STRATEGIC ENERGY MANAGEMENT PLAN (SEMP)

Vancouver Community College

Senior Management Support:

Ajay Patel, President & CEO

September 2022

Signature:

Partnering with:

BC Hydro
Power smart

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SEMP prepared by
Prism Engineering Ltd.

1. EXECUTIVE SUMMARY

This Strategic Energy Management Plan (SEMP) supports Vancouver Community College's (VCC) 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 and an action plan of how the target will be achieved.

In the 2011-2014 VCC Strategic Plan, one of the VCC's values is environment respect, which includes:

> *"VCC respects the environment and seeks to reduce its environmental impact" and to "respect the environment, and educate students, staff and faculty about environmental stewardship."*

In fiscal year 2021/22, VCC spent approximately $882,700 on energy ($656,500 for electricity, $166,700 for natural gas and $59,500 for steam). The total electricity, gas, and steam use in 2021/22 were 7,038,500 kWh, 16,670 GJ and 2,500 GJ respectively.

As part of VCC's 2011-2014 Strategic Plan, a preliminary **10%** energy reduction target below 2010/11 by 2015/16 for Vancouver Community College was selected. However, by the end of March 2014, results of energy monitoring indicated that the 10% energy reduction target had been achieved. Based on a review of the campus operations, a detailed review of energy usage and opportunities identified by the VCC energy management team, a new energy reduction target was set. The new target was **20%** energy reduction below 2010/11 by end of fiscal year 2017/18. The new target was achieved one year earlier, by end of March 2017. As a result, Vancouver Community College selected a new target to reduce energy savings by **25%** in March 2020. That target was also achieved 15 months before the target date.

The current target is as follows:

> ***VCC will reduce campus energy intensity in existing buildings by 50% from 2010/2011 fiscal year levels by end of 2024/2025 fiscal year through the implementation of cost-effective energy management initiatives.***

It is anticipated that over this period total cumulative electricity savings would be approximately 39 GWh. The cumulative fuel (gas and steam combined) savings over the 14-year period would be approximately 242,000 GJ.

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

To meet this target, VCC has spent approximately $2,470,000 in the last eight fiscal years (2014/15 to 2021/22). During this period, BC Hydro has contributed $285,000 towards energy savings measures which has reduced the implementation cost to $2,185,000.

VCC has allocated funding of approximately $90,000 for fiscal year 2021/22 to upgrade lighting at Broadway Campuses. The potential annual electricity savings is 38,700 kWh for a cost avoidance of $2,600. In addition to the lighting upgrade, VCC has secured funding of $60,000 to replace gas-fired domestic hot water heaters with heat pumps at Building A Broadway Campus as a low carbon electrification (LCE) project.

2. INTRODUCTION

This SEMP supports VCC's commitment to energy efficiency and conservation by providing **a framework for reducing energy consumption** and its associated environmental impact. It includes a specific energy reduction target and an action plan of how the target will be achieved.

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

To assist VCC with energy management, BC Hydro sponsored an Energy Management Assessment (EMA) for the organization in March 2012. The purpose of this assessment was to conduct a holistic analysis of energy-related practices at VCC and identify opportunities for organizational improvement. The 2012 EMA identified the five most critical areas for energy management at VCC, which included the need for an Energy Manager. A dedicated Energy Manager sponsored by the BC Hydro Power Smart program was engaged in March 2013 to address this gap.

The five critical areas identified by the BC Hydro Energy Management Assessment for VCC are:

1. Policy	• Quantify past energy conservation activities; Create organization-wide directive, the SEMP; Communicate and report on the SEMP; Update the SEMP
2. Targets / Reporting	• Develop target; Develop specific KPIs; Incorporate operational parameters; Communicate to public and technical audiences; Develop procedure and follow-up on out-of-variance sites
3. Plans / Actions	• Develop and Identify systems where upgrades were and can be performed; Execute work scopes including energy baseline studies. Analyze results; Maintain and prioritize project list; Plan for capital projects & review with management
4. Teams / Committees	• Obtain approval for Energy Manager and train energy manager; Assign tasks to Energy Manager; Establish a working committee
5. Employee Awareness	• Evaluate past activities; Determine avenues for communications and available resources; Plan & deliver communications; Encourage curriculum; Communicate: simply, quantified savings, SEMP, externally; Create feedback mechanism; Develop acknowledgement program.

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

It should be noted that VCC has participated in subsequent EMAs in December 2013, December 2015, March 2018, and May 2022. During the previous sessions, improvements were discussed with VCC's leadership and included in the EMA reports.

3. OUR COMMITMENT

3.1 Energy Commitment

Through signing this SEMP, VCC's President & CEO, **Ajay Patel**, has approved and signed VCC's commitment to energy conservation.

3.2 Climate Change Commitment

Under the Carbon Neutral Government Regulation of BC's Greenhouse Gas Reduction Targets Act, VCC reports on emissions to BC Climate Action Secretariat, and purchases credits to offset these emissions. As part of this, a Carbon Neutral Action Report is prepared by VCC each year outlining efforts undertaken and planned to reduce carbon emissions. Through the purchase of offsets **VCC is carbon neutral by definition**.

These reports can be found at:

http://www.vcc.ca/about/college-information/reports-and-publications/

As part of VCC's 2021 Strategic Energy Management Plan, VCC committed to seeking innovative and improved practices that reduce its carbon footprint. The College had set a target to reduce its energy use emissions by **50%** below fiscal year 2010/11 by March 2025. As of March 2022, the energy use was reduced by 48%.

3.3 Why Energy Management is Important to Us?

There are multiple commitments and reasons why energy management is important to VCC. First, the VCC *Environmental Policy* (2012 update) reads:

> *"The College establishes and maintains high standards of environmental stewardship to protect natural resources and minimize environmental impact. The College considers environmental factors in all its planning and decision-making activities."*

In the 2011-2014 VCC Strategic Plan, one of the VCC's values is environment respect, which includes:

> *"VCC respects the environment and seeks to reduce its environmental impact" and to "respect the environment, and educate students, staff and faculty about environmental stewardship."*

Furthermore, energy management also allows VCC to:

- Reduce operating costs through energy conservation and efficiency;
- Minimize the environmental impact of our 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 our successes to the general public and other colleges and universities;
- Strive towards educating those who will shape the future of our community, province, and country on the importance of managing the resources we use.

4. OUR ORGANIZATION

4.1 Organizational Profile

Vancouver Community College (VCC) opened its doors in 1965, and currently focuses on delivering more than 140 certificates, diplomas, and bachelor's degree in a variety of disciplines including arts, hospitality, health, transportation, English language, and education. There are two main campuses: the *Downtown campus* and the *Broadway campus*. Both campuses are included in this SEMP. In August 2014, a new building - the Motive Power Centre located on Annacis Island - was added to VCC buildings. Referred to as the Annacis Island Campus (AIC); this was a shared facility with BCIT. The energy consumption of AIC was not included in previous versions of SEMP. It should be noted that since April 2022, AIC is not part of VCC anymore.

Table 1: Organization Profile

Organization Profile				
PEOPLE	**Sector**	Education (post-secondary)		
	Number of Full Time Students (2021/22 – approximate):	FTE students 6,524 FTE Students	**Number of Sites:**	Two main sites: - *Downtown campus 34,030 m²* - *Broadway campus 37,719 m²*
OPERATIONS	**Energy Management Issues / Obstacles**	▪ Availability of funding for energy efficiency projects; ▪ Limited sub-metering, particularly natural gas; ▪ Energy awareness and the behavioural change amongst faculty, staff, and students. ▪ Transient student population.		
	Core Business Metrics	1. Building floor area (m²) 2. Full-time equivalent (FTE) students 3. Classroom hours		
	Business Year	April 1st to March 31st		
	Budget Cycle	April 1st to March 31st		
	Operations/Maintenance Budget *(includes salaries, supplies, janitorial)*	**2013/14**: $6,101,609 **2016/17**: $5,863,373 **2019/20**: $6,582,000	**2014/15**: $5,622,387 **2017/18**: $5,980,965 **2020/21**: $6,800,000	**2015/16**: $5,806,876 **2018/19**: $6,408,028 **2021/22**: $4,479,000
	Utilities Budget* ***(Elec, Gas, Steam, Water)***	**2013/14**: $1,283,500 **2016/17**: $1,207,600 **2019/20**: $1,129,000	**2014/15**: $1,245,200 **2017/18**: $1,177,300 **2020/21**: $888,000	**2015/16**: $1,235,500 **2018/19**: $1,191,000 **2021/22**: $988,800
	Energy Efficiency Projects (Capital)	**2013/14**: $140,000 **2016/17**: $309,000 **2019/20**: $200,000	**2014/15**: $500,500 **2017/18**: $375,500 **2020/21**: $336,000	**2015/16**: $193,000 **2018/19**: $313,600 **2021/22**: $230,000

4.2 Finance

In Fiscal 2021/22, $230,000 was spent for lighting retrofits, installing variable frequency drives for fluid coolers, replacing gas-fired domestic hot water heaters with heat pumps and direct digital control upgrades at Downtown and Broadway Campuses.

For Fiscal 2022/23, a budget of $100,000 has been assigned for lighting upgrades at Broadway campus. In addition, a budget of $100,000 is assigned for a low carbon electrification project at Broadway Building A. The gas-fired domestic hot water heaters will be replaced with heat pumps that have higher efficiencies and reduce the greenhouse gas emissions significantly over the life of equipment. VCC purchased the equipment in 2021/22 and the installation will take place in 2022/23.

For subsequent years, the Energy Manager Consultant will present a comprehensive list of projects from which VCC can allocate the funds during the budget process. The budget for energy projects will be allocated on a project-by-project basis, dependant on the proposed payback and the available funds.

4.3 Facility Profile

VCC operates on two main campuses, as follows:

- Broadway Campus
- Downtown Campus

Table 2 describes these facilities in more detail.

Table 2: Facility Profile for Apr 1st, 2021, to Mar 31st ,2022 (2021/22 Fiscal)

Campus	Building	Area (m^2)	Purposes	Annual Energy Consumption (ekWh)	Annual Energy Cost ($)	Energy Intensity ($ekWh/m^2$)
Broadway	Building A	25,177	Administrative Offices (includes VPs, marketing and communications, finance, IT, HR), Registrar's Office and Student Counselling, Adult Basic Education, Music, Arts & Science, Automotive Trades, Language Studies, Cafeteria, Library	6,611,500	$411,200	175
	Building B	12,542	Health Sciences			
Downtown	Downtown Complex	34,003	Culinary, Baking and Pastry Arts (15 kitchen labs), Jewellery Art & Design, Dental Programs, Hospitality Management, Registrar's Office and Student Counselling, Cafeteria and 2 Restaurants, Hair Design and Aesthetics (including the hair salon and spa), Library	5,752,000	$471,500	169
Total		**71,722**		**12,363,500**	**$882,700**	**173**

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

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

Broadway

Site Name	Floor Area m²	Electricity kWh	Electricity Cost	Natural Gas GJ	Natural Gas Cost	Steam GJ	Steam Cost	ekWh / m²	Cost $/m²
Broadway- Electricity	37,719	2,992,100	$280,900			-	-	79	$7.45
Broadway- Gas	37,719	-	-	13,030	$130,300	-	-	96	$3.45
TOTAL		**Total ekWh= 6,611,500**			**Total cost= $359,600**			**175**	**$10.90**

Downtown

Site Name	Floor Area m²	Electricity kWh	Electricity Cost	Natural Gas GJ	Natural Gas Cost	Steam GJ	Steam Cost	ekWh / m²	Cost $/m²
Downtown- Electricity	34,003	4,046,400	$375,600	-	-	-	-	119	$11.05
Downtown- Gas	34,003	-	-	3,640	$36,400	-	-	30	$1.07
Downtown- Steam	34,003	-	-	-	-	2,500	$59,500	20	$1.75
TOTAL		**Total ekWh= 5,752,000**			**Total cost= $471,500**			**169**	**$13.87**

Total

Site Name	Floor Area m²	Electricity kWh	Electricity Cost	Natural Gas GJ	Natural Gas Cost	Steam GJ	Steam Cost	ekWh / m²	Cost $/m²
VCC- Electricity	71,722	7,038,500	$656,500					98	$9.15
VCC- Gas	71,722			16,670	$166,700			65	$2.32
VCC- Steam	71,722					2,500	$59,500	10	$0.83
TOTAL		**Total ekWh= 12,363,500**			**Total cost= $882,700**			**173**	**$12.31**

4.4 Key Performance Indicators

The standard metric used as a key performance indicator (KPI) within the Post-secondary Education sector is building area (m^2). This alone only paints part of the picture however, and to provide a metric which can be related to by all levels of the organization, full-time equivalent 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
2010/11	23,806,700	71,722	7,908	332	3,010
2011/12	23,945,100	71,722	7,799	334	3,070
2012/13	22,627,000	71,722	8,010	315	2,825
2013/14	21,684,700	71,722	7,888	302	2,749
2014/15	19,110,900	71,722	6,908	266	2,766
2015/16	18,504,800	71,722	6,240	258	2,966
2016/17	17,897,600	71,722	6,159	250	2,906
2017/18	15,750,900	71,722	6,149	220	2,562
2018/19	14,659,200	71,722	6,582	204	2,227
2019/20	14,246,100	71,722	6,814	198	2,091
2020/21	11,239,900	71,722	6,072	157	1,851
2021/22	12,363,500	71,722	6,524	173	1,895

5. UNDERSTANDING OUR SITUATION

5.1 Utility meters

VCC does not currently have sub-metered buildings, but has one electrical account, and one natural gas account per campus. The Downtown campus also uses steam.

