KPU
KWANTLEN POLYTECHNIC UNIVERSITY

STRATEGIC ENERGY MANAGEMENT PLAN

Fiscal Year 2025

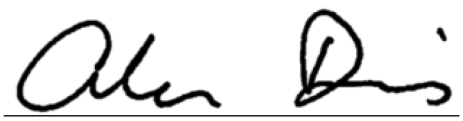
(April 1st 2024 – March 31st 2025)

PREPARED BY

Campus and Community Planning and Facilities Services

KPU SEMP 2024-2025 Approval:

Alan Davis, PhD
President & Vice Chancellor



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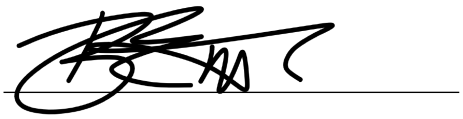

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1. Introduction

1.1 Overview

Kwantlen Polytechnic University (KPU) is committed to being a leader in environmental sustainability in all aspects of its operations. Starting in early 2020, KPU reinitiated its participation in the BC Hydro Commercial Energy Manager Program. Similar to KPU's prior participation in the program, the current iteration still concentrates on energy management. However, in light of the pressures arising out of the global issue of climate change, KPU and BC Hydro have broadened their collective considerations under the program to provide equal focus on the reduction of greenhouse gas (GHG) emissions, as they relate to buildings and associated infrastructure and activities.

KPU's partnership with BC Hydro coincided with the approval on March 31, 2021 of KPU2050 - KPU's first Official Campus Plan. KPU2050 establishes a strategic direction to guide campus development over a thirty-year planning horizon, providing a bold vision, a set of guiding principles, and a series of conceptual plans to shape KPU's campuses and meet the evolving needs of the campus community. KPU2050 also sets forth a Sustainability Framework, which includes a key direction to implement a phased electrification of campus building mechanical systems to support KPU's carbon neutrality goal by 2050.

KPU's energy management and carbon emissions reduction efforts also include a commitment to a continuous improvement process. With constantly changing social, cultural, technological, environmental, and economic landscapes, KPU adapts and continues the ongoing process that is protecting and enhancing our social and natural environment. More specifically, as KPU's buildings take on different functions and as technologies change, new opportunities for energy and GHG emissions reduction become possible. Such a continuous improvement model is a commitment to consistent effort towards maintaining, enhancing, and leveraging previous successes.

1.2 Organizational profile

Established by the government of British Columbia in 1981, KPU has grown to five campuses located in Richmond, Langley, and Surrey (the Surrey campuses include Civic Plaza in Surrey City Centre, the Surrey "Main" campus in Newton, and the Cloverdale campus, which was formerly referred to as KPU's "Tech" campus). KPU offers bachelor's degrees, associate degrees, diplomas, certificates, and citations in more than 140 programs.

PEOPLE	Sector	o Advanced Education (University)
	Number of Employees	o More than 1,400 faculty and staff
	Number of Students	o More than 20,000 students annually o Approximately 12,000 FTE students annually
SITES	Number of Sites	o Civic Plaza (air-space parcel) o Langley (physical campus) o Richmond (physical campus) o Surrey (physical campus) o Cloverdale [Tech] (physical campus)
OPERATIONS	Energy Management Challenges	o Availability of funding o Shifting enrolment patterns o Increased operating hours o Expansion of buildings o Multiple campuses o Occupational use zoning o Civic Plaza barriers to operational control o Staff capacity
	Core Business Metrics	o Building Floor Area (m^2) o Operating Hours o Student Full Time Equivalents (FTEs)
	Business Year/ Budget Cycle	o April 1 to March 31

1.3 Key Executive and Contact Personnel

The BC Hydro Commercial Energy Manager Program key contacts include:

Alan Davis	President & Vice Chancellor
Lucas Ozols-Mongeau	Manager, Planning & Sustainability, Campus & Community Planning Email: lucas.ozolsmongeau@kpu.ca

1.4 Key Planning Team

Key Planning Team members responsible for energy management and efforts to reduce carbon emissions include:

Brent Elliott	Associate Vice President, Campus & Community Planning
David Stewart	Executive Director, Facilities Services
Iain Hunter	Director, Maintenance & Operations, Facilities Services
Chani Joseph	Director, Planning, Sustainability & Development, Campus & Community Planning
Shawn Cahill	Manager, Maintenance & Capital Renewal, Facilities Services
Dan Brown	Facilities Building and Energy Systems Technical Analyst, Facilities Services
Lucas Ozols-Mongeau	Manager, Planning & Sustainability, Campus & Community Planning
Alicia Gowan	Sustainability Specialist, Campus & Community Planning

1.5 Key Partners

As KPU progresses with energy management and towards its goal of carbon neutrality, the following partners will continue to provide ongoing guidance:

Ron Mastromonaco, BC Hydro Senior Key Account Manager	Provides ongoing support and resources through the Commercial Energy Manager Program
Fortis BC	Provides support and resources to help reduce energy use and emissions
Province of BC	Reporting into and receiving ongoing support and resources
Municipalities of Surrey, Langley City, and Richmond	Ensures alignment with local climate change and sustainability policies

2. Commitment to Energy Management and GHG Emissions Reduction

2.1 Alignment with KPU Policies and Goals

KPU's Vision 2026 outlines its strategic Vision, Mission and Goal statements, describing KPU's path forward and view to the future, acknowledging the evolving local, regional and global context that surround our campuses.

As a core goal, sustainability is an important interconnected theme that spans the Vision 2026 document, and includes a number of broad sustainability goals to pursue:

1) Foster environmental sustainability through our offerings, research and operations; and,
2) Integrate planning to ensure KPU operations are aligned with our resources, thus sustaining quality and institutional health.
3) Ensure financial sustainability for KPU through long-term financial and enrolment planning

Recognising the role institutions have both in terms of globally contributing to climate change and towards taking the proactive steps needed to reduce GHG emissions, KPU signed the Global Universities and Colleges Climate Letter in 2019, committing to achieve carbon neutrality by 2050. Each signatory is responsible for establishing the criteria to achieve net-zero greenhouse gas emissions.

Further, KPU pursues energy management opportunities as a core value incorporated in its business practices, and especially when planning building expansions and renovations, and in daily operations. Just as institutions across the province work to reduce their impact on the natural environment, KPU strives to minimize its environmental impact by reducing consumption of electricity and natural gas. The university developed an Energy Conservation Policy and

Procedure to provide expectations and guidelines to control and reduce energy consumption. KPU is currently undergoing a process of updating and expanding this policy to advance a more holistic approach to sustainability and climate action, including the reduction of GHG emissions.

In sum, KPU's holistic and proactive commitment to energy management and carbon emission reduction aims to:

- Reduce energy consumption and associated greenhouse gas emissions;
- Create a healthy and comfortable learning and work environment;
- Minimize environmental impact and promote environmental sustainability; and,
- Minimize institutional expenditures for utilities.

2.2 Energy Management Targets and Benefits

Energy conservation has been a priority for KPU for over two decades. KPU's ongoing effort to conserve and reduce energy is reflected in the energy savings target established in partnership with BC Hydro of 300,000 kWh for the period of 2024-2025.

Energy management provides the following key benefits:

- Reduces our impact on the environment.
- Awareness and involvement can improve student and KPU community learning opportunities.
- Greater resilience to future price increases.
- Reduces greenhouse gas emissions.
- Reduces energy and maintenance costs.
- Project work creates employment opportunities.
- Projects can modernize buildings, equipment, and systems with newer and more energy efficient technologies. These projects may include co-benefits such as improved accessibility, more comfortable learning and work environments, and healthier campus spaces.
- New lighting technology can improve lighting levels while at the same time reduce energy consumption.
- Actively reducing carbon emissions can foster further research and innovation and support the greater public interest.

2.3 Greenhouse Gas Emissions Reduction Targets and Benefits

In recent years, KPU has been focusing efforts to expand work beyond energy conservation to include reducing GHG emissions through shifting operations to low carbon electrification. As a BC post-secondary institution, KPU is required to meet the requirements of the provincial government's Climate Change Accountability Act (2007) GHG emissions reduction targets, which are as follows:

- By 2030 – 40% below 2007 levels
- By 2040 – 60% below 2007 levels
- By 2050 – 80% below 2007 levels

It is noted that KPU's carbon neutral commitment, as outlined in KPU's Sustainability Framework under its Official Campus Plan, and as a signatory of the Global Universities and Colleges Climate Letter, exceeds the provincial requirements. KPU has therefore prepared an adapted GHG emissions reduction timeline which includes the following further emissions reductions targets:

- By 2025 – 50% below 2007 levels
- By 2030 – 60% below 2007 levels
- By 2035 – 70% below 2007 levels
- By 2040 – 80% below 2007 levels
- By 2045 – 90% below 2007 levels
- By 2050 – 100% below 2007 levels

Reducing GHG emissions provides the following key benefits:

- Directly minimised contributions to climate change and associated societal impacts.
- Awareness and involvement can improve student learning opportunities.
- Less susceptibility to future price increases in carbon tax.
- Builds infrastructure and facilities resilience.
- Support health and wellbeing of the university and surrounding community.
- Project work creates employment.
- Actively reducing carbon emissions can foster further research and innovation and support the greater public interest.
- Maintains KPU's reputation as a leader in sustainability and honours its partnerships and commitments with industry and government.

3. Situational Analysis

3.1 KPU Facilities Profile

From 2007 to 2023, KPU increased its total floor area by 17.8% and decreased greenhouse gas (GHG) emissions by 1% from 2007 levels. When considering all campuses, during this timeframe energy intensity was reduced from 253 ekWh/m^2 in 2007 to 210 ekWh/m^2 in 2023 which is a reduction in energy intensity of 12%; meaning that KPU's buildings are overall more energy efficient in 2023 than they were in 2007.

This energy intensity has decreased since last year, meaning KPU's building stock was slightly more efficient in 2023 than in 2022. Since 2007, improved energy efficiency has been accomplished by more energy efficient construction of new buildings and renovations, as well as updating to more energy efficient equipment and systems through the capital renewal program and energy efficiency upgrade projects.

In the following tables, the Langley Campus is divided into two campus sites, the "Main Site" and the "Horticulture" site due to data collection and operational reasons.

Current Key Metrics – Five Main Campuses

Campus	Year Built	Size (m^2)	Description	2023 Annual Energy Consumption (ekWh)	2023 Energy Intensity (ekWh/m^2)
Civic Plaza	2019	4,392	Air-space parcel including, classrooms, offices, administration	923,024	210
Langley Main Site	1993	17,538	Physical campus, including classrooms, offices, library, brewery, laboratories,	4,030,494	230
Langley Horticulture	1993	3,865	Part of Langley campus, including classroom, office, shop, greenhouses	1,804,585	467
Richmond	1992	34,696	Physical campus, including classrooms, offices, library, design studios, laboratories,	5,926,917	171
Surrey	1990	38,518	Physical campus, including classrooms, offices, library, laboratories, administration	8,791,643	228

Cloverdale (Tech)	2007	18,559	Physical campus, including classrooms, offices, library, shops, administration	3,280,466	177

3.2 Building Energy Performance Index (BEPI)

Understanding and monitoring building energy performance (in units of energy consumption per square meter) is an important tool to identify new energy efficiency project opportunities and issues related to maintaining energy performance. Specifically, building energy performance index (BEPI) data helps highlight the performance of our campuses, which allows KPU to identify the best opportunities for energy efficiency improvements and carbon emissions reductions.

