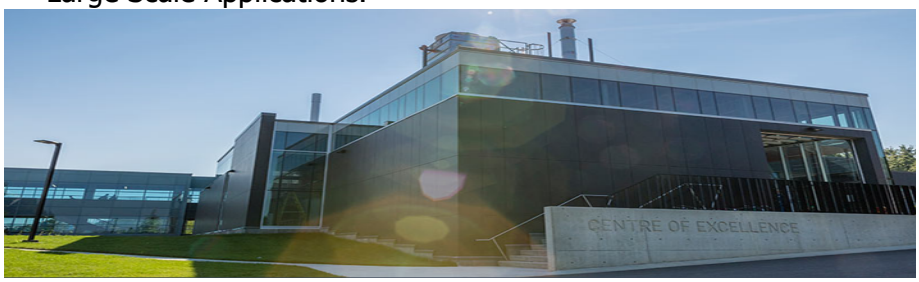


3.2. Sustainability at Lambton College

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 that is constantly changing.

Lambton College strives for a culture of sustainability that can be seen through academic activity and campus involvement. Such success includes, but not limited, to:

- 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, and many others.
- 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 Centre of Excellence in Energy & Bio-Industrial Technologies
    - 7,000 additional square footage and a major renovation attached to Lambton College's South Building (Main) Campus on the south side which was 100% opened in 2018.
    - A place to showcase the collaborative research projects currently happening within the Centre of Excellence (COE). Some current projects include:
        - Production Strain and Feedstock Validation and Scale Up of Pichia Pastoris for Collagen Production.
        - Invertebrate Bioconversion of Food Waste to Fertilizer.
        - Validation and Process Optimization of Turbostratic Graphene Reinforced Plastic Composites.
        - Process Optimization of Natural Fiber Reinforced Plastic Waste and Bioplastics for Large Scale Applications.



Picture 3. 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.

- The Nova Chemicals Heath Research and Athletic Complex (HRAC)
    - 100,000 additional square footage attached to Lambton College's South Building (Main) Campus on the north side which was 100% opened in 2019.
    - A place to modernize various programs, recreational facilities and research initiatives taking place at Lambton College. Some of these include, but not limited to:
        - The expansion of the nursing program with several beds containing AI-integrated patients located in the new nursing laboratory on the second floor of E Building.
        - The expansion of the massage therapy program with massage tables in the new massage therapy lab on the first floor of the E Building.
        - The new state-of-the-art research and innovation administrative offices are on the first floor of the E Building.
        - A new and expanded fitness centre on the upper (second) floor of D Building.
        - A new and additional indoor gym with room divider to expand on varsity, recreational and community-run programs on the first floor of D Building.

Picture 4. Health Research and Athletic Complex

- The newly opened West Campus Shop Entrance
    - 6,500 additional square footage attached to Lambton College's South Building (Main) Campus on the west bridge entrance which was 100% opened in 2023.
    - The movement of the campus bookstore from the lower level to the main level one (first floor) in addition to a couple new interactive classrooms
    - Past president and CEO of area named Judith A. Morris Atrium and Welcome Centre.

Picture 5. West Campus Shop Entrance

- Annual Innovation Week
    - Week hosted by Research & Innovation.
    - Showcases innovative ways the college faculty, staff and students are improving on operational/ learning efficiencies, increasing productivity and other ways.
- Greenhouse Gas Reduction Roadmap & Action Plan (GHG RRAP)
    - Final Version was completed February 2021.
    - Otherwise known as the college's roadmap to net-zero carbon emissions.

- Two carbon (GHG – Greenhouse Gas) reduction goals:
  - 37% reduction in GHG emissions by end of 2030 (relative to 2011 baseline year).
  - 100% reduction in GHG emissions by end of year 2050 = net-zero carbon (GHG) emissions (relative to 2011 baseline year).
- Long-term plan that directly impacts all energy and sustainability reporting.
- Focuses on pushing towards electrification through three different strategies: 1) Leadership; 2) Pragmatic and 3) Delayed.

- Annual Sustainability Week
  - Lambton College's commitment to the United Nations (UN's) 17 Sustainable Development Goals (SDGs) since 2023.
  - Our College President & CEO and previous SAC (Student Administrative Council) President signed off on this commitment.
  - UN (United Nations) PRME (Principles for Responsible Management & Education) Signatory event and signing by the President & CEO and student-led Lambton College Sustainability Club (LCSC) on Monday, March 4, 2024.
  - Week organized by the Lambton Sustainability Committee (LSC).

Picture 6. United Nations 17 Sustainable Development Goals

4. Site Analysis

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

Lambton College's Main Campus is in Sarnia, Ontario and the main building on-site is the South (Main) 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. Two island campuses are located on college owned property in The St. Clair Township – Fire & Public Safety Centre of Excellence (FPSCE) and the Industrial Training Centre (ITC). The third island campus is leased space and is located at the Community Employment Services (CES) building in Petrolia. See photos below for each building.

