STRATEGIC ENERGY MANAGEMENT PLAN (SEMP)

Justice Institute of British Columbia

Justice Institute
BRITISH COLUMBIA

LEARNING THAT TAKES YOU BEYOND

Senior Management Support:

Mike Proud, Vice President, Finance & Operations

Signature: Mike Proud

Digitally signed by Mike Proud
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TABLE OF CONTENTS

SEMP prepared with the assistance of Prism Engineering Ltd.

1. EXECUTIVE SUMMARY

This Strategic Energy Management Plan (SEMP) supports the Justice Institute of British Columbia's (JIBC) commitment to energy efficiency and conservation by providing a framework for reducing energy consumption and its associated environmental impact.

This SEMP includes a specific energy reduction target:

> ***JIBC will reduce campus energy intensity in existing buildings (New Westminster and Maple Ridge) by 50% from 2008/2009 fiscal year levels by the end of the 2029/2030 fiscal year with cost-effective energy management initiatives.***

Over this period, total cumulative electricity savings would be approximately 24.8 GWh. The cumulative fuel savings over the 21 years would be approximately 82,700 GJ.

To enable JIBC to achieve the reduction target, cost-effective energy management initiatives will be undertaken. In addition to energy savings potential, the initiatives undertaken will also be selected based on non-energy benefits, including occupant comfort, equipment reliability, maintenance costs, and operational improvements.

To meet the reduction target, JIBC has spent approximately $1,118,200 over the last eight fiscal years (2014/15 to 2021/22).

JIBC requires funding of approximately $935,000 for fiscal years 2022/23 and 2023/24 to upgrade mechanical and electrical systems at the New Westminster and Maple Ridge campuses. The potential annual energy savings resulting from the upgrades are estimated to be 162,000 kWh, and electricity demand will be reduced by 68kW. The estimated avoided energy cost will be approximately $25,000 per year by implementing the identified measures.

2. INTRODUCTION

This SEMP supports JIBC's commitment to energy efficiency and conservation by providing **a framework for reducing energy consumption** and its associated environmental impact. The SEMP includes a specific energy reduction target and an action plan for achieving the target.

By implementing the actions detailed in this SEMP, JIBC demonstrates leadership through innovation and accountability for the resources it uses as an organization. Further, JIBC is also reducing its exposure to energy cost escalations, demonstrating environmentally responsible development, and reducing its reliance on the Province's energy infrastructure.

An internal review of facilities operations conducted in 2017/18 identified the need for external support for energy management activities, including developing a strategic energy management plan. JIBC joined BC Hydro's Energy Manager Associate Program in March 2019 to address those needs.

To assist JIBC with energy management, Prism Engineering conducted energy audits for the New Westminster and Maple Ridge campuses in 2018/19. The audits identified opportunities for energy-related facility enhancements and organizational behavioural improvements. In 2019/20, retrocommissioning studies were carried out to identify deficiencies in the operation of mechanical systems and related controls and determine opportunities for corrective actions and other improvements that reduce energy consumption and demand and increase occupants' comfort.

The areas for improvement identified in the internal review, the energy audits and retrocommissioning include:

1. Policy	• Quantify past energy conservation activities; create an organization-wide directive, the SEMP; communicate and report on the SEMP; update the SEMP.
2. Targets / Reporting	• Develop target; develop specific Key Performance Indicators (KPIs); incorporate operational parameters; communicate to public and technical audiences; develop procedure and follow-up on out-of-variance sites.
3. Plans / Actions	• Identify systems where upgrades can be performed; execute work scopes, including energy baseline studies and analyze results; maintain and prioritize project lists; plan for capital projects; and review with senior management.
4. Teams / Committees	• Obtain approval for the Energy Manager position and train the Energy Manager; assign tasks to Energy Manager; and establish a working committee.
5. Employee Awareness	• Evaluate past activities; determine avenues for communications and available resources; plan and deliver communications; encourage curriculum; communicate simply, quantified savings, the SEMP, externally; create feedback mechanism, and develop acknowledgement program.

This SEMP provides the framework required to link together all aspects of energy management at JIBC and give strategic direction for JIBC to succeed in meeting its reduction target.

3. OUR COMMITMENT

3.1 Energy Commitment

By signing this SEMP, JIBC's Vice President, Finance & Operations, Mike Proud, has signified JIBC's commitment to energy conservation.

3.2 Climate Change Commitment

Under the Carbon Neutral Government Regulation of the Greenhouse Gas Reduction Targets Act, JIBC reports emissions to the British Columbia Climate Action Secretariat and purchases credits to offset these emissions. As part of this, a Climate Change Accountability Report (CCAR) is prepared by JIBC each year, outlining efforts undertaken and planned to reduce carbon emissions. Through the purchase of offsets, **JIBC is carbon neutral by definition**.

These reports can be found at:

https://www.jibc.ca/about-us/strategic-plans-reports

https://www2.gov.bc.ca/gov/content/environment/climate-change/public-sector/cnar/annual-reports-cnars-table

3.3 Why Energy Management is Important to Us

There are multiple commitments and reasons why energy management is important to JIBC.

JIBC strives to create and maintain a supportive learning environment that incorporates sustainability principles in all areas of operations. Sustainability is defined as meeting today's needs while not compromising the needs of future generations.

JIBC is committed to meeting or exceeding regulatory requirements and good organizational practices to support sustainability goals. JIBC is committed to the continual proactive improvement of operating practices. To fulfil these goals, JIBC is committed to the following:

- Ensuring an environment of inclusivity and respect for all students, staff, and visitors;
- Being a responsible neighbour and contributing positively to the local and regional community;
- Minimizing noise pollution and other statutory nuisance;
- Protecting students, staff and visitors with comprehensive health and safety practices;
- Responsible resource consumption;
- Green and, where practicable, local procurement practices;
- Sustainable waste management practices which follow the waste hierarchy (reduce, reuse, and recycle);
- Implementing energy efficiency initiatives and reducing emissions to air where possible;
- Minimization and responsible use of hazardous materials;
- Supporting sustainable transportation for students and staff;
- Sustainable water consumption and waste-water management; and
- Respecting the local environment, including habitat and wildlife.

Furthermore, energy management also allows JIBC to:

- Reduce operating costs through energy conservation and efficiency;
- Minimize the environmental impact of the organization;
- Reduce greenhouse gas emissions – of global importance;
- Reduce exposure to energy cost escalations;
- Reduce reliance on the Province's energy infrastructure;
- Demonstrate effective management of resources;
- Promote successes to the general public and other colleges and universities; and
- Strive towards educating those who will shape the future of the community, province, and country on the importance of managing the resources used.

4. OUR ORGANIZATION

4.1 Organizational Profile

Justice Institute of British Columbia (JIBC) is a public, post-secondary educational institution founded in 1978. JIBC is Canada's leading public safety educator with a mission to develop dynamic justice and public safety professionals through its exceptional applied education, training, and research. Each year, about 36,000 students study at one of JIBC's six campuses in British Columbia (BC) through online distance education and at locations in more than 130 BC communities and sites across Canada and around the world.

The New Westminster Campus is the main administrative campus, and the Maple Ridge Campus is a regional campus. Both campuses are included in this SEMP. JIBC also has campuses in Chilliwack, Victoria, the Okanagan, and Pitt Meadows. The energy consumption of these other campuses is not included in this SEMP.

Table 1: Organization Profile

Organization Profile				
PEOPLE	**Sector**	Education (post-secondary)		
	Number of Full-Time Equivalent (FTE) Students (2021/22):	FTE students 3,741 FTE Students	**Number of Sites:**	- New Westminster Campus 17,652 m^2 - Maple Ridge Campus 2,215 m^2
OPERATIONS	**Energy Management Issues / Obstacles**	▪ Availability of funding for energy efficiency projects; ▪ Limited sub-metering, particularly natural gas; ▪ Energy awareness and behavioural change amongst faculty, staff, and students; and ▪ Transient student population.		
	Core Business Metrics	1. Building floor area (m^2) 2. Full-time equivalent (FTE) students 3. Operating hours		
	Business Year	April 1 to March 31		
	Budget Cycle	April 1 to March 31		
	Operations/Maintenance Budget *(includes salaries, supplies, janitorial)* *	**2016/17**: $1,786,678 **2019/20**: $2,112,038	**2017/18**: $1,805,777 **2020/21**: $2,239,656	**2018/19**: $1,912,475 **2021/22:** $2,465,930
	Utilities Cost* ***(Elec, Gas)***	**2016/17**: $260,000 **2019/20:** $233,500	**2017/18**: $251,000 **2020/21**: $223,000	**2018/19**: $302,000 **2021/22**: $279,700
	Energy Efficiency Projects (Capital)	**2014/15**: $273,000 **2019/20**: $164,700	**2017/18**: $420,000 **2020/21**: $418,621	**2021/22**: $211,000

*Only New Westminster and Maple Ridge campuses are included.