A base year of 2007 was used in the development of BEPI data to coincide with the base year used for the BC Government Climate Change Accountability Act (2007) for carbon emissions reductions.

Energy Intensity - Total equivalent (e)-kWh/m^2 for each campus

Campus	2007	2016	2017	2018	2019	2020	2021	2022	2023
Civic Plaza					106	108	249	200	210
Langley Main	259	233	287	271	260	229	236	254	230
Langley Hort.	437	464	529	451	479	445	455	444	467
Richmond	226	164	196	203	170	152	156	179	171
Surrey	303	216	228	251	254	220	217	246	228
Cloverdale	179	180	196	184	192	178	185	192	177

Energy Intensity - Electrical kWh/m^2 for each campus

Campus	2007	2016	2017	2018	2019	2020	2021	2022	2023
Civic Plaza					106	108	249	200	210
Langley Main	94	107	133	132	131	113	117	119	115
Langley Hort.	86	65	93	76	81	78	80	104	103
Richmond	102	88	92	113	90	72	77	85	90
Surrey	151	129	133	144	135	105	101	117	115
Cloverdale	82	81	85	87	89	78	80	81	78

Energy Intensity – Natural Gas ekWh/m^2 for each campus

Campus	2007	2016	2017	2018	2019	2020	2021	2022	2023
Civic Plaza					0	0	0	0	0
Langley Main	165	126	154	139	129	116	120	135	114
Langley Hort.	351	399	436	374	398	367	375	340	364
Richmond	124	77	104	91	80	80	79	94	81
Surrey	152	87	95	107	119	115	115	129	113
Cloverdale	97	99	111	96	103	100	105	112	99

When evaluating the BEPI data, it is important to consider the following factors:

- Age of buildings and quality of construction
- Upgrades that have been completed to major mechanical systems and lighting
- Special use buildings and programs located on a campus that use higher energy levels to meet program requirements such as a laboratory that requires 100% fresh air
- Operating hours of the campus and any specialized equipment or systems such as greenhouse lighting or laboratory fume hoods

- Campuses that have more energy efficient buildings added such as the Wilson School of Design at Richmond Campus
- Campuses that have expansions to buildings that are more energy efficient such as the Surrey Main Building and Arbutus building
- Construction that requires significant fine tuning to control energy use such as Spruce building at Surrey Campus
- Passive design strategies, such as building orientation, window-to-wall ratios, and thermal performance
- If an energy model was completed for the building(s), and whether this model was used to inform the expected building performance

3.3 Building Related Greenhouse Gas Emissions

A key issue related to energy performance is GHG emissions and this data is also benchmarked along with energy use.

With a focus on building related GHG emissions, the overwhelming majority of KPU's emissions originate from gas-fueled mechanical equipment, particularly the boilers in our heating plants. In 2023, KPU produced 2,383 tCO^2e in total from its buildings (electrical and natural gas).

Carbon Emissions Totals – tCO^2e for each campus

Campus	2007	2016	2017	2018	2019	2020	2021	2022	2023
Civic Plaza					5	5	11	9	10
Langley Main	477	416	509	461	429	386	364	386	380
Langley Hort.	202	279	305	262	279	257	263	239	256
Richmond	704	419	561	497	527	524	516	615	533
Surrey	845	618	60	755	875	837	836	939	827
Cloverdale	358	346	385	337	359	347	364	386	344

Carbon Emissions Intensity – tCO^2e/m^2 for each campus

Campus	2007	2016	2017	2018	2019	2020	2021	2022	2023
Civic Plaza					.001	.001	.003	.002	.002
Langley Main	.032	.024	.029	.026	.024	.022	.020	.021	.022
Langley Hort.	.154	.108	.132	.119	.111	.100	.103	.115	.098
Richmond	.025	.015	.020	.017	.015	.015	.015	.018	.015

Surrey	.031	.017	.018	.021	.023	.022	.022	.024	.021
Cloverdale	.019	.019	.021	.018	.019	.019	.020	.021	.019

Carbon Emissions – Percentage (%) of total campus building emissions

Campus	2007	2016	2017	2018	2019	2020	2021	2022	2023
Civic Plaza					.2	.2	.5	0.3	0.4
Langley Main	18	18	20	19	17	16	16	17	15
Langley Hort.	7	12	12	11	11	10	11	9	10
Richmond	26	18	22	21	21	21	21	23	22
Surrey	31	27	26	31	34	34	34	35	34
Cloverdale	13	15	15	14	14	14	15	14	14

3.4 Opportunities and Challenges

In following KPU's goals of energy management and GHG emissions reduction, it is important to consider the building age, use, and building systems when evaluating the benchmark data and in the identification of potential new energy and emissions directions. Presently, optimization of the existing building envelope is the main priority over infrastructure replacement. With such considerations in mind, a list of energy and emissions opportunities and challenges for each of our five campuses has been generated through discussion with our Planning Team and through community engagement:

LANGLEY MAIN
Profile: Opened in 1993, Langley Main has the second highest energy intensity of all campuses. Most challenges on this campus are difficult to overcome given current available technologies.
Challenges
• Has a research lab which opened in 2012 which uses 100% fresh air ventilation and up to 14 air changes per hour which negatively affects energy consumption • Has a brew lab which opened in 2015 which is similar to an industrial brewery operation which negatively affects energy consumption • Electric car charging stations may need to be added in the future which will increase electrical consumption • KPU Langley has a large central plant with sporadic occupancy and use – scheduling and programming can have the most influence to address this • Piano rooms must be heated and air-conditioned at all times
Opportunities
• Improve electrical energy efficiency include converting existing T8 and T5 lighting to LED • Reduce carbon emissions by fuel switching the heating system from natural gas to electricity • Reduce energy consumption and GHG emissions through the conversion from a high temperature to a low temperature hydronic system – however, very cost prohibitive • Digital Music Technology program may shift need for pianos and therefore room temperature requirements that currently must be achieved 24x7 can be reduced to normal occupancy times for this area

LANGLEY HORTICULTURE

Profile: Opened in 1993, Langley Horticulture has the highest energy intensity of all campuses with only 4% of total floor area. This section of the campus is no longer a part of the Langley Main plant and is therefore now self-supportive for cooling.

Challenges

- Langley Horticulture greenhouses are operated in a "farm-type" manner meaning they are controlled manually to suit operational requirements. This leads system regulation up to the operator and their prioritization of energy reduction.
- Electrification of heating systems is challenging due to limited reserve electrical capacity in the main vault for the site and for BC Hydro's transformer serving the site
- Green team for Langley Horticulture campus no longer exists i.e. no known internal group advocating for energy reduction in operation controls
- The conversion from a high temperature to a low temperature hydronic system is very cost prohibitive – therefore more suitable for new construction
- Funding and capacity limitations to conduct horticulture electrical vault capacity assessment and retrofit

Opportunities

- New Carbon Capture and Storage (CCS) technology opportunity with Fortis BC Beta project which scrubs carbon, captures the flue gas, and consequently reduces the amount of CO2 released into the environment. Potential for significant GHG reductions.
- Transferring heating bill to the horticulture program could raise awareness on energy use and reduction. Audits and energy conservation could be embedded in curriculum.
- Looking into alternative fuels and greenhouse innovations could catalyze a new academic or research program at KPU
- Reduce carbon emissions by fuel switching main heating system from natural gas to electricity
- Improve electrical energy efficiency including converting existing greenhouse lighting to LED
- Reduce carbon emissions by expanding the research lab geothermal system with sufficient capacity to fully heat the research lab
- Natural gas unit heaters in greenhouses could be replaced with electric

RICHMOND
Profile: Richmond's main building opened in 1993 while the Wilson School of Design LEED Gold building opened in 2018. The campus is the most energy efficient campus but produces 22% of carbon emissions for KPU which is the second highest of all campuses.
Challenges
• Some non-mechanical building systems are near the end of life and are in need of replacement but are in competition for renewal dollars • Converting from a high temperature to low temperature hydronic system is cost prohibitive but would enable energy consumption and GHG emissions reductions
Opportunities
• Campus had lowest combined energy intensity for natural gas and electricity compared to all other campuses • Reduce carbon emissions through fuel switching the heating system from natural gas to electricity • Municipal district energy is nearby and expected to be able to serve this campus in the future • The current building controls are from 1992 and in need of modernization – opportunity to focus on occupation controls for air handling units

SURREY

Profile: Surrey's Main, Birch, Arbutus, Fir and Spruce buildings opened in 1990. There have been significant renovations and building expansions from opening to 2020, including the addition of the Cedar building in 1999, the Arbutus expansion in 2008, the Surrey Main expansion in 2009, and the Spruce building replacement in 2018. This campus produces the highest carbon emissions (35%) for KPU and has the highest intensity per square meter of carbon emissions.

Challenges

- As the oldest campus, many of the building systems are end of life and require replacement in the near future.
- The campus offers limited electrical capacity to electrify the building heating systems. Surrey is the largest campus, yet has the smallest eletrical service with a 2500 kVA service compared to the typical 3000 kVA service found on other campuses. The main transformers need to be replaced before any significant low carbon electrication of heating systems can be implemented.
- Reducing energy consumption and GHG emissions for the all buildings at Surrey are possible through the conversion from a high temperature to a low temperature hydronic system, however, this is cost prohibitive.
- Having the main server room for KPU which is a large electrical load and laboratories which use high volumes of conditioned ventilation air as well as fume hoods, mean high energy consumption.
- Additional electric car charging stations may be added in the future, which will increase electrical consumption.

Opportunities

- The blend of old and new buildings allows for a phased approach to decarbonization and electrification.
- A new Child Care Center in the planning stage to be built will increase the overall energy consumption for Surrey Campus, but this presents an opportunity to build an energy efficient building with the opportunity to educate the campus community (e.g. through Living Labs) about energy efficiency.
- Potential opportunity to reduce carbon emissions include fuel switching the heating system from natural gas to electricity. The RTU units on the Cedar building which have natural gas heating and DX cooling present an ideal first project, replacing the RTUs with ASHP techology for heating and cooling.
- With many future development projects proposed for Surrey Campus, it brings opportunities for new building design and construction to consider energy and GHG reductions from the start, as well as the possibility for retrofits of existing buildings.
- Improve electrical energy efficiency by converting existing interior lighting to LED and replacing parking lot lighting with LED

CLOVERDALE
Profile: The Cloverdale ("Tech") Main Campus consists of a LEED Gold building that opened in 2007 and a farrier barn. Cloverdale currently has five electric vehicle charging posts each with two level 1 outlets, with four plugs each.
Challenges
• Has sporadic occupancy of classrooms and offices that are determined based on Trades training, which is inherently energy inefficient • Cloverdale's electrical capacity is in good standing, however, it currently has poor distribution. • The Farrier Programming requires the use of natural gas. Currently, there are no viable alternative fuel sources that would mimic what is needed for teaching and learning purposes.
Opportunities
• Improve electrical energy efficiency by converting existing T8 and T5 lighting to LED • Reduce carbon emissions by fuel switching the heating system from natural gas to electricity

CIVIC PLAZA
Profile: Civic Plaza campus was built in 2019 and is located within a mixed-use building that includes a restaurant, café, hotel, and apartment complex. Along with the five campus floors that KPU owns and utilizes as academic and office spaces, a portion of space on the 9th floor KPU leases to generate revenue. This building utilizes geothermal district heating systems.
Challenges
• KPU does not control all operations and maintenance of the building systems for its five floors in this building. KPU only has minor zone controlling.
Opportunities
• Due to the nature of Civic Plaza's HVAC system, KPU can primarily effect change for energy-use and emissions reductions through advocacy rather than operational changes.