Picture 7. South (Main) Building

Picture 8. North Building

Picture 9. Lambton INN Residence & Event Centre

Picture 10. Skilled Trades Training Centre (STTC)

Picture 11. Suncor Sustainability Centre (SSC)

Picture 12. Sustainable Smart House

Picture 13. Fire & Public Safety Centre of Excellence (FPSCE)

Picture 14. Industrial Training Centre (ITC)

Picture 15. Community Employment Services (CES)

Table 5. Facility Information

Facility Information						
Facility Legal Name	**The Lambton College of Applied Arts and Technology**					
Facility College Name	Lambton College					
Type of Operation	Post-Secondary Educational Institution					
Building	**Address**					
Arkona Appliances and Bean'Stock[1]	1437 London Road, Sarnia, ON N7S 1P6					
South (Main)	1457 London Road, Sarnia, ON, N7S 6K4					
North Building	1431 London Rd, Sarnia, ON, N7S 1P6					
Lambton INN Residence & Event Centre	1485 London Rd, Sarnia, ON, N7S 1P6					
STTC (Skilled Trades Training Centre)	1485 London Rd BLDG "A", Sarnia, ON, N7S 1P6					
SSC (Suncor Sustainability Centre)[2]	1489 London Rd Unit A + B Sarnia, ON, N7S 1P6					
Sustainable Smart House	1489 London Rd, Sarnia, ON, N7S 1P6					
FPSCE (Fire & Public Safety Centre of Excellence)	459 Lasalle Line 26, St. Clair Township, ON, N7T 7Y1					
ITC (Industrial Training Centre)	463 Lasalle Line 26, St. Clair Township, ON, N0N 1G0					
CES (Community Employment Services)	4248 Oil Heritage Rd Unit 2, Petrolia, ON, N0N 1R0					
Gross Area (Sq. Ft.) Summary and Projections[3]						
Building / Year(s)	**2011-2018**	**2019-2021**	**2022**	**2023-2024**	**2025-2027**	**2028**
Arkona Appliances and Bean'Stock	N/A	9,042	N/A	N/A	N/A	N/A
South (Main)[4]	353,524	460,524	460,524	467,018	467,361	467,361
North Building[5]	61,217	33,432	33,432	33,432	33,432	10,107
Lambton INN Residence & Event Centre	112,996	112,996	112,996	112,996	112,996	112,996
STTC (Skilled Trades Training Centre)	23,564	23,564	23,564	23,564	23,564	23,564
SSC (Suncor Sustainability Centre)[6]	3,958	11,886	11,886	11,886	11,886	11,886
Sustainable Smart House	3,421	3,421	3,421	3,421	3,421	3,421
FPSCE (Fire & Public Safety Centre of Excellence)	25,949	25,949	25,949	25,949	25,949	25,949
ITC (Industrial Training Centre)[7]	N/A	6,265	6,265	6,265	6,265	6,265
CES (Community Employment Services)	3,660	3,660	3,660	3,660	3,660	3,660
Totals[8]	**588,289**	**690,738**	**681,696**	**688,190**	**688,534**	**665,209**

[1] The Arkona Appliances and Bean'Stock building was purchased by Lambton College in September 2019 and then demolished by September 2021. Since the building's energy (electricity and natural gas) consumption was included for years 2019-2021 we will include it as additional square footage during these three years. One thing to note is that the building was operated by the two retail stores - Arkona Appliances and Bean'Stock.
[2] The Suncor Sustainability Centre (SSC) is a single building but was originally divided into two sections, Unit A and Unit B. Unit A was used by Lambton College employees whereas Unit B was contracted out by an Injury Prevention company that leased the space. As such, Unit B from 2011-2018 was not included in the College's energy and greenhouse gas emissions data.
[3] Historical (actual) building areas range from years 2011 to 2024. Projected (forecasted) building areas range for years 2025 to 2028.

[4] For years 2011-2018, South (Main) Building contained 353,524 sq. ft. From 2019-2022, the building contained 460, 524 sq. ft. with the additions of the Health Research and Athletic Complex (HRAC) (100,000 sq. ft.) and the addition of the Centre of Excellence (COE) (7,000 sq. ft.). For years 2023-2024, the building added 6,494 sq. ft. of additional space with the new West Campus shop, Welcoming Centre and classrooms. From 2025-2028 it is forecasted to increase by a further 343.16 sq. ft. with the new Indigenous Outdoor Gathering Space.
[5] For years 2011-2018, the North Building contained 61,217 sq. ft. In 2019, the North Building Residence section was demolished that resulted in a reduction of building sq. ft. by 27,785 sq. ft. By approximately year 2028, only the Ontario Early Years Centre (OEYC) will be remaining resulting in an additional 23,325 sq. ft. being demolished.

[6] For years 2011-2018 the Suncor Sustainability Centre (SSC) Unit A was occupied by Lambton College. This included only 3,958 sq. ft of building space. By 2019, Lambton College took over Unit B resulting in an additional 7,928 sq. ft. of space that was originally leased by an Injury Prevention Training facility.
[7] The ITC (Industrial Training Centre) was bought by Lambton College in 2019. This added an additional 6,265 sq. ft. of building spaced owned and operated by the College.
[8] The 2025-2028 projected floor totals are forecasted. This total building area could significantly increase if the new Lambton College Student Residence is built and commissioned before the end of 2028.

