Vancouver School District

STRATEGIC ENERGY MANAGEMENT PLAN

Pathways to 2030 - and beyond

Update 2023/24

with the support of:

BC Hydro Power smart

A VSB SUSTAINABILITY RESOURCE

Vancouver School Board

Strategic Energy Management Plan (SEMP)

Update 2023/24

"Pathways to 2030 … and beyond"

VSB

With the support of:

BC Hydro
Power smart

January 16, 2024

Summary

Energy management has been a part of VSB operations and capital planning for many years. This has historically been focused to reduce energy costs. More recently, and more urgently has been the requirement for energy management to address climate change by reducing carbon emissions from facilities.

This document presents a Strategic Energy Management Plan (SEMP) as a guidance document for conservation and electrification activities. It identifies current (one-year time frame funded projects), short term (rolling three-year) and long term (to 2030 and beyond) opportunities for conservation and climate action. In the current year, projects are identified to achieve over 300,000 kWh of energy savings and over 100,000 kWh of added load from electrification.

This plan is driven around two key climate action objectives. These are:

> Objective 1: Achieve reductions in building related carbon emissions of 50% from 2010 levels by 2030. This target is set by the Province for all public sector organizations (PSO).
>
> Objective 2: Prepare new and current building systems for a future of low-carbon, and zero-carbon heating systems.

This energy strategy has six key action areas:

Action 1:	Lighting upgrades
Action 2:	Heating Plant Upgrades
Action 3:	Building System Upgrades and Replacement
Action 4:	Continuous Optimization of Buildings
Action 5:	Low-Carbon Implementation into the Seismic Mitigation Program
Action 6:	Electric Vehicle Opportunities

Three scenarios of level-of-effort implementation were created – these bound the range of activity from low (doing best efforts with current levels of capital funding and policies), a middle level of resources and high effort scenario (where all projects include substantial incremental resources for carbon reduction).

The implementation timeline of these scenarios are based on i) the capital plan priorities as a guide for seismic renewal and ii) the current suite of minor capital programs accessible to the District. Recent project results are used as a guide to the levels of carbon reductions possible. Each of the scenarios results in a different level of carbon emission reduction – ranging from a 22% reduction (lowest effort scenario) to a 42% reduction (highest effort scenario) by 2035.

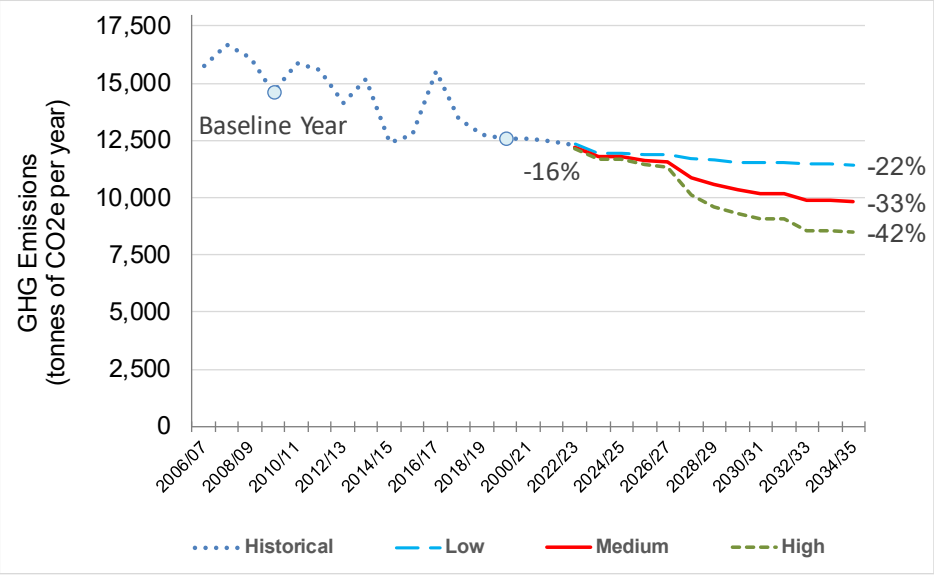
Capital investment requirements for these scenarios range from $38 to $98 million over the period 2023 to 2035. At present, funding has been identified for only a small fraction of this requirement. Further reductions beyond 2035 have been identified which require similar levels of capital investment.

Key summary results are shown in Table S-1 and a trajectory of carbon emission reductions is provided in Figure S-1.

Table S-1: Impact of Energy/Carbon Plan Implementation at 2035

		Level of Effort and Resources		
Item	**Units**	**Low**	**Medium**	**High**
Baseline Building Carbon Emissions	tonnes CO2/yr	15,120	15,120	15,120
Carbon reduction (tonnes)	tonnes / yr	(3,200)	(4,800)	(6,100)
…change from baseline	(%)	(22%)	(33%)	(42%)
Electricity Consumption change	kWh/yr	2,400,000	4,200,000	5,600,000
Net Change to total Utility, Offset, CoV Carbon Levy Costs	$ / yr	1,130,000	500,000	200,000
Total Capital Requirements 2020 – 2035	$	26,000,000	51,000,000	98,000,000

Figure S-1: VSB Building - Related Carbon Emissions by Scenario



Acknowledgements

The District is engaged with BC Hydro in their Energy Manager program for the K-12 educational sector. The Energy Manager program provides financial and technical support to energy managers across many sectors. A component of this partnership is the development of this Strategic Energy Management Plan (SEMP). This plan was developed by Vancouver School Board staff with the support of the Energy Manager Program of BC Hydro.

