Strategic Energy Management Plan Update

LANGARA COLLEGE 2015-2020

2019 & 2020 Calendar Year –April 1, 2022

Langara.
THE COLLEGE OF HIGHER LEARNING.

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Definitions

GHG: Greenhouse Gases

GSM: Gross Square Meters

tCo2e : tonnes of carbon dioxide equivalent

STARS: Sustainability Tracking and Reporting System. More information at: stars.aashe.org

LEED®: Leadership in Energy and Environmental Design

1. Executive summary

Located in beautiful Vancouver, BC, Canada, Langara College provides University, Career, and Continuing Studies education to more than 23,000 students annually. With over 1,700 courses and 130 programs offered, Langara's expansive academic breadth and depth allows students of all ages, backgrounds, and life stages to choose their own educational path.

Langara participated in the BC Hydro Energy Manager Program from 2009–2018. The purpose of the program it to help organizations make energy management part of their operational culture using a holistic approach to energy management, including Organizational, Technical and Behavioural activities. Having achieved this over the 10 year period, BC Hydro resources for this program are now redirected to help other institutions work towards this goal.

In 2009, Langara set a goal to reduce energy usage on campus by 15% over a 5-year period. At the end of the 5 years we met and exceeded our target, achieving 19% energy savings. This resulted in approximately $350,000[1] avoided energy costs over the period.

In 2014 a new 3-Year Strategic Energy Management Plan (SEMP) was developed by Langara to demonstrate Langara's continued commitment to energy management. The new target was to achieve overall energy savings of 25% compared to our 2009/10 baseline by 2017; an additional 10% over the previous 5-Year target set.

Over this past year, we extended our 3-Year SEMP from 2014 out to include 2020 and at the same time aligned our baseline and reporting requirements with the Ministry Level Carbon Neutral Action Reporting, Space Allocation reporting and AASHE STARS reporting conventions. This alignment is to facilitate reporting going forward and to incorporate a usage per unit area targets and reporting. As a growing campus it was necessary to include usage per unit area in our reporting to more clearly show our progress.

Due to Covid-19, our reporting out on progress has been delayed. This update includes results for both 2019 and 2020 calendar years. Note: 2020 is almost one full year of operation during Covid-19 and impact on energy and water usage of buildings is evident. For the purpose of understanding our progress, 2019 is considered our "Reporting Year".

2019: Comparing our campus level energy usage and emission for 2019 compared to 2007;

- our energy usage per GSM of campus area has decreased by 23% and
- our GHG emissions in tCo2e per GSM of campus area has decreased by 48%.

2020: Comparing our campus level energy usage and emission for 2020 compared to 2007;

- our energy usage per GSM of campus area has decreased by 35% and
- our GHG emissions in tCo2e per GSM of campus area has decreased by 52%.

Other benefits of energy saving initiatives, beyond energy, emissions and cost savings, include upgrades to aging infrastructure, occupant comfort from improved controls and operations and a better understanding of building systems on campus.

We are currently in the process of developing our next Strategic Energy Management Plan to align with the new 2025 Strategic Plan – Weaving a shared future. This planning has been delayed due to Covid-19 priorities.

[1] Value shown is estimated based on average billing period cost per consumption multiplied by the energy savings. Exact rate structures were not used for calculating the avoided cost.

2. Our commitment

2.1 A HISTORY OF ENERGY MANAGEMENT AT LANGARA

The Langara community has a strong commitment to environmental, financial, and social sustainability, which includes responsibility to students, faculty, staff, the institution, our community, and the world. As part of the College's commitment to reducing energy and greenhouse gas (GHG) Emissions, an Environmental Responsibility Policy was established in June 2001. The purpose of the board governance policy is as follows:

> *To provide direction to the College regarding the creation of learning and working environment characterized by social responsibility, the Board is committed to:*
>
> - *protecting and enhancing the environment for future generations, and*
> - *using and managing its own physical environment more sustainably*

In 2017, Langara College renewed its Sustainability policy to affirm its ongoing commitment to and responsibility for fostering an institutional culture characterized by leadership in environmental, social and financial sustainability. The College also established a sustainability committee to advise senior leadership and pursue opportunities for all members of the College community to make choices that promote sustainability in the teaching, learning, researching and working environments in alignment with strategic directions.

Langara has been actively monitoring and managing energy usage of its facilities for over 20 years. In addition, Langara was leading the way when it established a policy to have any new building construction be minimum LEED® Gold before it was required by the City of Vancouver. Today, Langara has 4 LEED Gold certified buildings; with our new Science & Technology (S&T) Building open, over 40% of the campus will be LEED Gold buildings.

The 2025 Strategic Plan – Weaving a shared future is an ambitious plan to strengthen the College's culture, programming, community connections, sustainability, and Indigenization. It again reaffirms the College's commitment to sustainability and includes a goal to achieve a STARS Bronze rating, but we were able to achieve Silver. We are now working towards Gold Certification.

2.2 WHY ENERGY MANAGEMENT

- The energy management plan increases the financial sustainability of the college; avoided costs related to energy consumption and associated emissions are realized in a reduction in ongoing operating costs to the College.
- In addition to the energy consumption savings, most of the energy projects completed to date, and planned for the future, update aged infrastructure and end of life equipment; this has resulted in a reduction in our differed maintenance liabilities.
- Most of the new systems related to energy projects include improved and or new integrated building controls providing operators with more visibility and understanding of building systems and their operation. This results in a more proactive approach to building operations, generally leading to improved indoor air quality, comfort for occupants, and increased productivity and learning.
- It supports the established environmental policies for the College and the current Academic Plan.
- There is also evidence to suggest student value being part of an institution that is taking action on climate change, most students believe this is a concern. This was supported by a recent sustainability assessment carried out at Langara, where 90% of respondents want sustainability to be a top priority for leadership at Langara, and as many as 73% of respondents think that climate change impacts will be significant and are worried about hose these impacts may affect their lives.

2.3 STAKEHOLDERS

Included below is a list of stakeholders for implementing Langara's Strategic Energy Management Plan; it is important to include the whole campus community, from academics, students, community members, utility providers, administration, and facilities & operations. The following table includes key stakeholders in Langara's Energy Management Program.

Table 1: Energy Management Program Stakeholders

Organization	***Contact Information***	***Title & Related Areas of Responsibility***
Langara	Michael Koke mkoke@langara.ca 604.323.5936	Vice President, Administration & Finance (Interim)
Langara	Dwayne Doornbosch ddoornbosch@langara.ca 604.323.5614	Director, Facilities
Langara	Patricia Baker patriciabaker@langara.bc.ca 604.323.5438	Associate Director, Facilities
Langara	Zeeshan Khan zkhan@langara.ca 604.323.5209	Manager, Building Operations
Langara	Raymond Yeung ryeung@langara.bc.ca 604.323.5775	Manager, Facilities Services
Langara	Scott Stuart sstuart@langara.bc.ca 604.323.5380	Construction Supervisor
Langara	Craig Vand'Erkamps cvanderkamps@langara.ca	Maintenance Supervisor
Langara	Alex Goldman agoldman@langara.ca 604.323.5394	Team Lead, Client Services Information Technology
Langara	Deborah Shratter dshratter@langara.ca	Communications Officer Communications & Marketing
Langara	Sustainability Student Ambassadors (SSA) Program	
ACML	Bill Palmeter & ACML Team	Chief Engineer Operation & Maintenance Services
Prism Engineering	Various Consultants Support	Energy Monitoring (PUMA)
BC Hydro	Ron Mastromonaco ron.mastromonaco@bchydro.com 604.699.6243	Key Account Manager
Fortis BC	Vlad Kostka vladimir.kostka@fortisbc.com 604.592.7967	Key Account Manager

3. Understanding our situation

3.1 BUILDINGS

Langara is a growing campus, since 2007 the Campus area has increased by 30%. This includes 3 New LEED Gold Buildings (Library, Student's Union Building and Science and Technology Building). In addition, in 2009 the C North portion of the campus was fully renovated to LEED Gold standards. Our new 25-year master plan for the campus was recently approved by the City of Vancouver which will lead to further growth of our campus.