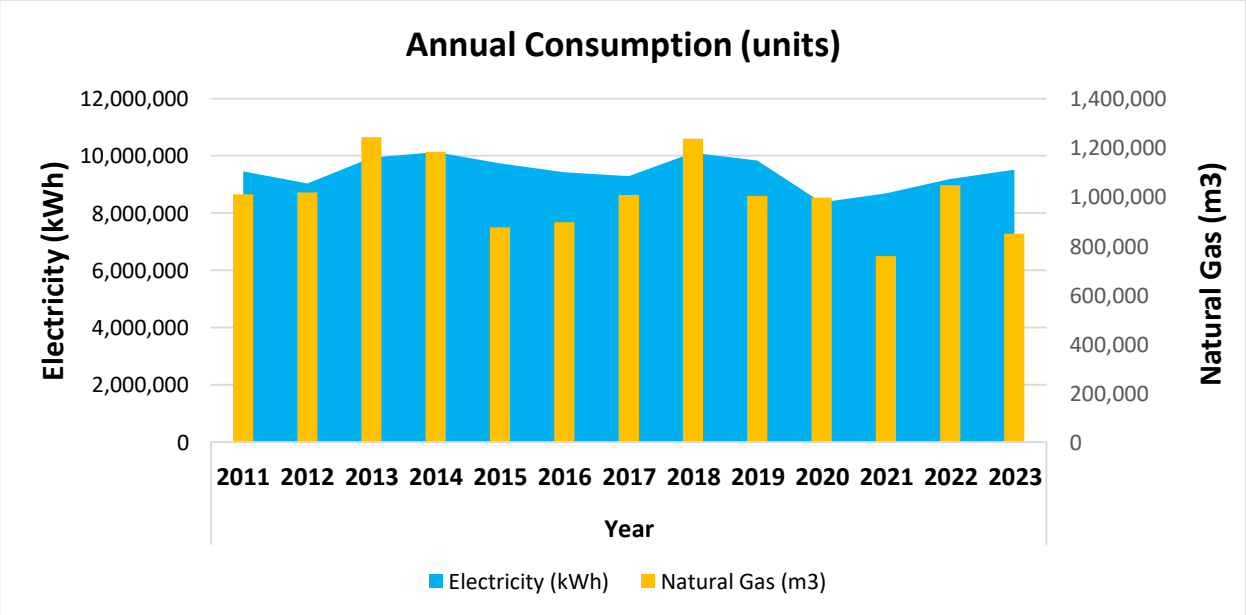
4.1. Historic Utility Data

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) and starts January 1 and ends December 31.

Table 6. Historical Annual Utility Consumption (2011-2023)

Annual Consumption (Units)						
Utility Source / Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Electricity (kWh)	9,459,296	9,033,072	9,937,512	10,130,610	9,730,842	9,418,820
Natural Gas (m^3)	1,008,853	1,017,341	1,243,128	1,182,598	875,465	896,360
Utility Source / Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Electricity (kWh)	9,283,876	10,103,006	9,835,093	8,367,083	8,680,883	9,190,184
Natural Gas (m^3)	1,007,261	1,236,026	1,002,738	996,841	758,215	1,047,367
Utility Source / Year	**2023**					
Electricity (kWh)	9,514,936					
Natural Gas (m^3)	849,475					

Figure 4. Historical Annual Utility Consumption



4.2. Historic GHG Emissions

Greenhouse Gas (GHG) emissions are expressed in terms of equivalent tonnes of Carbon Dioxide (tCO2e). 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 5. Examples of Scope 1 and 2 GHG Emissions

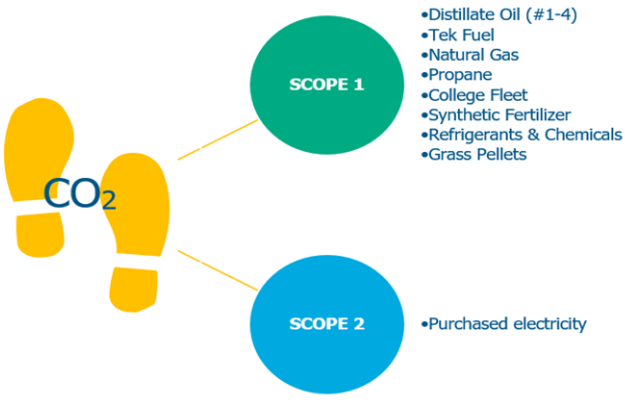
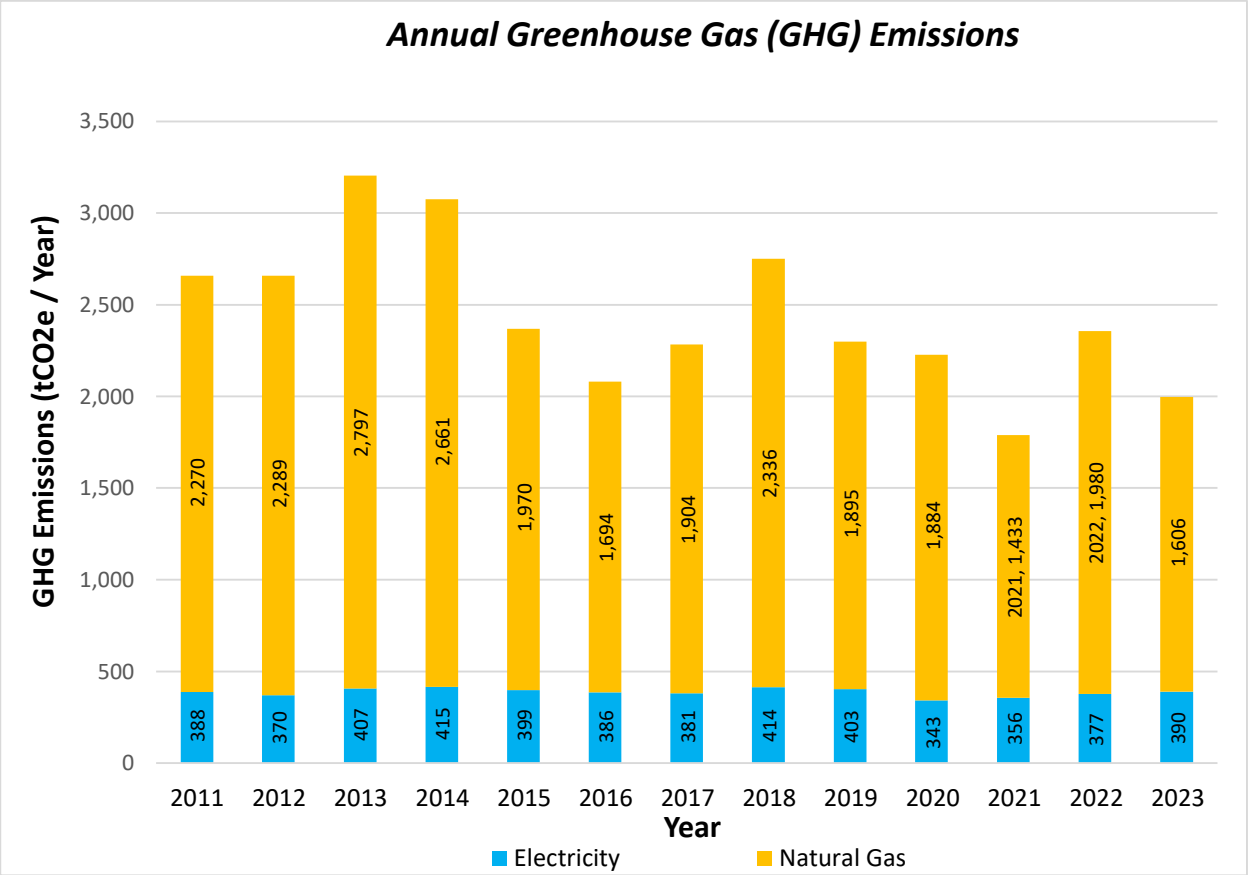