Management Concurrence

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Contents

Acronyms and Abbreviations

BEPI	"Building Energy Performance Index". A measure of the energy used by a building - on a "per floor area" basis (typically kWh/ft^2). BEPI is a common energy metric used in building operations and can include all energy use – heating, lighting, systems, and plug loads, or can be analyzed for one component, or one fuel only.
CNCP	Carbon Neutral Capital Program. A grant fund available to school districts. It currently dispenses about $5 million per year across the province for projects that reduce carbon emissions and improve energy efficiency.
C.Op.	"Continuous Optimization" - a program of BC Hydro to improve the energy efficiency of existing buildings through a review of operating issues. Commonly thought of as a 'tune-up' for buildings. BC Hydro provides 50% cost share funding for many of the activities of the program.
ekWh	equivalent kWh. The energy use converted into kWh for a common presentation as in a BEPI value. One GJ of natural gas consumption converts to 278 ekWh.
DDC	Direct Digital Control: A computerized control system for a building.
GJ	"Giga Joule" – literally, a billion joules. A measure of energy – most often used with natural gas or other heating fuels. A GJ is about the energy contained in a tank of gas for a passenger car.
kW	kilowatt (thousands of Watts) a measure of how fast energy is consumed (not how much). A kilowatt is *approximately* the power used by a counter-top kettle or a microwave oven
kWh	kilo watt-hour. "thousands" of watt-hours. A measure of energy consumed - but not how fast it is consumed.
LEED	Leadership in Energy and Environmental Design. A rating system of the design and construction of buildings.
NCP	New Construction Program. A BC Hydro incentive program to encourage the construction of high efficiency buildings.
PSO	Public Sector Organization
PSPX	Power Smart Express. A program of BC Hydro whereby incentives can be provided swiftly for direct change outs of equipment for more efficient equipment.
Power Smart	A program of BC Hydro to encourage energy conservation through education and incentives.
SEMP	Strategic Energy Management Plan. This document.
SMP	Seismic Mitigation Program
VBE	Vancouver Board of Education, Also School District #39, or VSB.
VSB	Vancouver School Board, Also School District #39 or VBE
W	Watt (W) - a measure of the rate of energy consumption.

1 Introduction

The Vancouver School Board (VSB) is the second largest school district in British Columbia, encompassing 116 sites, 50,913 students, and approximately 8,000 full-time and part-time employees. The District is committed to continuously improving the energy efficiency and environmental performance of its operations and activities – and has had an active energy management program for over a decade.

This document presents an energy strategy for the district that includes:

- Identification of current year conservation projects,
- a rolling three-year project list, and
- a pathway showing the opportunities to achieve longer term reductions in carbon emissions over the next 10-15 years.

Annual updates to this document will increment these annual and rolling lists and track progress of the District's carbon footprint reduction measures.

Purpose

The objectives of the strategic energy management plan (SEMP) are to:

- Define a multi-year strategy for managing energy consumption, managing costs, and reducing carbon emissions through an active energy management program, and
- Define and maintain a rolling action plan list to identify and execute actions over many years.

Energy Management Objectives

Energy management activities aim to achieve a number of objectives. These include to:

- Minimize annual energy, carbon tax, and carbon offset purchase costs,
- Reduce greenhouse gas (GHG) emissions,
- Optimize up-front capital costs for new and retrofit facilities,
- Minimize long term maintenance and operational staff burden and cost of (energy related) operations,
- Prepare VSB facilities for anticipated needs and impacts of climate change.

The objectives do not always align easily, and energy management activities must strive to achieve the best balance of benefits while remaining flexible in order to adapt to future opportunities and conditions.

2 Context for Energy Management

Energy management and climate change action are supported by several policy and plan commitments.

Policy directives that support energy management include:

- Education Plan 2026: The Board's 2026 Education Plan supports resource and energy management – primarily through the last point in Goal #2: "The Vancouver School Board will increase equity by improving stewardship of the district's resources by focusing on effectiveness, efficiency, and sustainability."

- VSB Environmental Sustainability Plan: The VSB Environmental Sustainability Plan (approved May 2018) includes actions to reduce resource consumption, water use, and waste generation, and to reduce carbon emissions and prepare for the impact of climate change.

- Carbon Neutral Public Sector: The Provincial government has directed all public sector organizations (PSOs) to be "carbon neutral" through the purchase of carbon offsets from the Ministry of the Environment.

- CleanBC Plan: The BC Government's Clean BC plan specifies that public sector organizations (PSO) will reduce the carbon emissions from their buildings by 50% by the year 2030 (from their 2010 level).

Business drivers that support energy management include:

- Leverage Capital Spending: The seismic mitigation program (SMP) is a once-in-a-generation opportunity for the District to leverage capital funding provided for seismic safety. Where possible, opportunities to reduce carbon emissions, energy use, and prepare the district for the changing climate are assessed and evaluated for feasibility.

- Instructional Comfort: A co-benefit of energy management is that properly tuned and functioning heating and lighting systems provide higher functioning buildings, which leads to improved occupant comfort, reduced occupant complaints, and a better learning environment.

- Cost Management: Energy Management is key to energy conservation - reducing energy waste and utility costs, while providing resiliency against energy price fluctuations.

- Infrastructure and asset management: Energy management is aligned with good infrastructure management practices.

3 Organizational Profile

Facility Profile

The VSB operates a large "fleet" of schools as well as associated support facilities. A summary of key annual operating statistics is shown in Table 1.