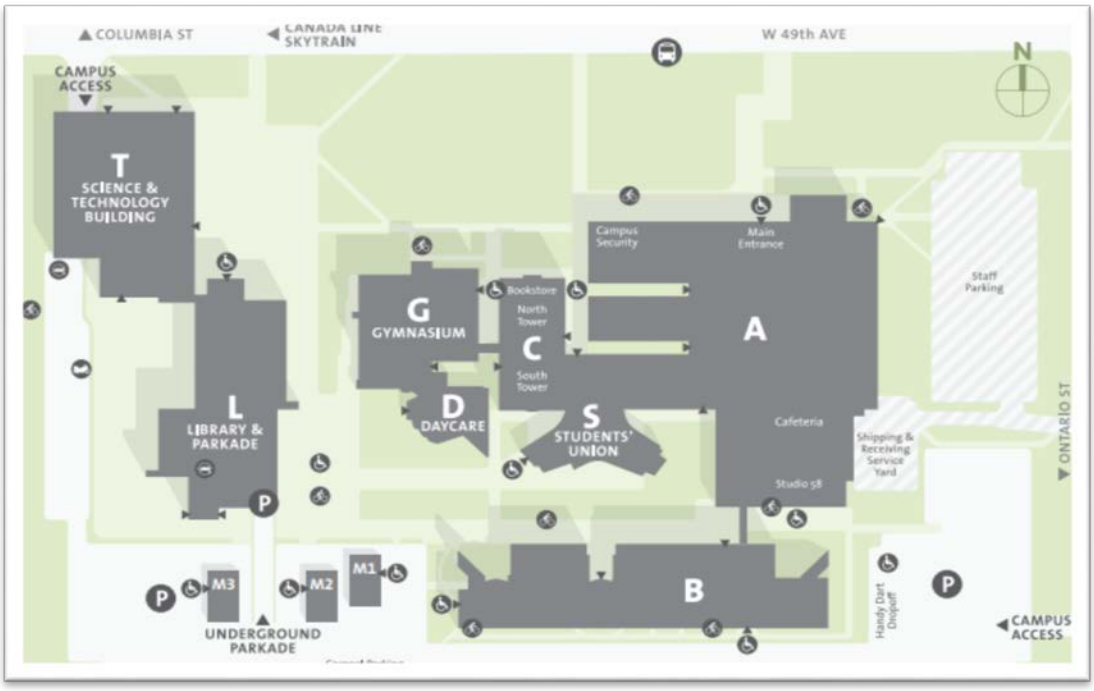


Figure 1: Campus Map

The following table and figure show the year build and area breakdown of the buildings, including the commonly referenced building groups.

Table 2: Campus Building Groups and Floor Areas (Gross Square Meters)

Building Group	Building	Floor Area (m2)
A Building	A Building 1970 (A)	25,675
	Gym 1970 (G)	2,205
	C South 1986 (C)	1,423
	Daycare 1986 & 1998 (D)	758
B Building	B Building 1996 (B)	9,239
C Building & Langara Students' Union (LSU)	C Building Renewed 2009 (C)	4,248
	LSU 2009	1,668
Library	Library 2007	7,754
Science & Technology	Science & Technology 2016	13,808
	Total	66,778

The figure below shows the percent buildings area breakdown for the campus.

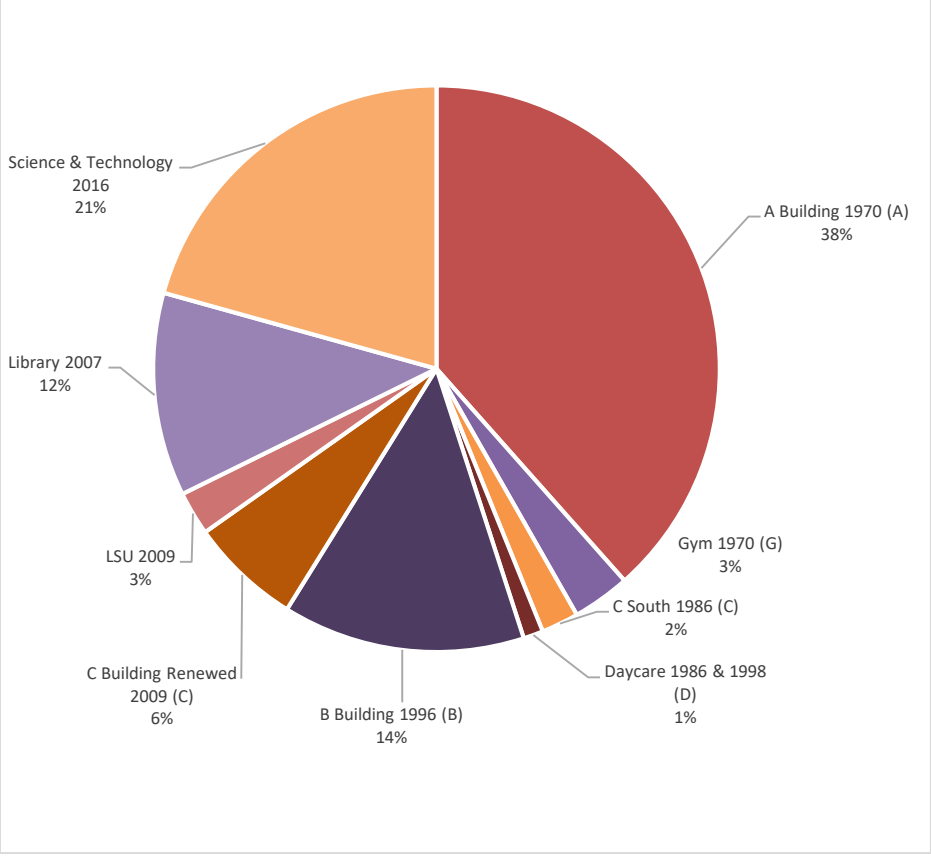


Figure 2: Buildings Area Breakdown

3.2 OVERALL CAMPUS ENERGY USE

3.2.1 Energy Billing Meters

A single gas and electrical billing meter serves the entire campus. The account information for each meter is included in the table below.

Table 3: Campus billing electrical and natural gas meters

Meter Type	Utility Provider	Account Number
Electrical	BC Hydro	6189553
Natural Gas	Fortis BC	8025002701

3.2.2 Energy Usage Summary

The overall energy usage starting from 2007 to 2020 is included in the table and charts below.

Table 4: Energy Use Summary

Year	*GSM:*	*Electrical - Consumption - kWh*	*Natural Gas - Consumption - ekWh*	*Energy Total - Consumption - ekWh*
2007	51,302	7,771,360	10,224,972	17,996,332
2008	51,302	7,782,720	9,081,389	16,864,109
2009	52,970	8,676,707	9,025,583	17,702,290
2010	52,970	9,287,048	7,721,417	17,008,465
2011	52,970	9,064,165	7,506,778	16,570,942
2012	52,970	8,576,475	6,994,694	15,571,169
2013	52,970	8,331,052	6,467,333	14,798,386
2014	52,970	8,367,636	5,812,917	14,180,553
2015	52,970	8,251,055	5,641,972	13,893,027
2016	66,778	9,738,836	7,091,222	16,830,059
2017	66,778	11,460,509	7,393,500	18,854,009
2018	66,778	11,512,927	6,538,611	18,051,538
2019	66,778	11,084,516	6,986,528	18,071,044
2020	66,778	8,707,939	6,544,944	15,252,883

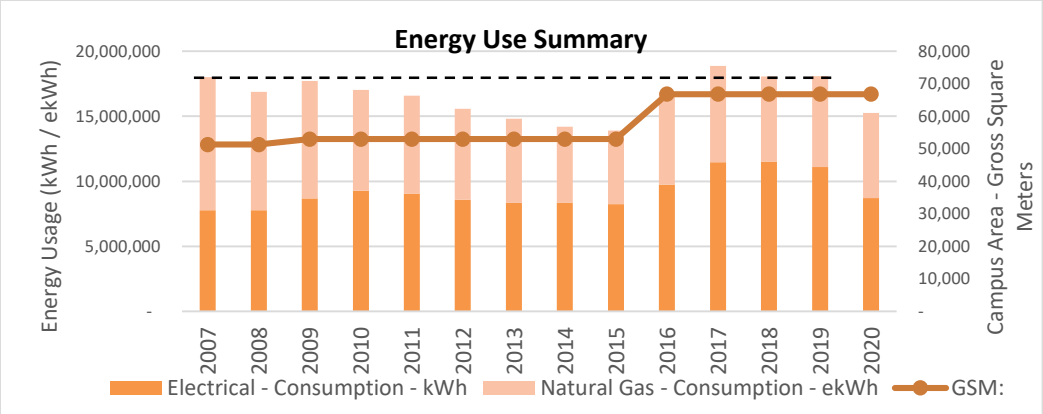


Figure 3: Energy Use Summary Chart

Figure 3 is a chart of the overall energy usage by year, including the increases in campus area. It is noteworthy that the total energy usage in 2007 is the same as 2018 & 2019.