Table 7. Historical Annual Greenhouse Gas (GHG) Emissions (2011-2023)

GHG Emissions (tCO2e Per Year)						
Utility Source / Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Electricity (tCO2e)	388	370	407	415	399	386
Natural Gas (tCO2e)	2,270	2,289	2,797	2,661	1,970	1,694
Totals	**2,658**	**2,659**	**3,204**	**3,076**	**2,369**	**2,080**
Utility Source / Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Electricity	381	414	403	343	356	377
Natural Gas	1,904	2,336	1,895	1,884	1,433	1,980
Totals	**2,284**	**2,750**	**2,298**	**2,227**	**1,789**	**2,356**
Utility Source / Year	**2023**					
Electricity	390					
Natural Gas	1,606					
Totals	**1,996**					

Figure 6. Historical Annual Greenhouse Gas Emissions



4.3 Conservation Strategies to Date

Lambton College 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 tables 8 through 10 below.

Table 8. 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 for college's 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 GA fees and GHG emissions). Continuously evolving.
Multiple Buildings	Renewable Energy	No	Pending	Renewable energy projects incorporated into the college's GHG RRAP (reporting/ forecasting on 2011-2050 energy/ GHG data).
Multiple Buildings	Purchasing Practices	Yes	2017	Since 2017, all new lighting upgrades/additions will be LEDs. Lambton College also took advantage of the previous Ontario government funding 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 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, 2) Manager; 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.

Table 9. Targeted Utilities and Proposed Conservation Measures (2019-2024 ECDM Plan)

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

Building	Measure	Impacted Utility		Expected Year of Implementation
		Electricity	Natural Gas	
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

Building	Measure	Impacted Utility		Expected Year of Implementation
		Electricity	Natural Gas	
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

Table 10. Targeted Utilities and Actual Conservation Measures (2019-2023)

Building	Measure	Impacted Utility		Implementation Year
		Electricity	Natural Gas	
Lambton INN Residence & Event Centre	Schedule RTUs	X	X	2018-Present
Lambton INN Residence & Event Centre	Lighting Upgrade: Incandescent and Flourescent to LED	X		2021
North Building	Combine/Consolidate ECE Centre Refrigerators	X		2019-2024
North Building	Water Conservation: Ultra Low Faucet Aerators		X	2019-Present
North Building	Reduce Thermostat Settings - Occupied Areas		X	2019-Present
North Building	Repair/Replace Weather Stripping		X	2019-Present
North Building	Lighting Upgrade: Incandescent to LED	X		2019-Present
North Building	Insulate DHW Piping: ECE Centre		X	Unknown
North Building	Schedule AHUs	X	X	2019-Present
North Building	Schedule Exhaust Fans	X	X	2019-Present
North Building	DHW Plant Upgrade		X	Unknown
South Building	Water Conservation: Ultra Low Faucet Aerators		X	2019-Present
South Building	Lighting Controls: Recommission Photocells	X		2019-Present
South Building	Summer Shut Down of Heating Plant	X	X	Not Implemented
South Building	Lighting Upgrade: LED Retrofit Lamps	X	X	2019-Present
South Building	Greenhouse Heating Conversion: Electric to Natural Gas	X	X	Before 2011
South Building	Lighting Controls: Occupancy Sensors	X		2019-Present
South Building	BAS Controls: Individually Schedule AHUs	X	X	2019-Present
South Building	BAS Recommissioning	X	X	Being Proposed