4.2 Finance

Overall, in Fiscal 2021/22, JIBC expended $211,000 for installing energy-efficient systems at its New Westminster and Maple Ridge campuses, which included lighting retrofits, HVAC equipment retrofits and DDC upgrades. These projects were completed in March 2022.

For Fiscal years 2021/22 and 2022/23, a budget of $380,000 is allocated for installing a more energy-efficient pump system in the Water Treatment Plant B System at the Maple Ridge Campus. Also, a budget of $50,000 was assigned for replacing end of useful life air handling units with more efficient types at the Maple Ridge Campus.

For subsequent years, the Facilities Division will present a comprehensive list of projects from which JIBC can allocate funds during the capital budget process. The budget for energy projects will be allocated on a project-by-project basis, depending on the proposed payback and funding availability.

4.3 Facility Profile

JIBC operates at six campuses, as follows:

- New Westminster
- Maple Ridge
- Chilliwack
- Okanagan
- Victoria
- Pitt Meadows

Only New Westminster and Maple Ridge campuses are included in this SEMP. Table 2 describes these two campuses in more detail.

Table 2: Facility Profile for April 1, 2021, to March 31, 2022 (2021/22 Fiscal)

Campus	Area (m^2)	Purposes	Annual Energy Consumption (ekWh)	Annual Energy Cost ($)	Energy Intensity (ekWh/m^2)
New Westminster	17,652	Administration, Classroom and Gymnasium Blocks	3,099,600	$201,600	176
Maple Ridge	2,215	Administration, Classroom, Change Room, Laundry, Equipment Storage, Maintenance, Water Treatment Plants A & B Systems	929,300	$78,100	420
Total	**19,867**		**4,028,900**	**$279,700**	**203**

A summary of the energy intensities by energy source type is shown in Table 3.

Table 3: Building Areas and Energy Data Summary (2021/2022 fiscal)

New Westminster

Site Name	Floor Area m^2	Electricity kWh	Electricity Cost	Natural Gas GJ	Natural Gas Cost	ekWh / m^2	Cost $/$m^2$
New West – Electricity	17,652	1,176,300	$123,500			67	$7.00
New West – Gas	17,652	-	-	6,924	$78,100	109	$4.43
TOTAL		**Total ekWh=3,099,600**		**Total Cost=$201,600**		**176**	**$11.43**

Maple Ridge

Site Name	Floor Area m^2	Electricity kWh	Electricity Cost	Natural Gas GJ	Natural Gas Cost	ekWh / m^2	Cost $/$m^2$
Maple R – Electricity	2,215	447,200	$56,400			202	$25.49
Maple R – Gas	2,215	-	-	1,736	$21,700	218	$9.79
TOTAL		**Total ekWh=929,300**		**Total Cost=$78,100**		**420**	**$35.28**

Total

Site Name	Floor Area m^2	Electricity kWh	Electricity Cost	Natural Gas GJ	Natural Gas Cost	ekWh / m^2	Cost $/$m^2$
JIBC – Electricity	19,867	1,623,500	$179,900			82	$9.06
JIBC – Gas	19,867	-	-	8,660	$99,800	121	$5.02
TOTAL		**Total ekWh=4,028,900**		**Total Cost=$279,700**		**203**	**$14.08**

*Only New Westminster and Maple Ridge campuses are included.

4.4 Key Performance Indicators

The standard metric used as a key performance indicator (KPI) within the post-secondary education sector is the building area (m2). However, this alone only paints part of the picture and provides a metric related to all levels of the organization; full-time equivalent (FTE) students are also analyzed in Table 4.

Table 4: Energy Usage Intensity by Area and FTE Students

Fiscal Year	Total Energy Usage (ekWh)	Area (m^2)	FTE Students	ekWh/m^2	ekWh/ FTE Student
2008/09	5,868,943	19,867	2,694	295	2179
2009/10	4,877,258	19,867	2,447	246	1993
2010/11	4,151,600	19,867	2,402	209	1728
2011/12	4,232,350	19,867	2,744	213	1542
2012/13	3,895,100	19,867	2,687	196	1450
2013/14	3,872,977	19,867	2,597	195	1491
2014/15	3,860,881	19,867	2,963	194	1303
2015/16	3,661,420	19,867	2,765	184	1324
2016/17	4,182,101	19,867	2,697	211	1551
2017/18	3,831,394	19,867	2,440	193	1570
2018/19	3,708,108	19,867	3,507	187	1057
2019/20	3,588,513	19,867	3,781	181	949
2020/21	3,507,692	19,867	3,311	177	1059
2021/22	4,028,939	19,867	3,741	203	1077

5. UNDERSTANDING OUR SITUATION

5.1 Utility Meters

JIBC does not currently have sub-metered buildings but has one electrical account and one natural gas account for each campus.

Table 5: Utility Accounts

Name	Fuel Type	Account Number	Vendor Name	Rate
GAS- NEW WESTMINSTER	Natural Gas	738252	Fortis BC	Large Commercial
GAS- MAPLE RIDGE	Natural Gas	1043565	Fortis BC	Small Commercial
ELEC-NEW WESTMINSTER	Electrical	1618056-0	City of New Westminster	
ELEC-MAPLE RIDGE	Electrical	1232-7605-951	BC HYDRO	Rate 1600

5.2 Utility Consumption and Costs

Overall utility energy use and cost for JIBC are noted in the charts below. As shown in Figure 1, in 2021/22, electricity accounted for 40% of the total energy used but 64% of the overall energy cost. Natural gas accounted for 60% of the total energy consumption and 36% of the overall energy cost.

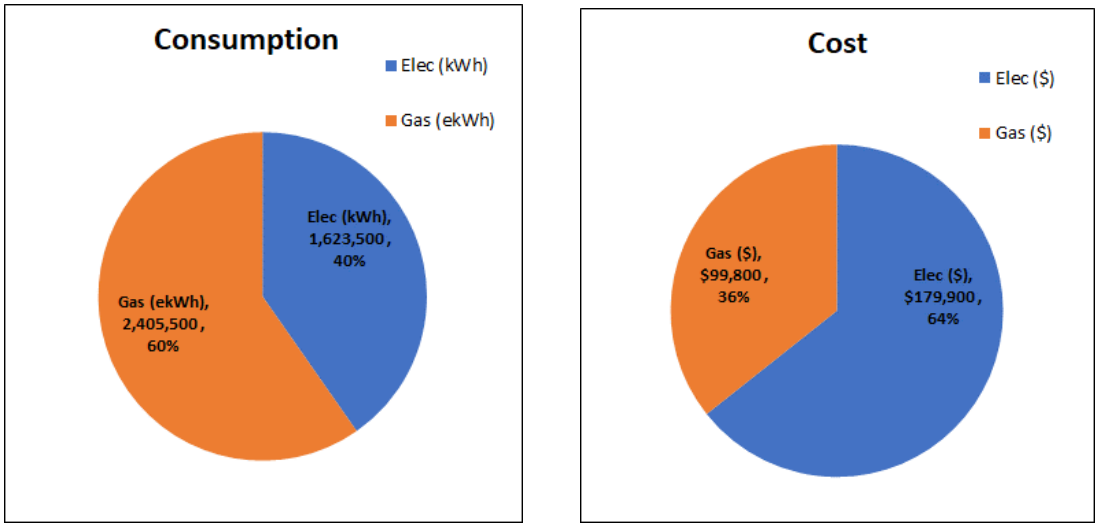

Figure 1: FY 2021/22 Energy Consumption and Cost Breakdown.

The historical energy consumption (in ekWh) and costs for JIBC are shown graphically below.