- In other words, our energy savings from 2007 to 2015 was enough to run our new Science & Technology Building (T Building) including a NEW second Data Center.

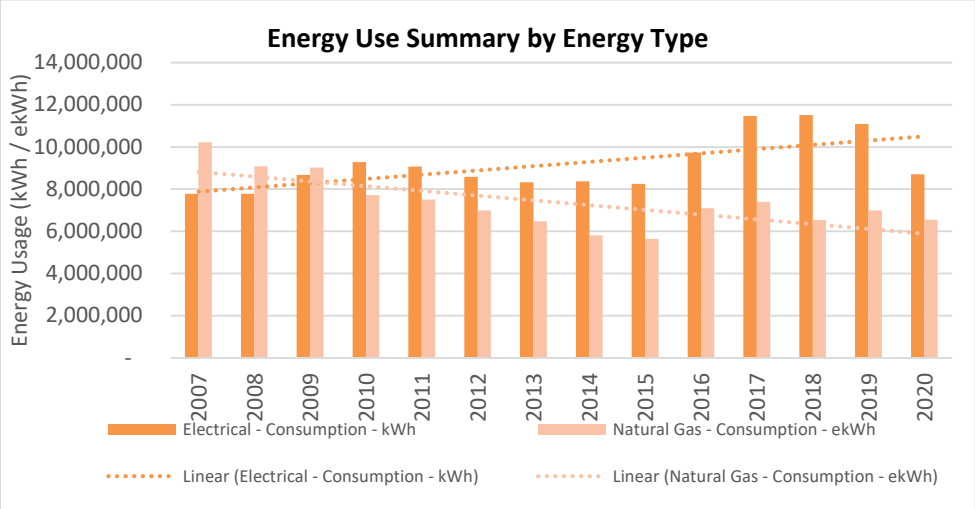


Figure 4: Energy Use Summary by Energy Type Trend

The chart above shows an overall trend of decreased use of gas and increase in electricity usage on campus from 2007 to 2020.

3.2.3 Energy Usage Per Gross Square Meters (GSM)

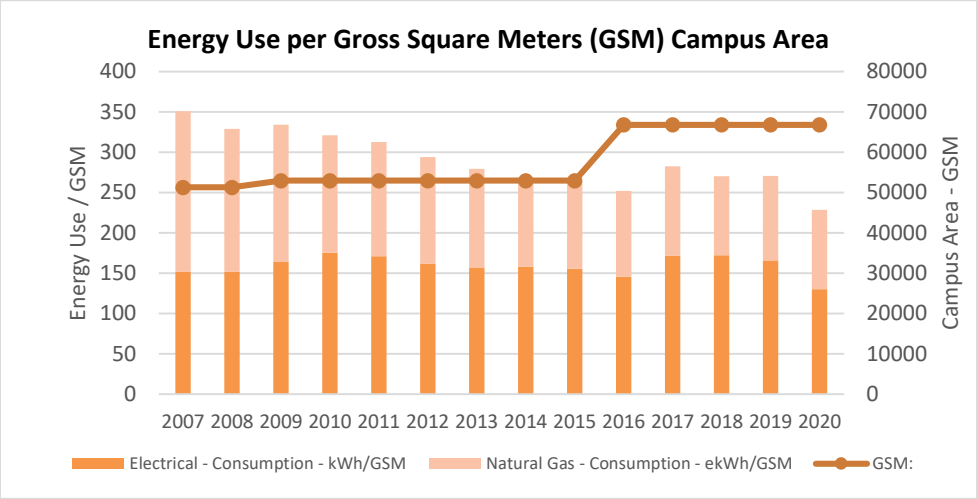


Figure 5: Energy Use per Gross Square Meters (GSM) with Campus Area

The chart above shows that the overall energy use per GSM has been decreasing as expected. The campus level Building Energy Performance Indicator (BEPI) is considered a key performance indicator (KPI) for Langara as it can account for area increases on campus.

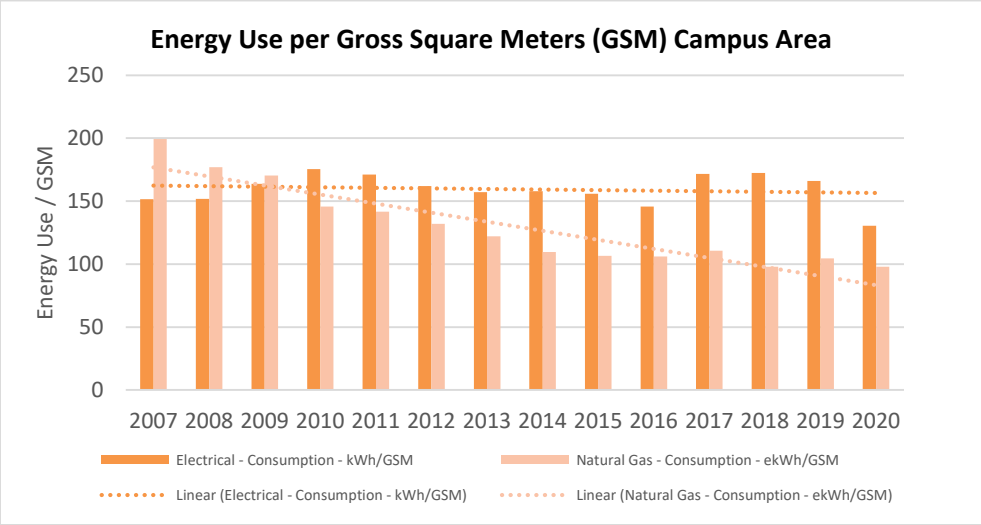


Figure 6: Energy Use per GSM by Energy Type Trend

Figure 6 above shows the trend for each energy type per GSM. The overall trend was a decreased use of gas per GSM. On the other hand, while the electricity usage per GSM has a had some variation, it has remained almost the same. 2020 has some additional decrease in electricity per GSM, this is likely attributed to Covid-19.

The chart below summarizes the change in overall energy usage for the total campus area for 2015, 2019 and 2020 compared to 2007 base period. *This data is not corrected for weather.*

Table 5: Summary of Change in Overall Energy Usage on Campus Compared to 2007

Year	Campus Area Change GSM:	Electrical - Consumption - kWh/GSM	Natural Gas - Consumption - ekWh/GSM	Energy Total Consumption - ekWh/GSM	Comments
2015 less 2007	1,668	4	-93	-89	Prior to T Building & New Data Center #2
% change	3%	3%	-47%	-25%	
2019 less 2007	***15,476***	***15***	***-95***	***-80***	***Reporting Year Includes T Building***
% change	***30%***	***10%***	***-48%***	***-23%***	
2020 less 2007	15,476	-21	-101	-122	COVID 19 Impacts Reduced Campus Population
% change	30%	-14%	-51%	-35%	

Table 5 above shows that in our "Reporting Year" for STARS Energy performance,

We have reduced our overall energy usage per GSM by 23 % compared to 2007.

- This includes a 48% reduction in gas usage per GSM and an overall increase in electricity per GSM of 10% compared to 2007.

The decrease in gas and increasing electricity usage is expected as we shift to geo-exchange and heat recovery technologies on campus / low carbon electrification concepts.

The chart below shows the constant trend of decreased in Natural Gas consumption per GSM from 199 ekWh / GSM to 105 ekWh / GSM or 48% reduction from 2007 to 2019.