Table 5: Utility Accounts

Name	Fuel Type	Account Number	Vendor Name	Rate
GAS-DTN	Natural Gas	1178581	Fortis BC, Shell	Large Commercial
GAS-BWY	Natural Gas	1178795	Fortis BC, Shell	Large Commercial
ELEC-DTN	Electrical	1180840001	BC HYDRO	1611
ELEC-BWY	Electrical	5551123351	BC HYDRO	1610
STM-DTN	Steam	58	Creative Energy	Creative Energy

5.2 Utility Consumption and Costs

The overall utility energy use and cost for VCC are shown by the pie charts below. As shown in Figure 1, in 2021/22 electricity accounted for 57% of the total energy use, but 74% of the overall energy cost. Natural gas accounted for 37% of the total energy consumption, and 19% of the overall energy cost. Purchased steam accounted for 6% of the total energy consumption, and 7% of the overall energy cost.

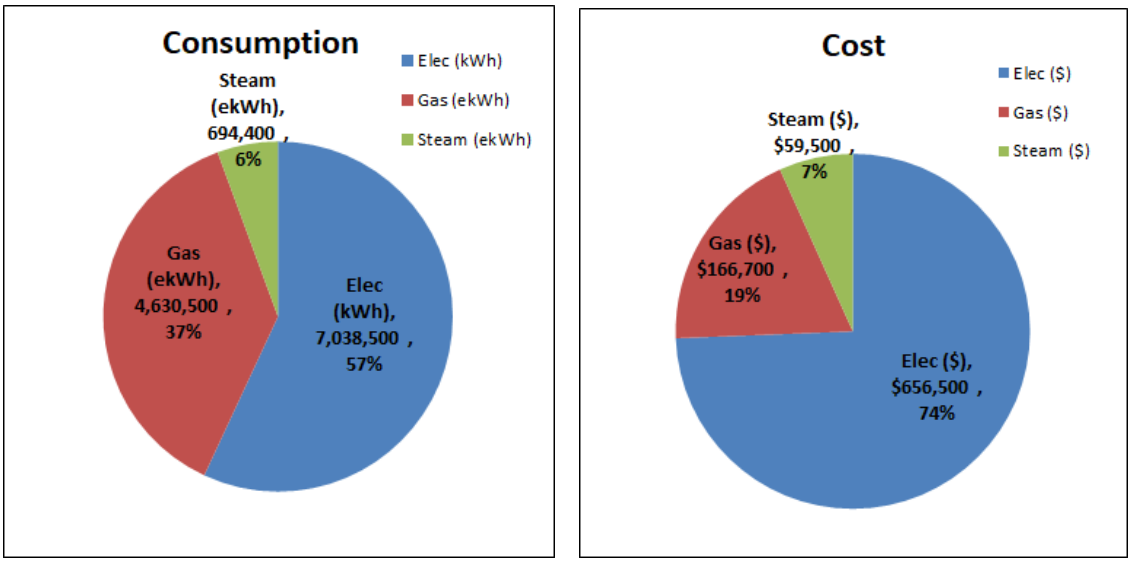

Figure 1: FY 2021/22 Energy Consumption and Cost Breakdown

The historical energy consumption (in ekWh) and costs for VCC is shown graphically below.

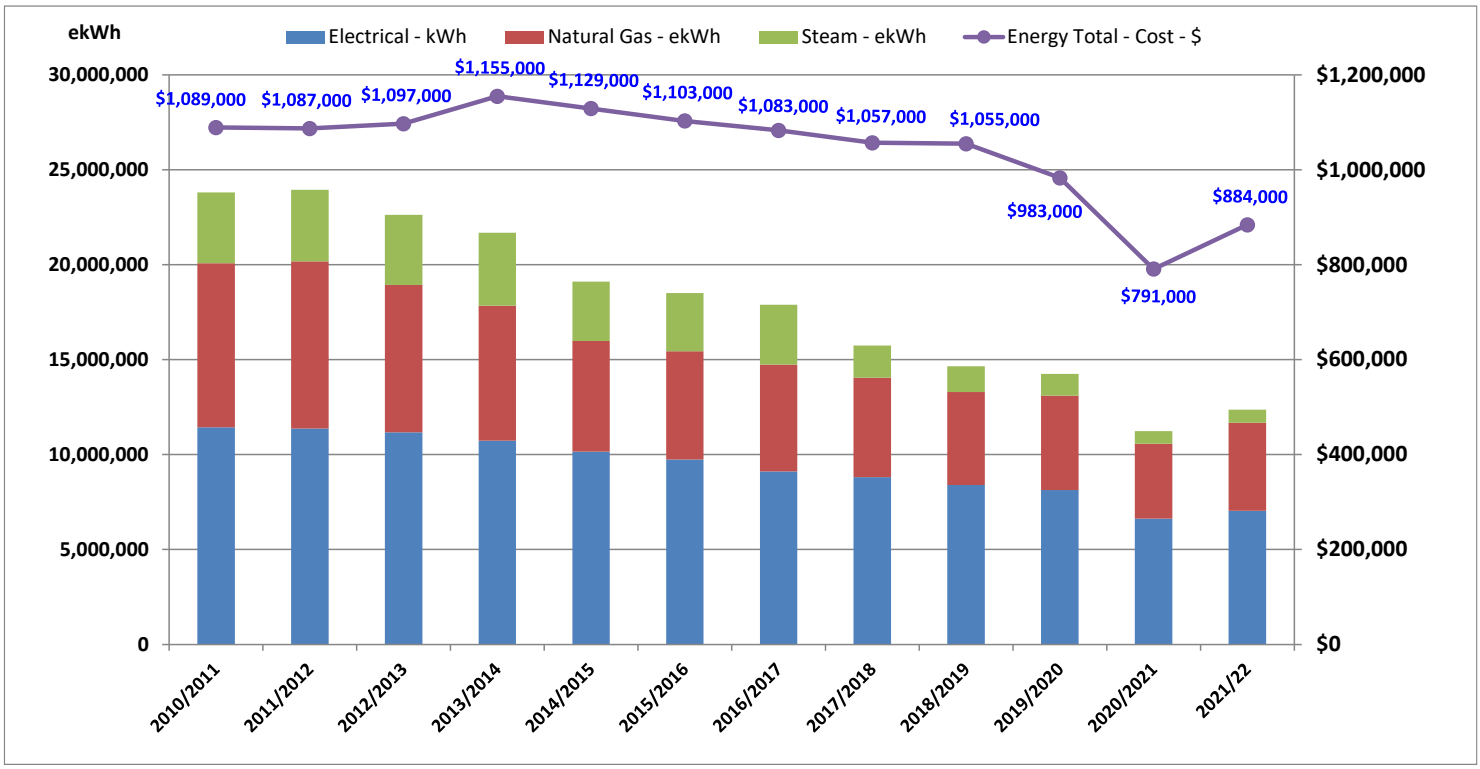

Figure 2: Historical Energy Consumption and Cost – both campuses

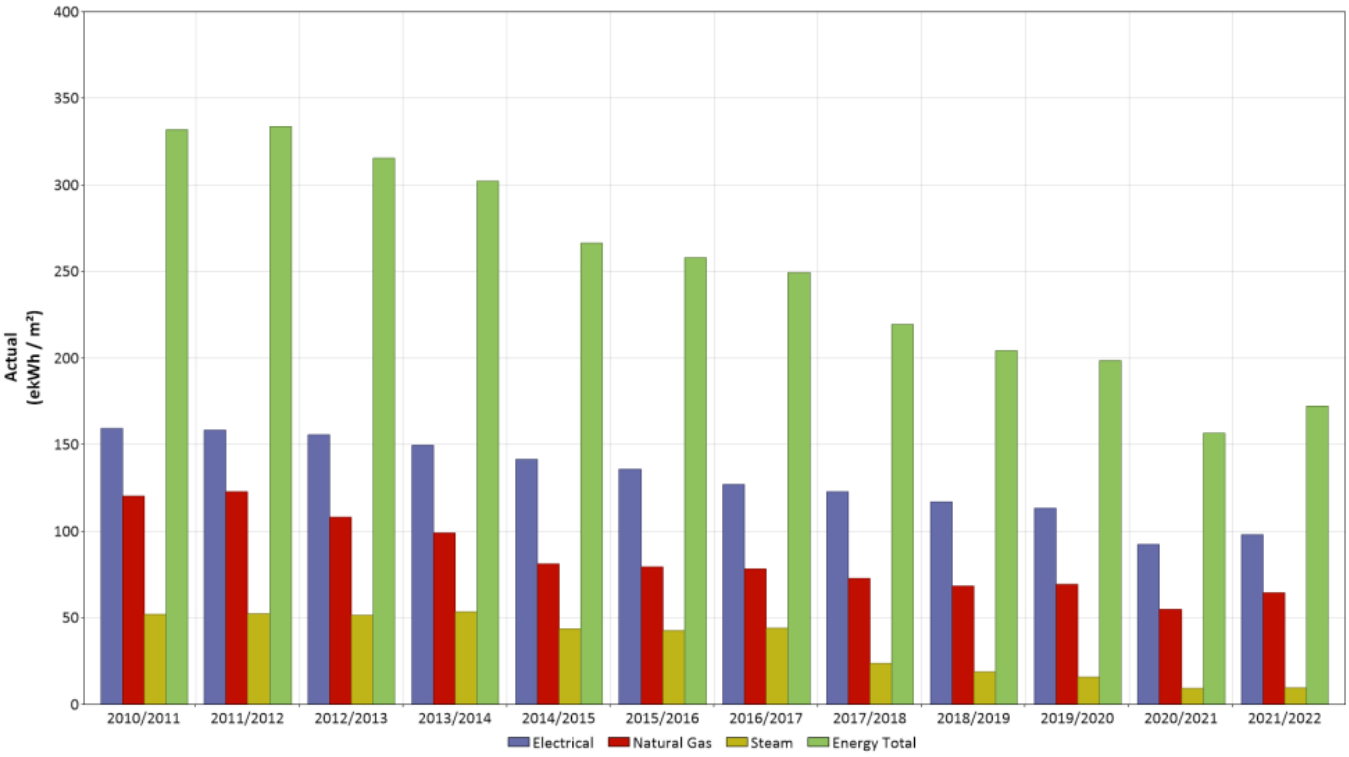

Figure 3: Historical Energy Use Intensity – both campuses

5.3 Base Period Selection

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

- A full 12-month base period, as close to the fiscal 2010/2011, was selected to incorporate seasonal fluctuations in weather.
- The base period selected was after any major retrofits which have occurred – the base period therefore represents consistent operation.
- The base period selected was prior to the Energy Manager Program start and matches the year in which VCC became carbon neutral under the Carbon Neutral Government Regulation of BC's Greenhouse Gas Reduction Targets Act.