4. Projects and Actions

The following section outlines current energy management, low-carbon electrification, and greenhouse-gas reduction studies and projects. The first section highlights studies KPU has undertaken which will help inform current and future projects. The following sections highlight the projects that are 1) counted for this fiscal year's savings 2) active projects that likely won't be counted towards this fiscal year's savings 3) potential future projects/studies KPU could consider undertaking in future years.

Legend:

LCE: Low carbon electrification

GHG-R: Greenhouse gas reductions

EE: Energy efficiency

CA: Climate adaptation

EER: Electrical energy reductions

4.1 Studies

Study	Campus(es)	Study Type	Start Date	Status
Low-Carbon Emissions	Land-based*	LCE, GHG-R	2022	Completed: March 6, 2024
Comprehensive Building Infrastructure Audit & Assessment	Land-based	LCE, GHG-R, EE	2022	In progress
Transformer Room Temperatures	Langley, Cloverdale, Richmond	CA	2023	In progress
Energy Assessment Including Evaluation of Night-time Energy Use	One campus at a time (ongoing)	GHG-R	2023	In progress
ASHRAE Level Two Audit – Surrey Campus	Surrey	EER	2024	In progress

*Land-based includes KPU's four physical campuses: Surrey, Richmond, Cloverdale, and Langley

Low-Carbon Emissions Study (DIALOG)

A Low-Carbon Emissions Study has been conducted to develop strategic carbon reduction pathways for each campus through a comprehensive assessment, and subsequent recommendation of viable energy management, infrastructure and technology, and possible partnership opportunity pathways unique to each site. The studies explore a full spectrum of options and recommends those that are deemed most viable, informed by smaller sub-studies previously completed or underway currently. Final reports have been created and submitted for all four land-based campuses. These studies have been evaluated and a draft implementation plan has been developed to ensure that carbon emissions reductions achieved by the project work meet the timeline required by BC Government legislation and are coordinated to match the anticipated annual funding that will be available. The Heat Recovery Ventilator project at Richmond Campus that was noted previously in this SEMP is one of the projects identified in these studies.

Comprehensive Building Infrastructure Audit & Assessment (VFA)

KPU has engaged with a provincial partner consulting firm to conduct a "true life cycle" condition assessment of its major mechanical, electrical, and building envelope infrastructure. Currently underway, this detailed study is intended to provide a realistic alignment of all KPU infrastructure replacement timelines so that mechanical, electrical, and building envelope replacement strategic planning is conducted through a proper risk assessment, timeline, and financial lens. This study will help inform the timeline for the replacement of infrastructure and installation of new infrastructure to reduce greenhouse gas emissions and overall energy use.

Transformer Room Temperatures Study (Stantec)

This study aims to evaluate existing mechanical equipment and current cooling systems in the main transformer rooms at Langley, Cloverdale, and Richmond to determine if and where KPU might consider investing in enhanced mechanical cooling (e.g. air conditioning units) to prepare for higher anticipated temperatures due to climate change.

Energy Assessment Including Evaluation of Night-time Energy Use

Overnight energy use has been analyzed to determine if there are energy savings opportunities at KPU-owned campuses. So far, the day and night-time electrical consumption when KPU is closed has been analyzed to determine the night base load and ratio of day-to-night consumption. This information will help inform an RFP for a night energy audit.

ASHRAE Level Two Audit – Surrey Campus

A Request for Quotation (RFQ) was developed to conduct an ASHRAE Level Two audit for Surrey Campus which includes an assessment of the high night electrical consumption that has been previously identified. A competitive process was used for pricing this work. A consultant has been selected and KPU is in the process of issuing a contract for this work.

4.2 Actions for Fiscal Year 2025 Target

KPU has an annual energy savings target of 300,000 kWh for Fiscal Year 2025 (April 1st 2024-March 31st 2025). Based on the known estimated annual energy savings, KPU has the *potential* to save over 236,165 kWh. KPU does not have an annual greenhouse gas reduction target through the BC Hydro Energy Management program, however, KPU has its own set of GHG emissions targets set out in its Sustainability Framework as seen in Section 2.3 above. The following tables on Page 20 highlight which projects contributed to KPU's Fiscal Year 2025 energy savings target.

Electrical Energy Reduction Projects

Project	Campus(es)	Status	Start Date	End Date	Electrical Energy Reductions (Savings)	Natural Gas Reductions (Savings)	GHG Reductions (Savings)
Exterior Lighting Replacement	Land-based	In progress	2022	Fall/ Winter 2025	204,165 kWh		
T8 to LED (hallways and common areas)	Richmond	In progress	Feb. 2024	May 2024	32,000 kWh		
				Totals	236,165 kWh	454 GJ	23.9 tCO2e

Note: All energy and emissions values are annual estimates.

Low Carbon Electrification Projects

Project	Campus(es)	Status	Start Date	End Date	Increase in Electrical Energy	Natural Gas Reductions (Savings)	GHG Reductions (Savings)
Domestic Hot Water Boiler Electrification	Richmond	In progress	2022	~2024			
Rooftop Unit & Air Source Heat Pump	Surrey (Cedar)	In progress	2022	~2024	154,110 kWh	1,766 GJ	86 tCO2e
				Totals	154,110 kWh	1,776 GJ	86 tCO2e

Note: All energy and emissions values are annual estimate

Project Descriptions

Exterior Lighting Replacement (evaluation & retrofit) – All Land-based Campuses

This project involved replacing all exterior building, parking lot, and site lighting with LEDs to increase site lighting levels for safety and reduce energy consumption at all KPU-owned campuses. The total estimated energy savings are 128,303 kWh/yr., based on Surrey and Langley campuses. Estimated savings at Richmond and Cloverdale campuses are negligible or not yet available.

T8 to LED (hallways and common areas) – Richmond Campus

This project involved replacing T8 lighting with LED lighting in hallways and common areas which generally have a longer run time than offices and classrooms. This approach allowed for maximum savings from a limited budget in a short time frame and before the end of this fiscal year. The BC Hydro calculator that was completed for this project indicated it would provide 32,000 kWh in savings.

Domestic Hot Water Boiler Electrification – Richmond Campus

The domestic seasonal hot water boiler at Richmond Campus was converted from natural gas to electric. The new electric domestic hot water boiler will be used year-round, instead of seasonally, to provide all domestic hot water for the Richmond Main campus. The project is expected to be completed by fall 2024.

Rooftop Unit & Air Source Heat Pump – Surrey Campus

The existing Rooftop RTU equipment on the Cedar building is at the end of life and the technology is being changed from natural gas heating with DX cooling to more efficient Air Source Heat Pump (ASHP) technology to increase energy efficiency and to reduce carbon emissions by fuel switching the heating energy from natural gas to electricity. Due to limitations in the available electrical capacity only five of the seven RTU units can be replaced and the other two cannot be replaced until upgrade work to increase the main electrical capacity for the campus is completed.

The project completion has been significantly delayed due to supply chain issues impacting equipment delivery and building permit delay issues.

A CleanBC incentive agreement providing $77,400 in project incentive funding has been approved by BC Hydro. The project will use Energy Star Portfolio Manager (ESPM) for Monitoring and Verification (M&V) of the energy savings and a data exchange permission has been provided to BC Hydro.

4.3 Ongoing Energy Projects

At this time, the following active projects are those that the planning team anticipates will directly achieve BC Hydro's targets for KPU's energy management and greenhouse gas emissions reduction program for *future years'* submissions. See Appendix #1 for a record of completed projects as of December 2023.

Ongoing Electrical Energy Reduction Projects

Project	Campus(es)	Status	Start Date	End Date	Electrical Energy Reductions (Savings)	Natural Gas Reductions (Savings)	GHG Reductions (Savings)
Controls Optimization	Langley	Almost complete	2024	~Nov. 2024	102,600 kWh	454 GJ	23.9 tCO2e
Building Management System Replacement	Richmond	In progress	2023	2025	127,125 kWh	1,112 GJ	55 tCO2e
Building Management System Optimization and Tuning	Surrey	In progress	2024	Jan 2025	Estimated ~142,000 kWh		
Continuous Optimization	Langley	In progress	2024	TBD	TBD	TBD	
Continuous Optimization	Cloverdale	In progress	2024	TBD	TBD	TBD	
				Totals	371,725 kWh	1,112 GJ	55 tCO2e

Note: All energy and emissions values are annual estimates.

Ongoing Low Carbon Electrification Projects

Project	Campus(es)	Status	Start Date	End Date	Increase in Electrical Energy	Natural Gas Reductions (Savings)	GHG Reductions (Savings)
Heat Recovery Ventilator	Richmond	In progress	June 2024	Likely earliest 2026	13,567 kWh	1,040 GJ	
Transformer Replacement	Surrey	In progress	2021	2026			
				Totals	13,567 kWh		

Note: All energy and emissions values are annual estimates.

Project Descriptions

Controls Optimization – Langley Campus

The Building Automation System (BMS) at Langley campus has been evaluated to identify energy savings opportunities that can be achieved by implementing improved programming and optimization on five of the main Air Handling Units (AHU). The improved programming and optimization work have been completed. Monitoring and verification (M&V) work will be completed once several months of data are collected from the next heating season. It is anticipated that the M&V work will be completed, and the energy savings verified in December 2024.

Building Management System Replacement – Richmond Campus

The existing Building Management System (BMS) at Richmond Campus is obsolete and is being replaced. The design work includes replacing the entire existing BMS system and enhancing it by installing additional zone occupancy and CO_2 sensors and optimizing controls strategies where possible and practical. It also includes expanding the system to control some areas of the building with stand-alone controls, such as stairwells and main entrances, and enhancing and optimizing the Atrium ventilation control to increase free cooling in the summer and reduce energy consumption. The project has been tendered, a contractor has been selected, and a contract is in the process of being issued by KPU.

Heat Recovery Ventilator – Richmond Campus

KPU intends to issue a negotiated request for proposal (NRFP) document to identify and select a suitable consultant to evaluate the original main building at Richmond Campus and identify suitable Heat Recovery Ventilation (HRV) equipment and systems to reduce energy consumption and associated carbon emissions. HRVs also enhance air circulation replacing stale indoor air with fresh outdoor air, and reducing air pollutants in the process. The project terms of reference and deliverables for the NRFP to hire a consultant has been completed and is ready to be sent to Procurement.

Transformer Replacement – Surrey Campus

This project will involve completing a design review to replace the existing transformer to facilitate ongoing low carbon electrification at the Surrey Campus. The current transformer cannot facilitate fully the fuel switching of the heating systems from natural gas to electric or accommodate increased electric vehicle charging stations. The proposed size change will be from 2500 kVA to 7000kVA. The project is presently in the design phase and will be a multi-year project. Additionally, a more efficient transformer will require less power to operate leading to lower emissions.