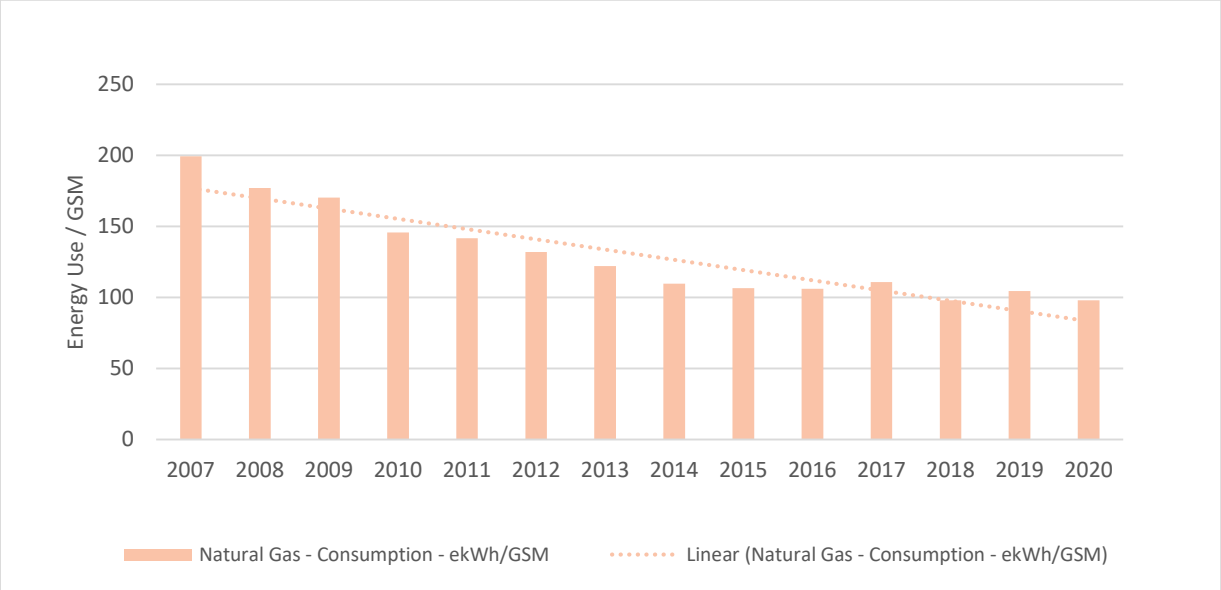


Figure 7: Natural Gas Usage per GSM Trend

3.2.4 Energy Cost Summary

Table 6: Summary of Energy Cost by Year

Year	*GSM:*	Electrical Cost - $	Natural Gas Cost - $	Total Cost - $
2007	51,302	416,336.55	352,830.83	$769,167.38
2008	51,302	427,725.30	356,929.92	$784,655.22
2009	52,970	496,501.46	267,459.98	$763,961.44
2010	52,970	547,309.51	262,824.08	$810,133.59
2011	52,970	567,835.79	206,542.38	$774,378.17
2012	52,970	578,564.69	196,457.09	$775,021.78
2013	52,970	604,813.15	192,261.75	$797,074.90
2014	52,970	653,665.54	181,324.49	$834,990.03
2015	52,970	686,209.30	135,714.81	$821,924.11
2016	66,778	897,377.37	156,090.88	$1,053,468.25
2017	66,778	1,025,124.26	190,699.81	$1,215,824.07
2018	66,778	1,017,775.67	211,568.77	$1,229,344.44
2019	**66,778**	**982,342.73**	**314,012.03**	**$1,296,354.76**
2020	66,778	750,442.92	189,230.96	$939,673.88

While we have seen energy usage per GSM decrease, the overall cost of energy has been going up, in particular for electricity. While gas usage from 2008 to 2018 was decreasing or relatively the same, the cost in 2019 shows the volatility of gas costs (pipeline issue increased gas by a factor of 10) and this will continue to be an issue with carbon tax , supply issues and need to address the climate crisis.

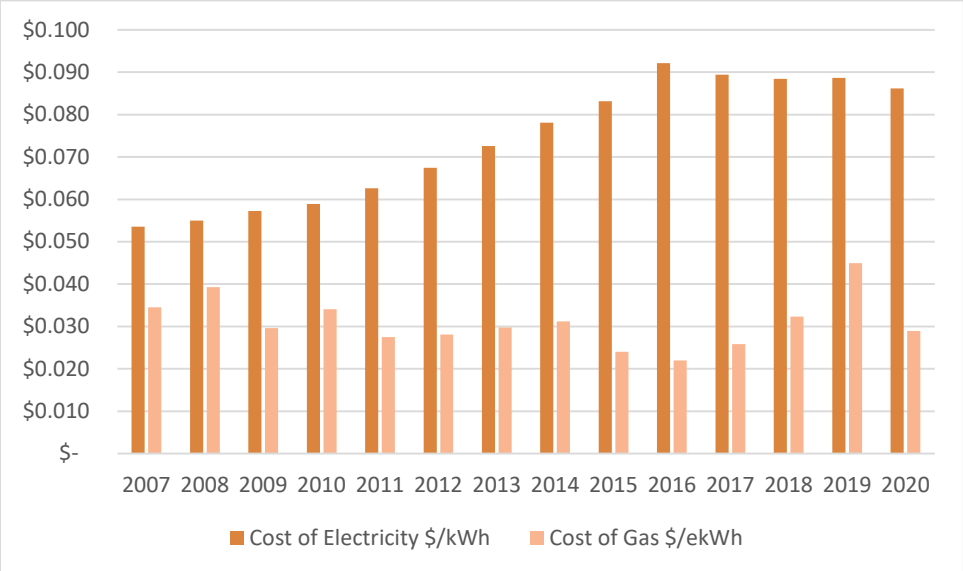


Figure 8: Cost of Energy Comparison ($/ekWh)

The Figure below summarizes the overall energy costs. It shows that from 2007 to 2015, energy costs stayed generally the same, while we were saving energy. It is noteworthy that in 2019 we saw an increase in cost for energy – this was a result of the pipeline explosion that increased the cost of gas by 10X for a couple months' period, equivalent to about $100,000 impact. The next year, 2020, we see a decrease of $350,000 compared to the previous year. This is the result of decreased occupancy on campus due to Covid-19.