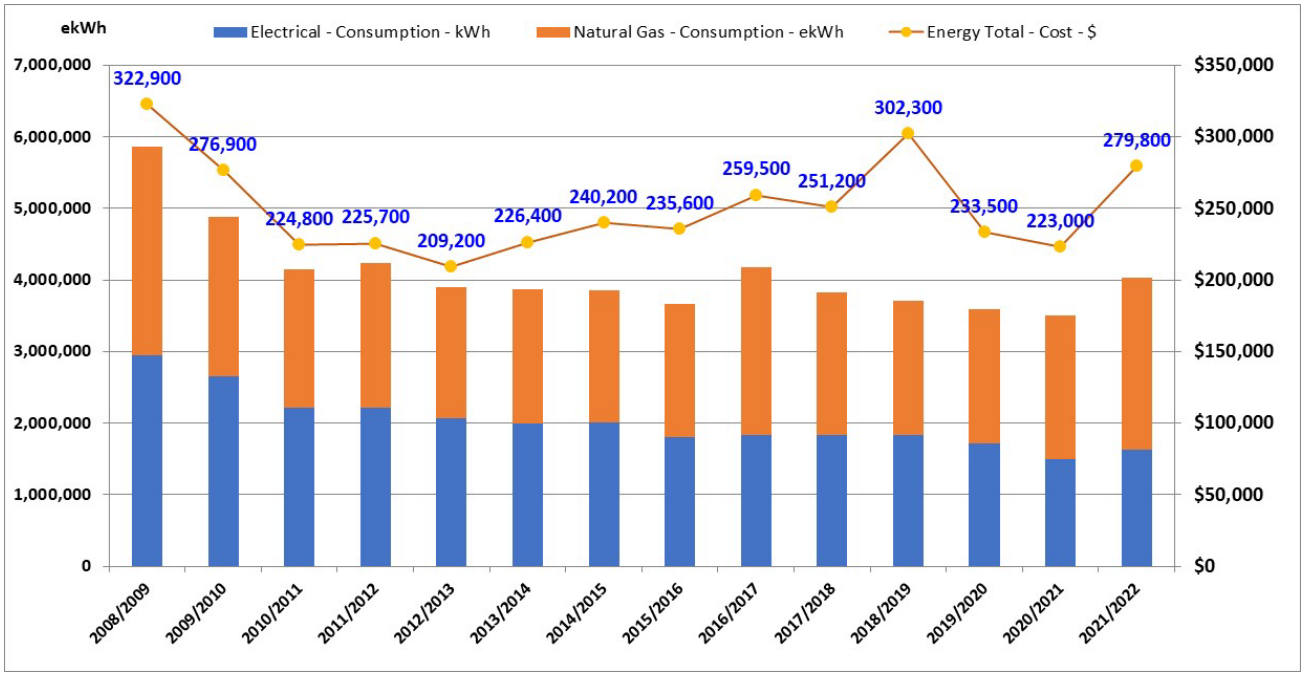

Figure 2: Historical Energy Consumption and Cost – New Westminster and Maple Ridge campuses.

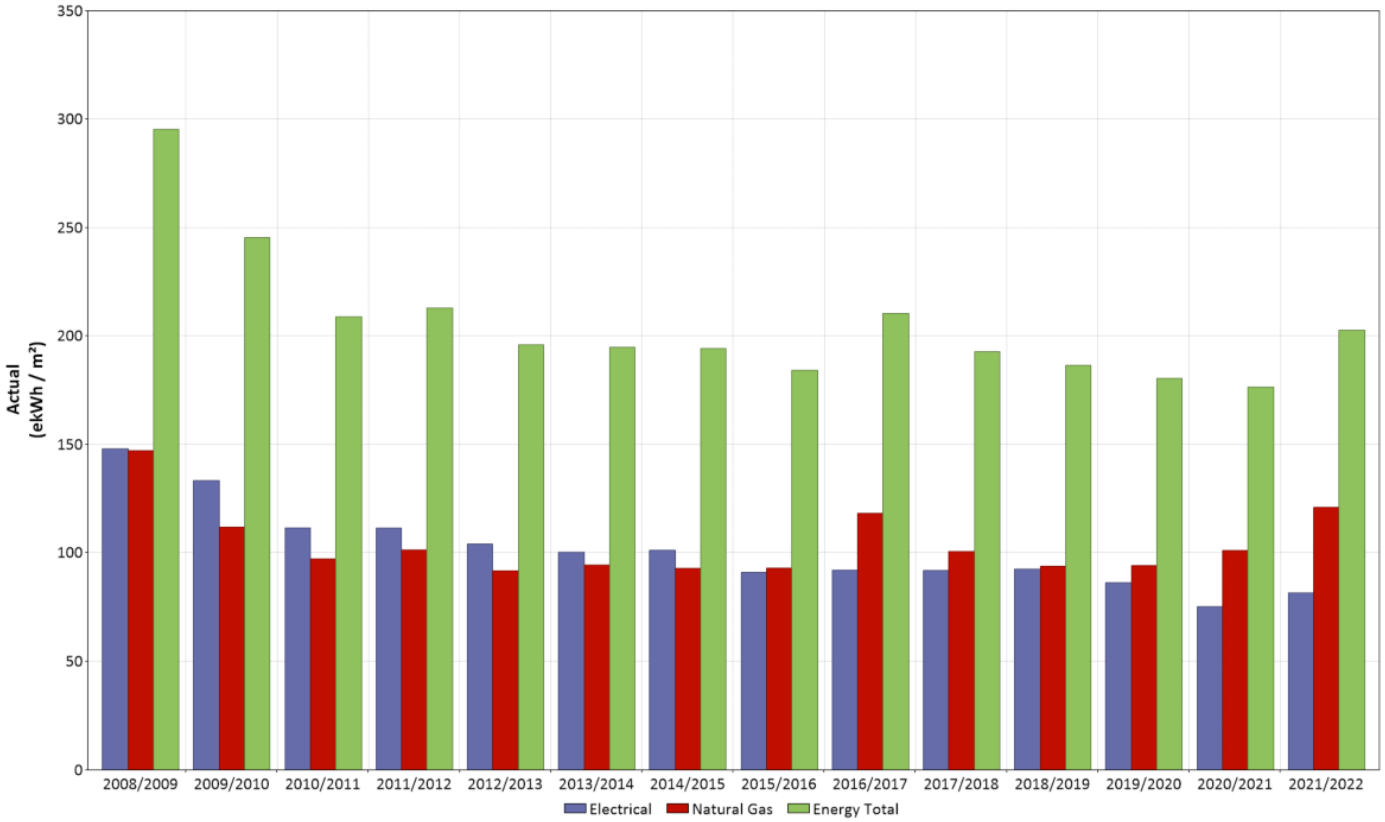

Figure 3: Historical Energy Use Intensity – New Westminster and Maple Ridge campuses.

5.3 Base Period Selection

A 'base period' must be selected to provide a platform for comparing energy use to track energy savings. The base periods have been established for each energy account based on the following considerations:

- A full 12-month base period, as close to fiscal 2008/2009, was selected to incorporate seasonal fluctuations in weather; and
- The base period selected was prior to major retrofits which have occurred since at the New Westminster Campus, therefore the base period does not represent consistent operations.

The base periods for each energy account are shown in the table below.

Table 6: Base Period Selection

Site Name	Fuel Type	Account Number	Base Start	Base End	Days
GAS- NEW WESTMINSTER	Natural Gas	738252	April 1, 2008	March 31, 2009	365
GAS- MAPLE RIDGE	Natural Gas	1043565	March 21, 2008	March 20, 2009	365
ELEC-NEW WESTMINSTER	Electrical	1618056-0	March 29, 2008	March 30, 2009	367
ELEC-MAPLE RIDGE	Electrical	1232-7605-951	March 21, 2008	March 20, 2009	365

The baseline is used to calculate energy savings moving forward in time, normalized for weather. Where a correlation between energy consumption and outdoor temperature exists (i.e., 'cooling' or 'heating' in the table above), a model (equation) has been generated for predicting energy consumption based on weather data.

5.4 Energy Breakdown

The building energy end-use breakdowns are illustrated below in Figure 4 and Figure 5.

The lighting system is the highest cause of electrical energy use (approximately 41% of overall annual use). The second highest cause of electrical energy use is fans, followed by plug loads (31% and 12% respectively).

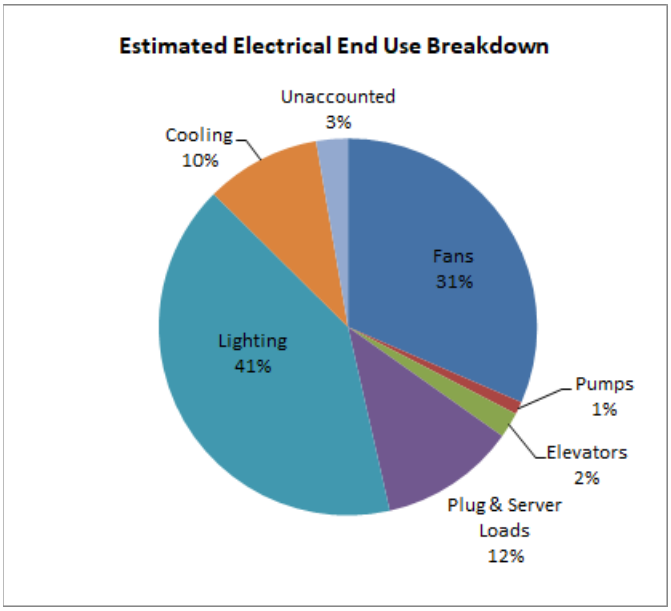

Figure 4: Electrical Energy End-Use Breakdown for New Westminster Campus (2018).

The highest cause of gas use (approximately 51% of overall gas use) is envelope losses. The second-highest gas usage cause is ventilation heating, followed by domestic hot water heating (at 37% and 10%, respectively).