Building	Measure	Impacted Utility		Implementation Year
		Electricity	Natural Gas	
South Building	Install VFDs & 2-Way Control Valves on Hot and Chilled Water Pumps and Coils[1]	X		2019-Present
South Building	Install Variable Speed Kitchen Hood Exhaust System	X	X	Not Implemented
South Building	Lighting Upgrade: Exterior Parking LED	X		2018-2019
South Building	BAS Upgrade: Install Wireless Occupancy Sensing Thermostats in Rooms	X	X	2019-Present
South Building	Install Lead Condensing Boilers		X	2018-2019
Suncor Centre	Tighten AHU Schedules	X	X	2019-Present
Suncor Centre	Lighting Controls: Occupancy Sensors	X		2019-Present
Suncor Centre	Fuel Conversion: Install Instantaneous Gas Fired Water Heater	X	X	2018-2019
Suncor Centre	HVC Controls: Expand BAS at Suncor Centre	X	X	Not Implemented
Skilled Trades Learning Centre	Water Conservation: Ultra Low Faucet Aerators		X	2019-Present
Skilled Trades Learning Centre	Tighten Occupancy Schedules		X	2019-Present
Skilled Trades Learning Centre	Building Envelope: Repair/Replace Weather Stripping		X	2019-Present
Skilled Trades Learning Centre	Lighting Upgrade: LED Retrofit Lamps	X	X	2019-Present
Skilled Trades Learning Centre	Lighting Controls: Occupancy Sensors	X		2019-Present
Skilled Trades Learning Centre	Building Envelope: Interlock RTUs with Overhead Doors	X	X	Not Implemented
Skilled Trades Learning Centre	HVAC Controls: Install Occupancy Sensing Thermostats	X	X	2019-Present
Skilled Trades Learning Centre	Lighting Upgrade: Exterior LED Fixtures	X		Not Implemented
Skilled Trades Learning Centre	Expand BAS: Control Rooftop Units, Implement CO2 Control	X	X	2018-Present

Building	Measure	Impacted Utility		Implementation Year
		Electricity	Natural Gas	
Skilled Trades Learning Centre	Install High Efficiency DHW Heater		X	Not Implemented
Fire College	Lighting Upgrade: Halogen to LED	X	X	Not Implemented
Fire College	Maximize Use of Reservoir for Fire Fighting	X		Not Implemented
Fire College	Lighting Controls: Occupancy Sensors	X		2018-Present
Fire College	Lighting Controls: Photocells	X		2018-Present
Fire College	Install a VFD on Fire Pump	X		2023-2024
Fire College	Re-Commission Solar DHW System		X	Not Implemented
Fire College	Interlock Overhead Doors with Heaters		X	2023-2024
Fire College	Reset / Limit Vestibule Temperature		X	2023-Present
Multiple Buildings	Variable Air Volume System with Demand Control Ventilation	X	X	2019-Present
Sarnia Campus	Lighting Control	X		2020-Present
Sarnia Campus	Lighting Fixture Retrofit	X		2021-Present
Sarnia Campus	Convert Pumps from CV to VV	X		2020-Present
Sarnia Campus	Recommissioning/Upgrade Controls and Adjust Schedule	X		2018-Present
Sarnia Campus	Lighting Fixture Replacement	X		2018-Present
Sarnia Campus	Kitchen Demand Ventilation	X	X	Not Implemented
Sarnia Campus	Boiler System Upgrades	X	X	2018-2019
Sarnia Campus	Relamp & Reballast	X		2018-Present
Sarnia Campus	Expand BAS	X	X	2018-Present
Sarnia Campus	Piping Insulation	X		2018-Present
Sarnia Campus	Weather stripping Doors and Windows	X		2018-Present

Building	Measure	Impacted Utility		Implementation Year
		Electricity	Natural Gas	
Sarnia Campus	Upgrade AHUs	X	X	2022-Present
Sarnia Campus	Ground Source Heat pumps (250 ton)	X	X	Not Implemented
Sarnia Campus	Roof Replacement		X	2018-Present
Sarnia Campus	Window Upgrades			Not Implemented
Sarnia Campus	360kW Rooftop Solar	X		Not Implemented
Sarnia Campus	3095 kW Carport Solar	X		Not Implemented
South Building	Installment of EMIS (Energy Management Information System) - Kaizen FDD and Kaizen Energy	X	X	2018-2019
South Building	Energy Curtailment Plan (during Ontario Peak Demand Periods to Reduce Global Adjustment Fees and GHG Emissions)	X		2018-2019

[1] All newly installed AHUs and RTUs will have this feature.