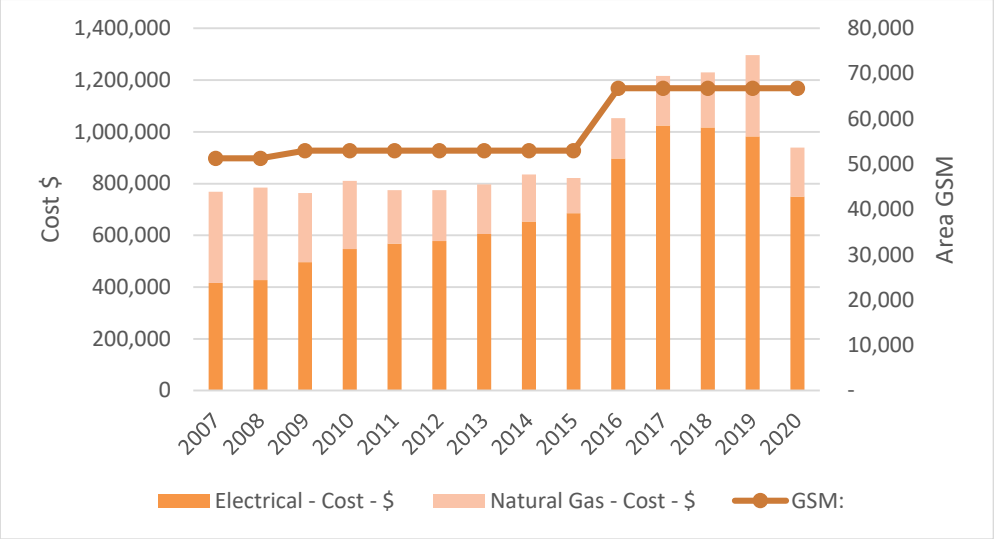


Figure 9: Total Energy Cost Summary

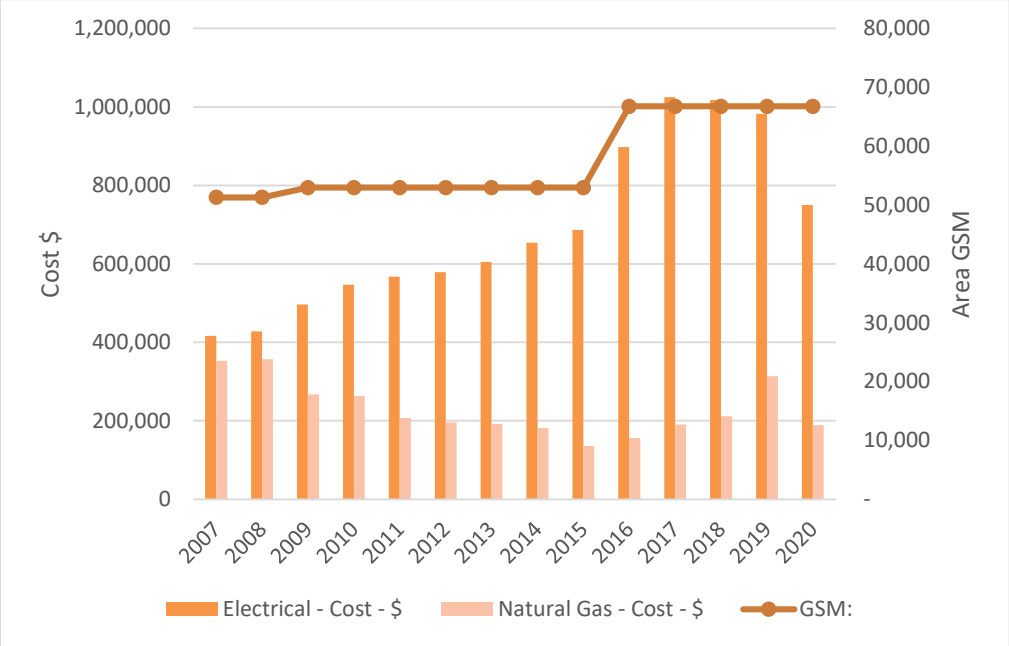


Figure 10: Total Energy Cost Summary by Energy Type

3.2.1 Energy Cost – Covid Impacts

The Cumulative Savings charts above show that due to Covid lockdown/ remote work from campus; the total avoided costs from utilities; $400,000 from electricity and $150,000 in water, or a total of approximately $550,000 over approximately 18 months. Gas usage remained similar to heat buildings.

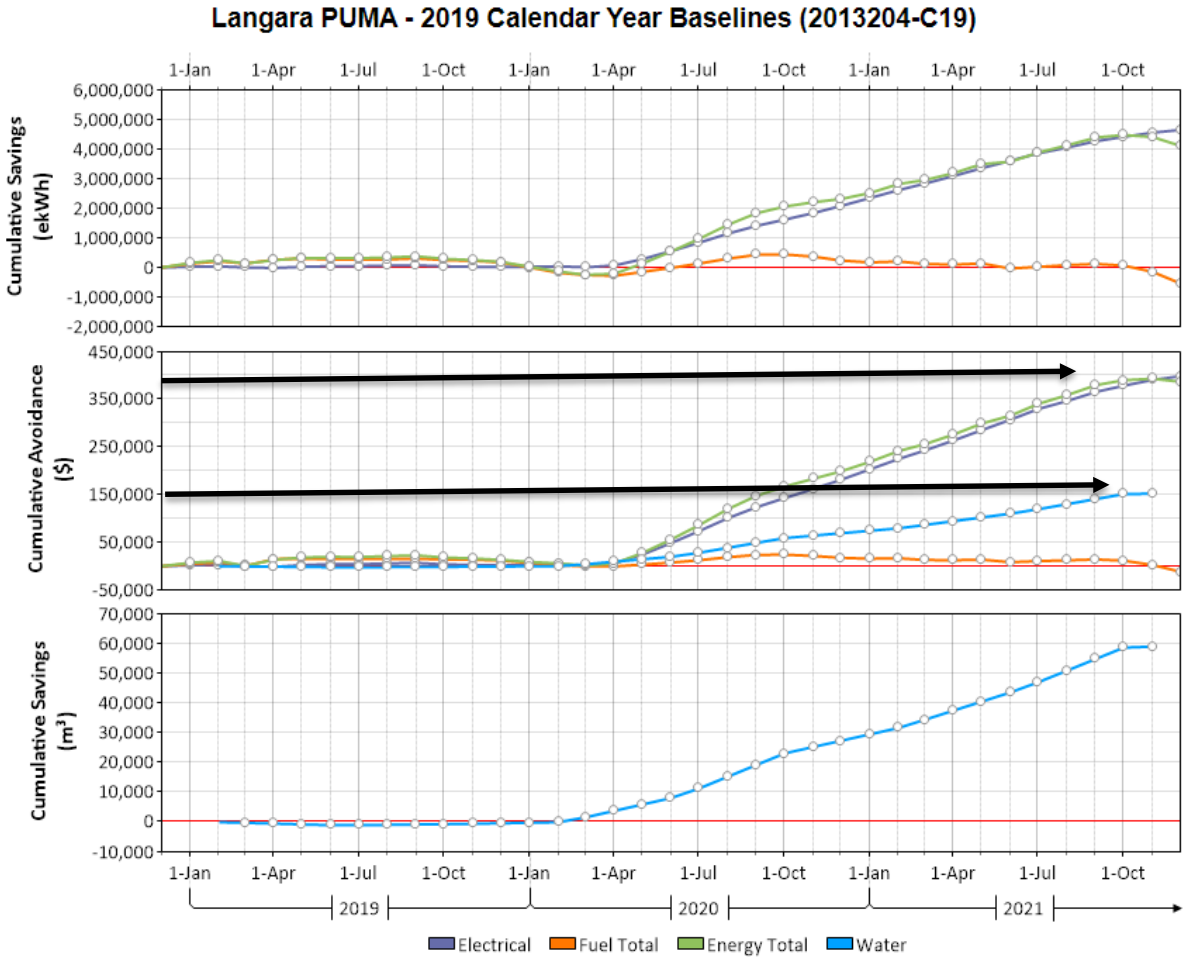


Figure 11: Cumulative Energy and Cost Savings

There is work to do to understand "how do we optimize space usage and energy on the post-Covid-19 campus?"

3.2.2 Estimated Buildings Energy Usage Breakdown 2015

In 2009/10, as part of the BC Hydro Continuous Optimization program, additional electrical sub metering and an Energy Management Information System (EMIS) was installed for each "building group". This provided a better understanding of energy usage breakdown on campus and was integral to our strategic energy management planning and identifying projects.

The table below summarizes the sub-metering available and a high-level overview of mechanical systems for the buildings on campus.

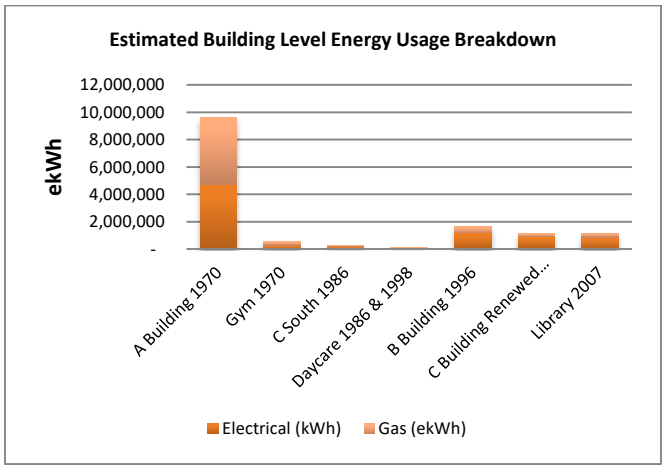
Table 7: Buildings mechanical system summary and sub-metering

Group	Building and Year of Construction	General Mechanical System Information	Electrical Sub-metering	Gas Sub-metering
A Building	A Building 1970 (A)	Upgraded to variable volume from constant volume air distribution for 2 largest fan systems, includes cooling and reheats. On DDC control.	Electrical loads are sub-metered at building level, with exception of Gym, C South, and Daycare which are smaller loads and have been estimated based on area and system level factors. A sub-meter for C-South & Gym is available. The load of the new science building is also separately sub-metered.	Main gas sub-meter tracks all gas use on campus and is calibrated against the billing meter. Rooftop units, unit heaters, A Building cafeteria kitchen, and program-specific applications (kilns, welding, labs, etc.) are also sub-metered separately for isolating the central heating plant load. A gas sub-meter serves the Library. Additional gas meter on heating plant and BTU meters have been installed.
	Gym 1970 (G)			
	C South 1986 (C)	Mostly converted to variable air volume, with cooling and reheats. On DDC Control.		
	Daycare 1986 & 1998 (D)	Constant volume and RTUs. On programmable thermostats.		
B Building	B Building 1996 (B)	Variable air volume with cooling and reheats. On DDC Control.		
C Building & LSU	C Building Renewed – North 2009 (C) and New LSU 2009 (S)	Thermenex heat recovery system, with Geothermal, and domestic hot water preheat. Water to water heat pumps, Chilled beams, and variable air volume system. On DDC control.		
	LSU 2009			
Library	Library 2007	Geothermal, water-to-water heat pumps, radiant heating, variable air volume system. On DDC Control.		
Science & Technology	Science & Technology 2016	The mechanical system incorporates the Thermenex energy management system, an innovative locally designed energy recovery and transfer system in which waste heat is captured from building areas requiring cooling and selectively redistributed to mechanical systems requiring heat energy. Particularly significant given the high energy use of a lab building, the system dramatically reduces overall energy consumption, operating costs and greenhouse gas emissions. The building further reduces the need for mechanical systems by using stack effect in the six-storey lightwell for return air flow. The Thermenex system then captures the heat at the roof and redistributes it where needed.		