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
Downtown	Electrical	1180840001	March 26, 2010	March 25, 2011	365
Downtown	Natural Gas	1178581	April 1, 2010	March 31, 2011	365
Downtown	Steam	58	April 1, 2010	March 31, 2011	365
Broadway	Electrical	5551123351	April 8, 2010	April 7, 2011	365
Broadway	Natural Gas	1178795	April 1, 2010	March 31, 2011	365

The baseline will be 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

To determine a breakdown of energy consumption by end-use under current conditions, a detailed inventory of all energy consuming equipment would be required. To undertake this task for the entire campus is time intensive. In February 2003 an Energy Audit was conducted for the Vancouver Community College by Prism Engineering. Although changes have been made to building use since this time, the end-use breakdown shown below still provides an indicative view of where electricity is used at the two VCC campuses.

As can be seen on the charts, the largest consumer of electricity is heat pumps, lighting and air distribution systems.

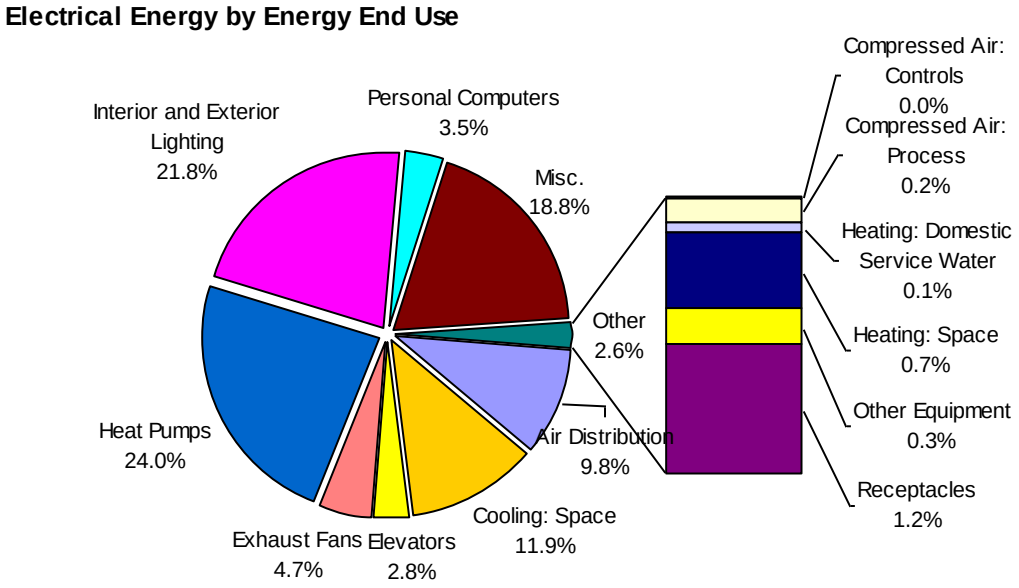

Figure 4: Electrical Energy End Use Breakdown for Downtown Campus (2001)

The miscellaneous electrical end uses at Downtown Campus include kitchen and cafeteria refrigeration systems, hairdressing, and laundry equipment as well as lab equipment and tools.

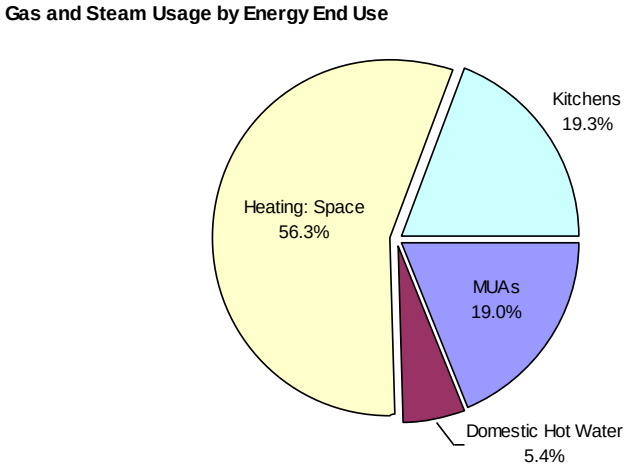

Figure 5: Gas and Steam Energy End Use Breakdown for Downtown Campus (2001)

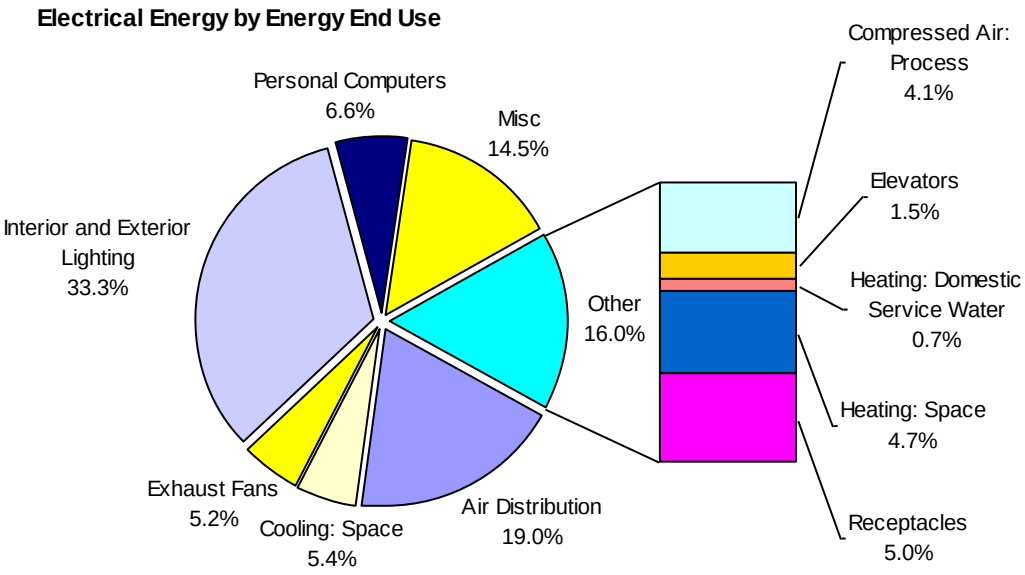

Figure 6: Electrical Energy End Use Breakdown for Broadway Campus – Building A (2001)

The miscellaneous electrical end uses at Broadway include kitchen and cafeteria refrigeration systems, as well as workshop equipment and tools.

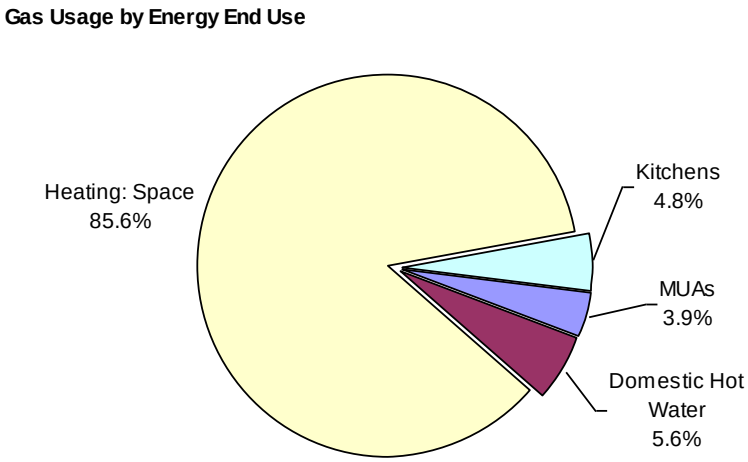

Figure 7: Gas Energy End Use Breakdown for Broadway Campus – Building A (2001)

5.5 Benchmarking

Comparison to College Sector

The following figure includes a comparison of the energy use intensity of both VCC campuses compared to other educational institutions located in BC as determined by Prism's Utility Management and Analysis software. The chart also shows the median energy intensity for 14 campuses in BC. The energy data is for calendar year 2022.

The figure shows the difference between the VCC campuses. Both campuses have energy use intensities below the median. The VCC Downtown Campus (163.4 ekWh/m^2) has the lowest energy use intensity in the comparison. The VCC Broadway Campus (163.8 ekWh/m^2) has the second lowest energy use intensity among the shown campuses.

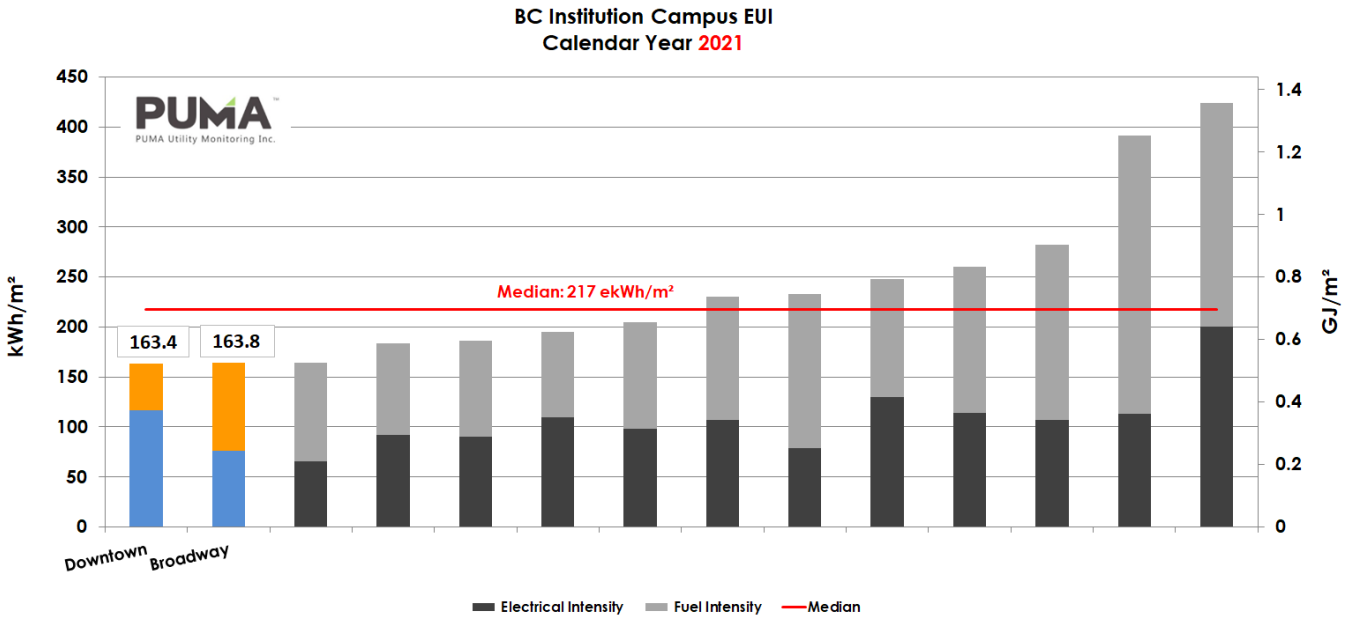

Figure 8: Benchmarking comparison to other colleges in BC

It should be noted that above energy use intensities are for calendar year 2021 (not fiscal year 2021/22).
Other charts and tables in this report are based on 2021/22 fiscal year.

6. OUR ACTIONS

As part of **VCC's 2011-2014 Strategic Plan** a preliminary target of a 10% reduction in electricity and fuel energy usage was selected. However, by the end of March 2014, results of energy monitoring indicated that the 10% energy reduction target had been achieved. Based on a review of the campus operations, a detailed review of energy usage and opportunities identified by the VCC energy management team, a new energy reduction target was set. The new target was reducing energy intensity by 20% from 2010/2011 fiscal year levels by end of 2017/2018 fiscal year. An analysis of the savings in March 2017 indicated that the 20% energy reduction target had been achieved. Therefore, a new energy reduction target was set to reduce campus energy intensity by 25% from 2010/2011 fiscal year levels by 2019/2020 fiscal year through implementation of cost-effective energy management initiatives. VCC achieved this target 15 months earlier than targe date.

The current energy reduction target for VCC is as follows:

VCC will reduce **campus energy intensity in existing buildings by 50% and 60% from 2010/2011 fiscal year levels by 2024/2025 and 2029/2030 fiscal years respectively** through implementation of cost-effective energy management initiatives.

Progress towards the target will be corrected for fluctuations in weather.

6.1 Annual Goals and Objectives

The following table outlines annual goals for energy reduction so that the overall goal can be achieved.