4.4 Future Potential Projects

Looking forward to the next project cycle, Fiscal Year 2026 (April 1st 2025 – March 31st 2026), a number of projects are outlined below that are anticipated to be undertaken to advance KPU's energy and greenhouse gas emissions reduction efforts. To support this, KPU has completed a Carbon Reduction Plan, which identifies a series of emission reduction measures to the year 2032, that will reduce institutional building GHG emissions to align with Provincial climate targets. Although KPU is unlikely to meet the institution's 2025 target of 50% GHG emissions reduction below 2007 levels, largely due to the challenges outlined in Section 3.4 of this report, this new Plan provides a framework to align end of life infrastructure replacement with fuel switching opportunities. Combined with an annual commitment of $5 million dollars from the University to support decarbonization, KPU is well positioned to achieve subsequent reduction targets. For more details, please review Appendix 3 – KPU Carbon Reduction Plan.

The following list primarily consists of recommendations from the Low Carbon Emissions study noted in Section 4.1. These projects have been identified as viable future projects pending funding availability.

Project	Campus(es)	Project Type	Status	Start Date
Overnight Energy Use	Land-based*	EE, GHG-R	Exploratory	2023
Interior Lighting Project – T8 Conversion to LED	Langley, Cloverdale, Richmond	EER	TBD	Pending funding availability
Exterior Glazing	Richmond	EE, GHG-R	Design Complete + Starting Phase 1 Install (Into construction in next 12 months)	
Heating plant – Install electric ASHP for first stage of heating	Surrey, Cloverdale, Langley – Main	LCE, GHG-R	Potential for further investigation	
Retro-commissioning of existing controls	Surrey, Cloverdale, Langley – Main	EE, GHG-R		
Add heat recovery (HRV) to HVAC system	Surrey, Cloverdale, Langley - Main	EE, GHG-R		
Domestic hot water tank replacement	Surrey, Cloverdale	GHG-R		
Header House Heating Plant – Add e-ASHP for hot water generation	Langley - Horticulture	EE, GHG-R		
Replace natural gas heaters with radiant tube electric alternatives	Langley – Horticulture (Header Polyhouse)	GHG-R		

*Land-based includes KPU's four physical campuses: Surrey, Richmond, Cloverdale, and Langley

5. APPENDIX 1 – History of Energy Conservation, Low Carbon Electrification, and Greenhouse Gas Emissions Reductions Projects (to Dec 2023)

Since inception, KPU has been active in advancing change to support sustainability and efficient resource management. The energy management projects implemented have resulted in significant and ongoing cost avoidance for energy expenses and reductions in greenhouse gas emissions.

Description (Record of Improvements)	Project Type	Estimated Savings	Campus	Completion Year
Hort. Garage Heating Conversion	LCE		Langley	2023
Rooftop Chiller Replacement	EE		Langley	2023
Building Management System Optimization	EER	79,000 kWh	Langley	2022
Electrical Vault Capacity Assessment & Retrofit (Horticulture)	LCE		Langley	2022
Domestic Hot Water Boiler	LCE		Richmond	2022
Brew Lab Electrification	LCE		Langley	2022
Interior T8 to LED Lighting Project	EER	178,186 kWh	Surrey	2022
Controls Optimization	EER	188,000 kWh	Surrey	2021
Optimize BMS systems in 2 buildings	EER	1300 GJ and 188,000 kWh; 74.5 tCO2e	Surrey	2021
Greenhouse #6 Lighting	EER		Langley	2021
Halogen to LED (Design Wing)	EER	5720 kWh	Richmond	2015
T8 dual lamp lighting fixtures to T5 high output single lamp fixtures	EER		KPU Tech	2015
Washroom sink area lighting to LED fixtures.	EER		KPU Tech	2015
DDC Controls upgrades (from 1990's) -building controls systems replaced			Langley	2015

Description (Record of Improvements)	Project Type	Estimated Savings	Campus	Completion Year
Conversion of hot water to instantaneous heaters (for remaining of Langley campus)		39,222 kWh 12 tCO2e $5,434	Langley	2015
Replacement of large single Horticulture boiler with 5 smaller condensing boilers			Langley	2014
Converted last portion of Birch and Surrey Main from pneumatic controls to DDC (direct digital control) and removed obsolete air compressors in each building			Surrey	2014

6. APPENDIX 2 – Awards

Award Description	Awarded By	Year
Sustainability Tracking, Assessment & Rating System (STARS), Silver Rating	Association for the Advancement of Sustainability in Higher Education (AASHE)	2024
LEED Gold achieved for the Wilson School of Design at Richmond Campus	Canada Green Building Council (CaGBC)	2018
KPU was one of the winners of Canada's Greenest Employers award	Canada's Greenest Employers	2015
LEED Silver achieved for the Langley West Wing renovation	CaGBC	2014
BC Hydro Power Smart Excellence Award - Leadership Excellence	BC Hydro	2014
LEED Gold achieved for Institute for Sustainable Horticulture Lab (ISH)	CaGBC	2014

Note: Past awards and project descriptions from before 2014 can be found in previous SEMPs.

7. APPENDIX 3 – KPU Carbon Reduction Plan

KPU CARBON REDUCTION PLAN

Facilities Services

September 2024

Table of Contents

Executive Summary

This document outlines Kwantlen Polytechnic University's (KPU's) comprehensive plan to reduce greenhouse gas emissions and align with British Columbia's climate targets. The initiative focuses on transitioning from natural gas to more sustainable energy sources, improving energy efficiency across campuses, and addressing asset lifecycle management. KPU's carbon emissions primarily stem from the use of natural gas for heating, hot water, and other energy needs. The institution's infrastructure, while essential for educational purposes, contributes significantly to its carbon footprint, necessitating urgent action to meet regulatory and environmental standards.

This initiative is integrated into KPU's asset lifecycle replacement plan, ensuring that energy-efficient alternatives are used as aging equipment is replaced. By coordinating these efforts, KPU aims to enhance operational efficiency while simultaneously reducing carbon emissions and maximizing the benefits of each investment. This plan relies on four main drivers to lower carbon emissions:

1. Using Renewable Natural Gas (RNG) for its campuses. This transition will help mitigate the carbon impact of existing natural gas consumption while KPU implements more permanent electrification solutions.
2. Upgrading the electrical infrastructure. This will ensure sufficient capacity for new technologies, including air source heat pumps (ASHPs) and electric boilers.
3. Electrification of heating systems. Replace existing natural gas-fired heating systems with heat pumps and electric boilers.
4. Implementing energy conservation measures alongside equipment upgrades. This includes retro-commissioning building management systems and optimizing ventilation and heating systems to maximize energy efficiency.

The total estimated budget for this carbon reduction initiative is approximately $60 million over the next eight years. This includes both dedicated funding for carbon emissions reductions and funds from the maintenance, modernization, and renewal (MMR) budget.

The anticipated carbon reductions from these initiatives are substantial, projecting a decrease of approximately 2,200 tonnes of CO2 per year by 2032. This aligns KPU with provincial emissions reduction targets and demonstrates the University's commitment to sustainability.

Potential risks associated with the initiative include fluctuating costs of renewable energy sources, the variability of the electrical grid's carbon intensity, and delays in implementation due to design and permitting processes. Additionally, the necessity for ongoing funding and commitment from stakeholders will be critical to the successful execution of this plan.

In summary, KPU is taking a proactive approach to reducing its carbon footprint through strategic investments in energy efficiency and sustainable energy solutions, positioning the institution as a leader in environmental stewardship within the educational sector. Under this plan, KPU will achieve the mandated 2050 reduction targets eighteen years ahead of schedule.

Introduction

This plan has been developed in response to the Government of British Columbia's Climate Change Accountability Act, which mandates carbon emissions reductions for all public institutions. These reductions are based on using 2007 as the baseline year with steady decreases in emissions through to 2050. The Act mandates the following emissions reductions:

- 16% below 2007 levels by 2025
- 40% below 2007 levels by 2030
- 60% below 2007 levels by 2040
- 80% below 2007 levels by 2050

In addition to these targets, KPU has established more aggressive reduction goals of 50% by 2025, 60% by 2030, and 100% by 2050.

In 2020, KPU began researching different pathways through which these targets would be achieved. Since then, several consulting studies have been initiated to understand the source and quantity of KPU's carbon emissions and identify practical approaches to reducing them. These studies were used to develop KPU's carbon reduction plan, which prioritizes energy conservation where practical and then focuses on replacing fossil-fueled infrastructure with equipment that utilizes clean electricity.

Although this plan focuses on reducing carbon emissions at KPU campuses, it is part of a more robust asset replacement plan. Most of the buildings on KPU campuses are at the midpoint in life expectancy and will soon require major infrastructure upgrades. The heating systems, most of which consume carbon-emitting natural gas, will reach their end of life by the early 2030s and will need to be replaced. This coincides with the timing of the carbon reduction targets outlined in the Climate Change Accountability Act. The necessary asset replacements will be tied to the required carbon emission reductions, leading to KPU's buildings having minimal carbon emissions while at the same time having new highly efficient heating systems fueled by clean electricity.

KPU is required to calculate its carbon emissions annually using the Clean Government Reporting Tool (CGRT). Throughout the year, KPU tracks the consumption of various fuel types and applies the carbon emission factors (determined by the Ministry) to each type, resulting in a calculated total tonnage of CO2 emitted. These results are reported to the BC Government's Ministry of Environment and Climate Change Strategy and made public through its website. In 2023, the reported emissions were 9.3% below the 2007 baseline.

This plan will reduce carbon emissions before the BC Government target dates by utilizing a variety of proven technologies but will also leave opportunities to adopt new technologies, such as carbon capture, as they become commercially viable.

Carbon Emissions at KPU

This section outlines the sources of carbon emissions and the corresponding annual tonnage, which were calculated using the CGRT. Using the CGRT data, a comparison chart of carbon emissions for all post-secondary institutions was developed.

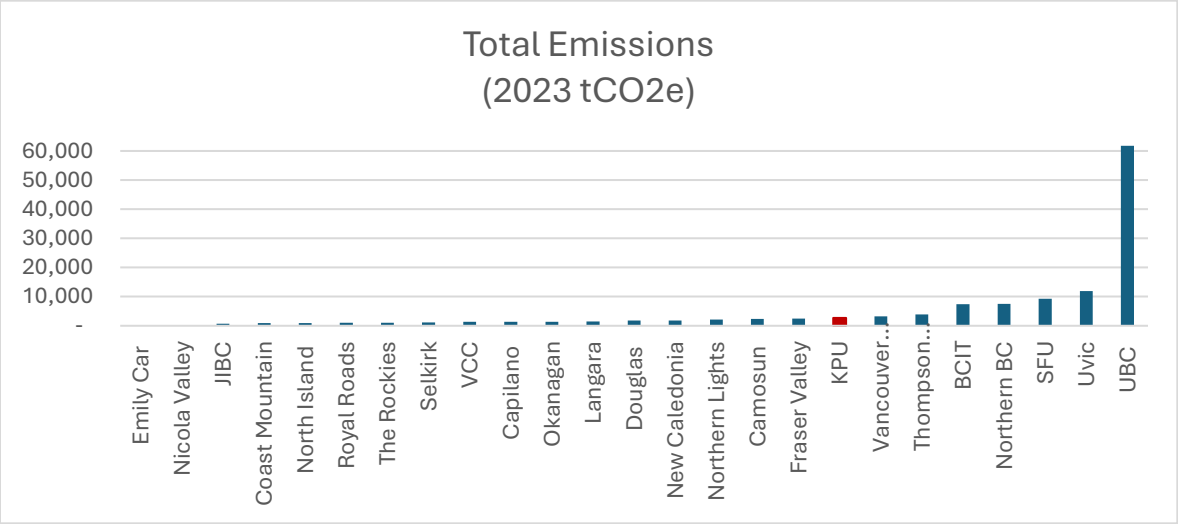
Sources of Carbon at KPU

The following table outlines the sources of carbon emissions at KPU campuses in 2023 and the activities/uses that result in emissions. Natural gas is the greatest source of carbon emissions, which is driven primarily by space heating and the production of domestic hot water.