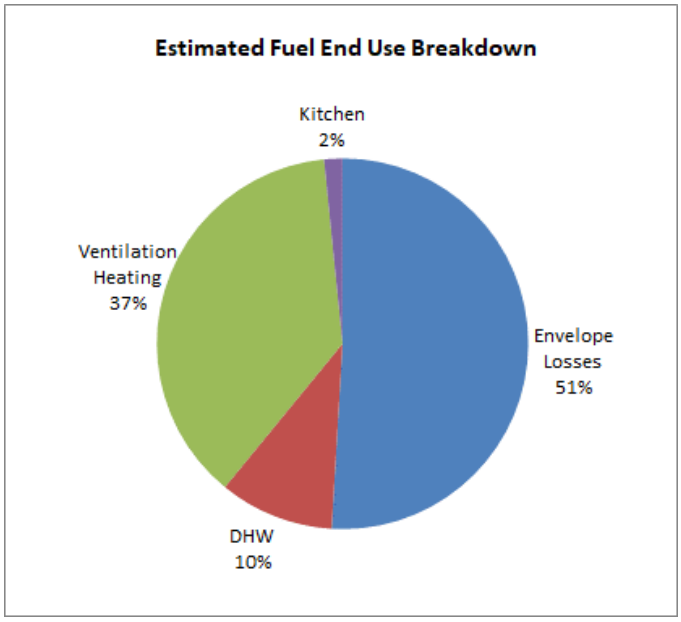

Figure 5: Gas End-Use Breakdown for New Westminster Campus (2018).

5.5 Benchmarking

Comparison to College Sector

The chart below compares the energy use intensity of JIBC's New Westminster and Maple Ridge campuses to other educational institutions located in BC as determined by Prism's Utility Management and Analysis (PUMA) software. The chart also shows the median energy intensity for fifteen (15) other post-secondary campuses in BC.[1] The energy data is for the **calendar year 2021**, which is adjusted for weather in different zones.

The chart shows the difference between the post-secondary institutions and the JIBC campuses. The New Westminster Campus has a low energy use intensity (164 ekWh/m^2), well below the median. The Maple Ridge Campus (424 ekWh/m^2) has the highest energy use intensities in the comparison.

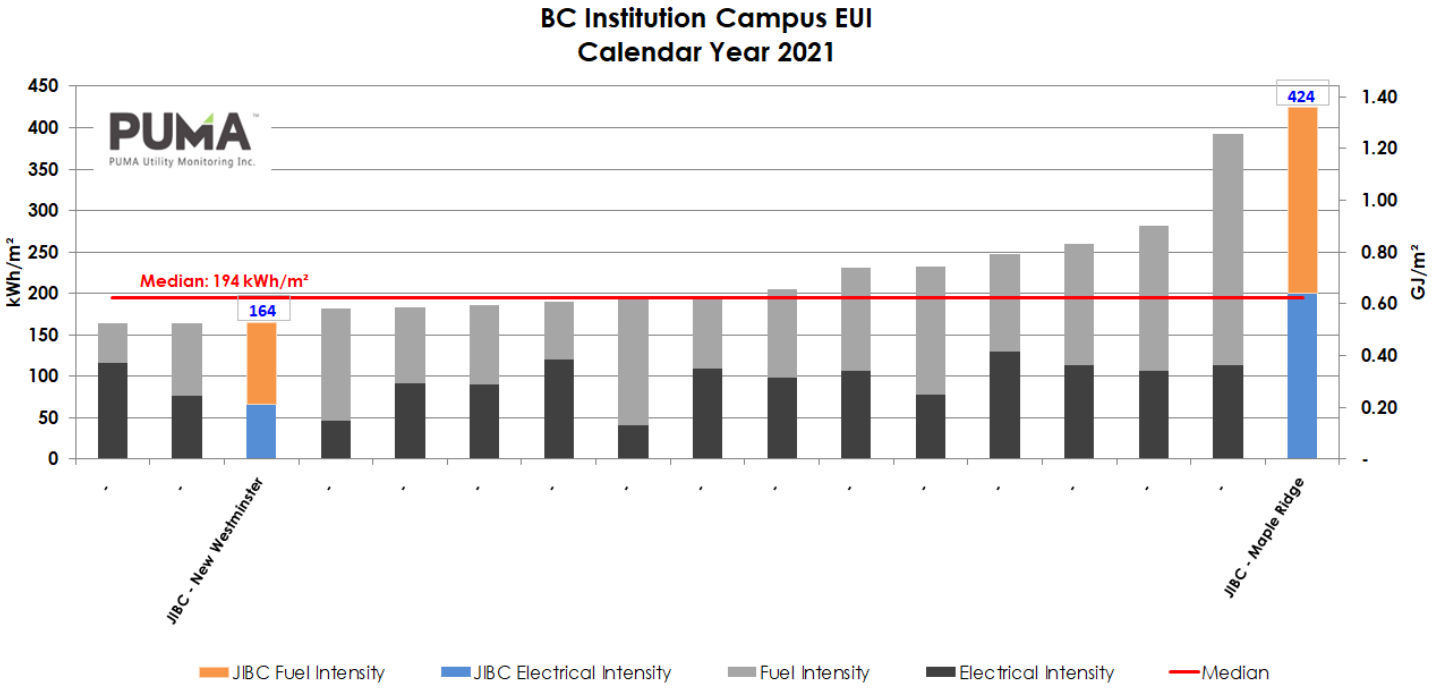

Figure 6: Benchmarking comparison to other post-secondary institutions in BC.

It should be noted that the above energy use intensities are for the calendar year 2021 (not the fiscal year 2021/22). Other charts and tables in this report are based on the 2021/22 fiscal year. It is also noteworthy that the Maple Ridge Campus is designed for hands-on firefighting practice and training. There are two water treatment systems at the campus, both equipped with two main pumps with a capacity of 150 and 60 horsepower, respectively. The operation of these large-size pumps is unique for a post-secondary institution, resulting in a higher energy use index than other institutions.

[1] These 15 buildings are from five colleges and universities in BC.

6. OUR ACTIONS

A target of a 50% reduction in total electricity and fuel energy use compared to the baseline 2008/2009 has been selected to be achieved by the fiscal year 2029/2030. The target will be realized through the implementation of cost-effective energy management initiatives.

The target pertains to the New Westminster and Maple Ridge campuses only. Progress towards the target will be corrected for fluctuations in the weather.

6.1 Annual Goals and Objectives

The following table outlines the annual achievements and goals for energy reduction.

Table 7: Annual Energy Reduction Targets

	Electricity			Fuel			Overall Energy			
	Reduction Target	Energy Intensity	Energy Use	Reduction Target	Energy Intensity	Energy Use	Reduction Target	Energy Intensity	Energy Use	
Fiscal Year	% of Base Period	kWh/m²	kWh	% of Base Period	ekWh/m²	ekWh	% of Base Period	ekWh/m²	ekWh	
2008/2009 **(Base)**		148.2	2,943,378		147.3	2,925,565		295.4	5,868,943	Actual
2009/2010	10%	133.5	2,651,871	24%	112.0	2,225,387	17%	245.5	4,877,258	"
2010/2011	25%	111.7	2,218,272	34%	97.3	1,933,327	29%	209.0	4,151,600	"
2011/2012	25%	111.5	2,215,790	31%	101.5	2,016,560	28%	213.0	4,232,350	"
2012/2013	30%	104.2	2,070,009	38%	91.9	1,825,091	34%	196.1	3,895,100	"
2013/2014	32%	100.4	1,994,995	36%	94.5	1,877,982	34%	194.9	3,872,977	"
2014/2015	32%	101.3	2,012,301	37%	93.0	1,848,580	34%	194.3	3,860,881	"
2015/2016	38%	91.2	1,811,303	37%	93.1	1,850,117	38%	184.3	3,661,420	"
2016/2017	38%	92.1	1,829,928	20%	118.4	2,352,173	29%	210.5	4,182,101	"
2017/2018	38%	92.1	1,828,874	32%	100.8	2,002,519	35%	192.9	3,831,394	"
2018/2019	37%	92.6	1,840,105	36%	94.0	1,868,003	37%	186.7	3,708,108	"
2019/2020	42%	86.4	1,715,805	36%	94.3	1,872,708	39%	180.6	3,588,513	"
2020/2021	49%	75.3	1,496,326	31%	101.2	2,011,366	40%	176.6	3,507,692	"
2021/2022	45%	81.7	1,623,479	18%	121.1	2,405,460	31%	202.8	4,028,939	"
2022/2023	46%	80.0	1,589,424	32%	100.2	1,989,384	39%	180.1	3,578,808	Projected
2023/2024	47%	78.5	1,559,990	34%	97.2	1,930,873	41%	175.7	3,490,863	"
2024/2025	48%	77.1	1,530,557	36%	94.3	1,872,362	42%	171.3	3,402,918	"
2025/2026	49%	75.6	1,501,123	38%	91.3	1,813,850	44%	166.9	3,314,973	"
2026/2027	50%	74.1	1,471,689	40%	88.4	1,755,339	45%	162.4	3,227,028	"
2027/2028	51%	72.6	1,442,255	42%	85.4	1,696,828	47%	158.0	3,139,083	"
2028/2029	52%	71.1	1,412,821	44%	82.5	1,638,316	48%	153.6	3,051,138	"
2029/2030	53%	69.7	1,383,388	46%	79.5	1,579,805	50%	149.1	2,963,193	"

These targets may be subject to adjustment over time due to the following:

- The timing of implementation of projects;
- Availability of funding for energy projects; and
- Major changes in building use.