Table 7: Annual Energy Reduction Actual and Targets

	Electricity			Fuel			Overall Energy			
	Reduction	Energy Intensity	Energy Use	Reduction	Energy Intensity	Energy Use	Reduction	Energy Intensity	Energy Use	
Fiscal Year	% of Base Period	kWh/m²	kWh	% of Base Period	ekWh/m²	ekWh	% of Base Period	ekWh/m²	ekWh	
2010/2011 **(Base)**		160	11,440,400		172	12,366,300		332	23,806,700	**Actual**
2011/2012	1%	159	11,368,100	-2%	175	12,577,000	-1%	334	23,945,100	"
2012/2013	2%	156	11,172,400	7%	159	11,454,600	5%	315	22,627,000	"
2013/2014	6%	150	10,738,000	11%	152	10,946,700	9%	302	21,684,700	"
2014/2015	11%	142	10,155,300	28%	124	8,955,600	20%	266	19,110,900	"
2015/2016	15%	136	9,742,400	29%	122	8,762,400	22%	258	18,504,800	"
2016/2017	20%	127	9,114,500	29%	122	8,783,100	25%	250	17,897,600	"
2017/2018	23%	123	8,817,500	44%	97	6,930,600	34%	220	15,748,100	"
2018/2019	27%	117	8,392,600	50%	87	6,264,700	38%	204	14,657,300	"
2019/2020	29%	113	8,132,300	51%	85	6,112,700	40%	198	14,245,000	"
2020/2021	42%	92	6,628,800	63%	64	4,609,600	53%	157	11,238,400	"
2021/2022	38%	98	7,038,500	57%	74	5,325,300	48%	172	12,363,800	
2024/2025	40%	96	6,864,200	60%	69	4,946,500	50%	165	11,810,700	**Target**
2029/2030	45%	88	6,292,200	75%	43	3,091,600	61%	131	9,383,800	"

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

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

It should be noted that actual Electricity, Fuel and Overall Energy use and intensities in Fiscal Year 2020/21 were much lower than target due to pandemic and less occupancy in the campuses. For future years the targets are set based on the assumption that college will be fully occupied.

6.2 Planned Actions

To enable VCC 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 taken will also be selected based on non-energy benefits, including occupant comfort, equipment reliability, maintenance costs, and operational improvements.

6.2.1 Potential Projects

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

- **Lighting**

  Multiple opportunities at both campuses, examples include:

  - *Daylight controls installs for high fenestration areas*
  - *Adding lighting systems to DDC (Direct Digital Control)*
  - *Demand response and dimming control for corridors, classrooms, and offices*

- **Continuous Optimization of DDC System**

  - *Recommissioning Downtown and Broadway campus buildings to re-assess building performance after Round 1 is complete (5 years after the conservation measures that were implemented in 2017/18)*

- **Renewable Energy**

  - *Installing Photovoltaic panels on Broadway Buildings A and B*

- **Electrification**

  - *Replacing gas-fired domestic hot water heaters with heat pumps*
  - *Replacing gas-fired kitchens' make-up air units with heat pumps (serving culinary arts school)*
  - *Replacing gas-fired kitchens' equipment with induction units*

Table 8: Summary of Potential Energy Savings Projects – Three Fiscal Years

FY	Project	Location	Projected Completion Date	Potential Electrical Savings (kWh)	Potential Other Fuel Savings (GJ)	Potential Total Savings (Energy + Operational) ($)	Total Cost ($)	BC Hydro/ Fortis BC Incentive ($)	Projected Total Cost incl. Incentive ($)
2022/23 & 2023/24 & 2024/25	Behavioral Change Program	VCC	Mar-25	60,000	0	$3,600	$9,000	$3000	$6,000
2022/23	Dimming Controls for Corridors	BWY	Mar-23	7,300	0	$700	$25,000	$0	$25,000
"	Lighting Upgrades - Controls	BWY	Mar-23	1,400	0	$100	$5,000	$0	$25,000
"	Dimming Controls for Classrooms	BWY-B	Mar-23	30,000	0	$1,800	$65,000	$0	$65,000
2022/23 & 2023/24	Continuous Optimization - investigation	DTN	Mar-24	-	-	-	$40,000	$40,000	$0
"	Continuous Optimization - Investigation	BWY	Mar-24	-	-	-	$40,000	$40,000	$0
2024/25	Continuous Optimization - Implementation	DTN	Mar-25	158,000	200	$12,100	$24,000	$0	$24,000
"	Continuous Optimization - Implementation	BWY	Mar-25	115,300	500	$13,400	$26,000	$0	$26,000
	Total			**372,000**	**700**	**$31,700**	**$234,000**	**$83,000**	**$171,000**

Table 9: Summary of Potential Electrification Projects – Three Fiscal Years

FY	Project	Location	Projected Completion Date	Potential Electrical Savings (kWh)	Potential Other Fuel Savings (GJ)	Potential Total Savings (Energy + Operational) ($)	Total Cost ($)	BC Hydro/Clean BC Incentive ($)	Projected Total Cost incl. Incentive ($)
2022/23	Domestic Hot Water Heating Heat Pump	BWY-A	Jan-23	-100,000	1,500	$9,000	$210,000	$23,000	$187,000
2023/24	Culinary School Induction Equipment	DTN	Mar-24	-111,000	570	$1,000	TBD	TBD	TBD
2024/25	Kitchens' Make-up Air Units – Replace with Heat Pumps	DTN	Mar-25	-249,000	3,230	$24,000	TBD	TBD	TBD
	Total			**-460,000**	**5,300**	**$34,000**	**TBD**	**TBD**	**TBD**

Table 10: Summary of Energy Savings Projects-**Past**

FY	Project	Location	Projected Completion Date	Potential Electrical Savings (kWh)	Potential Other Fuel Savings (GJ)	Potential Total Savings (Energy + Operational) ($)	Total Cost ($)	BC Hydro/ Fortis BC Incentive ($)	Projected Total Cost incl. Incentive ($)
2014/15	Compressed Air Leakage Repairs	BWY	Jun-14	67,000	0	$4,600	$500	$0	$500
"	Align AHUs Operation with Occupancy	BWY	Aug-14	158,000	500	$17,000	$500	$0	$500
"	Lighting Retrofits-Ph1	DTN	Mar-15	237,000	0	$36,600	$276,500	$64,100	$212,400
"	Lighting Retrofits-Exterior	BWY	Mar-15	68,000	0	$10,000	$223,000	$15,250	$207,750
	Sub-Total			**530,000**	**500**	**$68,200**	**$500,500**	**$79,350**	**$421,150**
2015/16	Behavior Change Program	DTN & BWY	Mar-16	51,000	0	$3,800	$3,000	$0	$3,000
"	Lighting Retrofits and Controls-Interior	BWY	Mar-16	175,000	0	$25,000	$190,000	$46,600	$143,400
	Sub-Total			**226,000**	**0**	**$28,800**	**$193,000**	**$46,600**	**$146,400**
2016/17	Behavior Change Program	DTN & BWY	Mar-17	50,000	0	$4,000	$3,000	$1,000	$2,000
"	C.Op. Investigation	BWY	Mar-17	0	0	$0	$38,000	$19,000	$19,000
"	Lighting Retrofits and Controls	BWY	Mar-17	45,350	0	$5,000	$86,000	$0	$86,000
"	C.Op. Investigation	DTN	Nov-16	0	0	$0	$38,000	$19,000	$19,000
"	C.Op. Implementation	DTN	Mar-17	70,000	1,800	$35,000	$23,000	$0	$23,000
"	Lighting Retrofits and Controls	DTN	Mar-17	67,300	0	$6,100	$63,000	$0	$63,000
"	Add HPs to DDC and Occupancy Sensor (Floor 9)	DTN	Mar-17	57,500	0	$4,600	$55,500	$0	$55,500
"	Add RTUs-318 and-320 to DDC	DTN	Mar-17	13,100	0	$1,100	$2,500	$0	$2,500
	Sub-Total			**303,250**	**1,800**	**$55,800**	**$309,000**	**$39,000**	**$270,000**
2017/18	Behavior Change Program	DTN & BWY	Mar-18	20,000	0	$1,900	$3,000	$1,000	$2,000
"	Lighting Upgrades – LED Lamps	DTN	Mar-18	57,000	0	$6,700	$69,500	$8,000	$61,500
"	Lighting Upgrades – LED Lamps	BWY	Mar-18	114,700	0	$17,800	$145,000	$20,000	$125,000
"	Install Premium Efficient Motors for Fluid Coolers	DTN	Jan-18	12,000	0	$1,100	$22,000	$0	$22,000
"	Add First Floor Heat Pumps (31) to DDC and Add Occupancy Sensors for 12 Classrooms	DTN	Jan-18	160,300	0	$15,000	$66,000	$0	$66,000
"	C.Op. Implementation	BWY	Mar-18	100,000	700	$14,600	$70,000	$0	$70,000
	Sub-Total			**464,000**	**700**	**$57,100**	**$375,500**	**$29,000**	**$346,500**
2018/19	Behavioral Change Program	DTN & BWY	Mar-19	20,000	0	$1,200	$3,000	$1,000	$2,000

FY	Project	Location	Projected Completion Date	Potential Electrical Savings (kWh)	Potential Other Fuel Savings (GJ)	Potential Total Savings (Energy + Operational) ($)	Total Cost ($)	BC Hydro/ Fortis BC Incentive ($)	Projected Total Cost incl. Incentive ($)
"	Lighting Upgrades - LED Lamps	BWY	Mar-19	129,000	0	$19,400	$227,000	$23,400	$203,600
"	Add 1st Floor Heat Pumps (29) to DDC and Add Occupancy Sensors for 8 Classrooms/Boardroom	DTN	Dec-18	135,400	0	$8,100	$83,600	$0	$83,600
	Sub-Total			**284,400**	**0**	**$28,700**	**$313,600**	**$24,400**	**$289,200**
2019/20	Behavioral Change Program	VCC	Ongoing	20,000	0	$1,200	$3,000	$1000	$2,000
"	Lighting Upgrades - LED Lamps	DTN	Mar-20	307,000	0	$37,000	$197,000	$53,000	$144,000
	Sub-Total			**327,000**	**0**	**$38,200**	**$200,000**	**$54,000**	**$146,000**
2020/21	Lighting Upgrades - LED Lamps/Controls	BWY	Mar-21	61,000	0	$4,000	$112,000	$11,000	$101,000
"	Lighting Upgrades - Controls	BWY	Mar-21	5,000	0	$300	$6,000	$1,000	$5,000
"	Installing VFDs for 12 AHUs Fan Motors	BWY	Mar-21	118,500	0	$7,000	$110,000	$0	$110,000
"	Add 2nd & 3rd Floor Heat Pumps to DDC and Add Occupancy Sensors	DTN	Apr-21	175,000	0	$10,500	$120,000	$0	$120,000
	Sub-Total			**359,500**	**0**	**$21,800**	**$348,000**	**$12,000**	**$336,000**
2021/22	Install VFD for Cooling Towers	DTN	May-21	53,400	0	$5,200	$45,400	$0	$45,400
"	Adding Lighting and Exhaust Fans to DDC	DTN	Jan-22	23,700	0	$2,000	$35,200	$0	$35,200
	Sub-Total			**77,100**	**0**	**$7,200**	**$80,600**	**$0**	**$80,600**
Total 7 Years				**2,571,250**	**3,000**	**$267,800**	**$2,320,200**	**$284,350**	**$2,034,850**

Table 11: Summary of Electrification Projects-Past

FY	Project	Location	Projected Completion Date	Potential Electrical Savings (kWh)	Potential Other Fuel Savings (GJ)	Potential Total Savings (Energy + Operational) ($)	Total Cost ($)	BC Hydro/Clean BC Incentive ($)	Projected Total Cost incl. Incentive ($)
2020/21	Domestic Hot Water Heating Heat Pump	BWY-B	Mar-21	-58,000	800	$4,500	$132,000	$22,000	$110,000

6.2.2 Projects Completed

- **Energy Conservation and Awareness**: This activity, based on the BC Hydro Energy Wise Network Program, provides VCC with the campaign support to change behaviours across campus. The annual savings from changing behaviour is estimated at 0.5% of total electricity consumption per year.