Source	Typical Uses	Annual CO2 Emissions (tonnes - 2023)	Percentage
Natural Gas	• Space heating • Hot water • Cooking • Programming	2243 tCO_2e	91.24%
Electricity	• Air conditioning • Lighting • IT equipment • Ventilation	140 tCO_2e	5.59%
Gasoline	• Fleet vehicles • Small equipment	37.7 tCO_2e	1.53%
Paper	• Office use • Teaching	37.7 tCO_2e	1.53%

Comparison of PSI's

The following chart displays the total carbon emissions from all post-secondary institutions in British Columbia in 2023.



Analysis & Exploration

Since 2020, a number of studies were initiated to help inform this plan. A variety of external consultants were hired to investigate and evaluate the current internal situation at KPU as well as external factors with respect to carbon emissions.

Internal Studies

A summary of the studies that were performed is as follows:

2020 - Existing Buildings Emissions Analysis (Dialog): This study provides an analysis of HVAC equipment and identifies strategies to reduce carbon emissions for all main campuses.

2021 - GHG Reduction Prefeasibility Study (Stantec): This study's objective was to develop feasible engineering solutions to achieve significant greenhouse gas emissions reductions at Richmond, Cloverdale, and Langley Campuses.

2021 - Greenhouse gas emissions and Geothermal Pre-Feasibility Study (Stantec): The objective of this study was to develop feasible engineering solutions to achieve significant greenhouse gas emissions reductions at Surrey Campus. The potential to expand the geothermal system at the Surrey Campus was also analyzed as part of the study.

2021 - Baseline Study for Electrification of Heating Systems (Stantec): This study analyzes the electrical capacity required to convert heating systems from natural gas to electricity.

2021- District Energy Systems Analysis – Cloverdale Campus (Kerr Wood): This is a high-level strategic planning study for implementing a district energy system.

2021 - Decarbonisation and Low Carbon Electrification Planning (Prism): This study reviews and compares technical options that have been explored and recommends any additional options that should be explored.

2023 - ASHRAE Level Two Energy Audit – Richmond Campus (Stantec): The purpose of this audit is to identify energy savings and GHG emissions reduction measures.

2023 - ASHRAE Level Two Energy Audit - Langley Campus (Stantec): This audit identifies energy savings and GHG emissions reduction measures.

2023 - Electrical Capacity Forecast – All Campuses (Stantec): This study identified the current electrical usage and forecasted needs of each campus in comparison with existing capacity (transformer and BC Hydro supply).

2023 - Low Carbon Feasibility Study – Cloverdale Campus (Dialog): The purpose of this study is to assist KPU in developing a strategy to reduce GHG emissions and meet emissions reduction targets.

2024 - Low Carbon Feasibility Study – Langley Campus (Dialog): The purpose of this study is to assist KPU in developing a strategy to reduce GHG emissions and meet emissions reduction targets.

2024 - Low Carbon Feasibility Study – Richmond Campus (Dialog): The purpose of this study is to assist KPU in developing a strategy to reduce GHG emissions and meet emissions reduction targets.

2024 - Low Carbon Feasibility Study – Surrey Campus (Dialog): The purpose of this study is to assist KPU in developing a strategy to reduce GHG emissions and meet emissions reduction targets.

2024 - EV Charging Infrastructure Study – All Campuses (RAM Consulting): This study identified the electrical infrastructure requirements, equipment, requirements forecast, and location for EV charging stations at each campus

2024 - Asset Condition Assessments – All Campuses (VFA): This study was a comprehensive review of all mechanical equipment at each KPU campus to evaluate current conditions and predict the end of useful life in order to determine when each asset (and system) would need replacement.

The results of these studies revealed that there is a viable and cost-effective pathway for KPU to achieve and exceed the carbon reduction targets mandated by the BC Government. Most of the structures on KPU campuses are now at the midpoint in their life expectancies and will need upgrades to their heating, cooling, and other major systems in order for them to continue to operate. This presents a substantial opportunity to dovetail the carbon reduction requirements with the asset replacement plan, thereby accomplishing both needs simultaneously. There is also an opportunity to significantly reduce overall energy consumption through a variety of conservation efforts, which will result in lower emissions, lower operating costs, and prolonged longevity of the replacement assets.

All of these measures will be a burden to the existing electrical capacity. The current electrical capacity at most campuses is not sufficient to support future growth, electrification, EV charging and other initiatives that tax the electrical supply. For this reason, the electrical capacity at each campus will need to be upgraded to support future demand.

Studies of External Factors

A summary of the studies that were performed is as follows:

2022 – Emerging Sustainable Technologies Study (BES): This study provides a high-level review of emerging sustainable building energy technologies that could be considered for reducing GHG emissions.

2022 – RNG Feasibility Study: This study identifies and evaluates the benefits of using renewable natural gas (RNG) to reduce greenhouse gas emissions.

2023—Preliminary Climate Adaptation Study (Introba): This Preliminary Climate Adaptation Strategy is the first step towards identifying and assessing climate-related hazards and identifying opportunities to enhance resilience incorporated with planned decarbonization actions.

Although the Low Carbon Feasibility Studies identified several viable technologies to reduce carbon emissions with immediate effect, the Emerging Sustainable Technologies Study identified other technologies that could be adopted one day to provide the same or better results. These

technologies are not yet commercially ready; however, this is flexible in that these technologies could be adopted once they become viable.

Renewable Natural Gas is a term used to classify gasses that are produced from the decomposition of organic materials. RNG is deemed to be carbon-neutral by the BC Government with no emissions attributed to its usage. Fortis-BC, the gas supplier for most of British Columbia, plans to add 15% RNG to the natural gas supply by 2030, which will provide emissions savings of 15%, which is 1% from achieving the BC Government 2030 target if we do nothing. There is also the possibility that Fortis may add additional RNG to the natural gas supply in future. Currently, KPU has the option of contracting with Fortis to supply 100% RNG, which would cost approximately $261K annually.

One of the impacts of climate change is increasing temperature. The earth's temperature is expected to continue to increase well beyond 2050. This will result in a reduced number of heating days, which are the days required to heat our spaces and will increase the number of cooling days, which are the days required to cool our spaces. Reducing the amount of heat needed for spaces will result in fewer carbon emissions.

For the purposes of this plan, the effects of RNG on the gas supply and reduced heating requirements from global warming have not been included in the forecasted carbon reductions.

Approach

The following principles were established due to the internal and external studies and were used in developing this plan.

Asset Replacement

The current heating and cooling infrastructure at all KPU campuses will reach end-of-life over the next 8-10 years. This equipment will need to be replaced to mitigate the risk of sudden failure, which would significantly impact the KPU community, including interruption to teaching and learning. The requirement to replace this equipment within this timeline provides an opportunity to methodically install new carbon-neutral equipment in its place.

Energy Conservation

Several studies identified opportunities to reduce energy consumption, both natural gas and electricity. Reducing energy consumption will reduce emissions and operating costs.

Business Continuity

KPU is in the business of providing teaching and learning experiences at the campuses it operates. Shutting down buildings for long periods of time to implement carbon reduction technologies would negatively impact ongoing teaching and learning experiences. Additionally, gas-fired equipment replacement needs to be evaluated against other significantly impactful and disruptive end-of-life infrastructure such as roofs, elevators, and life safety systems.

Operational Viability/Reliability

Heating and cooling infrastructure is critical equipment and vital to positive teaching and learning experiences. Emission-reducing equipment must be reliable and capable of maintaining comfortable space temperatures during regular and peak times.

Funding

Based on the asset replacement timeline of 8-10 years and KPU's ability to implement large retrofit projects, an annual dedicated capital budget of $5.0M was used for developing the plan.

Electrical Capacity

Currently, there is a limited supply of electricity on each campus. The electrical infrastructure and supply will need to be upgraded to support this plan, as well as many other future projects. Upgrading this equipment impacts the timelines and timing of the carbon reduction measures being considered. The availability and capacity of electricity from BC Hydro could constrain the ability to fully implement this plan.

Renewable Natural Gas

KPU will need the gas supply in the foreseeable future, even with the carbon reduction efforts outlined in this plan. Gas will continue to be used in labs, cooking, and ancillary equipment, as well as to fuel redundant/emergency heating equipment. For this reason, RNG is planned as an alternative to natural gas.

Resourcing

The success of this plan will require adequate resourcing and expertise over and above current levels in the Facilities Services and Procurement departments. It is unrealistic to expect the sheer quantity of projects identified in the plan to be executed without additional support. These projects are complicated and would have significant negative impacts on the KPU Community if not properly managed. Each full project cycle from concept to delivery, through consultant/engineer team selection, design development and key partner engagement, general contractor award, and project construction phases, is an enormous commitment by Facilities and Procurement teams.

Equipment Categories

The equipment that is within the scope of this plan has been separated into two categories:

1. Carbon-reducing
2. Supporting infrastructure

Equipment that reduces carbon emissions (Emission Reduction Measures) replaces natural gas-burning assets with various technologies that primarily use electricity to accomplish the same result. The equipment in this category is required to be installed due to the expected end-of-life of the existing legacy equipment.

Supporting infrastructure is equipment that is needed to support electrification of KPU campuses and does not directly result in carbon reductions. Much of the existing equipment is near end-of-life or does not have sufficient capacity.

Emission Reduction Measures

This section outlines specific Emission Reduction Measures (ERMs) aimed at significantly lowering greenhouse gas emissions across KPU campuses. Each measure is strategically designed to align with KPU's sustainability goals and funding utilization.

Use of Renewable Natural Gas at Each Campus

KPU will implement the use of Renewable Natural Gas (RNG) as a transitional energy source across all campuses. RNG is produced from organic waste and has a much lower carbon footprint compared to conventional natural gas. By sourcing RNG, KPU can maintain its existing natural gas infrastructure while reducing emissions during the transition to more sustainable energy sources. This measure supports the gradual phasing out of fossil fuels and helps mitigate the immediate impact of carbon emissions associated with natural gas consumption. RNG will be needed to achieve KPU's carbon reduction goal of 50% by 2025.

Cloverdale Campus

ERM 1 – Retro-CX (2024)

This is a review of the building automation system (BMS) sequences to confirm they align with and achieve the original design intent, ensuring the buildings and equipment operate optimally in relation to energy efficiency and user comfort.

- CO2e Reduction: 9 tonnes per year
- Annual Operating Cost Impact: $8,437 reduction
- ERM Cost: $22,000

ERM 6 – Replace Domestic Hot Water (DHW) Heater (2024)

Replace the existing natural gas domestic hot water tank with an electric hot water tank. This work is timed with the remaining life of this equipment, which will be 14 years old in 2025.

- CO2e Reduction: 25.2 tonnes per year
- Annual Operating Cost Impact: $9,600 increase
- ERM Cost: $100,000

ERM 5 – Dedicated Outdoor Air Supply (DOAS) HRV Replacement (2027)

Replace the existing Dedicated Outdoor Air Supply (DOAS) that utilizes heat recovery technology with higher-performance heat recovery ventilation (HRV) units using improved technology to improve energy efficiency. This work is timed with the capital renewal of this equipment, which will be 27 years old and at the end of life in 2034.