Table 1: Operating Statistics for the VSB

	Item	Total	Units
People (2023/24)	Secondary Students	21,638	students
	Elementary Students	29,275	students
	Employees (FT and PT)	~ 8,000	employees
Facilities (2023/24)	Secondary Schools (number)	18	buildings
	Secondary Schools (area)	344,700	square meters
	Elementary Schools (number)	89	buildings
	Elementary Schools (area)	362,150	square meters
	Other facilities and sites	9	buildings
	Other facilities and sites	35,650	square meters
Budget (2023/24)	Total District operating	$ 605	$ million
	Operations and Maintenance	$ 76	$ million
	AFG Capital Allocation	$ 13	$ million
	SEP Capital Allocation	$ 1.5	$ million
	CNCP Capital Allocation	$ 0.6	$ million
Energy Use (July 2022 – June 2023)	Electricity Consumption	27,880,000	kWh
	Electricity expenditure	$ 3.2	$ million
	Natural Gas Consumption	307,600	GJ
	Natural Gas spending	$ 4.5	$ million

Past Energy Management

The District has implemented many energy management activities since at least 2005. In 2009 the District joined BC Hydro's Energy Manager program and began a program of upgrading lighting systems through-out the District. In 2013, the District established a multi-year energy management strategy. For the 2023 year, the energy management program has centered around annual project planning and one-year target setting.

A summary of the projects implemented from 2013 onward is shown in Table 2 and detailed in Appendix C. Combined, these projects result in savings (or avoided increases) of $966,000 annually.

Table 2: Recent Electricity and Natural Gas Conservation Projects

Year	**Electricity** Conservation Projects		**Natural Gas** Conservation Projects	
	Project Locations (number)	Total Electricity Savings kWh	Project Locations (number)	Total Natural Gas Savings GJ
2013/14	14	683,000	2	1,400
2014/15	8	495,000	8	1,470
2015/16	7	536,000	15	0
2016/17	18	662,000	2	4,500
2017/18	13	1,302,000	2	9,500
2018/19	7	587,000	1	1,175
2019/20	14	709,000	4	6,880
2020/21	6	455,000	5	3,300
2021/22	5	341,000	2	1,200
2022/23	10	325,000	9	4,500
Totals	**102**	**6,095,000**	**51**	**33,925**
Approximate annual savings		**$ 676,000**		**$ 290,000**

Notes:

1) The number of site locations may include the same site repeated in different years as some facilities were upgraded in multiple phases.

Current Building Performance

A commonly used measure of building energy efficiency is *the "energy use intensity*". This metric is the "*energy use per square meter of floor area*". This metric is an industry standard for comparing energy performance. Frequently it is called an "energy use index" (EUI) or a "Building Energy Performance Index" (BEPI). The units used here are "equivalent kilowatt-hours" (ekWh). Electricity is measured in kilowatt-hours, and natural gas in giga-joules (GJ). The GJ of natural gas can be converted to equivalent kWh to show the total energy use.

Impacts of COVID-19

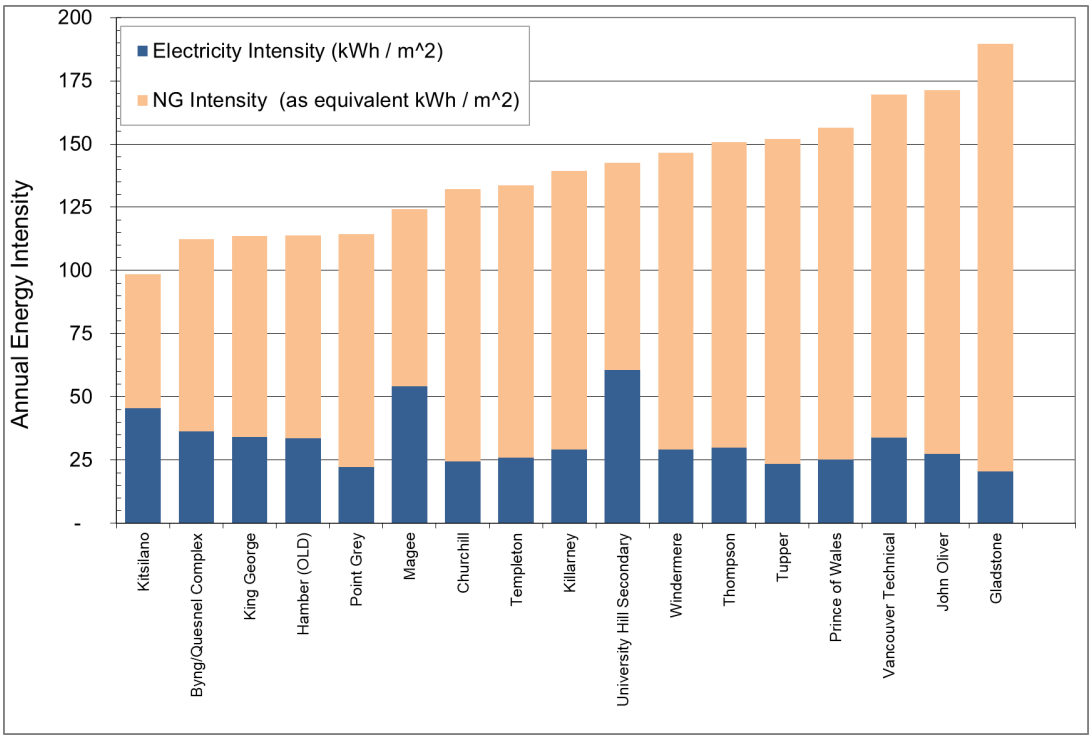
In 2020, District-wide changes were implemented to strengthen COVID-19 safety measures and mitigate the spread of COVID-19 within school-based facilities. Such measures included increasing ventilation rates and outdoor air supply, retrofitting existing ventilation equipment with MERV-13 filters and ensuring exterior windows were accessible and operable. This has resulted in total district heating and ventilation energy consumption to increase between 15-20% from 2019 levels. Currently, some of these measures will continue to be maintained.

Secondary Schools

The District operates 18 secondary schools, averaging about 19,000 m^2 each (about 200,000 square feet). Total energy use intensities (BEPI values) range from ~110 to 200 ekWh / m^2 (see

Figure 1) – not including the Britannia sites, which are part of a larger community center complex.