6.2 Planned Actions

To enable JIBC to achieve the reduction target outlined in Section 6.1, cost-effective energy management initiatives will be undertaken. In addition to energy savings potential, the initiatives undertaken will also be selected based on non-energy benefits, including occupant comfort, equipment reliability, maintenance costs, and operational improvements. JIBC's ability to carry out these projects depends on government funding, with lack of funding being the biggest risk factor.

Detailed energy studies were conducted for the New Westminster and Maple Ridge campuses in 2018 and 2019.

6.2.1 Potential Projects

Major potential projects which will help JIBC to achieve the reduction target include:

- **Mechanical**

  New Westminster Campus:

  - Install VFD for chilled water pumps (electrical savings)
  - Replace server room(s) heat pumps with more efficient units (electrical savings).

  Maple Ridge Campus:

  - Replace existing water circulating pumps circa 1983 in the Water Treatment Plant A and B Systems with high-efficiency types equipped with variable frequency drives (electrical savings); and
  - Replace existing air handling units serving the Administration building, Classrooms building and Fitness Trailer with more efficient units (electrical savings).

- **Other**

  New Westminster Campus:

  - Install photovoltaic (PV) solar panels (electrical savings).

Table 8: Summary of Potential Energy Savings Projects – Fiscal Year 2022/2023 & 2023/2024

FY	Project	Location	Potential Electrical Savings (kWh)	Potential Electrical Demand Savings (kW)	Potential Total Savings (Energy + Operational) ($)	Total Cost ($)	BC Hydro/ Fortis BC Incentive ($)	Projected Total Cost incl. Incentive ($)
2022/23 & 2023/24	Behavioural Change Program	NWC	20,000	0	$1,200	$3,000	$1,000	$2,000
"	Install Solar PV	NWC	100,000	0	$10,000	$215,000	$0	$215,000
"	Install VFD for Chilled Water Pumps	NWC	2,000	0	$150	$16,000	$0	$16,000
"	Pump Renewal – Water Treatment Plant A System	MRC	5,200	64	$9,500	$157,500	$0	$157,500
"	Pump Renewal – Water Treatment Plant B System	MRC	9,000	4	$1,100	$223,000	$0	$223,000
"	AHU Renewal – Various Locations	MRC	10,600	0	$1,500	$240,000	$0	$240,000
"	Heat Pump Units Renewal for Server Room (2)	NWC	15,650	0	$1,450	$80,000	$0	$80,000
	Total		**162,450**	**68**	**$24,900**	**$934,500**	**$1,000**	**$933,500**

Table 9: Summary of Energy Savings Projects - Past

FY	Project	Location	Electrical Savings (kWh)	Gas Savings (GJ)	Potential Total Savings (Energy + Operational) ($)	Total Cost ($)	BC Hydro/ Fortis BC Incentive ($)	Projected Total Cost incl. Incentive ($)
2014/15	Chiller Plant Upgrade	NWC	57,500	0	$3,500	$273,000	0	$273,000
2017/18	Boiler Plant Upgrade	NWC	0	570	$5,700	$517,000	$97,000	$420,000
2019/20	Continuous Optimization	NWC	14,100	42	$1,700	$20,000	0	$20,000
"	Holiday Scheduling	NWC	35,700	147	$3,700	$700	0	$700
"	Continuous Optimization	MRC	12,100	26	$1,000	$2,500	0	$2,500
"	Lighting Upgrade and Controls	MRC	38,500	0	$3,700	$57,000	$4,000	$53,000
2020/21	Lighting Upgrade	NWC	122,300	0	$16,700	$84,500	$4,000	$80,500
2021/22	Lighting Upgrade	NWC	25,500	0	$3,500	$35,000	$0	$35,000
"	Classroom AC Electrical Units Upgrade	MRC				$16,700	$0	$16,700
"	Admin Electrical Room AC Unit Upgrade	MRC				$9,200	$0	$9,200
"	Walk-in Cooler Retrofit	NWC				$11,000	$0	$11,000
"	AHU6 Fan VFD Retrofit	NWC				$8,700	$0	$8,700
"	Domestic Hot Water Tank Replacement	MRC				$2,500	$0	$2,500
"	DDC Engineering and Calibration	BOTH				$17,000	$0	$17,000
"	AHU101 Condensing Unit Replacement	MRC				$26,200	$0	$26,200
"	LED Lighting Replacement	MRC				$37,200	$0	$37,200

6.2.2 Projects Completed

- **Lighting Retrofits at New Westminster Campus:**
  - **2019/20:** The lighting upgrades to the New Westminster Campus were completed in FY 2019/20. The project involved upgrading the T8 fluorescent lighting systems to LED in select areas.
  - **2020/21:** The lighting upgrades to the New Westminster Campus were completed in FY 2020/21. The project involved upgrading the T8 fluorescent systems to LED in common areas.
  - **2021/22:** The lighting upgrades to the New Westminster Campus were completed in FY 2020/21. The project involved upgrading the downlight lighting systems to LED in common areas.
- **Lighting Retrofits at Maple Ridge Campus:**
  - **2019/20:** The lighting upgrades to the Maple Ridge Campus were completed in FY 2019/20. The project involved upgrading the T8 fluorescent lighting systems to LED in select areas.
  - **2021/22:** The lighting upgrades to the Maple Ridge Campus were completed in FY 2021/22. The project involved upgrading the T8 fluorescent lighting systems to LED in select areas.
- **Continuous Optimization of the DDC System at the New Westminster Campus:**
  - **Investigation:** The Continuous Optimization for the New Westminster Campus investigation phase was approved in 2017. The investigation report was completed in January 2019.
  - **Implementation:** Most of the recommended measures were implemented in 2019.
- **Continuous Optimization of the DDC System at the Maple Ridge Campus:**
  - **Investigation:** The Continuous Optimization for the Maple Ridge campus investigation phase was approved in 2017. The investigation report was completed in January 2019.
  - **Implementation:** The recommended measures were implemented in 2019.
- **Mechanical Systems Retrofits at New Westminster Campus:**
  - **2014/15 – Chiller Plant Upgrade:**

    At the end of its service life, the original chiller was replaced with a high-efficiency variable-speed compressor air-cooled chiller and new pumps and transformer upgrades.
  - **2017/18 – Boiler Plant Upgrade:**

    Two 20-year-old atmospheric boilers were replaced with two condenser boilers with reduced size, and each sized for 75% of the design capacity. In addition, variable flow pumping was installed.

- **2021/22 – Walk-in Cooler Retrofit:**

  The walk-in cooler in the kitchen area was retrofitted with new elements.

- **2021/22 – Install VFD for AHU6 Fan:**

  The fan of AHU6 was retrofitted with a new variable frequency drive (VFD).

- **2021/22 – DDC Upgrade:**

  The direct digital control (DDC) system was upgraded.

- **Mechanical Systems Retrofits at Maple Ridge Campus:**
  - **2021/22 – Replace Electric Domestic Hot Water Tanks:**

    The domestic hot water tanks serving the Maintenance Building washrooms were replaced.

  - **2021/22 – Classroom and Admin Buildings Electrical Rooms AC Upgrade:**

    The AC units serving the electrical rooms in the Classrooms and Administration buildings were upgraded to more efficient types.

  - **2021/22 – Replace AHU101 Condensing Unit:**

    The condensing unit of AHU101 serving the Classrooms Building was replaced.

  - **2021/22 – DDC Upgrade:**

    The direct digital control (DDC) system was upgraded.

7. MONITORING AND REPORTING – HOW ARE WE DOING?

7.1 Energy Savings

This section of the SEMP tracks the energy savings compared to the baseline. It provides the means necessary to track success towards the energy reduction target, as set in Section 6.1.

The following chart shows cumulative savings over time since the 2008/09 base period for utility monitoring for JIBC. The cumulative savings shown in the graph are represented by equivalent kWh (ekWh) and **adjusted for weather fluctuations**. *Negative* savings (downward slope) on the graph represent an *increase* in consumption and vice-versa. As time goes on, this graph will be updated, and progress followed.

As can be seen at the end of fiscal year 2021/22, the cumulative energy savings since the base period is positive, representing **a decrease in consumption compared to the base period**.

The total energy saved between April 1, 2009, and March 31, 2022, normalized for the weather, is approximately 20,912,851 ekWh.

[Electricity 12,755,100 kWh and natural gas 8,157,800 ekWh (29,368 GJ)]

Based on the above achievement, JIBC is moving in the right direction to meet the reduction target and will continue this momentum through an effective energy management program.

Figure 7: Cumulative Sum of **Energy Savings** – JIBC New Westminster and Maple Ridge campuses combined.