- CO2e Reduction: 46.8 tonnes per year
- Annual Operating Cost Impact: $12,381 reduction
- ERM Cost: $2,974,300

ERM 2 – Main Heating Plant Air Source Heat Pump (ASHP) + Gas Boiler (2029)

Add an ASHP for the first stage of heating and primary cooling for this campus. The work will require replacing the existing chiller, which will be near the end of its life when this measure is implemented with an ASHP. The second stage of heating will use the existing gas boilers fueled by RNG if conditions require them to operate until this measure is implemented. The main electrical capacity will need to be evaluated and upgraded.

- CO2e Reduction: 219.2 tonnes per year
- Annual Operating Cost Impact: $17,506
- ERM Cost: $2,317,700

ERM 3 – Main Heating Plant Air Source Heat Pump (ASHP) + Electric Boiler (2032)

Remove the existing natural gas boilers and install electric boilers to provide the second stage of heating; the ASHP provides the first stage of heating. This work is timed with the capital renewal of this equipment, which will be 30 years old and at the end of life in 2037.

- CO2e Reduction: 286.6 tonnes per year
- Annual Operating Cost Impact: $35,588 increase
- ERM Cost: $2,873,600

Langley Campus (Main)

ERM 1 – Retro-CX (2024)

This is a review of the building automation system (BMS) sequences to confirm they align with and achieve the original design intent, ensuring the buildings and equipment operate optimally in relation to energy efficiency and user comfort.

- CO2e Reduction: 18 tonnes per year
- Annual Operating Cost Impact: $13,820 reduction
- ERM Cost: $45,000

ERM 6 – Heat Recovery Added to Variable Air Volume (VAV) Ventilation System (2025)

Add HRV recovery coils to the existing VAV ventilation system Air Handling Units (AHU) or new dedicated HRV roof-mounted fan systems ducted to serve multiple AHU units. Further evaluation will be needed to determine the most effective approach that provides the best value for this upgrade work. This work is timed with the capital renewal of this equipment, which will be 34 years old and past end of life in 2027.

- CO2e Reduction: 50 tonnes per year
- Annual Operating Cost Impact: $26,733 reduction
- ERM Cost: $1,950,400

ERM 2 – Main Heating Plant Air Source Heat Pump (ASHP) + Gas Boiler (2027)

Add an ASHP as the first stage of heating. The second stage of heating will use the existing gas boilers fueled by RNG if conditions require them to operate until this measure is implemented.

- CO2e Reduction: 248.6 tonnes per year
- Annual Operating Cost Impact: $20,487 increase
- ERM Cost: $3,597,900

ERM 3 – Main Heating Plant Air Source Heat Pump (ASHP) + Electric Boiler (2031)

Remove the existing natural gas boilers and install electric boilers to provide the second stage of heating; the ASHP provides the first stage of heating. This work is timed with the capital renewal of this equipment, which will be 41 years old for the non-condensing boilers and past the end of life and 24 years old for the condensing boiler, which will be near the end of life in 2034.

- CO2e Reduction: 63.1 tonnes per year
- Annual Operating Cost Impact: $23,096 increase
- ERM Cost: $2,841,500

Langley Campus (Horticulture)

ERM 4 – Air Source Heat Pump (ASHP) + Gas Boiler (2032)

Add an ASHP as the first stage of heating. The second stage of heating will use the existing gas boilers fueled by RNG if conditions require them to operate until this measure is implemented. The main electrical capacity must be upgraded before this measure can be implemented.

- CO2e Reduction: 151.1 tonnes per year
- Annual Operating Cost Impact: $12, 247 increase
- ERM Cost: $1,609,300

ERM 5 – Air Source Heat Pump (ASHP) + Electric Boiler (2033)

Remove the existing natural gas boilers and install electric boilers to provide the second stage of heating; the ASHP provides the first stage of heating. This work is timed with the capital renewal of this equipment, which will be 31 years old and past the end of life in 2038.

- CO2e Reduction: 36.1 tonnes per year
- Annual Operating Cost Impact: $13, 202 increase
- ERM Cost: $595,000

Richmond Campus

ERM 4 – Heat Recovery Ventilators (HRV) on 85% of Roof Top Units (RTU) (2024)

Add HRV recovery coils and upgrade the existing Roof Top Units (RTU) that serve the variable air volume ventilation (VAV) system.

- CO2e Reduction: 50 tonnes per year
- Annual Operating Cost Impact: $12,333 reduction
- ERM Cost: $1,000,000

ERM 1 – RTU Heating by Air Source Heat Pump (ASHP) (2026)

Add an ASHP as the first stage of heating. The second stage of heating will use the existing gas boilers fueled by RNG if conditions require them to operate until this measure is implemented.

- CO2e Reduction: 202.1
- Annual Operating Cost Impact: $10,502 increase
- ERM Cost: $3,650,000

ERM 5 – Electric Boiler Heating and Domestic Hot Water (DHW) (2030)

Remove the existing natural gas boilers and install electric boilers to provide the second stage of heating; the ASHP provides the first stage of heating. This work is timed with the capital renewal of this equipment, which will be 40 years old and end of life in 2032.

- CO2e Reduction: 250.2 tonnes per year
- Annual Operating Cost Impact: $89,767
- ERM Cost: $4,518,900

Surrey Campus

ERM 1 – Retro-CX (Surrey) (2024)

This is a review of the building automation system (BMS) sequences to confirm they align with and achieve the original design intent, ensuring the buildings and equipment operate optimally in relation to energy efficiency and user comfort.

- CO2e Reduction: 29.1 tonnes per year
- Annual Operating Cost Impact: $21,194 reduction
- ERM Cost: $45,000

ERM 3 – Main Heating Plant Air Source Heat Pump (ASHP) (2027)

Add an ASHP as the first stage of heating. The second stage of heating will use the existing gas boilers, but they can operate on RNG, if necessary, until this measure is implemented. It will be necessary to evaluate the most practical and beneficial approach and whether to install centralized ASHP units adjacent to the existing boiler room or install them in a distributed manner adjacent to each building.

- CO2e Reduction: 250 tonnes per year
- Annual Operating Cost Impact: $52,438 increase
- ERM Cost: $4,384,400

ERM 4 – Main Heating Plant Air Source Heat Pump (ASHP) + Electric Boiler (2031)

Remove the existing natural gas boilers and install electric boilers to provide the second stage of heating; the ASHP provides the first stage of heating. This work is timed with the capital renewal of this equipment, which will be 41 years old for the non-condensing boilers and past the end of life and 24 years old for the condensing boiler, which will be near the end of life in 2034.

- CO2e Reduction: 162.5 tonnes per year

- Annual Operating Cost Impact: $59,490 increase
- ERM Cost: $902,400

Supporting Infrastructure

Funding from the Ministry of Post-Secondary Education and Future Skills is a critical component in KPU's strategy to maintain and upgrade its infrastructure while aligning with sustainability goals. Funding is provided in various Certificates of Approval (COA), such as the Major Maintenance and Capital Renewal (MMR) program. The MMR program evaluates the replacement of end-of-life equipment and essential upgrades that support energy efficiency and emissions reduction initiatives across all campuses while also ensuring other critical built infrastructure replacement is addressed (e.g. roofs, elevators, major civil systems, life safety).

The MMR budget enables KPU to implement necessary improvements to the existing infrastructure, ensuring that facilities not only meet operational needs but also comply with current environmental standards. By synchronizing supporting infrastructure projects with carbon emissions reduction measures, KPU can achieve significant long-term savings in energy costs and reduce greenhouse gas emissions. Some of these projects, but not all, could be funded within the MMR program.

EV Chargers & Electrification of KPUs Fleet

The installation of EV chargers across all campuses is essential to supporting the transition to electric vehicles (EVs) within KPU's fleet. This measure will facilitate the replacement of existing gasoline or diesel-powered vehicles with electric alternatives.

The EV charger installation will not only reduce greenhouse gas emissions from the fleet but also encourage the use of electric vehicles among staff and students, promoting a culture of sustainability within the KPU community. By investing in this infrastructure, KPU can effectively transition to a cleaner, more sustainable transportation system that complements its broader carbon reduction strategy.

Overall, this initiative emphasizes KPU's commitment to environmental responsibility and aligns with the province's objectives for reducing carbon emissions. The estimated cost to install EV chargers at all campuses is $1,400,000.

Cloverdale Campus

Upgrade Transformer Equipment (2033)

Dialog reports determined in 2024 that there is sufficient electrical capacity to electrify the heating and domestic hot water systems with the current building configurations. However, there is insufficient capacity for additional EV chargers, electrified heating systems, and programs.

- CO2e Reduction: 0
- Annual Operating Cost Impact: 0
- ERM Cost: $4,500,000

Langley Campus (Main)

Upgrade Main Campus Primary Transformer Equipment (2029)

The Dialog reports determined in 2024 that there is sufficient electrical capacity for the electrification of the heating and domestic hot water systems with the current building configurations. However, there is insufficient capacity for additional EV chargers, electrified heating systems, and programs.

- CO2e Reduction: 0
- Annual Operating Cost Impact: 0
- ERM Cost: $4,500,000

Langley Campus (Horticulture)

Upgrade Transformer Equipment (2026)

The Dialog reports indicate the electrical capacity for the Horticulture site is heavily loaded and will need evaluation before any upgrade work is performed. It is anticipated that an electrical capacity evaluation and upgrade will be required before any heating system electrification work can be performed.

- CO2e Reduction: 0
- Annual Operating Cost Impact: 0
- ERM Cost: $1,000,000

ECM 7 – C02 HP Domestic Hot Water (DHW)Heaters (2033)

This project entails replacing the DHW heaters using conventional electrical hot water heaters at the end of useful life. The revised project has an estimated cost of $100,000. In the 2038 replacement year, the cost of natural gas will be roughly the same as electricity due to the carbon tax, resulting in no impact on annual operating cost vs using natural gas.

- CO2e Reduction: 31.8 tonnes per year
- Annual Operating Cost Impact: $0
- ERM Cost: $100,000

Richmond Campus

Replace BMS (2024/25)

This project will replace the existing building automation system (BMS), which is at the end- of-life, with a new enhanced system that will include the following to reduce energy consumption and associated greenhouse gas emissions. The project will include adding additional demand ventilation where possible and practical to optimize ventilation to suit occupant load rather than provide a fixed volume based on maximum occupancy. Adding equipment that currently has standalone control and is not connected to the BMS. Enhancing the lighting controls will increase energy efficiency. The new equipment will also allow improved algorithms to reduce energy consumption and GHG emissions. This project has been tendered for construction, a contractor has been selected, and the project is about to start. Fortis will provide incentive funding on completion.

- CO2e Reduction: 54 tonnes per year
- Annual Operating Cost Impact: $0
- ERM Cost: $2,275,000

Upgrade Main Campus Primary Transformer Equipment (2031)

The Dialog reports determined in 2024 that there is sufficient electrical capacity for the electrification of the heating and domestic hot water systems with the current building configurations, with the exception of ECM 5. However, there is not enough capacity for additional EV chargers, electrified heating systems, and programs.