  Planned activities for **2014/15** included:

  - **Random Acts of Green:** A competition to share photos of VCC's staff and students' green actions (From September to October 2014)
  - **Communications:** Recruitment to the Green Team and behaviour modeling through increased membership
  - **Training:** Instructions and training session for students on use of leak tags for compressed air distribution lines

  Planned activities for **2015/16** included:

  - **Infographic & Newsletter:** Updating the sustainability infographic on a quarterly basis and writing a newsletter (September, January, March, Summer)
  - **Communications:** Two success stories on the technical projects
  - **Student Promotions:** Support during Welcome Days for sustainability engagement

  Planned activities for **2016/17** included:

  - **Elevators Campaign:** Target students to use stairs instead of elevators
  - **Room Booking Campaign:** Target Program assistants, Dean assistants, Department assistants who book the rooms for classes and labs to book the rooms only for the hours needed

  Planned activities for **2017/18** included:

  - **Communications:** Working with the ESAG and the VCC Green Team, VCC produced a green e-newsletter in 2017 and a success story regarding one million Dollar savings on avoided energy cost since fiscal year 2010/11.
  - **Holiday Shutdown Campaign:** A "Holiday Shutdown" campaign was planned and implemented in December 2017.

  Planned activities for **2018/19** included:

  - **Communications:** Working with the ECAT (Environmental Committee Action Team), VCC prepared a success story regarding update savings on avoided energy cost since fiscal year 2010/11.
  - **Space Heater Campaign:** A "Space Heater" campaign was implemented in November 2018.
  - **Holiday Shutdown Campaign:** A "Holiday Shutdown" campaign was implemented in December 2018.

- **Lighting Retrofits at Downtown Campus:**
    - **2014/15:** The phase 1 of lighting upgrade in Downtown was approved for implementation in 2014. This phase was completed by March 2015.
    - **2016/17:** The lobby and exterior lighting systems were upgraded with LED technology. Occupancy sensors were installed in washrooms and daylight sensors were installed in cafeteria sitting area and select corridors. The upgrades were completed by March 2017.
    - **2017/18:** The lighting upgrades to the Downtown campus were completed in March 2018. The project involved upgrading the T8 fluorescent lighting systems to LED in select areas such as the parkade, lecture theatre, carpentry shop, and hallways. Occupancy sensors were installed in the parkade to automatically dim the lights down to 50% when there are no occupants. Incandescent exit signs were also retrofitted with LED conversion kits. These upgrades would result in savings of over 57,000 kWh per year.
    - **2019/20:** Additional lighting upgrades at the Downtown campus were completed in March 2020. The annual energy savings was approximately 307,000 kWh. The project cost was $197,000, which was reduced to $144,000 after BC Hydro incentive.
    - **2020/21:** Control upgrades at the Downtown campus were completed in March 2021. The annual energy savings was approximately 5,000 kWh. The project cost was $6,000, which was reduced to $5,000 after BC Hydro incentive.
    - **2021/22:** The lighting system upgrade for the Downtown campus was to extend the existing DDC system to include lighting in common area hallways and corridors on the 3rd floor, which were operating continuously. Lighting in these areas were scheduled to turn off overnight. Estimated annual energy savings for this upgrade was approximately 11,400 kWh.
- **Lighting Retrofits at Broadway Campus:**
    - **2014/15 Exterior**: The exterior and parkade lighting upgrade in Broadway campus was approved for implementation in February 2015. The upgrades were completed by end of March 2015.
    - **2015/16 Interior:** The interior lighting upgrade in Broadway campus was approved for implementation in June 2015. The upgrades were complete by end of March 2016.
    - **2016/17:** The Automotive Shop in Building A was re-lamped with LED technology lamps. The fluorescent luminaires in Building B corridors were replaced with new LED luminaires. The upgrades were completed by March 2017.
    - **2017/18:** The lighting upgrades at the Broadway campus were completed in March 2018. The project involved retrofitting all of the fluorescent luminaires (approximately 1,600 in total) in Building B with dimmable LED T8 lamps and drivers. This upgrade is expected to result in savings of approximately 115,000 kWh per year.
    - **2018/19:** Additional lighting upgrades at the Broadway campus were completed in March 2019 that included upgrading all T8 fluorescent luminaires in Building A to LED technology. The annual energy savings was approximately 129,000 kWh. The project cost was $227,000, which was reduced to $204,000 after BC Hydro incentive.

- **2020/21:** Lighting upgrades at the Broadway campus were completed in March 2021 that included installing LED lamps. The annual energy savings was approximately 61,000 kWh. The project cost was $112,000, which was reduced to $101,000 after BC Hydro incentive.

- **Continuous Optimization of DDC System at Downtown Campus:**
  - **Investigation:** The investigation phase of the Continuous Optimization for Downtown campus was approved in September 2015. The investigation report was complete by November 2016.
  - **Implementation:** Majority of the recommended measures were implemented in March 2017. Installing variable frequency drives for fluid coolers is planned for future fiscal years.

- **Continuous Optimization of DDC System at Broadway Campus:**
  - **Investigation:** The investigation phase of the Continuous Optimization for Broadway campus was approved in June 2016. The investigation report was complete by July 2017.
  - **Implementation:** The recommended measures were implemented by March 2018, which are estimated to save 100,000 kWh electricity and 700 GJ natural gas per year.

- **Mechanical Systems Retrofits at Downtown Campus:**
  - **2016/17 -** Add Fifteen Heat Pumps and Two Rooftop Units to DDC System:

    Fifteen heat pumps serving tower's floor 9 offices and classrooms were added to the DDC system and a weekly schedule was used to control the units. In addition, two Rooftop units serving JJ Restaurant and a storage room were added to DDC with weekly schedules.
  - **2017/18 -** Add Thirty-One Heat Pumps to DDC System:

    Thirty-One heat pumps serving third floor offices and classrooms were added to the DDC system and a weekly schedule was used to control the units.
  - **2018/19 -** Add Heat Pumps serving first and second floors to DDC System:

    Thirty-seven heat pumps serving first and second floor offices and classrooms were added to the DDC system, and a weekly schedule was used to control the units.
  - **2020/21 –** Replace Standard Efficiency Motors with Premium Efficiency:

    In 2021, the standard efficiency electrical motors of three existing fluid coolers were replaced with premium efficiency motors. Estimated annual energy savings for this upgrade was approximately 12,000 kWh.
  - **2021/22 –** Add 7 Exhaust Fans to DDC:

    In January 2022, 7 exhaust fans serving floor 3 were added to the DDC system with weekly operation schedule to avoid their continuous operation. Estimated annual energy savings for this upgrade was approximately 12,300 kWh.

7. MONITORING AND REPORTING – HOW ARE WE DOING?

7.1 Energy Savings

This section of the SEMP tracks the energy savings in comparison to the baseline and 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 2010/11 base period for Vancouver Community College. As time goes on, this graph will be updated, and progress followed. The cumulative savings shown in the graph are represented by equivalent kWh (ekWh) and are **adjusted for fluctuations in weather**. *Negative* savings (downward slope) on the graph represent an *increase* in consumption, and vice-versa.

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 in comparison to the base period**.

The total energy saved between April 1st 2011 and March 31st 2022, normalized for weather, is over 62,121,000 ekWh.

[Electricity 22,936,000 kWh, natural gas 27,438,000 ekWh (98,800 GJ) and steam 11,747,000 ekWh (42,300 GJ)]