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 11. Renewable Energy Generation Operated by Lambton College

Building	Renewable Energy Description	In Operation	Utility
Sustainable Smart House	fixed PV system Rated for ~2.5kW of power	No (removed from site)	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 12. Targeted Utilities and Proposed Conservation Measures (2024-2028)

Building	Measure	Impacted Utility		Expected Year of Implementation
		Electricity	Natural Gas	
Lambton INN Residence & Event Centre	Schedule RTUs	X	X	Annually Ongoing
Lambton INN Residence & Event Centre	Lighting Upgrade: Incandescent and Flourescent to LED	X		Annually Ongoing
Lambton INN Residence & Event Centre	Student Residence Watt Waste Challenge	X		2024
Lambton INN Residence & Event Centre	Install Variable Speed Kitchen Hood Exhaust System	X		2025
North Building	Combine/Consolidate ECE Centre Refrigerators	X		2024
North Building	Water Conservation: Ultra Low Faucet Aerators		X	Annually Ongoing
North Building	Reduce Thermostat Settings - Occupied Areas		X	Annually Ongoing
North Building	Repair/Replace Weather Stripping		X	Annually Ongoing
North Building	Lighting Upgrade: Incandescent to LED	X		Annually Ongoing
North Building	Insulate DHW Piping: ECE Centre		X	(ECE moving to South Building)
North Building	Schedule AHUs	X	X	Annually Ongoing
North Building	Schedule Exhaust Fans	X	X	Annually Ongoing
North Building	DHW Plant Upgrade		X	2028
South (Main) Building	Water Conservation: Ultra Low Faucet Aerators		X	2019-Present
South (Main) Building	Lighting Controls: Recommission Photocells	X		2019-Present
South (Main) Building	Summer Shut Down of Heating Plant	X	X	Not Implemented
South (Main) Building	Lighting Upgrade: LED Retrofit Lamps	X	X	Annually Ongoing
South (Main) Building	Greenhouse Heating Conversion: Electric to Natural Gas	X	X	Before 2011
South (Main) Building	Lighting Controls: Occupancy Sensors	X		Annually Ongoing
South (Main) Building	BAS Controls: Individually Schedule AHUs	X	X	Annually Ongoing

Building	Measure	Impacted Utility	Impacted Utility	Expected Year of Implementation
		Electricity	Natural Gas	
South (Main) Building	BAS Recommissioning	X	X	Being Proposed
South (Main) Building	Install VFDs & 2-Way Control Valves on Hot and Chilled Water Pumps and Coils[1]	X		Annually Ongoing
South (Main) Building	Install Variable Speed Kitchen Hood Exhaust System	X	X	2026
South (Main) Building	BAS Upgrade: Install Wireless Occupancy Sensing Thermostats in Rooms	X	X	Annually Ongoing
South (Main) Building	Install Lead Condensing Boilers		X	Being Evaluated
South (Main) Building	Motor Repair on Phase IV Main Heating Loop	X	X	2024
South (Main) Building	Motor Replacement on Phase IV Main Heating Loop	X	X	2025
South (Main) Building	Execution of EMIS (Energy Management Information System) - Kaizen FDD and Kaizen Energy	X	X	Annually Ongoing
South (Main) Building	Energy Curtailment Plan (during Ontario Peak Demand Periods to Reduce Global Adjustment Fees and GHG Emissions)	X		Annually Ongoing
Suncor Centre	Tighten AHU Schedules	X	X	Annually Ongoing
Suncor Centre	Lighting Controls: Occupancy Sensors	X		2028
Suncor Centre	Fuel Conversion: Install Instantaneous Gas Fired Water Heater	X	X	2028
Suncor Centre	HVC Controls: Expand BAS at Suncor Centre	X	X	2028
Skilled Trades Learning Centre	Water Conservation: Ultra Low Faucet Aerators		X	Annually Ongoing
Skilled Trades Learning Centre	Tighten Occupancy Schedules		X	Annually Ongoing
Skilled Trades Learning Centre	Building Envelope: Repair/Replace Weather Stripping		X	Annually Ongoing
Skilled Trades Learning Centre	Lighting Upgrade: LED Retrofit Lamps	X	X	Annually Ongoing
Skilled Trades Learning Centre	Lighting Controls: Occupancy Sensors	X		Annually Ongoing
Skilled Trades Learning Centre	Building Envelope: Interlock RTUs with Overhead Doors	X	X	2025
Skilled Trades Learning Centre	HVAC Controls: Install Occupancy Sensing Thermostats	X	X	Annually Ongoing
Skilled Trades Learning Centre	Lighting Upgrade: Exterior LED Fixtures	X		2025
Skilled Trades Learning Centre	Expand BAS: Control Rooftop Units, Implement CO2 Control	X	X	Annually Ongoing
Skilled Trades Learning Centre	Install High Efficiency DHW Heater		X	2026
Skilled Trades Training Centre	Supply and install new economizer actuator and control module for RTU (TRANE) unit	X	X	2025