Figure 1: Energy Consumption Intensity: Secondary Schools (2022/2023)



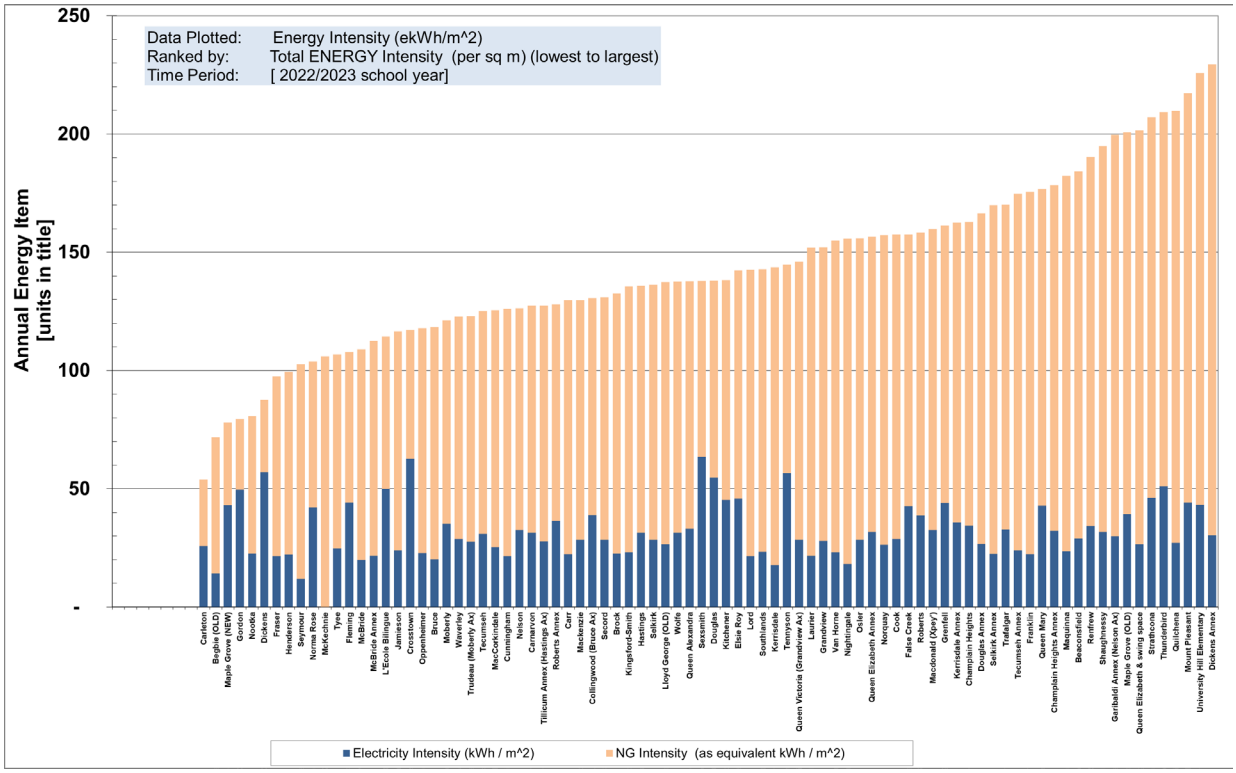
Notes:

1) Natural Gas Consumption for Britannia Secondary & Elementary complex is not known reliably due to insufficient sub-metering within the Britannia School and Community center complex. Data monitoring upgrades in progress.

Elementary Schools

The District operates 89 elementary schools and annexes, averaging about 4,300 square meters each (about 46,000 square feet). BEPI values range from 100 to 250 ekWh/m^2 (Figure 2). Note that this is for the total of both electricity and natural gas.

Figure 2: Energy Consumption Intensity: Elementary Schools (2022/2023)



Notes:

1) Sites showing zero energy consumption are undergoing seismic upgrades e.g. Cavell, Bayview, Livingstone, Weir, David Lloyd George, wə́k̓ʷaṉəs tə syaqʷəm, Hudson

2) Electricity consumption data for McKechnie is currently not available due to electrical system upgrades

4 Going Forward: To 2030 and beyond

Energy management has historically been about managing costs – both capital spending on equipment, and operating utility and maintenance costs. The current environment for energy management strategies requires continued action on costs, but also must include carbon emissions reduction, create facilities to be resilient to energy system disruption, and be capable of addressing future climate change impacts. This section describes a '*pathway'* for energy management over the next decade at the VSB.

Getting to 2030

Scientific research of the impact of climate change, Federal and Provincial policy, and the general public's understanding of the impacts of global climate change are driving all sectors of society to eventually function at low-carbon or zero-carbon emission levels. The current benchmarks (e.g. Federal climate change targets) defined to achieve a reasonably stabilized climate indicate that:

- over the next decade, global carbon emissions must decrease by about 50%, and
- further reductions to near zero are required by 2050.

Beyond 2030

Moving from 2030 onward to 2050 requires that all installations and upgrades be suitable for a zero-carbon future beyond 2030. As buildings are long-life infrastructure, the systems we put in place today must be made ready for the future.

Actions taken today must avoid 'locking in' carbon-intensive technologies and systems – but also maintain the flexibility to adapt to evolving technologies available to the District in the future.

Finding a Pathway to Low-Carbon & No-Carbon Buildings

There are several 'pathways' to a low carbon future – depending on the specific site, the systems in place, the age of the facility, and whether the site is on the seismic risk mitigation program.

Traditional heating systems use natural gas boilers to make either steam or 'high temperature' water (typically ~85 deg C) which is circulated through the building to provide heating (see Figure 3). The steam or hot water is the 'heat delivery' system. The endpoint is the radiators and heating coils transfer the heat into the working spaces.

A low-carbon or no- carbon heating system typically uses a heat pump to create 'low-temperature' water (~50 deg C) for heating (see Figure 4). The systems within a building to deliver the heat must be designed for the temperature of the water.