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

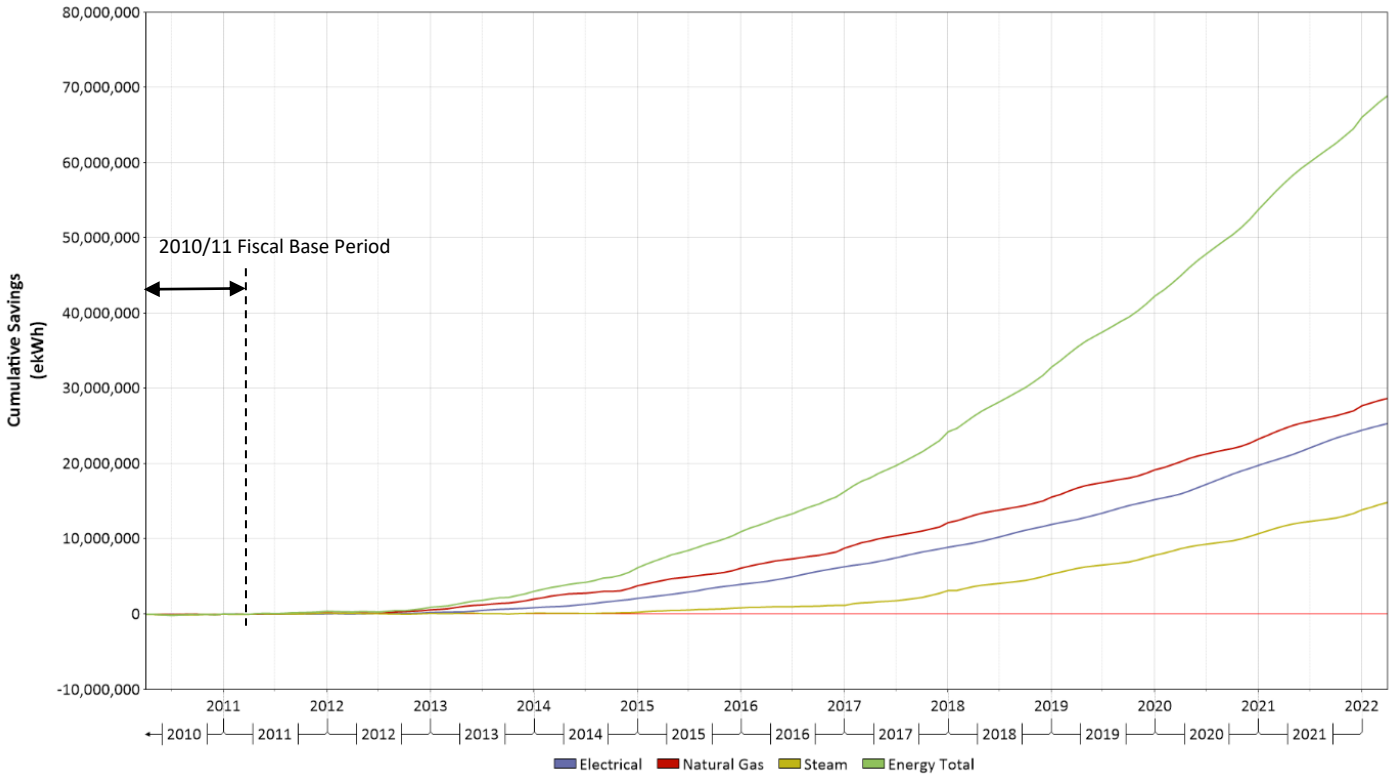

Figure 9: Cumulative Sum of **Energy Savings** – VCC BWY and DTN combined

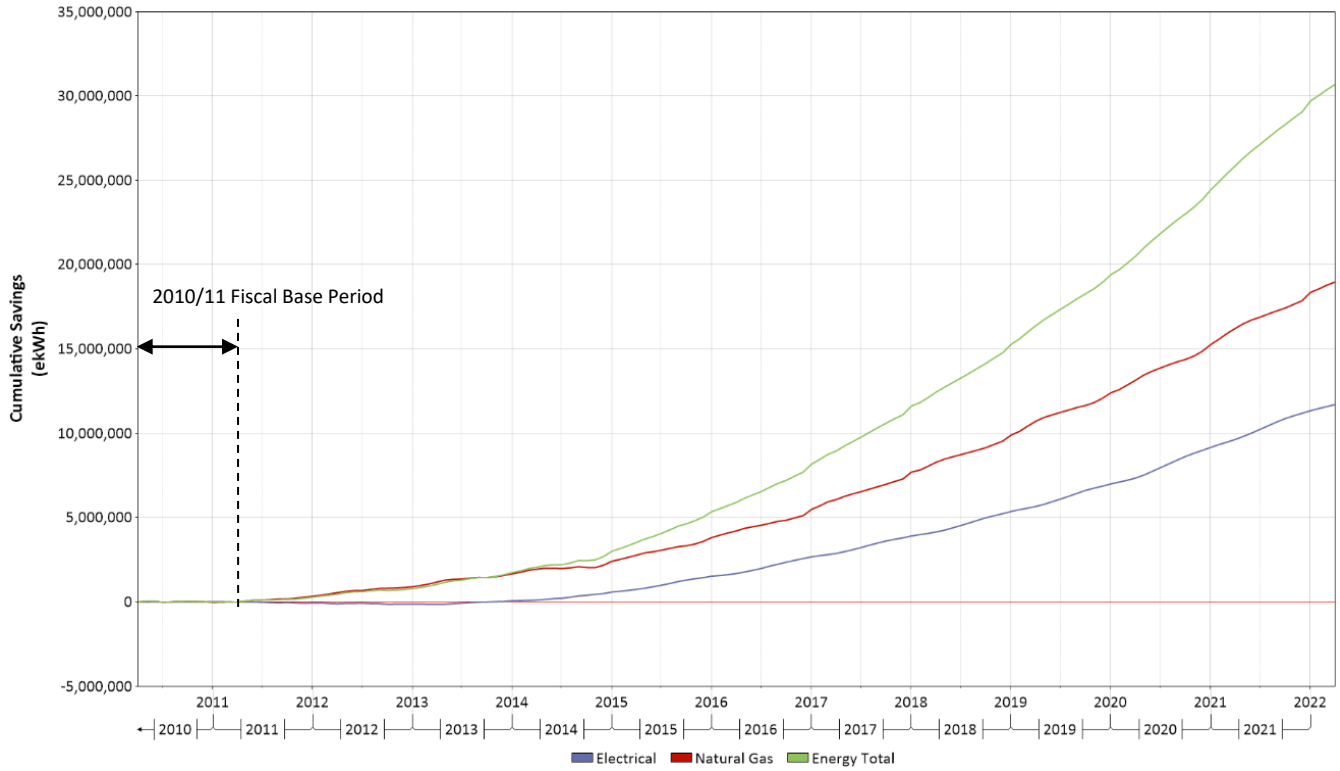

Figure 10: Cumulative Sum of **Energy Savings** – **Broadway** Campus only

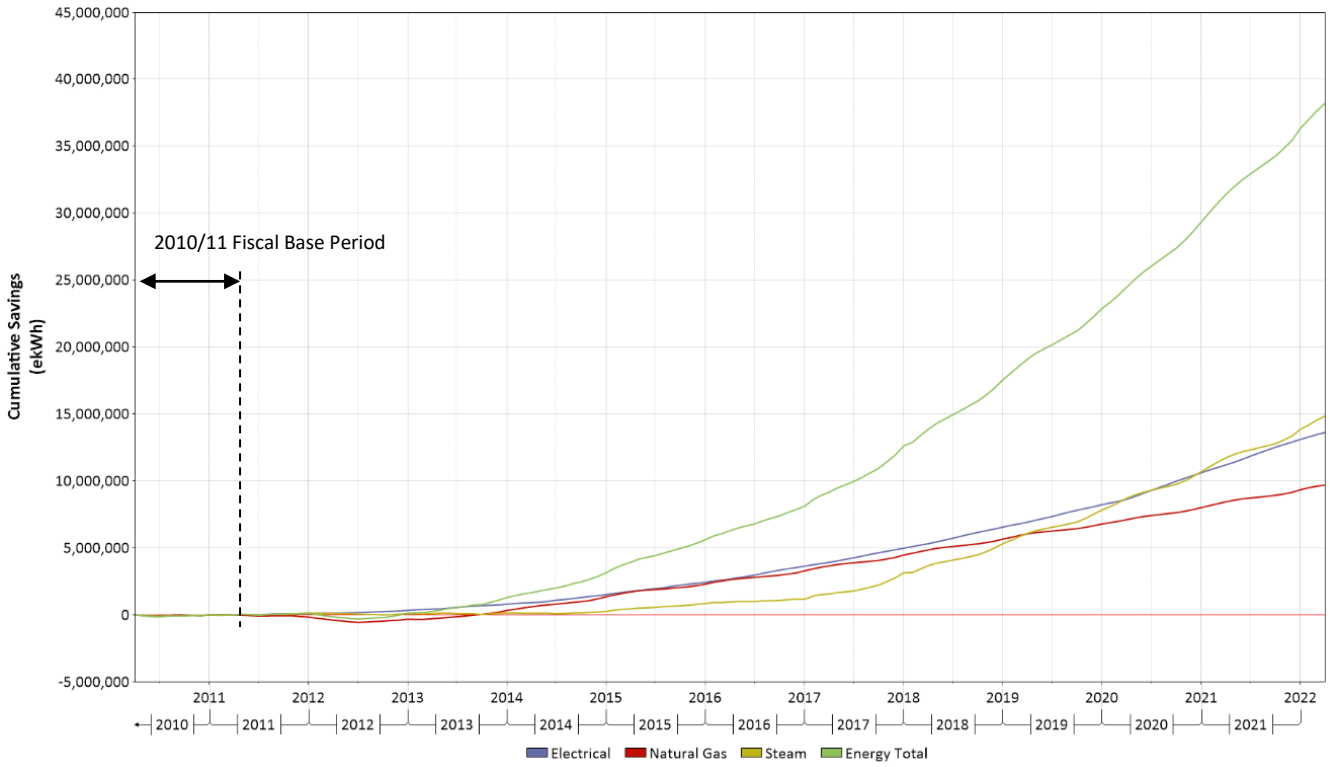

Figure 11: Cumulative Sum of **Energy Savings** – **Downtown** Campus only

As time goes on, we will update this section with more current data.

A breakdown of Energy Savings per year is shown in Table 12, Table 13 and Table 14 for VCC, Broadway campus and Downtown campus respectively.

Table 12: Summary of Energy Savings by Year – **VCC**

Fiscal Year	Electrical Savings -kWh	Natural Gas Savings - GJ	Steam Savings - GJ	Fuel Total Savings - GJ	Energy Total Savings - ekWh
2011/2012	36,333	593	432	1,025	321,052
2012/2013	270,204	2,709	-47	2,662	1,009,708
2013/2014	730,605	5,948	91	6,039	2,408,046
2014/2015	1,472,681	6,982	1,180	8,161	3,739,744
2015/2016	1,866,410	8,480	1,868	10,347	4,740,656
2016/2017	2,437,699	10,371	2,146	12,516	5,914,439
2017/2018	2,665,708	12,258	7,610	19,868	8,184,527
2018/2019	3,122,904	13,071	8,708	21,779	9,172,724
2019/2020	3,398,232	12,605	9,430	22,034	9,518,862
2020/2021	4,860,099	15,861	10,872	26,733	12,285,940
2021/2022	4,490,389	14,427	11,247	25,674	11,622,025
Grand Total	**22,936,496**	**98,776**	**42,289**	**141,065**	**62,120,927**

Table 13: Summary of Energy Savings by Year – **Broadway** Campus

Fiscal Year	Electrical Savings -kWh	Natural Gas Savings - GJ	Steam Savings - GJ	Fuel Total Savings - GJ	Energy Total Savings - ekWh
2011/2012	-96,945	2,006	-	2,006	460,220
2012/2013	-38,461	2,278	-	2,278	594,195
2013/2014	251,875	2,747	-	2,747	1,015,060
2014/2015	637,648	2,987	-	2,987	1,467,247
2015/2016	940,581	5,187	-	5,187	2,381,302
2016/2017	1,188,711	6,674	-	6,674	3,042,586
2017/2018	1,270,497	7,953	-	7,953	3,479,757
2018/2019	1,513,573	8,759	-	8,759	3,946,593
2019/2020	1,688,001	8,778	-	8,778	4,126,390
2020/2021	2,286,729	11,065	-	11,065	5,360,268
2021/2022	2,069,600	9,899	-	9,899	4,819,208
Grand Total	**11,714,284**	**68,332**	**-**	**68,332**	**30,695,301**

Table 14: Summary of Energy Savings by Year – **Downtown** Campus

Fiscal Year	Electrical Savings -kWh	Natural Gas Savings - GJ	Steam Savings - GJ	Fuel Total Savings - GJ	Energy Total Savings - ekWh
2011/2012	133,278	-1,413	432	-981	-139,167
2012/2013	308,665	431	-47	385	415,512
2013/2014	478,730	3,201	91	3,291	1,392,986
2014/2015	835,033	3,995	1,180	5,175	2,272,497
2015/2016	925,828	3,293	1,868	5,161	2,359,354
2016/2017	1,248,989	3,697	2,146	5,842	2,871,853
2017/2018	1,395,212	4,304	7,610	11,914	4,704,770
2018/2019	1,609,330	4,313	8,708	13,020	5,226,131
2019/2020	1,710,231	3,826	9,430	13,256	5,392,472
2020/2021	2,571,770	4,797	10,872	15,669	6,925,672
2021/2022	2,420,789	4,528	11,247	15,775	6,802,817
Grand Total	**11,222,212**	**30,444**	**42,289**	**72,733**	**31,425,626**

Similarly, as we have just done for energy, we can also generate the same CUSUM chart for greenhouse gas emission avoidance, as shown in Figure 12.

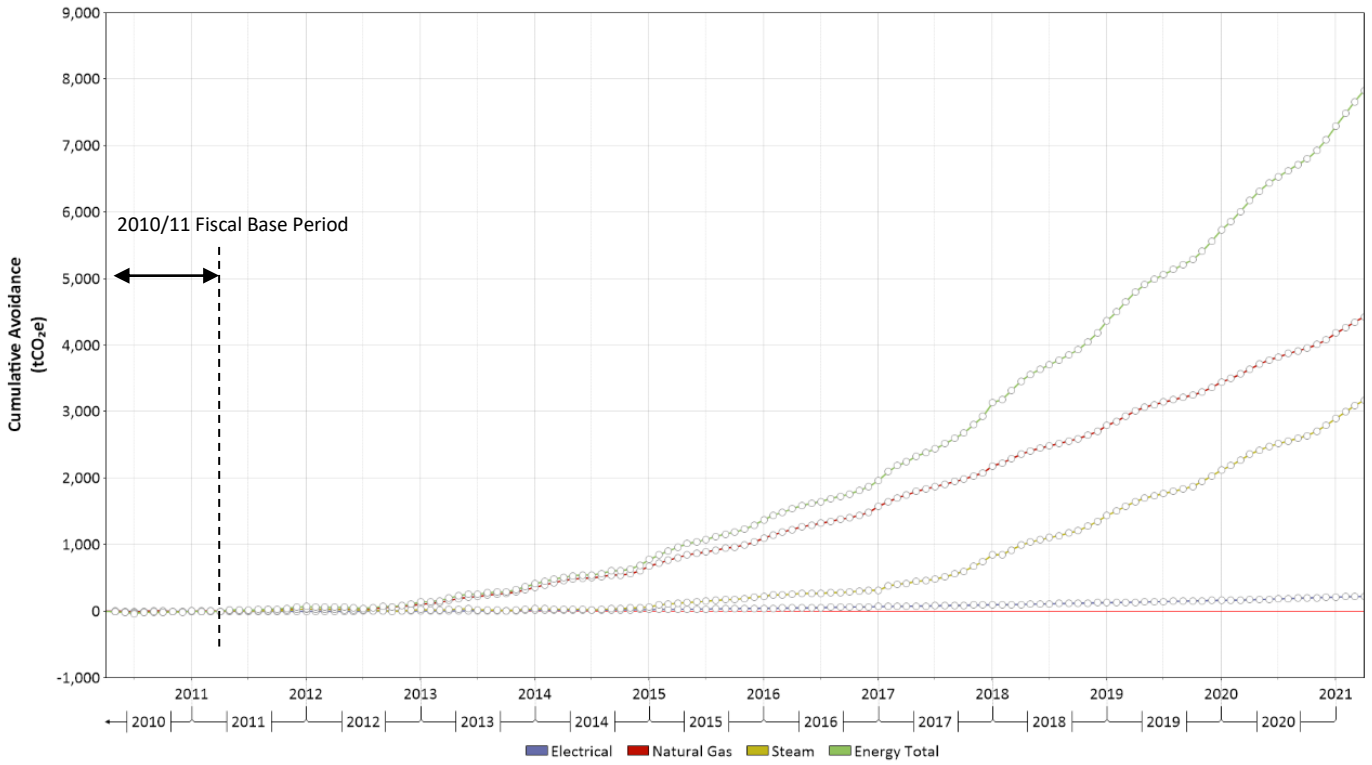

Figure 12: Cumulative sum of GHG **emission avoidance** – since 2010/11 base period

The cumulative GHG emission avoidance by the end of Fiscal Year 2021/22 is approximately 9,882 tonnes of eCO_2.

A breakdown of Emission Avoidance per year is shown in Table 15.