Sub-metering now provides a better understanding of both the electrical loads and gas usage loads on campus. Gas usage breakdown is still estimated based on limited submeter and BTU meter data at the time, previous building audits and hot water load studies. The following estimated end use breakdown was carried out in 2015 to guide us in making decisions around potential energy saving opportunities.

Note: This energy usage breakdown was prior to construction of T Building.

The estimated energy usage breakdown by building prior to T Building is shown in the figures below:



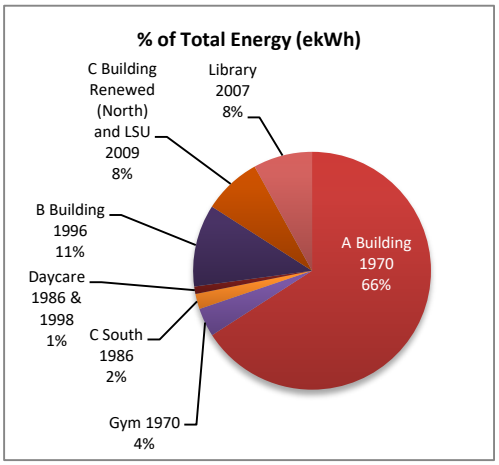


Figure 12: Buildings energy usage breakdown 2015 Estimate

It is notable that A Building is 47% of the campus area, and contributes to 66% of the campus energy usage. B Building is the next largest energy user. This was useful in targeting our projects and initiatives over the past few years.

The figures below show the energy usage breakdown for each building on campus.

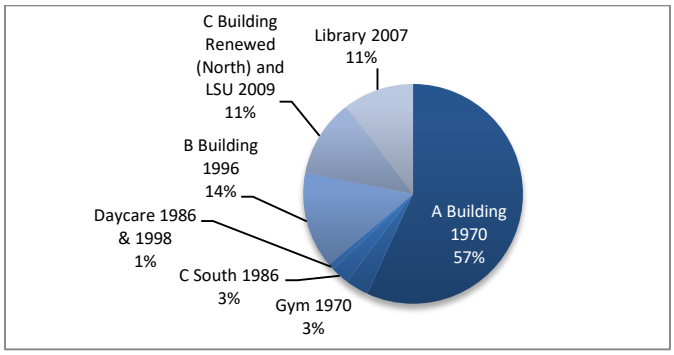


Figure 13: Electrical energy usage breakdown 2015

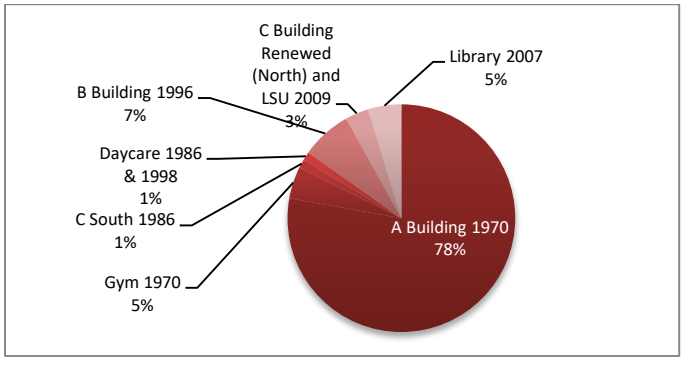


Figure 14: Natural Gas energy usage breakdown 2015

3.2.3 Estimated Buildings Energy Usage Breakdown 2020

More recently, using additional metering and data available, the campus energy usage and savings were further analysed. In particular, we looked at the gas and electricity usage of our LEED Gold Library and T Buildings compared to the rest of campus as submeter data for gas and electricity was available and complete for 2019.

Figure 15: T & L Buildings

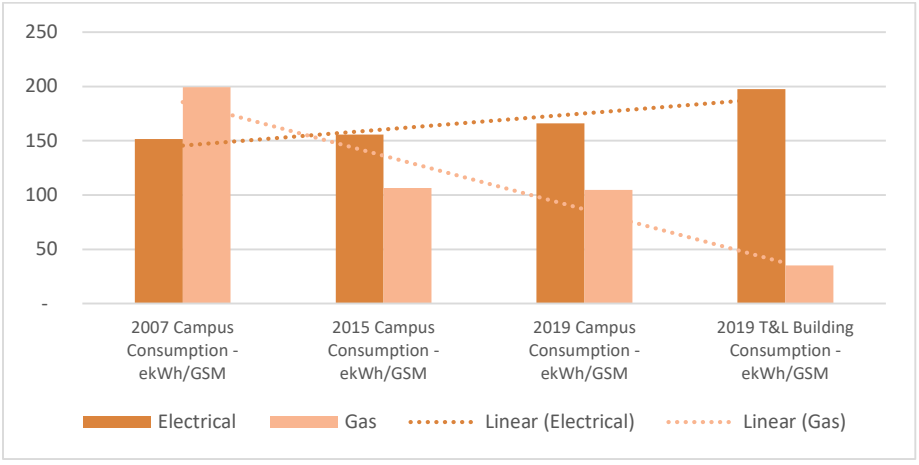


Figure 16: Energy Use Intensity Trend Comparison 2020 Analysis Campus versus T & L Building

This figure shows that while the Campus Level Gas Usage per GSM decreased by 48%; when you look at the performance of our only our Library and T Building combined, compared to campus level usage in 2007 base period, we have decreased our gas consumption per sqft by 82%.

Electrical consumption has increased as we electrify to decrease greenhouse gases using renewable and heat recovery technologies. These two buildings are also served by our new, more energy efficient central heating plant that we plan to extend to the rest of campus over the next few years.

3.2.4 Central Heating Plant Discussion

We have completed Phase I & II of this project. The new central heating plant is connected to our new Science and Technology Building, however, it has been designed to serve the rest of campus including heating and domestic hot water. The initial objective was to isolate building A from other buildings by tying them into a new heating plant in the Library; this also addresses the need for renewal of our heating and domestic hot water systems to decrease risk and costs as failures may occur with aged equipment.

Moving the central plant has a number of beneficial project outcomes. These are summarized below.

- Infrastructure improvements: Firstly, a relocation and renewal of the heating plant would improve the FCI of all buildings on campus as it currently serves A, B, portions of C, Gym and Daycare, including decreased risk to infrastructure as a result of loss of heat.
- Cost Effectiveness: Serving the campus from a new central plant would minimize disruption, risk and cost when A building renewal is scheduled and required. Continuing to centralize the heating plant will minimize operating costs associated with annual inspections of multiple plants.
- Innovation: Continuing to centralize the heating and including features in the design for future integration, will better prepare us to take advantage of renewable energy options as well as possible district heat options in the region in the future. Future ability to connect to a renewable energy source would improve emissions further in addition to minimizing risk to volatile energy rates.
- Strategic Alignment: This initiative is in line with the government's efforts to reduce greenhouse gases and improve FCI and reduce deferred maintenance costs.
- Energy and Emissions Reduction: The new heating plant would have more efficient technology, and in addition, the system, piping and controls would be designed to make use of the condensing/more efficient range of the boilers. New buildings would be designed for low temperature, (like the existing Library, C Building, Student Union and Science Building). A Building has also had most areas updated to utilize lower temperature heating; this was completed with Strategic Infrastructure funding in 2018.

We are currently in phase 3 of the project, and when the new central heating plant is extended to the rest of campus (existing buildings), we expect to achieve a further 15-20% reduction in the campus level energy Gas usage intensity (or savings of 7840 Gj - refer to Thermal Energy Study). This is a reduction of 64% thermal energy use per GSM compared to 2007.