- CO2e Reduction: 0
- Annual Operating Cost Impact: 0
- ERM Cost: $4,500,000

Surrey Campus

Cedar Building Heating System Replacement (2024)

The first stage of this project is in progress, and it replaces 5 of the 7 Roof Top Units (RTU) that are heated by natural gas to ASHP equipment that uses electricity for heating; this project is already funded, and the values are not included in the cost estimates for this ECM. This ECM is for the second phase of this project to replace the remaining 2 of 7 RTU units with ASHP technology. This project's second phase cannot be implemented until the main electrical vault upgrade and capacity increase are completed.

- CO2e Reduction: 68 tonnes per year
- Annual Operating Cost Impact: $2,344 increase
- ERM Cost: $1,180,690

Cedar Building Heating System Replacement (2025)

The first stage of this project is in progress, and it replaces the remaining 2 of the 7 Roof Top Units (RTU) that are heated by natural gas to ASHP equipment that uses electricity for heating; this project is already funded, and the values are not included in the cost estimates for this ECM. This ECM is for the second phase of this project to replace the remaining 2 of 7 RTU units with ASHP technology. This project's second phase cannot be implemented until the main electrical vault upgrade and capacity increase are completed.

- CO2e Reduction: 60 tonnes per year
- Annual Operating Cost Impact: $5722
- ERM Cost: $1,800,000

Upgrade Main Campus Primary Transformer Equipment (2024/25)

The main electrical system design is being upgraded from 2.5 MW to 7 MW, which is an increase in capacity of 4.5 MW to allow for future changes such as finalizing the electrification of the Cedar heating system, electrification of the main heating system, adding a new daycare building, possibly adding a new student residence building, adding electric car chargers, buildings, etc. BC Hydro's

local infrastructure constraints will limit the initial increase in capacity to 1.1 MW, and the balance of the 4.5 MW requested will follow at a later date, which is unknown at this time.

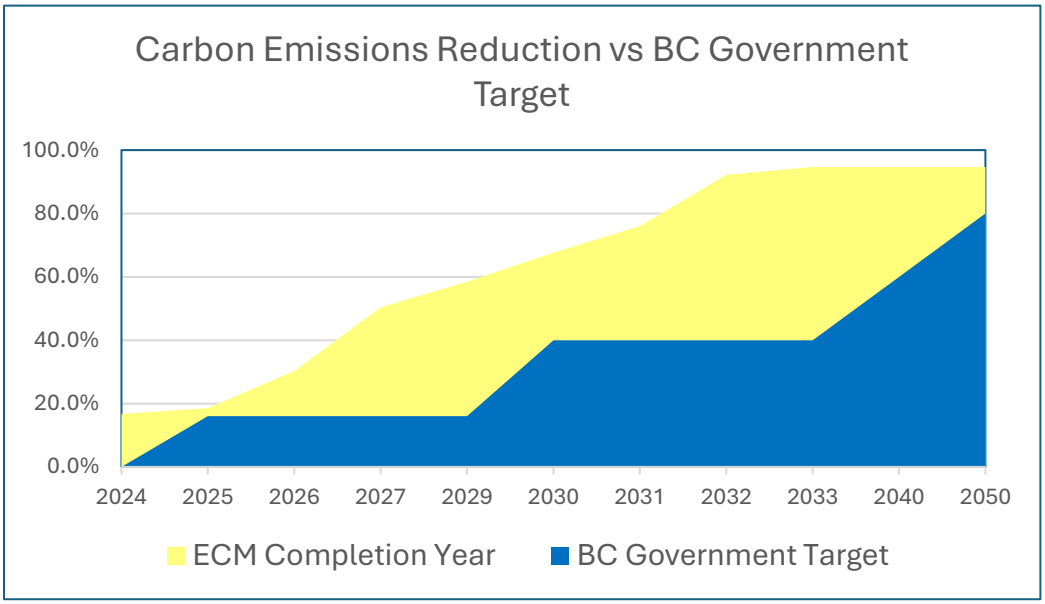
- Estimated Cost: $4,300,000

Carbon Emissions Forecast

The graph below illustrates the yearly incremental reduction in tCO2e values from 2024 to 2050 compared to the BC Government's Target for reductions.

The yellow area of the graph is the work identified in this plan to reduce carbon emissions; the blue area represents the current BC Government emissions reductions targets.

This information is illustrated by year from 2024 until 2050.



An important consideration in interpreting this information and the graph is that the Government changes the emissions factors from time to time, and these changes in emissions factors will impact the calculated value of the greenhouse gas emissions reductions should they change in future.

Another consideration is that the current electrical grid is not green, and the emission factor for electricity varies from year to year, depending on how much electricity the province imports.

It is anticipated that the electrical grid will eventually have no emissions as more hydro and other green power sources are added in the future.

Budget and Cash Flow

Overview

Key factors related to the budget and anticipated cash flow for the project work are summarized below.

- A budget value of $5,000,000 per year is anticipated in addition to the funding provided by the MMR program to reduce carbon emissions,
- The existing MMR budget will be evaluated to replace end-of-life equipment and to provide upgrade work that will support the work to reduce carbon emissions where other significant non-gas-fired infrastructure is not also a risk to KPU,
- The initial cash flow for the new budget was kept lower than the cost estimates to allow for design fees, contingency amounts, and other factors that are not included in the estimates, such as modifications to the buildings to accommodate the revised equipment, taxes, etc.,
- The Class D estimates in the Dialog reports will be plus/minus 20% accurate,
- BC Government "Climate Accountability Act" specifies the target dates and CO2e reductions required, which affects projects selected and associated cash flow,
- Prioritization of ERMs that reduce energy consumption first where possible,
- The Dialog reports did not include the costs of upgrading electrical system capacity. If KPU adds buildings, EV charging stations, etc., in conjunction with electrifying heating systems, additional electrical capacity may be needed, and this has been added to this implementation plan,
- Project costs are estimated in today's dollars with no escalation, and the final costs will vary depending on the year the work is performed.

Cash Flow

The following tables illustrate the anticipated cash flow for project work.

Emissions Reduction Measures

2024	2025	2026	2027	2028	2029	2030	2031	2032
$1,712,000	$1,950,400	$3,650,000	$4,384,400	$3,597,900	$5,292,000	$4,518,900	$3,743,900	$4,482,900

Supporting Infrastructure

2024	2025	2026	2029	2031	2033
$4,180,690	$5,375,000	$2,450,900	$4,500,000	$4,500,000	$4,600,000

The actual cash flow is anticipated to vary and may be impacted when more detailed design work is completed for each ECM.

The cash flow for the ERM projects does not include consulting fees, taxes, contingency funds, or building modifications for project work.

Financial Impact

Overview

The BC government's goal of reducing carbon emissions and the annual increases in the carbon tax to advance this goal will significantly impact the cost of energy and associated carbon emissions for heating at KPU.

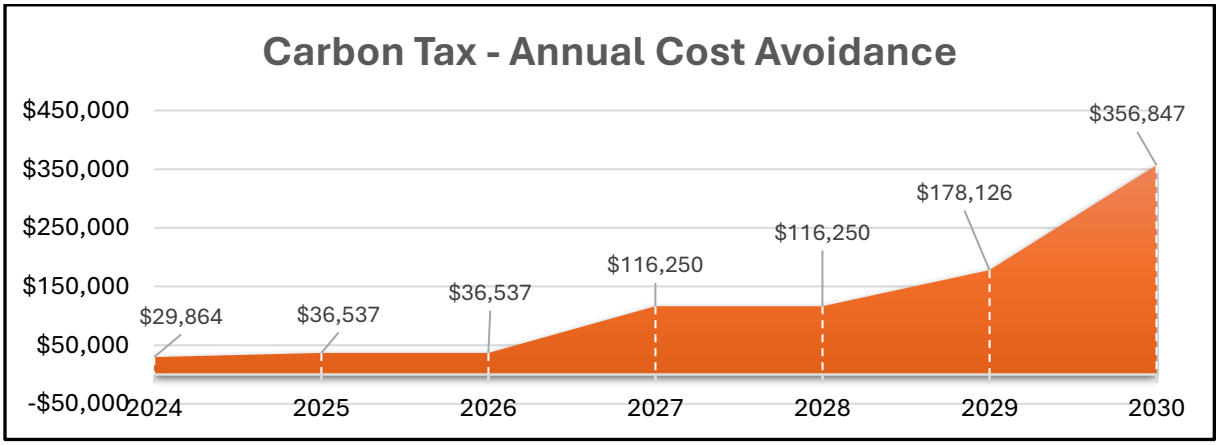
This plan uses a multi-phase approach that first reduces energy consumption and associated energy costs and then electrifies heating systems. There are several issues to consider related to the financial impact in relation to this plan:

- The work performed to increase energy efficiency,
- The escalation of the carbon tax, which will increase annually,
- Natural gas cost reductions due to the electrification of heating systems,
- Electricity costs increase due to the electrification of heating systems,

The expense related to writing-off existing assets (assuming there will still be book value) and the annual depreciation expense from adding new assets has not been accounted for in this analysis.

Carbon Tax

On April 1, 2024, B.C.'s carbon tax rate rose from $65 in 2023 to $80 per tCO_2e for 2024 and will increase by $15 dollar per tonne increments to $170 per tonne in 2030. The graph below shows the increasing amount of the carbon tax that will be payable per year if we do not electrify the heating systems and continue to use natural gas.

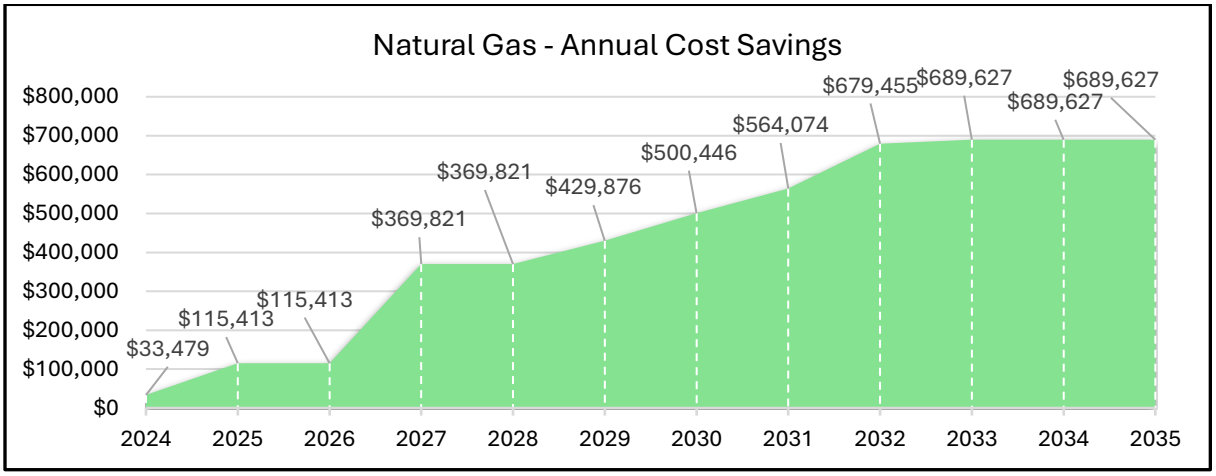


If we do nothing to perform the work indicated in this plan to switch heating fuel from natural gas to electricity, the carbon tax will increase to $356,847 per year in 2030 due to continued carbon emissions from using natural gas.