Building	Measure	Impacted Utility		Expected Year of Implementation
		Electricity	Natural Gas	
Fire College	Lighting Upgrade: Halogen to LED	X	X	2025
Fire College	Maximize Use of Reservoir for Fire Fighting	X		2024
Fire College	Lighting Controls: Occupancy Sensors	X		Annually Ongoing
Fire College	Lighting Controls: Photocells	X		Annually Ongoing
Fire College	Re-Commission Solar DHW System	X	X	2025
Fire College	Interlock Overhead Doors with Heaters	X	X	2025
Fire College	Reset / Limit Vestibule Temperature	X	X	Annually Ongoing
Industrial Training Centre	Reduce water intake meter pipe size from 6 inches to 1 inch		X	2024
Industrial Training Centre	Reduce HVAC schedule to accommodate high vacancy	X	X	2024
Multiple Buildings	Variable Air Volume System with Demand Control Ventilation	X	X	Annually Ongoing
Sarnia Campus	Lighting Control	X		Annually Ongoing
Sarnia Campus	Lighting Fixture Retrofit	X		Annually Ongoing
Sarnia Campus	Convert Pumps from CV to VV	X	X	Annually Ongoing
Sarnia Campus	Recommissioning/Upgrade Controls and Adjust Schedule	X	X	Annually Ongoing
Sarnia Campus	Lighting Fixture Replacement	X		Annually Ongoing
Sarnia Campus	Kitchen Demand Ventilation	X	X	2025
Sarnia Campus	Boiler System Upgrades	X	X	2028
Sarnia Campus	Relamp & Reballast	X	X	Annually Ongoing
Sarnia Campus	Expand BAS	X	X	Annually Ongoing
Sarnia Campus	Piping Insulation	X	X	Annually Ongoing
Sarnia Campus	Weather stripping Doors and Windows	X	X	Annually Ongoing
Sarnia Campus	Upgrade AHUs	X	X	Annually Ongoing
Sarnia Campus	Ground Source Heat pumps (250 ton)	X	X	2028
Sarnia Campus	Roof Replacement	X	X	Annually Ongoing
Sarnia Campus	Window Upgrades	X	X	2028
Sarnia Campus	360kW Rooftop Solar	X		2028
Sarnia Campus	3095 kW Carport Solar	X		2028

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:

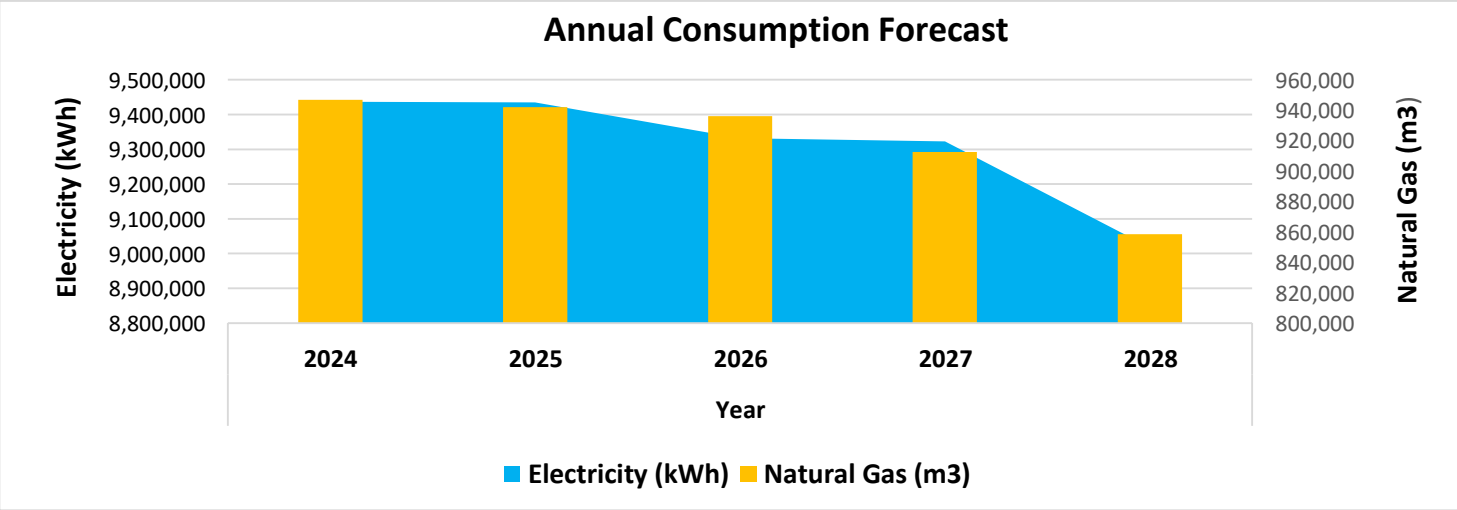
Table 13. Forecast of Annual Utility Consumption

Annual Consumption (Units)										
Utility Source / Year	2024		2025		2026		2027		2028	
	Units	% Change[1]	Units	% Change[1]	Units	% Change[1]	Units	% Change[1]	Units	% Change[1]
Electricity (kWh)	9,437,324	0.00%	9,435,634	-0.02%	9,332,658	-1.11%	9,322,917	-1.21%	9,017,530	-4.45%
Natural Gas (m^3)	946,844	0.00%	942,074	-0.50%	936,284	-1.12%	912,681	-3.61%	858,452	-9.34%
Potential Savings[2]	-		-$2,621.58		-$19,933.08		-$33,098.55		-$102,967.28	

[1] % Change = [Utility Source/Year Annual Consumption - Utility Source / Year 2024] x 100%
[Utility Source/ Year 2024]

[2] Negative Potential Savings values are forecasted annual savings compared to positive Potential Savings values which are forecasted annual $ gains meaning costs for combined utilities is increasing. Savings are estimated assuming the College continues to pay $0.14 / kWh CAD for electricity and $0.50 / m^3 CAD for natural gas on average.