Table 15: Summary of Emission Avoidance by Year (Tonnes of equivalent CO_2) – VCC

Fiscal Year	Electricity	Natural Gas	Steam	Fuel Total	Energy Total
2011/2012	1.5	29.5	29.3	58.9	60.4
2012/2013	10.5	135.1	-3.2	131.9	142.4
2013/2014	25.0	296.6	5.7	302.3	327.3
2014/2015	47.6	348.1	88.1	436.2	483.8
2015/2016	63.3	422.8	140.6	563.4	626.7
2016/2017	79.4	517.1	161.5	678.6	758.1
2017/2018	80.9	611.2	572.9	1,184.1	1,264.9
2018/2019	82.1	651.8	655.5	1,307.3	1,389.4
2019/2020	109.3	628.5	709.9	1,338.4	1,447.6
2020/2021	162.7	790.9	818.4	1,609.3	1,772.0
2021/2022	43.6	719.4	846.7	1,566.0	1,609.6
Grand Total	**705.8**	**5,151.2**	**4,025.3**	**9,176.5**	**9,882.2**

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 increased, then more would have been spent than beforehand. So, by looking at avoided cost 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 13.

As can be seen, **the cumulative energy <u>cost</u> avoidance by end of Fiscal Year 2021/22 is approximately $4,272,000**.

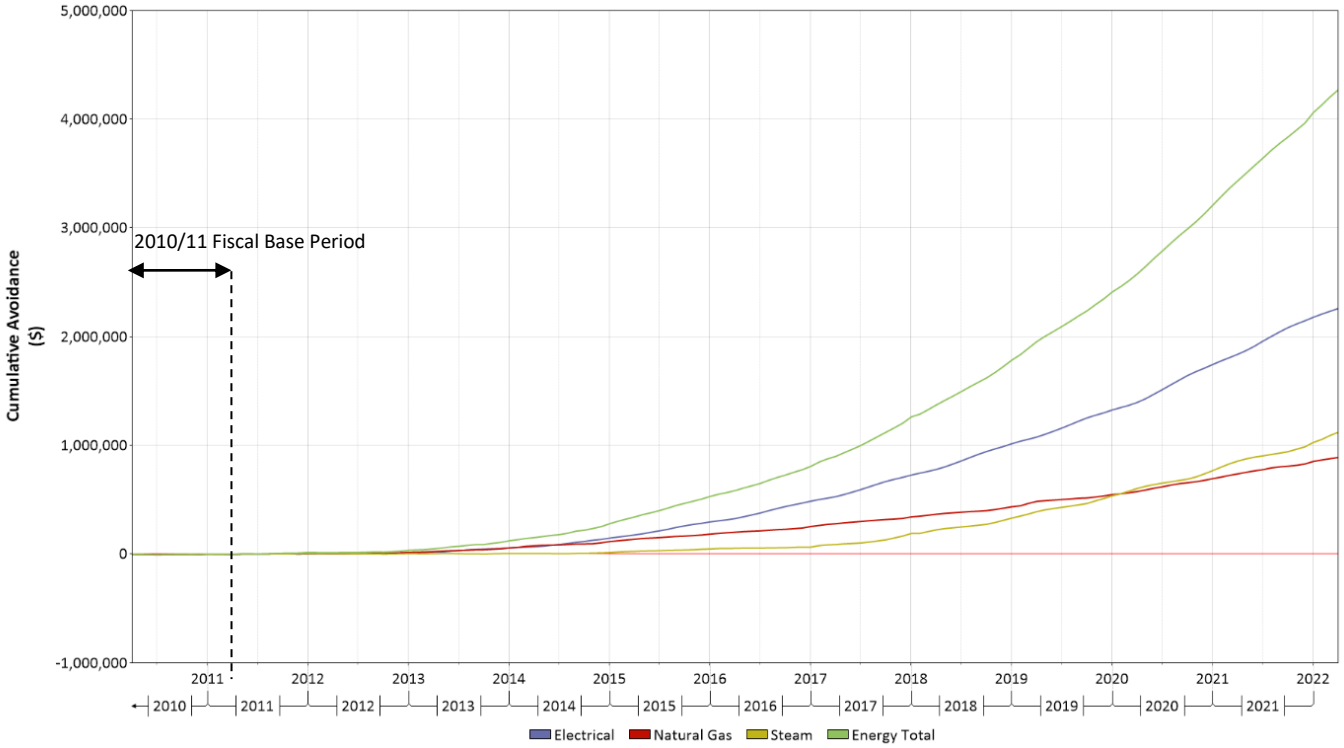

Figure 13: Cumulative sum of **<u>cost</u> avoidance** – since 2010/11 base period

Table 16: Summary of Cost Avoidance by Year – VCC

Fiscal Year	Electrical	Natural Gas	Steam	Fuel Total	Energy Total
2011/2012	$3,527	$3,993	$6,011	$10,004	$13,531
2012/2013	$16,089	$20,456	-$630	$19,826	$35,915
2013/2014	$48,563	$53,168	$1,045	$54,213	$102,776
2014/2015	$109,144	$60,635	$20,001	$80,636	$189,779
2015/2016	$150,434	$64,628	$28,447	$93,075	$243,508
2016/2017	$201,488	$77,750	$34,668	$112,418	$313,906
2017/2018	$250,210	$87,033	$134,777	$221,810	$472,020
2018/2019	$297,424	$117,999	$166,986	$284,985	$582,409
2019/2020	$319,357	$90,632	$214,163	$304,795	$624,152
2020/2021	$442,626	$162,741	$251,070	$413,811	$856,436
2021/22	$420,868	$150,675	$265,473	$416,148	$837,015
Grand Total	**$2,260,241**	**$889,933**	**$1,122,016**	**$2,011,949**	**$4,272,190**

8. COMMUNICATIONS

To keep key stakeholders and the campus community informed of the energy management efforts at VCC, the following communication methods are currently used:

- Monthly facility meetings - energy projects are discussed and energy performance from utility monitoring reports reviewed with operators and management.
- Quarterly Energy Management reporting – results from ongoing energy management projects are reviewed and future potential projects discussed. This meeting is required as part of the BC Hydro energy management program and ensures tracking against required energy reduction targets to stay in the program.
- Success Story reporting – The energy team has prepared success stories on topics such as lighting upgrades and achievements of cost avoidance. The success stories have been shared with VCC staff and students.

Currently the greater community of staff and students of VCC have little exposure to the energy management efforts that supports their campus to run efficiently. Staff are engaged annually during the "holiday shutdown campaign" and through other behavioural campaigns. VCC is part of the BC Hydro Energy Wise Network, where support is provided for the campus energy management team to facilitate up to two behavioural campaigns annually.

In upcoming fiscal years, VCC would like to expand methods of communication with the community of staff and students at VCC campuses, by way of the following methods:

- **2022/23 –** In addition to above, improvement in energy performance will be published in the VCC digest on a quarterly basis;
- **2023/24 –** Facilities plan to purchase and install several monitors throughout campus that will display an energy dashboard consisting of energy management stories and demand visualization.
- **2023/24 –** Energy performance improvements will be highlighted on current monitors located at campuses entrances. Content will be updated periodically by VCC energy management team.

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

This section analysis will be used to set achievable yet visionary targets for the future of VCC campuses.

The term "net zero" can refer to energy and/or emissions. A net zero energy building is one that 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 is one that has high performance with minimal energy use and the energy use it has is from low or zero carbon sources such BC electricity and renewable energy respectively. VCC's path to net zero will involve various projects in the following categories:

- **Energy Efficiency and Behavioural**

  Majority of VCC's projects completed to date are of the first category - "Energy efficiency and Behavioural". VCC has had great success in achieving 48% reduction by end of FY 2021/22 in this category and there are still opportunities to reduce further energy and emissions via energy efficiency.

- **Fuel Switching**

  This category of projects will contribute primarily to reduction of emissions at VCC, though at times energy reduction will also be realised, such as switching from gas-fired systems to electric heat pumps, where the efficiency of the electrified system is higher than that of the gas-fired system. At Broadway campus - Building B, the gas-fired domestic hot water heaters were replaced with electrical heat pumps in 2021. Currently, domestic hot water heaters at Building A, which use natural gas are being replaced with electrical heat pumps.

- **Renewable Energy**

  Sources of renewable energy can be on-site or from utility provider. At VCC there is opportunity for addition of Photovoltaic (PV) solar panels on roof of Broadway campus buildings to generate electricity on site. At Downtown campus the steam utility provider, Creative Energy, is planning to switch fuel source to biomass by 2025. This will significantly reduce the emissions associated with the campus steam consumption.

Through an analysis of existing planned Energy Efficiency and Behavioural, and implementation of Fuel Switching and Renewable Energy projects, the following reduction levels are possible:

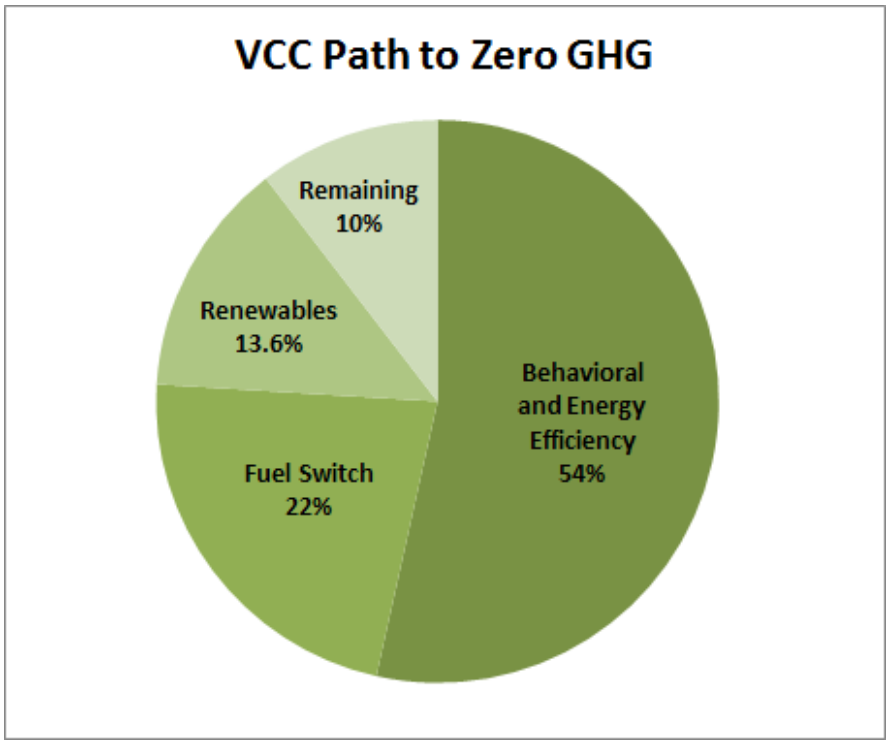

Figure 14: Breakdown of GHG Reduction

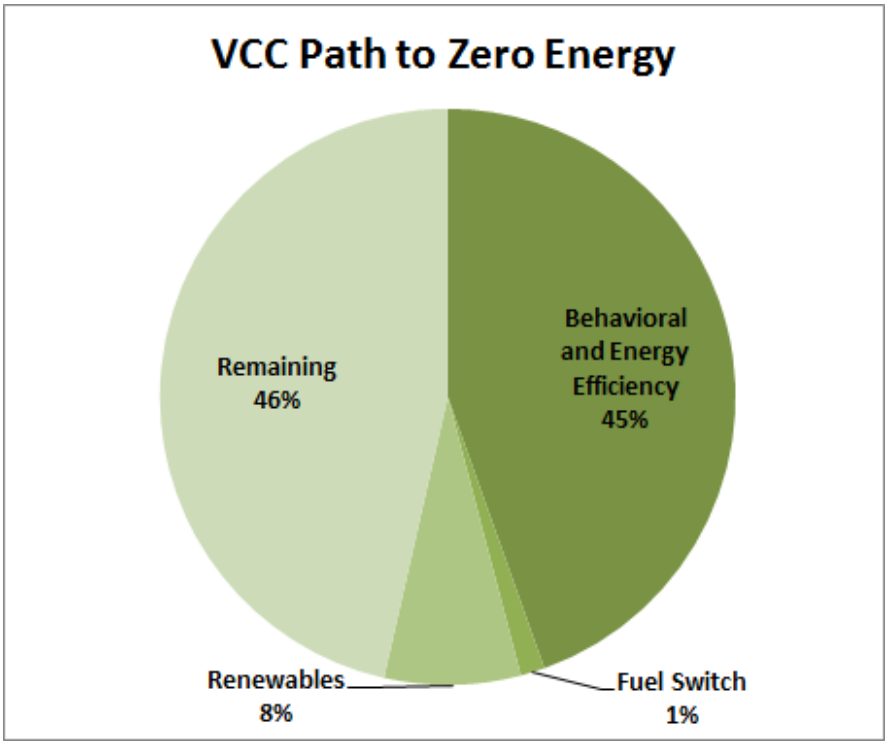

Figure 15: Breakdown of Energy Reduction

Table 17 lists the projects associated with achieving the reductions displayed in Figure 16 and 17 below. The figures indicate the near future (through fiscal year 2030) path for VCC approaching net zero energy and emission at Downtown and Broadway campuses.