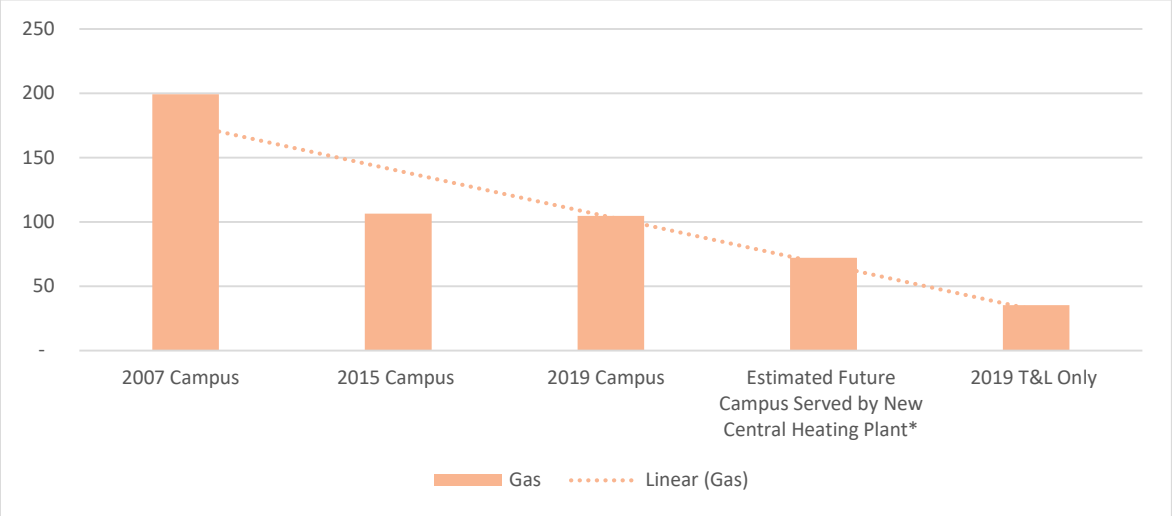


Figure 17: Natural Gas Use Intensity Trend Comparison Campus vs. T & L Building (ekWh/GSM)

That said, it is only with further deep retrofits to envelope or whole building renewal, incorporating renewable and newer technologies (geothermal and heat recovery) that we will achieve the next level of

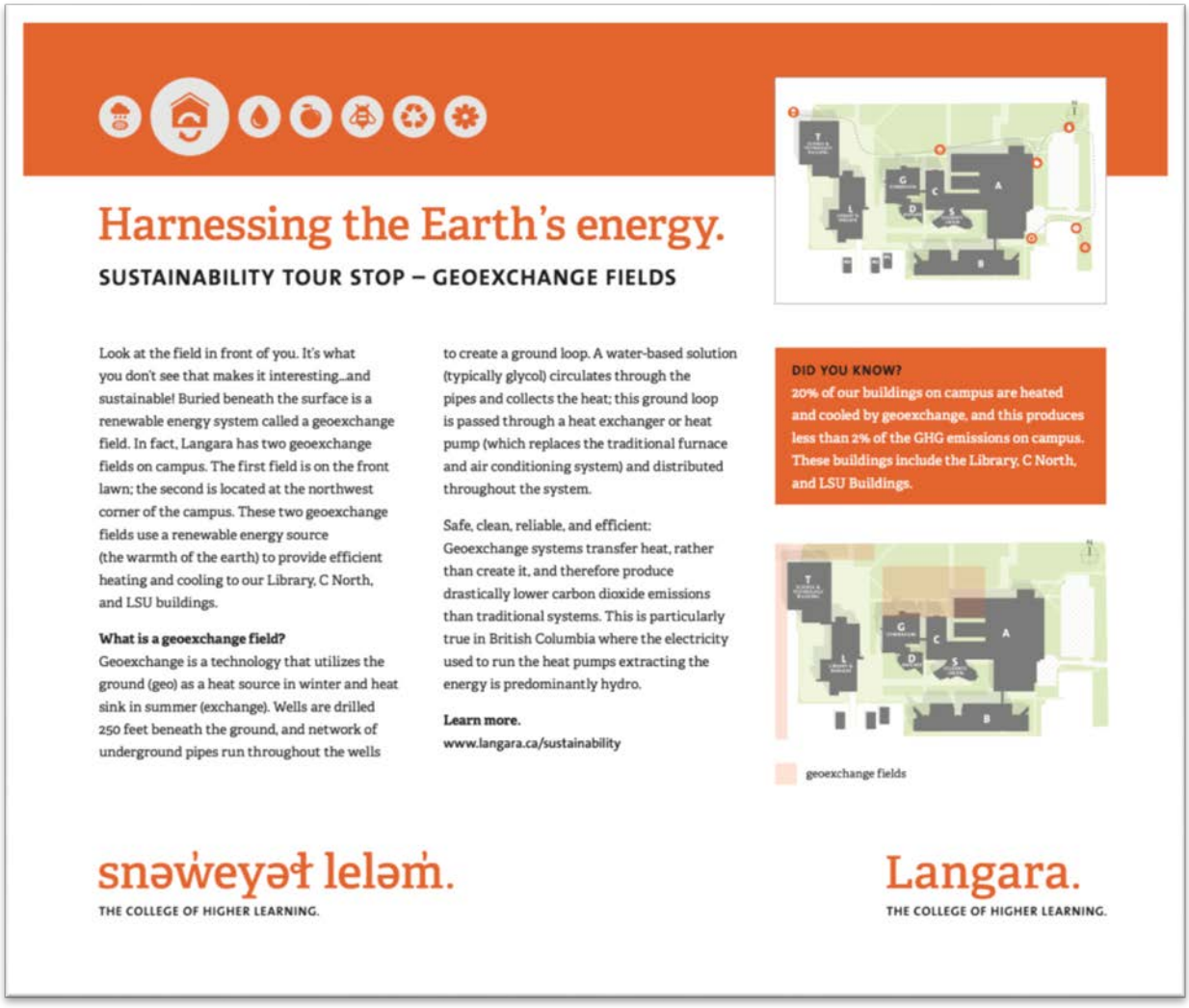
emissions savings. We have demonstrated it is possible to achieve these significant savings with the analysis of our L & T Buildings.

3.2.5 Renewables Discussion

3.2.5.1 Harnessing the Earth's Energy

Langara currently has 3 LEED certified buildings served by geo-exchange and our T Building, C North and LSU buildings also use a thermal gradient header technology "Thermenex" to reuse waste heat within the buildings. These technologies are renewable and have decreased our reliance on natural gas for heat. We demonstrated in the analysis in the previous sections that these technologies have decreased our gas usage per GSM in our L & T Buildings by 82% compared to 2007 levels.

Although we do not currently have metering in place to estimate the equivalent energy from Geo-Exchange and Heat Recovery, we wanted to carry out an analysis to understand better the proportion of renewable energy on campus. This is a high-level estimate intended to give a general magnitude of energy use replaced with renewable / heat recovery technologies.



Comparing the performance of these newer buildings using renewable technologies, compared to what we expect our campus energy use per GSM to be once we have completed our Central Heating Plant extension across campus, we have estimated the amount of renewables utilized on campus - the difference is approximately 37 ekWh / GSM.

The table below summarizes the building areas that use Geo-exchange and Heat Recovery technologies or in other words, more energy efficient and renewable technologies.

Geo-Exchange / Heat Recovery Buildings	**Area (GSM)**
C Building Renewed 2009 (C)	4,248
LSU 2009	1,668
Library 2007	7,754
Science & Technology 2016	13,808

Using the areas of the building and the factor of 37 ekwh/GSM above, it is estimated that our buildings on campus produce about a combined total of 1,000,000 ekwh of energy from renewable sources. This is equivalent to 14% of our ekWh of natural gas usage on campus or 6% of our total energy use on campus.

3.2.5.2 Creating a more sustainable campus with solar power.

A set of solar panels have been installed on the rooftop of the Science & Technology Building and two Langara students helped make the project a reality. The Langara Sustainability Club was established in October 2016 with a goal to raise awareness and take action to address environmental concerns at the College. Led by co-founders and environmental business students, Cameron Bower and Sterling Keful, the students' first project was to raise funds towards the purchase and install solar panels for the new Science and Technology building.

The Sustainability Club helped to successfully fund the project through a variety of on-campus fundraising activities. A grant from Vancity and a gift from an individual donor helped make the project a reality.

The solar panels were installed in September 2018. The electricity generated from the 6kW system installed is estimated to be approximately 6,000 kWh per year. This is the equivalent to an EV Car travelling 32,000kms. Or 1,600 trips to school at an average of 20km distance.