Figure 7. Forecast of Annual Utility Consumption



4.7. GHG Emissions Forecast

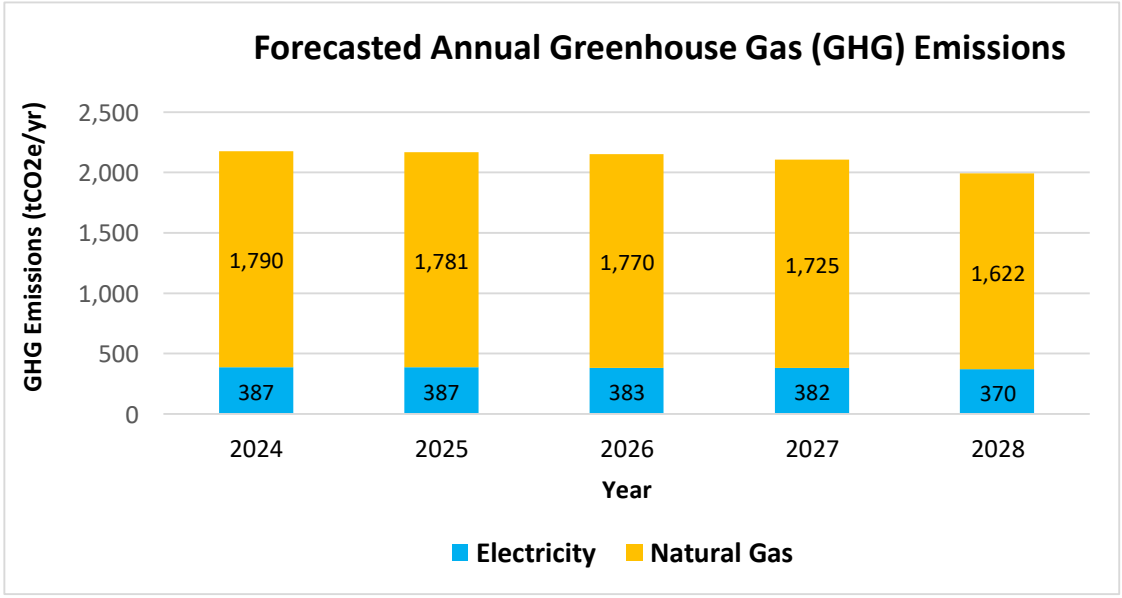
The forecasted greenhouse gas emissions for the Sarnia campus are calculated based on the forecasted energy consumption data analyzed in the previous section and are tabulated in the following table:

Table 14. Forecast of Annual Greenhouse Gas Emissions

GHG Emissions (tCO2e Per Year)					
Utility Source / Year	**2024**	**2025**	**2026**	**2027**	**2028**
Electricity	387	387	383	382	370
Natural Gas	1,790	1,781	1,770	1,725	1,622
Totals	**2,176**	**2,167**	**2,152**	**2,107**	**1,992**
Reduction from Baseline Year (2011)[1]	**-18%**	**-18%**	**-19%**	**-21%**	**-25%**

[1] A Reduction from Baseline Year (2011) with a negative value is an actual reduction in GHG emissions (tCO2e/yr). 2011 is the College's baseline year for its Greenhouse Gas Reduction Roadmap & Action Plan (GHG RRAP) or Roadmap to Net-Zero Carbon Emissions.

Figure 8. Forecast of Annual Greenhouse Gas Emissions



5. Closing Comments

Thanks for everyone's assistance in making the next five-year Energy Conservation and Demand Management Plan for Lambton College a success. Our facility has been a primary resource for educating and accommodating various needs and desires for our students, our people, and our local and global community. According to Research Infosource Inc., the College continues to be in the top three applied research colleges in Ontario and in Canada on an annual basis. Our strong relationships with industry and resource infrastructure continue to evolve on our campus.

Energy conservation and demand management will continue to play an important role in many parts. These measures will be continuously included in our facilities operations & deferred maintenance; school curriculum & program delivery; commitment to the UN's 17 SDGs & Lambton College's Roadmap to Net-Zero Carbon Emissions by 2050; and overall health and wellbeing.

As we embark on our next Strategic Plan, we will continue to collectively collaborate, engage, and support on values that will see The Lambton College of Applied Arts and Technology be a leader in industry, innovation, and inclusivity.

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. Here, the same baseline year is used for the College's GHG RRAP (year 2011) to compare and contrast % changes of information.
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	CO2	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.
Category 6 cable	CAT 6	Category 6 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	CO2e	CO2e 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.
Greenhouse Gas Reduction Roadmap & Action Plan	GHG RRAP	Lambton College's Greenhouse Gas Reduction Roadmap & Action Plan (GHG RRAP) is the College's Roadmap to Net-Zero Carbon Emissions. The 2011 baseline year is used to set two GHG reduction goals: 1. Reduction of 37% GHG emissions from 2011 (baseline) levels by end of year 2030 and 2. Reduction of 100% GHG emissions from 2011 (baseline) levels = Net-Zero Carbon (0 tCO2e/yr)
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 building with zero net energy consumption, meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site.
Sensible Heat		Sensible heat is heat exchanged by a body or thermodynamic system 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.
Metric Tonnes of Carbon Dioxide Equivalent.	tCO2e	tCO2e represents the universal metric to calculate and quantify the amount of GHG emissions being emitted by the College. tCO2e is calculated on an annual level (hence the term being seen as tCO2e/yr). The unit is calculated from the summation of the 6 well-known greenhouse gases: carbon dioxide (CO2); methane (CH4), nitrous oxide (N2O); Hydroflourocarbons (HFCs); Perfluorocarbons (PFCs) and Sulphur hexaflouride (SF6).
Variable Frequency Drive	VFD	A variable frequency drive is a device that allows for the modulation of an electrical or mechanical piece of equipment.

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