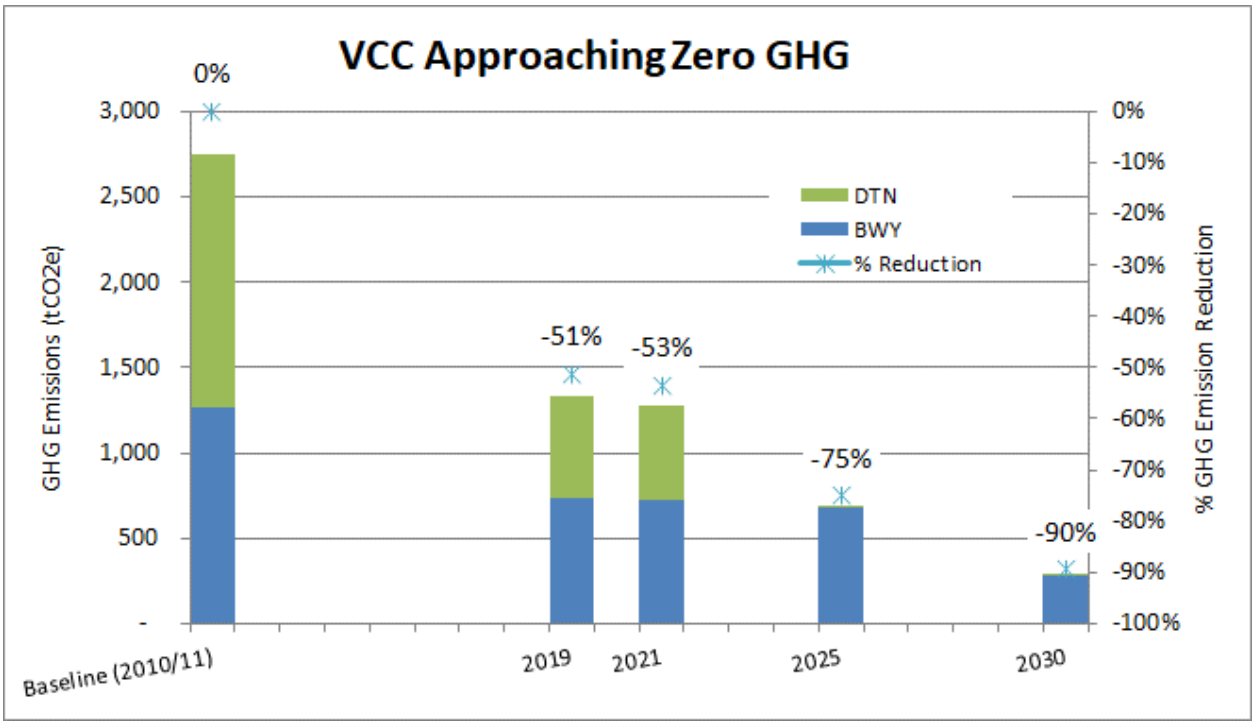

Figure 16: Modelled GHG Reduction

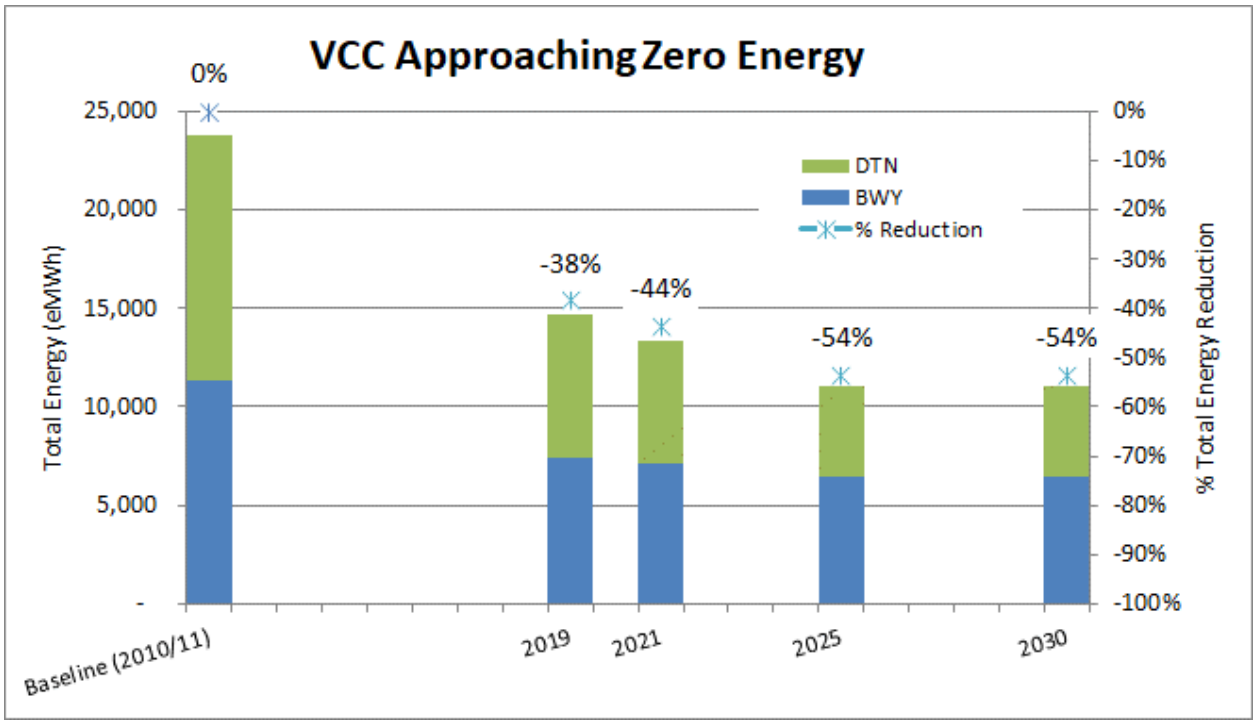

Figure 17: Modelled Energy Reduction

The analysis indicates that it is plausible for Downtown campus to achieve Net Zero GHG by 2025. This is mainly dependent on the Creative Energy steam utility provider to switch to biomass fuel source, and electrification of the building's MUAs and culinary arts kitchen equipment. For Broadway campus, a significant GHG reduction will be possible when NEU district energy extends to the campus. The remaining 10% of GHGs can be eliminated by planning for A Building renewal to be net zero (this has not been included in the analysis).

Getting to Zero Energy is modelled mainly through energy efficiency and behavioural projects. The model does include installation of solar PV on Broadway campus buildings, but much more renewables are needed to make the campuses fully self sufficient for their energy needs.

This bottom-up analysis provides grounds for VCC to comfortably set future targets, knowing there is a plan for what projects need to progress to achieve the set targets. Based on the analysis, the following future targets are achievable:

- **Energy Reduction Targets**
    - 45% by 2021
    - 50% by 2025
    - 60% by 2030
- **GHG Emission Reduction Targets**
    - 50% by 2021
    - 60% by 2025
    - 75% by 2030

Table 17: Summary of Future Projects

Category	FY	Campus	Description	Electrical Energy Savings (kWh)	Natural Gas Energy Savings (GJ)	Steam Energy Savings (GJ)	Total Energy Savings (eMWh)	GHG Emissions Savings (tCO_2e)
Behavioral	2023	BWY	Behavioral Change Campaigns	10,000	0	0	10	0.1
Behavioral	2023	DTN	Behavioral Change Campaigns	10,000	0	0	10	0.1
Fuel Switch	2023	DTN	Culinary school electrification	-111,000	570	0	47	27.4
Fuel Switch	2024	DTN	MUAs electrification	-249,000	3,230	0	648	158.8
Behavioral	2024 & 2025	BWY	Behavioral Change Campaigns	40,000	0	0	40	0.4
Behavioral	2024 & 2025	DTN	Behavioral Change Campaigns	40,000	0	0	40	0.4
Energy Efficiency	2025	BWY	Kitchen Hood Demand Controlled Ventilation-Pilot	5,000	50	0	19	2.5
Energy Efficiency	2025	DTN	Install Kitchen Hood Demand Controlled Ventilation	95,000	950	0	359	48.2
Energy Efficiency	2025	BWY	Upgrade to Premium Efficiency Motors	65,000	0	0	65	0.6
Energy Efficiency	2025	DTN	Upgrade to Premium Efficiency Motors	33,000	0	0	33	0.3
Renewable	2025	DTN	Creative Energy (steam) source change to biomass	0	0	4,900	1,361	368.9
Fuel Switch	2025	DTN	Install centralized heat pump to replace steam	-528,000	0	0	-528	-4.8
Renewable	2025	BWY	Install PV on Buildings A roof (align with renewal)	418,000	0	0	418	3.8
Renewable	2025	BWY	Install PV on Buildings B roof	42,000	0	0	42	0.4
Fuel Switch	2030	BWY	Neighbourhood Energy Utility (NEU) extension to VCC campus	0	0	0	0	422.5

10. ADAPTATION TO CLIMATE CHANGE

The Province of BC has developed an adaptation strategy in 2021. VCC is aware of the impacts of climate change locally and has considered developing the necessary foundations, which are:

- Identify 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)
        - Add window films and shading to reduce over heating
    - Other immediate adaptation initiatives that VCC can consider
        - Installing moisture sensors to move elevators above ground in case of flooding
        - Integrating controls to filter or eliminate outdoor air when outdoor air conditions are worse than indoor (e.g., forest fire pollution)
- Conduct a climate change vulnerability risk assessment of Downtown Campus, and incorporate learnings into building renewal as part of end-of-life upgrades
    - Provide training / capacity building for internal staff
    - Get stories from operation staff on what is currently vulnerable
    - Pick a framework (and modify it to fit) for adaptation process at VCC
- Review assets up for renewal (e.g., mechanical equipment) and consider assessing their capacity for future climate (up to 2050 or asset life)
- Consider whether developing an adaptation plan or incorporate adaptation into existing policies

11. APPENDIX - STAKEHOLDERS

Executive Support:	**Ajay Patel,** President & CEO		
VCC Energy Management Consultant:	**Prism Engineering** Majid Pishvaei, PEng, CEM Robert Greenwald, PEng Adam Franklin, PEng Taniell Hamilton	**Energy Management**	**Sladjana Borovcanin,** MA, BID, Director, Facilities Management **Ross McPherson,** FMP, PMP, Associate Director, Facilities Management **Steve Horn**, FMA, SMA, Facilities Manager **Ron Singh**, Facilities Manager **Diana Cabrero Purata,** Facilities Coordinator

Executive support is critical to a successful implementation of the plan. Other stakeholders not listed by name in the table above include Administration, Facilities, Employees, Students, the surrounding community, and the Utility providers.

Contact Info				
Name	**Title**	**Organization**	**Email**	**Phone**
Sladjana Borvcanin	Director, Facilities Management	VCC	sborovcanin@vcc.ca	604-871-7000 Ext 8304
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

Energy Manager: Please complete appropriate year below

- Note: All areas (in your contract Year) must be covered in order to receive 4th quarter payment

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 15 (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 8)		
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 17 & 18 (Tables 8, 9 & 10) Page 33 (Table 17)		
b) Initiative List: Behavioural and Organizational	Page 20 (Section 6.2.2)		
c) Studies: Outline which buildings have had studies completed	Page 18 & 19 (Table 10)		
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 23 to 25		
b) Outlined GHG tonnes saved	Page 26		
c) Actual dollars saved to the organization	-		
d) Outlined avoided cost	Page 27 (Section 7.2)		
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				