Over the past couple years we added additional solar panels for a total of 83. It is now a 30.98 kWp (kilowatt peak) system. In 2021 our solar panels generated 30,870 kWh of electricity.

3.3 EMISSIONS SUMMARY

Under B.C.'s Carbon Neutral Government (CNG) Program, all public sector organizations (PSOs) are required to measure and report greenhouse gas (GHG) emissions from building, fleet, and paper use. For more information on CNG Program requirements, visit the CNG website.

To convert consumption data to GHG emissions, BC uses the Clean Government Reporting Tool (CGRT). CGRT provides standardized measurement and reporting for GHG emissions based on the BC Best Practices Methodology for Quantifying Greenhouse Gas Emissions. To measure annual GHG emissions, PSOs and voluntary local governments enter their yearly consumption data into CGRT which converts the data into GHG emissions.

The table below is a summary of the Langara's emissions data for the 2007 government reporting baseline and 2015–2020 in tCo2e.

Table 8: Emissions Summary

	2007	2015	2016	2017	2018	2019	2020
Buildings Natural Gas	1,848	994	1,219	1,327	1,174	1,254	1,175
Buildings Electricity	172	79	103	124	124.3	120.0	94.0
Supplies		114	164	134	124.5	115.0	33.8
Fleet		1.5	1.7	1.7	1.7	1.7	1.8
Total	2,020	1,189	1,487	1,587	1,425	1,491	1,305

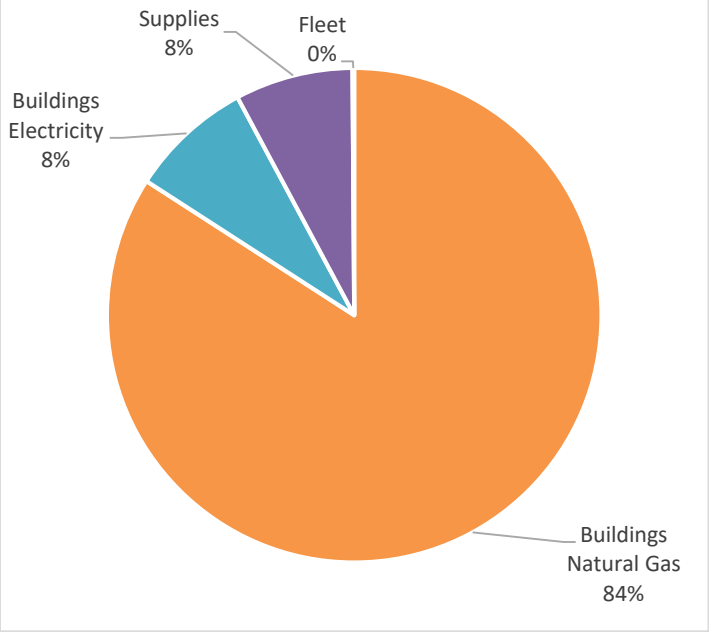


Figure 18: 2019 Emissions Breakdown by Category

The pie chart above shows the breakdown of campus emissions by category; it shows that natural gas contributes the most to our emissions, making up 84% of our emissions, followed by electricity and supplies (office paper) contributing 8% each. Fleet is an insignificant emissions contributor on our campus.

Table 9: Buildings Emissions per GSM & Reduction Summary

	2007	2015	2016	2017	2018	2019	2020
Buildings tCo2e	2,020	1,073	1,322	1,451	1,298	1,374	1,269
Campus Area (GSM)	51,302	52,970	66,778	66,778	66,778	66,778	66,778
tC02e/GSM	0.03938	0.02025	0.01979	0.02173	0.01944	0.02058	0.01900
Decrease Compared to 2007		49%	50%	45%	51%	48%	52%

Buildings make up over 90% of our emissions. The table above includes our buildings total emissions from Natural Gas and Electricity along with an analysis of emissions per GSM of campus. The analysis shows that ***Langara's Buildings emissions per GSM have decreased by 48% comparing 2019 to 2007*** baseline using standardized measurement and reporting for GHG emissions based on the B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions.

On an absolute basis, not accounting for campus area changes, emissions for campus buildings have decreased by 32%.

Note: 2019 is used for reporting as 2020 had abnormal operation due to Covid-19.

4. Actions - energy saving projects and initiatives

The following is a summary of projects and initiatives carried out over the most recent few years.

4.1 FISCAL 2020/2021

- Hired a co-op student dedicated to developing an ongoing sustainability student ambassador program for the College, with goals to increase employee and student engagement as well as to conduct benchmarking for AASHE STARS. Read the news article "Sustainability Student Ambassadors Forge Green initiatives".

- Continue to add and purchase additional electric vehicle (EV) stations across campus. Today we have 28 EV Stations.
- Next phase of our New Central Heating plant – engaged a consultant for analysis and design.
- Replaced all walk-in coolers, saving liters of water per year.
- Upgraded our large strobic exhaust fans to variable speed for improved energy usage and extend equipment life.
- Additional solar panels – added 45 solar panels for a total of 83. It is now a 30.98 kWp (kilowatt peak) system
- Actively pursuing bronze STARS rating. Engaged a consultant for process. In 2021 we achieved AASHE STARS Silver Rating and will be actively pursuing Gold over the next few years.
- New green roof integrated into our roofing project for Langara Global (international education) offices.

4.2 FISCAL 2019/2020

- Work with the Student Engagement Office to increase awareness and engagement of sustainability activities on campus.
- T Building fume hood and lab ventilation controls optimization, including addition of Strobic exhaust fan speed drives.
- Gym lighting upgrade to LED for both energy and lighting quality improvements.
- Kitchen walk-in cooler upgrades to improve energy and water efficiency.
- A Building roofing upgrade, including use of lighter color roof.

4.3 FISCAL 2018/2019

- Incorporated LED lighting upgrades and improved ventilation distribution into space planning and renovation processes for repurposed and upgraded areas.
- Continued participation in Energy Wise Awareness Program, including fume hood/green labs campaign, kitchen equipment and plug loads, and general awareness.
- Completed student-led renewable energy project T Building solar panel installation.
- Commissioned campus wide BTU metering initiative allowing Langara to understand gas usage by building on campus; this allows us to benchmark building performance and identify poor performing buildings systems.
- Continued to work with operators on building controls training and operation.
- Continued T Building fume hood and lab ventilation controls optimization.
- Supported sustainability tour development, related to energy usage and building systems.

4.4 FISCAL 2017/2018

- Completed the Strategic Infrastructure Funding (SIF) fan upgrade project in March 2018.
- Upgraded LED exterior lighting.
- Incorporated LED lighting upgrades and improved ventilation distribution into space planning and renovation processes for repurposed and upgraded areas.
- Continued participation in Energy Wise Awareness Program, including fume hood/green labs campaign, kitchen equipment and plug loads, and general awareness.
- Worked with the Student Engagement Office to increase awareness and engagement of sustainability activities on campus
- Supported the Langara College Foundation in their student-led renewable energy projects.
- Continued to work with operators on building controls training and operation

4.5 FISCAL 2016/2017

- Strategic Infrastructure Funding (SIF) awarded to upgrade A Building fan systems (S6 and S7) from constant air volume to variable air volume (VAV).
- New LEED Gold Science & Technology Building opened.
- Fine Arts workshop dust collector and air compressor upgrade

- Campus-wide LED exterior lighting upgrades
- LED lighting upgrades during space planning and renovation process
- Library LED lighting upgrade and redesign completed
- Green IT: Campus-wide thin client desktop and server virtualization implementation continues
- Optimizing building controls, including improved graphics and analysis tools
- Installing additional metering to capture more accurate and detailed energy usage
- Continuing monitoring, targeting, and reporting (MT&R) of buildings' energy use
- Training for operators on building automation systems
- Increase awareness of the impact of unnecessary fume hood usage on Langara's GHG emissions*

* This campaign will focus on fume hood safety and operation as a pilot with the goal of building a more comprehensive green labs program in the future.

4.6 FISCAL 2014/2015

- Green IT: Thin client desktop and server virtualization implementation 25% complete
- Aligning building heating, ventilation, and air conditioning (HVAC) control with the building operation schedules
- Installing additional occupancy sensors for classroom lighting control
- Connecting server room air cooling units and Daycare supply fans into Building Controls System(DDC) for better control
- DDC upgrade at Library, C Building, and LSU
- Continuing monitoring, targeting, and reporting (MT&R) the buildings' energy use
- Training for operators on building automation systems