Meeting the dual objectives of 1) making substantial short-term reductions in carbon emission, and 2) preparing the District for a long term evolution to very-low-, or no-carbon emissions requires a bundle of different energy management actions. These include:

Lighting Upgrades

'LED' lighting technologies have displaced older fluorescent, halogen, HPS, and other lighting technologies for all areas of schools. There are opportunities remaining for the District to implement lighting upgrades.

Building Optimization

Building optimization or 'recommissioning' actions review a buildings set-up and operations. These 'tune-ups identify efficiencies in automation programs and controls.

Steam System Conversions

Transitioning an existing building from steam heating to low/no carbon heating requires:

- Step 1: Convert to a water system by simultaneously: (1a) replacing the steam boilers with water boilers or a heat pump, (1b) replacing the heat distribution piping with hydronic (water) piping and (1c) replacing the heat delivery components.

- Step 2: Addition of a heat pump to reduce the use of fossil fuels.

Step 2 could be achieved at the time of implementation of Step 1 if sufficient capital were available.

High Temperature Water System Conversions

Transitioning an existing building from high temperature water heating to low/no carbon heating requires:

- Step 1: Convert from old inefficient boilers to new boilers capable of operating at low temperature

- Step 2: Replace the heat delivery components (radiators and coils) to function with low temperature water

- Step 3: Retrofit the low temp water system for a heat pump

In converting an existing high temperature water system to low temperature operation, Steps 1 and 2 can be implemented together or separately, but both must be completed before Step 3.

Mechanical Upgrades

Many of the components of the existing buildings are suitable for replacement – air handlers, unit ventilators, pumps, and motors etc. This renewal activity has the potential to create more efficient and more comfortable learning environments.

New School Development

New schools – either through the seismic mitigation or expansion programs are more efficient than older schools. As well the capital funding may be able to support heat pumps. If not, the schools are designed to be 'heat pump ready' for future addition of heat pump technology.

Advancing and Emerging Technologies for Low-/No- Carbon Heating Systems

New technologies are appearing in the marketplace using refrigerants as the medium to distribute heat within a building. The VSB is currently pilot-testing Variable Refrigerant Flow (VRF) technology, at several sites for the rooftop Child Care centers. This technology is widely used in Europe and Japan but is more recent to the North American market. Other technologies exist or are emerging and are to be following and evaluated.

A summary of the types of sites relevant for each type of action is summarized in Table 3 – indicating the typical savings achievable, and an estimate of the number of sites that each action is applicable to.