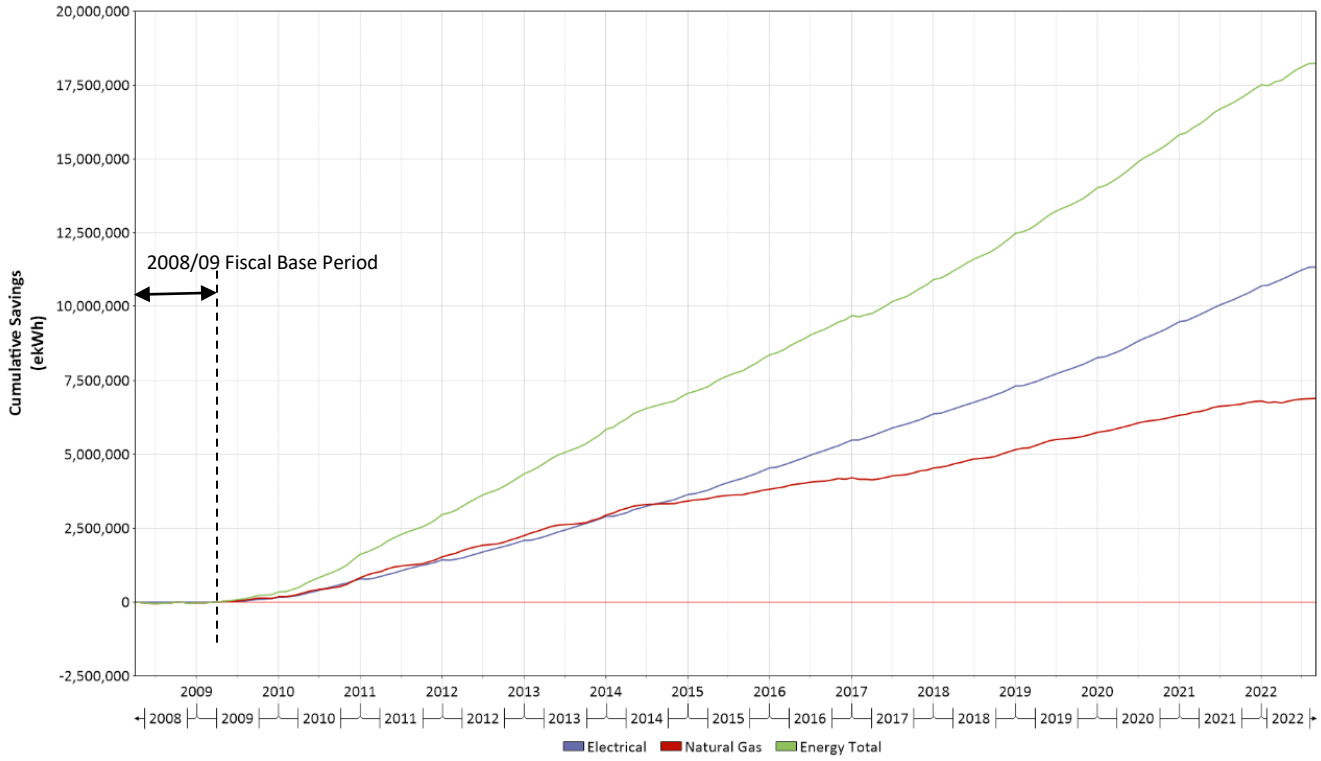

Figure 8: Cumulative Sum of **Energy Savings** –New Westminster Campus only.

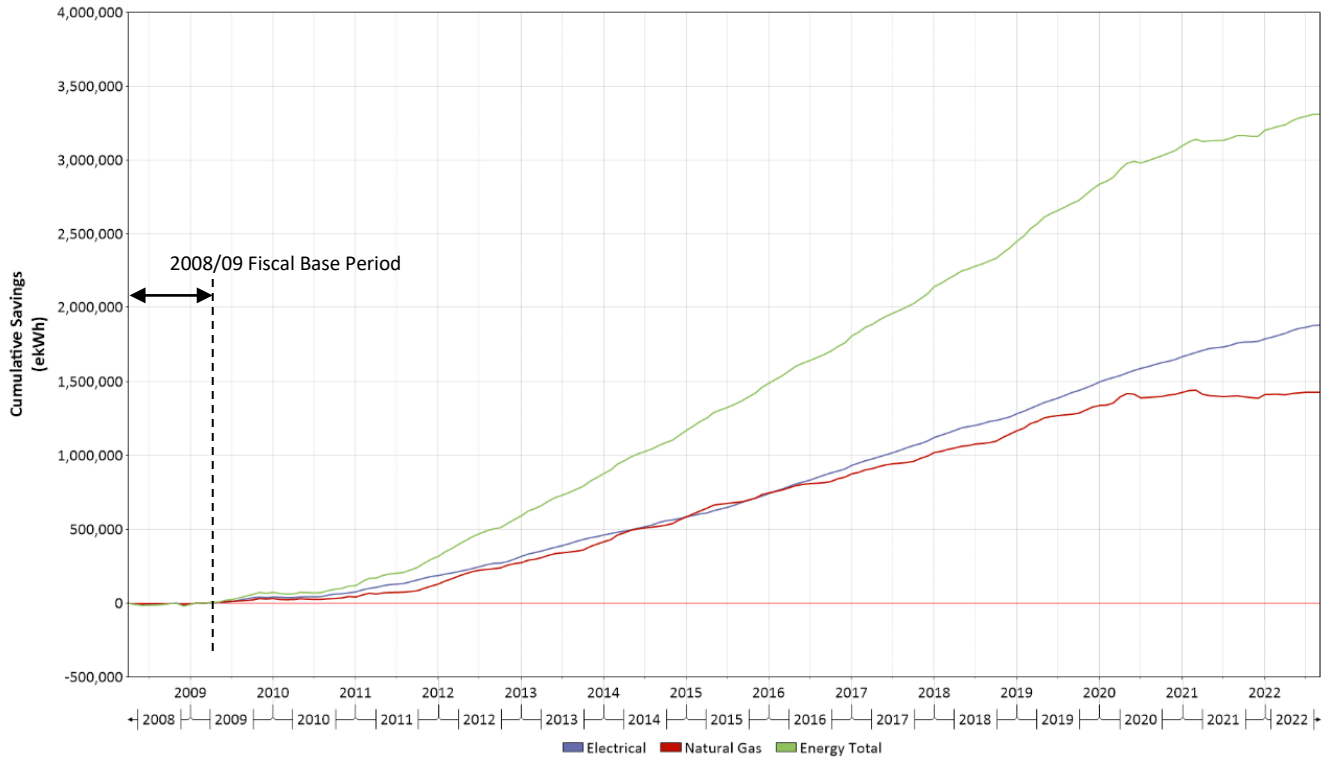

Figure 9: Cumulative Sum of **Energy Savings** –Maple Ridge Campus only

Over time, this section will be updated with more current data.

A breakdown of Energy Savings per year is shown in Table 10, Table 11 and Table 12 for JIBC's New Westminster and Maple Ridge campuses, respectively.

Table 10: Summary of Energy Savings by Year – JIBC

Fiscal Year	Electrical Savings -kWh	Natural Gas Savings - GJ	Natural Gas Savings -ekWh	Energy Total Savings - ekWh
2008/2009	3,218	16	4,422	7,640
2009/2010	265,858	1,053	292,494	558,353
2010/2011	713,547	2,891	802,991	1,516,537
2011/2012	733,230	3,023	839,644	1,572,874
2012/2013	858,290	3,086	857,269	1,715,559
2013/2014	939,519	3,086	857,202	1,796,721
2014/2015	892,614	1,788	496,640	1,389,254
2015/2016	1,109,657	2,152	597,862	1,707,519
2016/2017	1,097,434	1,104	306,772	1,404,206
2017/2018	1,102,088	2,450	680,593	1,782,681
2018/2019	1,088,238	2,885	801,314	1,889,553
2019/2020	1,217,525	2,686	746,204	1,963,729
2020/2021	1,426,110	2,106	585,129	2,011,239
2021/2022	1,307,739	1,041	289,248	1,596,987
Grand Total	**12,755,069**	**29,368**	**8,157,783**	**20,912,851**

Table 11: Summary of Energy Savings by Year – New Westminster Campus

Fiscal Year	Electrical Savings -kWh	Natural Gas Savings - GJ	Natural Gas Savings -ekWh	Energy Total Savings - ekWh
2008/2009	1,212	0	0	1,212
2009/2010	229,338	977	271,468	500,807
2010/2011	644,173	2,756	765,434	1,409,607
2011/2012	625,436	2,583	717,493	1,342,929
2012/2013	720,357	2,640	733,347	1,453,704
2013/2014	805,027	2,482	689,316	1,494,343
2014/2015	769,861	1,190	330,539	1,100,400
2015/2016	927,581	1,648	457,796	1,385,378
2016/2017	913,127	643	178,527	1,091,654
2017/2018	909,373	1,946	540,631	1,450,004
2018/2019	919,007	2,238	621,588	1,540,595
2019/2020	1,015,275	2,087	579,680	1,594,955
2020/2021	1,255,660	2,045	568,106	1,823,766
2021/2022	1,191,480	1,052	292,113	1,483,593
Grand Total	**10,926,908**	**24,286**	**6,746,039**	**17,672,946**

Table 12: Summary of Energy Savings by Year – Maple Ridge Campus

Fiscal Year	Electrical Savings -kWh	Natural Gas Savings - GJ	Natural Gas Savings -ekWh	Energy Total Savings - ekWh
2008/2009	2,006	16	4,422	6,429
2009/2010	36,520	76	21,026	57,546
2010/2011	69,374	135	37,557	106,931
2011/2012	107,794	440	122,151	229,945
2012/2013	137,934	446	123,922	261,855
2013/2014	134,492	604	167,886	302,378
2014/2015	122,753	598	166,101	288,854
2015/2016	182,075	504	140,065	322,141
2016/2017	184,307	462	128,245	312,552
2017/2018	192,716	504	139,962	332,677
2018/2019	169,231	647	179,726	348,957
2019/2020	202,250	600	166,524	368,774
2020/2021	170,450	61	17,023	187,473
2021/2022	116,260	-10	-2,866	113,394
Grand Total	**1,828,161**	**5,082**	**1,411,744**	**3,239,905**

Similarly, as provided for energy savings, the same CUSUM chart for greenhouse gas emission avoidance has been generated, as shown in Figure 10.