Natural Gas Savings

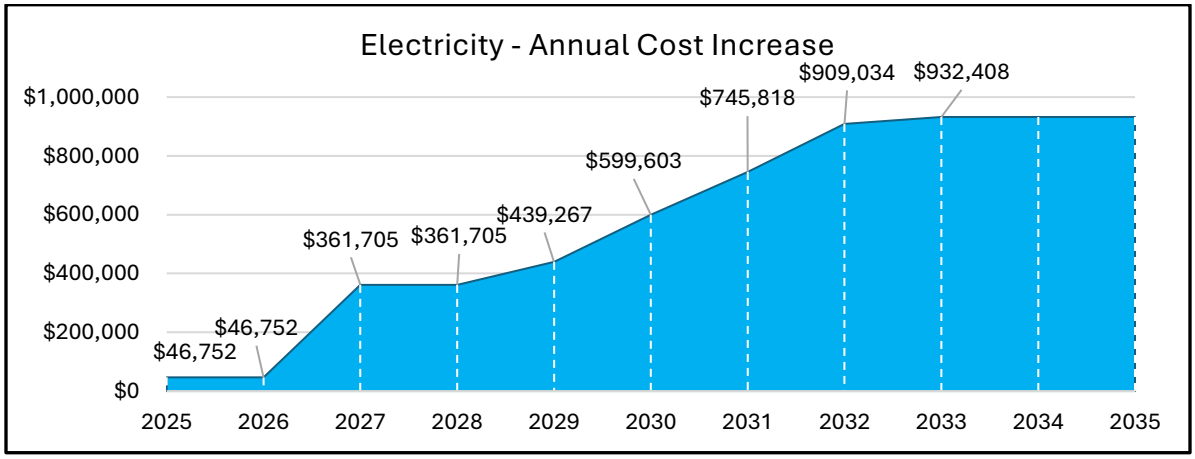
Electrification of heating systems by fuel switching from natural gas to electricity will reduce natural gas costs. It will also provide cost avoidance on future carbon tax costs, which would be an added cost of continuing to use natural gas. This graph represents current market conditions. The liquified natural gas (LNG) plant in Kitimat, BC is now in the testing phases and could see up to 2,000,000 gigajoules per day of natural gas being taken out of the domestic supply once fully operational, which could result in significant price increases.

The graph below illustrates the cost savings associated with this plan to reduce carbon emissions based on the current market rates.



Electrical Cost Increase

Electrification of heating systems by fuel switching from natural gas to electricity will increase electricity costs as heating will be provided by electricity instead of natural gas.



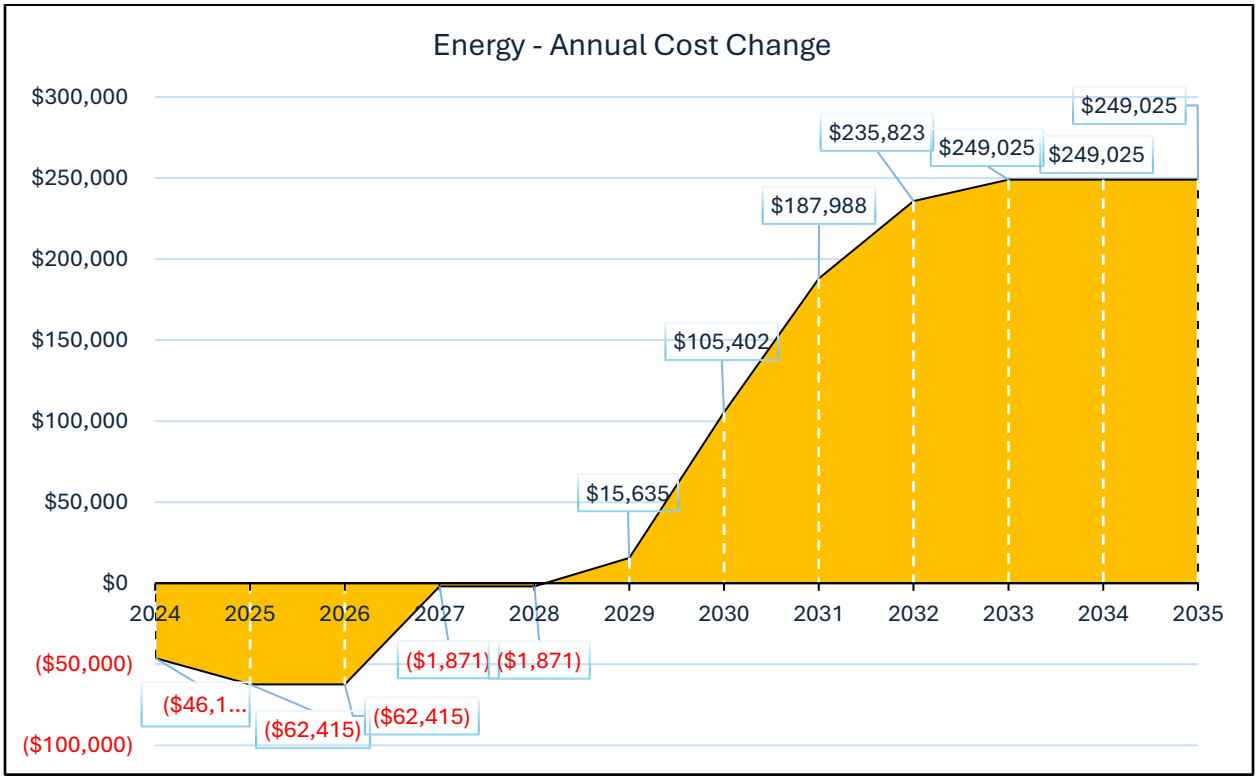
Annual Energy Cost Change Summary

There are several factors to consider related to the annual cost of heating when fuel switching from natural gas to electricity.

- RNG will be needed to achieve KPU's carbon reduction goal of 50% by 2025,
- Natural gas costs will be reduced, notwithstanding unknown supply and demand cost impacts from LNG
- Electricity costs will increase,
- Carbon tax costs on natural gas will be avoided.

The graph below illustrates the impact of work to increase energy efficiency at the start of the plan implementation with a reduction in annual costs up to the year 2029 when electrification of the heating system equipment begins.

As the heating systems switch from natural gas to electricity, the costs of energy will increase as electricity costs more per unit of heating energy than natural gas.



The cost of having 50% of the natural gas as RNG to achieve KPU's 2025 goal is estimated to be an additional $130,500 per year, which is not included in the graph above's annual cost changes.

Implementation Funding

This implementation plan is funded from two separate budget sources to accelerate the reduction in carbon emissions. The first source is dedicated Emissions Reduction Measures (ERM) funding, and the second source is a portion of the MMR budget funding and any other COA's that are issued to KPU for this plan.

The ERM funding will focus directly on projects to reduce carbon emissions, and the MMR budget funding will be prioritized for supporting infrastructure that facilitates the carbon emissions reduction projects, such as electrical infrastructure upgrades. The work identified in both budgets is synchronized with the replacement of end-of-life equipment where possible and practical.

The projects that will be funded from each budget stream are summarized in the two sections below.

Emissions Reduction Measures Funding

The average annual estimated budget value for construction costs from 2024 to 2033 is $3,648,044 per year; design costs, contingencies, permits, and taxes are not included. Many projects are anticipated to be multi-year, so the cash flow rate per year will be able to be increased closer to $5,000,000 once project work is started and other costs, such as design fees, are determined.

The annual expenditures are anticipated to vary from year to year due to the complexity of the work, possible supply chain issues, and the overall time frame for designing, tendering, and performing the work.

The proposed projects, estimated project costs, and annual total estimated costs are in the table below.

Campus	ERM #	Project Name	Tonnes CO2e	Estimated Cost
2024				
Surrey	ERM 1	Retro-CX	29	$45,000
Langley	ERM 1	Retro-CX	18	$45,000
Cloverdale	ERM 1	Retro-CX	9	$22,000
Richmond	ERM 4	HRV on 85% of RTU (all except 2/5)	50	$1,000,000
Cloverdale	ERM 6	Electric Hot Water Heater	25	$100,000
				$ 1,712,000
2025				
Langley	ERM 6	HRV Added to VAV	50	$1,950,400
				$1,950,400

2026

Richmond	ERM 1	RTU Heating by ASHP (heating coils)	202	$3,650,000
				$3,650,000

2027

Surrey	ERM 3	Main Heating Plant ASHP	250	$4,384,400
				$4,384,400

2028

Langley	ERM 2	ASHP +Gas Boiler (Main)	249	$3,597,900
				$3,597,900

2029

Cloverdale	ERM 5	HRV Added to DOAS (RTU units)	47	$2,974,300
Cloverdale	ERCM 2	ASHP +Gas Boiler	219	$2,317,700
				$5,292,000

2030

Richmond	ERM 5	Electric Boiler Heating & DHW	251	$4,518,900
				$4,518,900

2031

Surrey	ERM 4	Main Heating Plant ASHP +Electric Boiler	163	$902,400
Langley	ERM 3	ASHP +Electric Boiler (Main)	63	$2,841,500
				$3,743,900

2032

Cloverdale	ERM 3	ASHP +Electric Boiler	287	$2,873,600
Langley	ERM 4	ASHP +Gas Boiler (Horticulture)	151	$1,609,300
				$4,482,900

2038

Langley	ERM 5	ASHP +Electric Boiler (Horticulture)	36	$595,500
				$595,500

Supporting Infrastructure Funding

The annual expenditures are anticipated to vary from year to year due to the complexity of the work, possible supply chain issues, and the overall time frame for designing, tendering, and performing the work.

The proposed projects, estimated project costs, and annual total estimated costs are outlined in the table below.

Campus	ECM #	Project Name	Estimated Cost
2024			
Surrey		Cedar RTU Replacement (5/7)	$1,180,000
Surrey		Transformer Upgrade (Start)	$2,000,000
Richmond		BMS Replacement Project Starts	$1,000,000
			$4,180,000
2025			
Surrey		Transformer Upgrade (Completion)	$2,300,000
Surrey		Cedar RTU Replacement (2/7) (remainder)	$1,800,000
Richmond		BMS Replacement Project Completion	$1,275,000
			$5,375,000
2026			
All Campuses		EV Charger Infrastructure	$1,400,000
Langley		Upgrade Transformer Equipment (Hort)	$1,000,000
Langley	ECM 9	Polyhouse Electric Heat (Hort)	$50,900
			$2,450,900
2029			
Langley		Upgrade Main transformer equipment	$4,500,000
			$4,500,000
2031			
Richmond		Upgrade transformer equipment	$4,500,000
			$4,500,000

2033

Cloverdale		Upgrade transformer equipment	$4,500,000
Langley	ECM 7	Electric Hot Water Tank	$100,000
			$4,600,000

Conclusion

KPU's carbon reduction plan is driven by four main goals: using Renewable Natural Gas (RNG), upgrading electrical infrastructure, electrifying heating systems, and implementing energy conservation measures. These goals are designed to transition the university away from fossil fuels and towards more sustainable energy solutions, reducing greenhouse gas emissions and ensuring compliance with British Columbia's climate targets.

The plan includes a range of energy conservation measures, such as retro-commissioning building automation systems, optimizing ventilation and heating systems, adding heat recovery systems to reuse waste heat, and switching heating systems from natural gas to electricity. It is also integrated into KPU's asset lifecycle replacement plan, ensuring that energy-efficient alternatives are used as aging equipment is replaced.

With a budget of approximately $60 million over eight years, KPU's plan is expected to reduce carbon emissions by about 2,300 tonnes of CO2e annually by 2032. By achieving these reductions, KPU will meet its carbon reduction targets well ahead of schedule.