Figure 3: Conventional Heating System Configuration

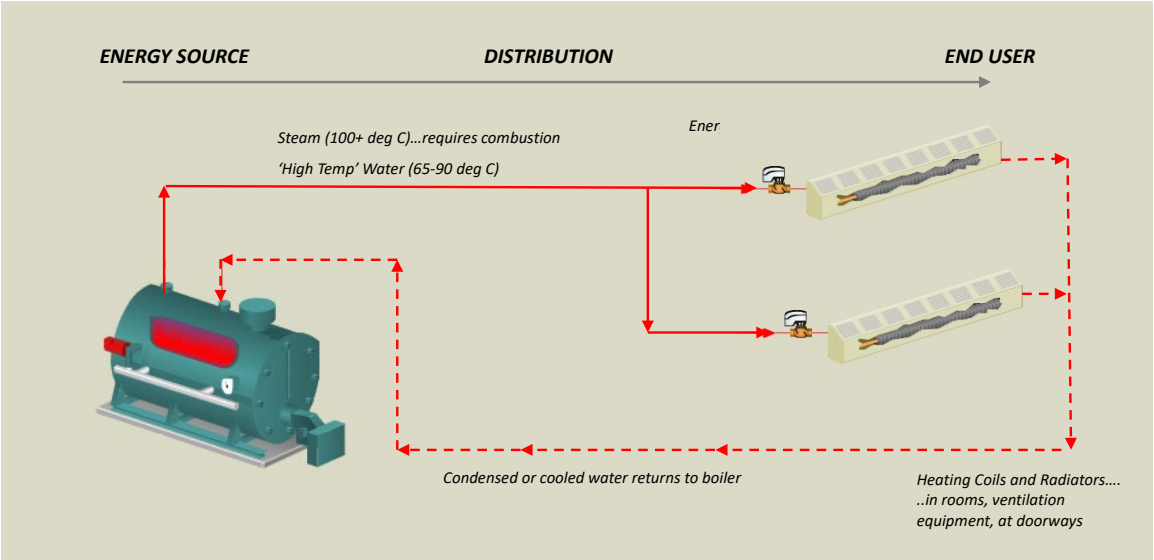


Figure 4: Common Low-Carbon Heating System Used in VSB Schools

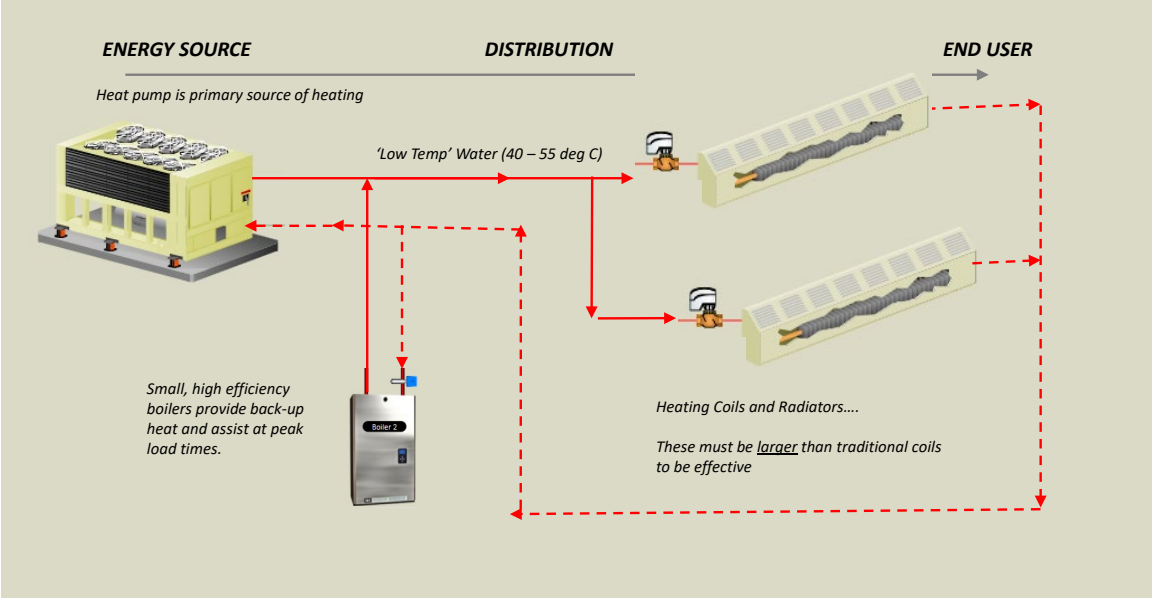


Table 3: Pathway Options to Reduce Carbon Emissions

Item	Number of Potential sites	Activity	Carbon Savings (per site from baseline)	Cost
Lighting Upgrades	~10-20	Upgrade lighting to LED – this includes projects both within and outside the seismic mitigation program.	small	Depends on size of project ($50k to $150k is typical)
Building Optimization	~ 12	Optimize the building operations	5% - 15%	$25k (elementary) to $75k (secondary)
Steam - to water conversions *Note: Projects identified are stand-alone activities. Does not include sites subject to the seismic mitigation program.*	4-5 (elem) 1-2 (sec)	Step 1: Replace steam heating system with hydronic system at low temperatures incl i) heat source, ii) distribution, iii) delivery components	~10%-25%	$1.5 million (each elementary) $5 - $10 million (each secondary)
		Step 2: Add heat pump to provide a low carbon heat source	40%	$500k to $1.5 million depending on size
Convert high temperature water system to low temp *(NB Steps 1 and 2 can be implemented together or separately, but both must be completed before Step 3)*	12-16	Step 1: Convert from existing high temperature boilers to new condensing boilers capable of operating at low temperature	30% - 50%	$350k (elementary) ~ $700k (secondary)
		Step 2: Replace radiators and coils to work with low temperature water	5% - 15%	several $100k
		Step 3: Add heat pump to provide a low carbon heat source	Incremental 30%	~$750k
Mechanical Upgrades	20-50	Upgrade heat delivery systems (e.g., unit ventilators or air handlers) with new components Rework mechanical pumping and piping systems for greater efficiency	10% - 25%	$400k (elementary) $1 – 1.5 million (secondary)
Seismic Mitigation Project	~ up to 40	Project type 1: Seismic upgrade – may or may not include mechanical system upgrades	5% to 15%	Ranges from "included in project" to several $100k (elem) additional funding.
		Project type 2: New site – with low temp water system – but no heat pump	30% - 50%	Typically zero (included with SMP project cost)
		Project type 3: New site – with low temp water system and current technology heat pump	60% - 80%	Elementary: $400k if no electrical service upgrade is required to $800k if electrical service upgrades required.
New Technologies	N/A	Retrofit, or build new with heating and cooling technologies that are new to the market and not yet widespread in the BC market or yet deployed in the VSB.	N/A	N/A

Key Actions

This section categorizes the key opportunities going forward.

Action 1: Lighting upgrades

Since 2008, the VSB has replaced many older lighting systems ("T12s" and old model "T8s") with newer "T8s" and more recently LED retrofits. The district still has facilities with older generation lighting systems. Replacing old lighting has the primary benefit of improving the classroom lighting quality.

Based on the number of projects implemented over the past decade, there are estimated to be about 2-3 years of lighting projects remaining. This action will:

- Change out T12 lighting systems for facilities that are not pending imminent seismic upgrading.
- Upgrade older T8 systems (more than 10 years old) to 'TLED" or "LED fixture" technology.
- Upgrade exterior lighting throughout the District.

Action 2: Heating Plant Upgrades

Most existing boilers within the district are considered "at or beyond" their manufacturer's specified service life based on age, and typical equipment lifetimes. [Note that all functioning boilers are properly maintained, regularly inspected, and meet BC Safety Authority requirements – regardless of age]. As most schools operate for ~40-60 hours / week, there is rarely a viable business case to replace a *functioning* older boiler for a newer one based on energy savings alone. However, replacements are made based on needs for facility renewal, reducing maintenance callouts, and modernization. As well heating plants are sometimes upgraded in seismic retrofits.

When boilers are replaced, this action will:

- ensure that all new boilers are the most efficient possible for the expected operating conditions,
- be suitable for future lower temperature operating conditions when updates are made to heat delivery systems, and
- be suitable for future retrofit into a heat-pump or other low carbon heating system.

Action 3: Building System Upgrades and Replacement

This action focuses on upgrading the energy delivery and ventilation systems to take advantage of low temperature heating water, and modern variable speed pumping systems. This could include replacing unit ventilators in classrooms with modern units, upgrading coils inside air handlers, and (most importantly), converting a steam-heating

facility to a water heated one. These upgrades carry substantial costs and so have to be implemented in larger 'pieces' than lighting projects or elementary heating plant replacements.

This action will:

- seek funding for upgrades to heat delivery systems, and
- prepare schools for future low carbon heat sources.

Action 4: Continuous Optimization and Controls Improvements

In 2018, the Energy Management Program began conducting building 'tune-ups' (also known as recommissioning) to restore building mechanical systems back to their original commissioned state. Optimization projects have been completed at four secondary schools, while eight elementary projects are currently underway.