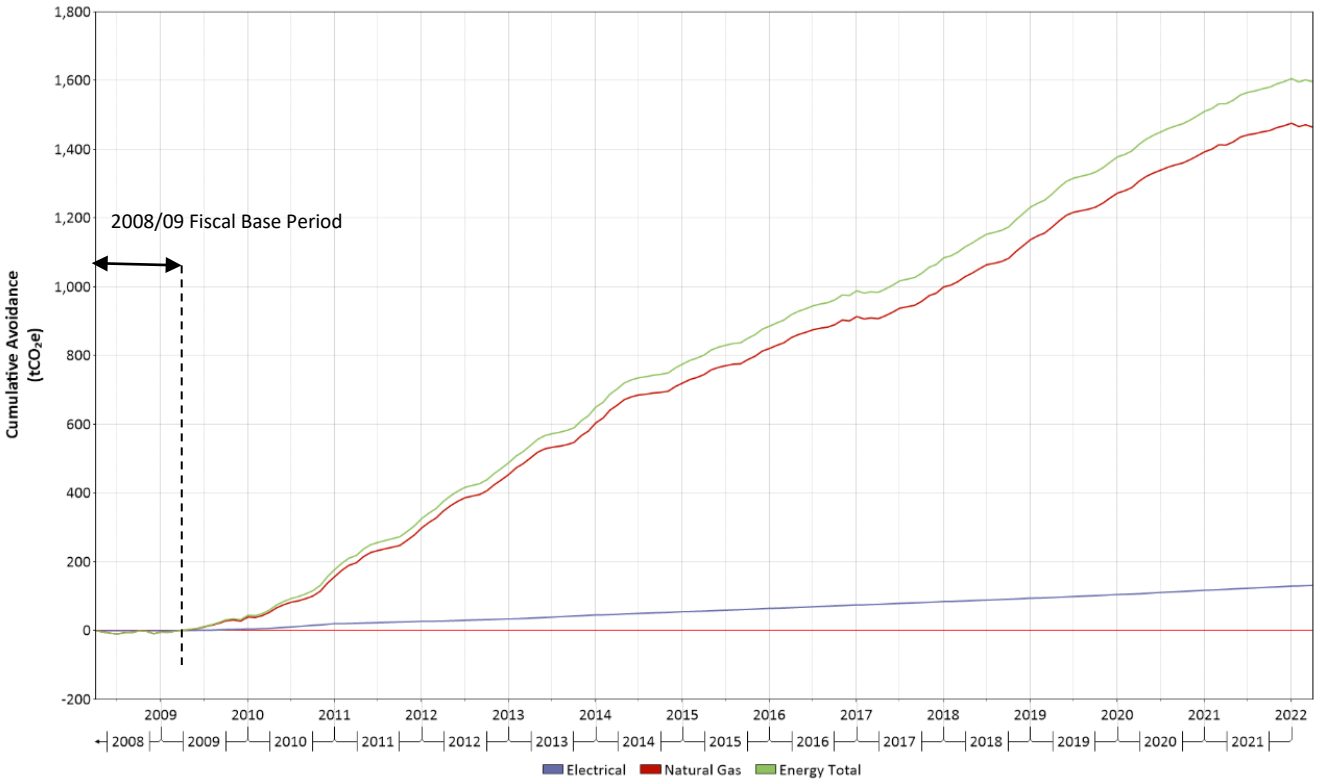

Figure 10: Cumulative Sum of GHG **Emission Avoidance** – Since 2008/09 Base Period.

The cumulative GHG emission avoidance by the end of the fiscal year 2021/22 is approximately 1,596 tonnes of eCO_2.

A breakdown of Emission Avoidance per year is shown in Table 13.

Table 13: Summary of Emission Avoidance by Year (Tonnes of equivalent CO_2) – JIBC

Fiscal Year	Electricity	Natural Gas	Energy Total
2008/2009	0.1	0.8	0.9
2009/2010	6.5	52.5	59.0
2010/2011	14.9	144.1	159.0
2011/2012	6.6	150.7	157.3
2012/2013	8.2	153.9	162.1
2013/2014	11.1	153.9	165.0
2014/2015	9.5	89.2	98.6
2015/2016	10.0	107.3	117.3
2016/2017	9.9	55.1	64.9
2017/2018	9.9	122.2	132.1
2018/2019	9.8	143.8	153.6
2019/2020	11.0	134.0	144.9
2020/2021	12.8	105.0	117.8
2021/2022	11.8	51.9	63.7
Grand Total	**132.0**	**1,464.4**	**1,596.4**

7.2 Avoided Energy Cost

Cost avoidance is avoided spending, not necessarily decreased spending. If an energy project is implemented that yields consumption savings, but energy rates increase at the same time, then looking at the actual cost savings/decrease in the bills will not show the full cost that was avoided. In other words, if that same project had not been implemented and energy rates had increased, more would have been spent than beforehand. By looking at avoided costs rather than just actual cost savings, the full financial impact of the energy management initiatives is captured.

Similarly, as for energy, the same CUSUM chart for energy cost avoidance can be generated, as shown in Figure 11.

As can be seen, **the cumulative energy <u>cost</u> avoidance by the end of the fiscal year 2021/22 is $1,484,157.**

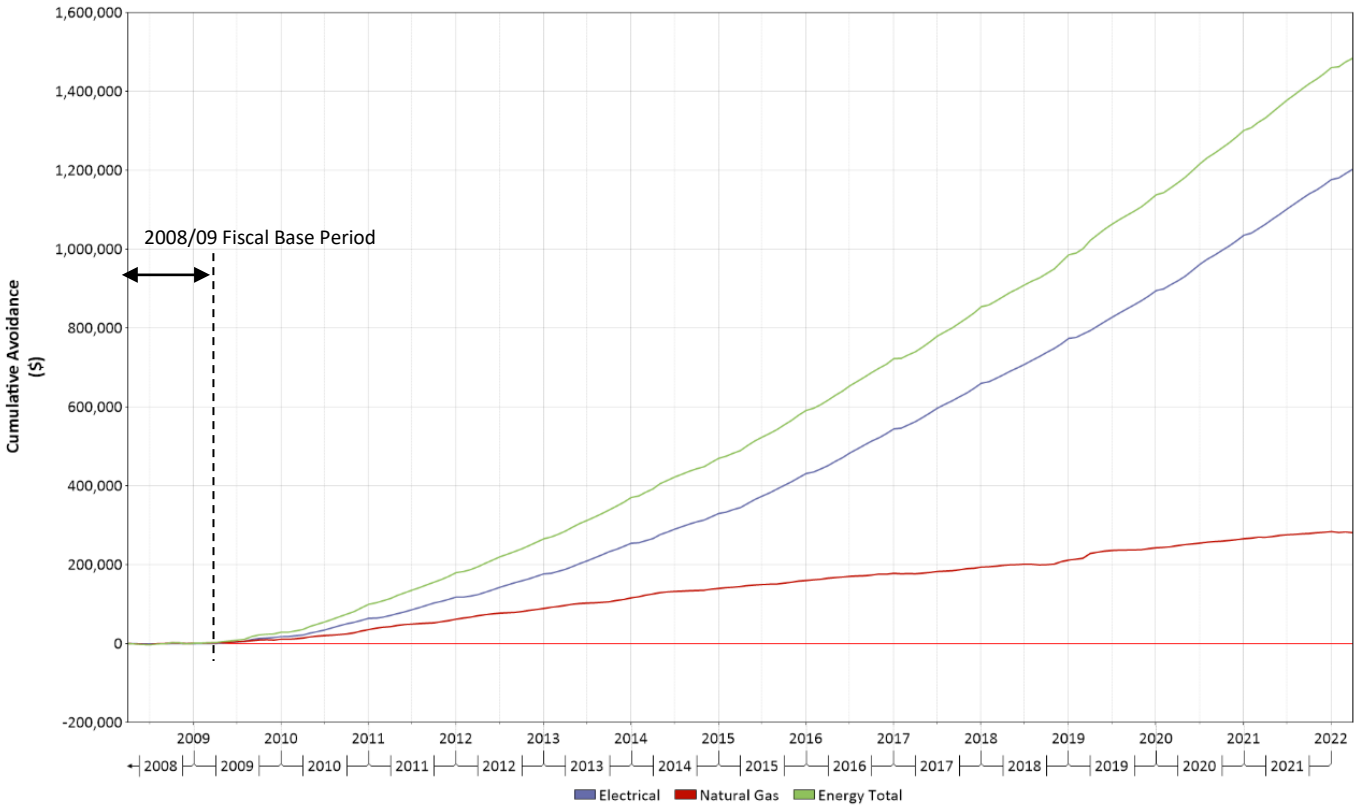

Figure 11: Cumulative Sum of **<u>Cost</u> Avoidance** – Since 2008/09 Utility Monitoring Base Period.