This action will:

- Implement the BC Hydro Continuous Optimization Program (C.Op) in phases, completing 1-3 sites annually.
- upgrade DDC and communications systems for all applicable (i.e. non-manually operated) facilities to be connected to the District-wide control network by 2035.

Action 5: Low-Carbon Implementation into the Seismic Mitigation Program

The seismic mitigation program has upgraded or replaced over 20 facilities within the district and the current capital plan defines an additional 20-25 facilities potentially requiring upgrades over the next decade. This program – a "once in a generation" opportunity – can be leveraged to improve energy efficiency, prepare for climate change impacts, and reduce carbon emissions.

This action will:

- encourage the inclusion of energy management considerations into PDR reports, and subsequent facility design
- Develop energy specific guidance material for new school construction
- Contribute to design and construction standards
- Explore and Pilot Test evolving technologies

Action 6: Electric Vehicle Opportunities

Electric vehicles are rapidly becoming commonplace in the transportation sector and there are emerging opportunities for the VSB to advance electrification of its vehicle fleet - currently ~ 80 vehicles based at 2 sites (not counting numerous pieces of specialty equipment). Fleet electrification requires more than simply vehicle purchases as charging infrastructure and electrical capacity at sites may require upgrades.

As well, to ensure a successful transition to an electrified fleet, careful planning and consideration is required to ensure current vehicle options meets the various transportation needs of the District.

This action will:

- Participate with BC Hydro on a capacity assessment and an EV study for existing vehicle base-locations.
- Work with our vehicle suppliers to determine the costs and availability of suitable electric vehicles.
- Monitor evolving technologies for public and/or VSB charging infrastructure to evaluate suitable cost recovery models for the provision of charging infrastructure.
- Upgrade existing charging infrastructure with networked charging models.

A detailed listing of all the projects identified for either execution or evaluation is contained in Appendix A.

5 Energy Plan Implementation

Project List

A summary of the identified projects for the current and next several years is shown in Table 4. A detailed listing of the identified and possible future opportunities is provided in Appendix A.

Projects completed at present are 2022/23 with the 2023/24 projects currently being implemented. These projects achieve incremental annual reductions of:

- 200,000 to 300,000 kWh electricity consumption
- 3,000 to 5,000 GJ of natural gas consumption
- ~200 to 250 tonnes of carbon emissions,
- $50,000 - $80,000 of incremental utility cost savings or avoided costs.

Table 4: VSB Energy Plan: Management: Three Year Opportunities from 2022/23

Year	Summary Description	Electricity Savings (kWh / yr)	Natural Gas Savings (GJ / year)	Carbon Reduction (tonnes CO2e / yr)	Utility Savings ($/year)
2022/23 Projects (completed)	• Lighting Projects at twelve sites • Heat plant replacements at one existing sites • Re-commissioning of one site • Heat plant replacement at one SMP site. • Heat pump installation at two SMP sites	610,000	~5000	~245	$ 95,000
2023/24 Projects (underway)	• Lighting Projects at six sites • Heat plant replacements at one existing sites • Re-commissioning of four sites • Heat pump installation at two SMP sites	400,000	~5,000	245	$ 100,000
2024/25 Projects being (planned/underway).	• Lighting Projects (6-7 sites) • Proposed 1 heat plant replacement • LCE Project at 1 site • Re-commissioning of 4 sites	~200,000	~5,000	~245	$ 80,000
2025/26 – 2030 Projects on the horizon	• Lighting opportunities decreasing. • 1 - 2 heating plant replacements annually. • Continued re-commissioning program. • Leverage seismic opportunities as available.	~50,000 – 100,000 annually	~3,000 – 6,000 annually	150 – 300 annually	$ 50,000 - $80,000 annually

Notes:
1) All projects are dependent upon approval of budget. Only 2023/2024 project year funds have been approved to-date.
2) Some projects that reduce carbon emissions, will also result in increases in electricity consumption.
3) Electricity savings shown here are for the specific conservation projects identified. Electrical savings achieved may exceed the incentivized amounts reported by BC Hydro due to specific incentive program requirements.

Carbon Reduction Scenarios

This energy strategy addresses the requirement to reduce carbon emissions and does not focus solely on the management of energy costs (the more traditional driver for energy management). This plan includes a longer-term perspective to identify the opportunities to achieve carbon reductions by District facilities.

The long-term planning tool for capital renewal is the annual VSB Capital Planning cycle. Each year the district submits a "five-year" requested forecast of capital needs for major capital funding and an annual forecast for minor capital programs. In practice – given the demands for capital funding on the Education Ministry, no school district is able to realize their full capital plan request list. Regardless, it is valid as a statement of capital funding priorities.

The major and minor capital activities the district plans for are:

- Major capital including the Seismic Mitigation Program (SMP) - potentially impacting 25 sites (over a decade or more), and several desired expansion projects.

- Minor capital programs including the Annual Facilities Grant (AFG), the School Enhancement Program (SEP), the Carbon Neutral Capital Program (CNCP), and the Playground Enhancement Program (PEP).

Capital funding is approved annually. General assumptions for the scenarios below are that future funding is in line with historical precedent.

Combining the currently approved and proposed capital planning project list, and some assumptions about internal project funding and results (see methodology in Appendix B), three scenarios are developed for analysis. In each scenario, the current programs continue, however the resources available for carbon reduction vary. These are planning-level scenarios and are not developed to predict the full scope, timing, and details of each project in the capital plan. However, they do provide an opportunity to 'bound the problem' with high, low, and middle scenarios.

The scenarios are:

- **Level 1 Low:** CNCP funding continues, internally funded optimization and small renewal efforts continue. Major capital programs are focused on non-energy related building components and only allow for a minor level envelope of funding for replacing or upgrading mechanical systems.