Table 14: Summary of Cost Avoidance by Year – JIBC

Fiscal Year	Electrical	Natural Gas	Energy Total
2008/2009	$482	$2,279	$2,761
2009/2010	$21,209	$11,798	$33,007
2010/2011	$49,605	$28,762	$78,367
2011/2012	$52,955	$27,890	$80,844
2012/2013	$64,087	$26,166	$90,253
2013/2014	$77,847	$28,850	$106,697
2014/2015	$78,565	$18,717	$97,282
2015/2016	$106,461	$21,341	$127,802
2016/2017	$111,520	$11,306	$122,826
2017/2018	$118,038	$21,217	$139,256
2018/2019	$112,756	$30,257	$143,013
2019/2020	$126,363	$19,992	$146,355
2020/2021	$143,330	$20,891	$164,221
2021/2022	$139,656	$11,817	$151,473
Grand Total	**$1,202,875**	**$281,282**	**$1,488,157**

8. COMMUNICATIONS

The following communication methods currently used to keep key stakeholders informed of the energy management efforts at JIBC include:

- Quarterly facility meetings - energy projects are discussed, and energy performance from utility monitoring reports is reviewed with operators and management; and
- Quarterly energy management reporting – results from ongoing energy management projects are reviewed, and future potential projects are discussed.

Currently, the greater community of staff and students of JIBC have little exposure to the energy management efforts that support campuses to run efficiently. In upcoming fiscal years, JIBC will expand methods of communication with the community of staff and students at JIBC campuses by way of the following methods:

- **2022/23** – Energy management reporting on utility usage will be made available on the Intranet and published quarterly in JIBC News (Just in Time).

9. FUTURE TARGETS: JIBC'S PATH TO NET ZERO

As described in the last two sections, JIBC has already achieved and exceeded its current energy reduction targets. The analysis in this section will be used to set achievable yet visionary targets for the future of JIBC campuses.

The term "net zero" can refer to energy and/or emissions. A net zero energy building has high performance with minimal energy use and meets its energy needs from heat recovery and locally generated renewable sources. A net zero-emission building has high performance with minimal energy use. The building uses energy from low or zero-carbon sources such as BC electricity and renewable energy. JIBC's path to net zero will involve various projects in the following categories:

- **Energy Efficiency and Behavioural**

  Most of JIBC's projects completed to date are of this first category - "Energy Efficiency and Behavioural." JIBC has had great success in achieving reductions to date in this category, and there are still opportunities to reduce further energy and emissions via energy efficiency.

- **Fuel Switching**

  The fuel-switching category of projects will contribute primarily to reducing emissions at JIBC. However, at times energy reduction will also be realized, such as switching from gas-fired systems to electric heat pumps, where the electrified system's efficiency is higher than that of the gas-fired system.

- **Renewable Energy**

  Sources of renewable energy can be on-site or from a utility provider. There is an opportunity to add photovoltaic (PV) solar panels on the roof of the New Westminster Campus building to generate electricity on-site.

10. ADAPTATION TO CLIMATE CHANGE

JIBC is aware of climate change impacts locally and intends to develop the necessary foundations, which are:

- Identifying internal stakeholders (build an internal team with representatives from risk management, sustainability, capital upgrade/ asset planning, and operations):
    - Have the team initiate “low-hanging fruit" adaptation tasks immediately
        - Back up building documentation;
        - Move building documentation away from flood zones (e.g., basement mechanical rooms); and
        - Add window films and shading to reduce overheating.
    - Other immediate adaptation initiatives that JIBC can consider:
        - Installing moisture sensors to move elevators above ground in case of flooding; and
        - Integrating controls to filter or eliminate outdoor air when outdoor air conditions are worse than indoor (e.g., forest fire pollution).
- Conducting a climate change vulnerability risk assessment of the New Westminster and Maple Ridge campuses and incorporating learnings into building renewal as part of the end-of-life upgrades:
    - Provide training/capacity building for internal staff;
    - Get stories from operation staff on what is currently vulnerable; and
    - Pick a framework (and modify it to fit) for the adaptation process at JIBC.
- Reviewing assets up for renewal (e.g., mechanical equipment) and consider assessing their capacity for future climate (up to 2050 or asset life); and
- Considering whether to develop an adaptation plan or incorporate adaptation into existing policies.

11. APPENDIX – STAKEHOLDERS

Executive Support:	***Mike Proud,*** *CPA, CGA, BCom, Vice President, Finance& Operations*		
JIBC Energy Management Consultant	***Prism Engineering*** *Majid Pishvaei, PEng, CEM* *majid@prismengineering.com* *Also:* *Robert Greenwald, PEng* *Adam Franklin, PEng*	**Energy Management Committee**	***Julie Brown,*** *BCom, MBA, RPA, FMA, SFP, Director, Campus Planning & Facilities Operations* ***Dale Bradley****, PE, FMP, Senior Manager, Facilities* ***Blake Smith****, CEM****,*** *Manager, Facilities*

Executive support is critical to the successful implementation of the SEMP. To foster engagement, a meeting regarding the SEMP will be held with stakeholders twice a year to review progress and discuss future items. Other stakeholders not listed in the table above include infrastructure and program area staff, faculty, students, the surrounding community, and utility providers.

Contact Info				
Name	**Title**	**Organization**	**Email**	**Phone**
Julie Brown	Director, Campus Planning & Facilities Operations	JIBC	jbrown@jibc.ca	604-528-5525
Ron Mastromonaco	Key Account Manager	BC Hydro	ron.mastromonaco@bchydro.com	604-699-9418
Denise Umezawa	Program Manager	BC Hydro	Denise.Umezawa@bchydro.com	604-690-0216

12. APPENDIX - BC HYDRO: ENERGY MANAGER ASSESSMENT FORM - SEMP SELF- EVALUATION

For BC Hydro to complete

File Number		
Quarter	④	
PSE Signature: SEMP Completed		Date:
Projects that used PS incentives:		

PS Program Incentive	kWh
PSP	
PSP Express	
New Construction	
Total	
Behavioural Program (2%)	

Turnaround time for 4th Q review: _____days

Year 2 +: Strategic Energy Management Plan requirements

Elements which must be included in SEMP	Page number where the element is addressed in the SEMP	Energy Manager evaluation	PSE Agrees
1) A purpose statement which answers the following questions:	-	✓	
a) What is your kWh reduction target?	Page 13 (Section 6.1)		
b) What is the Key Performance Indicator?	Page 7 (Section 4.4)		
c) Who do you need to engage to make your plan successful?	Page 28 (Section 11)		
2) A table that compares all your buildings.	-	✓	
a) BEPI	Page 7 (Table 3)		
3) Explain what the opportunities are to become more efficient.	-	✓	
a) Project list	Page 15 (Table 8)		
b) Initiative List: Behavioural and Organizational			
c) Studies: Outline which buildings have had studies completed	Page 14 (Section 6.2)		
4) Outline the budget to implement projects.	-	✓	
a) If no budget, explain why not and what you intend to do about getting a budget.	Page 6 (Section 4.2)		
5) Conclusion: How is your plan doing?	-	✓	
a) Outlined kWh saved	Pages 19 to 21		
b) Outlined GHG tonnes saved	Page 22		
c) Actual dollars saved to the organization	-		
d) Outlined avoided cost	Page 23		
6) Conclusion: Senior Management Support			
a) Approval of the SEMP: Signature on the SEMP	Cover Page of Final		

Tracking:

	2nd Q Draft SEMP Submitted Date	Date PSE Coaching Comments Returned to EM	4th Q SEMP submitted date	Reviewed and Coaching comments returned to EM: Date	*If EM needed to resubmit: date	If PSE reviewed: Date
Energy Manager						
PSE						

PSE Coaching Comments for Improvements (Not required for sign-off)

	Date: Duration	Date: Duration	Date: Duration	Date: Duration
Energy Manager contacted PSE for assistance.				