- **Level 2 Medium:** Funding is more available for energy systems than Level 1 and resulting carbon reductions are better. Most projects can devote some capital to reducing carbon emissions – though complete renewal as a zero-carbon facility is problematic. As a result, some projects can transition to low carbon heating and cooling systems.

- **Level 3 High:** All funding programs continue and achieve high impact results. Capital funding is sufficient to allow for major replacement and retrofits of heating and mechanical systems with all SMP projects. As well, seismic funding continues to be provided to the District.

The results of this analysis are shown in Table 5 and the carbon reduction shown in Figure 5. Note the totals are shown to 2035 to capture all the identified projects on the capital plan to completion – as some would initiate several years before their impact would be realized.

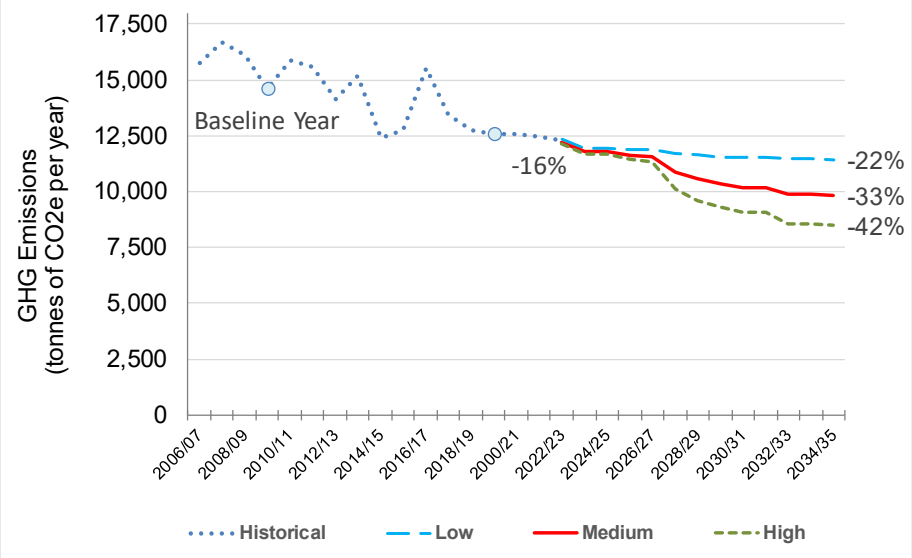
The carbon emissions scenarios are shown graphically in Figure 5. The current building GHG emissions for the District are about 16% below the baseline year level (2010). The consumption of natural gas (the primary driver of GHG emissions) is affected by the weather. The variability seen in the historical GHG emissions from 2006/07 to the present is primarily a function of the weather. There have been several natural gas conservation measures taken over the past 15 years, but these account for only a portion of the decrease. Going forward, a more concerted effort towards natural gas reduction will become apparent as a more definite reduction – regardless of background weather conditions.

Table 5: Energy and Carbon Reduction Scenarios at 2035

Item	Units	1) Low	2) Med	3) High
NG / GHG Baseline (2010)				
2010 Natural Gas Consumption	GJ / yr	298,310	298,310	298,310
Baseline Building Carbon Emissions	tonnes CO2/yr	15,160	15,160	15,160
NG / Carbon Impacts to 2035				
NG Consumption Change…	GJ/yr	(65,000)	(98,000)	(126,000)
Carbon reduction (tonnes)	tonnes / yr	(3,200)	(4,800)	(6,200)
…compared to baseline levels	(%)	(22%)	(33%)	(42%)
Electricity Impacts				
Current Electricity Consumption (19/20)	kWh/yr	24,540,000	24,540,000	24,540,000
Elec consumption at 2035	kWh/yr	27,100,000	28,900,000	30,200,000
Consumption change	kWh/yr	2,500,000	4,300,000	5,600,000
Utility Cost Impacts (Annual)				
Natural Gas Spending Change	$ / yr	($651,000)	($980,000)	($1,260,000)
Electricity Spending Change	$ / yr	$253,000	$432,000	$557,000
Carbon Offset Change	$ / yr	($84,000)	($126,000)	($163,000)
Vancouver Carbon Levy	$ / yr	$1,615,000	$1,178,000	$1,069,000
NET utility Spending Change	$ / yr	$1,133,000	$504,000	$203,000
Capital Requirements				
Total Capital Required from 2020 – 2035	$	$26,000,000	$51,000,000	$98,000,000

Notes:
1) Values are planning level estimates only and do not include site-level costing.
2) All costs and savings are shown in 2022 dollars. No discounting of future cash flows nor forecasting of cost escalation for different components has been attempted.

Figure 5: VSB Building -Related Carbon Emissions by Scenario



Note: Reductions shown are based on assumptions about the capital resources being available. No capital has been currently secured beyond current year programs and approved seismic projects.

Funding Sources:

Achieving the reductions shown by any of the scenarios shown in Figure 5 is highly dependent on the level of capital funding the District can deploy. None of the current capital funding programs are confirmed beyond each year's allocation. The possible sources of capital funding programs includes:

- **Annual Facilities Grant (AFG):** The District receives approximately $10 million annually through the Provincial AFG allocation. This amount has remained essentially unchanged over the past few years. As a result of normal cost inflation, the AFG allotment purchases about 1/3 less than a decade ago. This funding is generally completely consumed for high priority or life safety systems. Limited to no funds are available for deferable projects.

- **School Enhancement Program (SEP):** The SEP funding program is suitable for similar projects to AFG funding. For the past few years, SEP funding requests have been used to fund components of the SMP that are not funded through that initiative.

- **Carbon Neutral Capital Program (CNCP):** The CNCP program funds carbon reducing initiatives – typically heat plant replacement projects. This program has funded most heat plant re-builds and control system upgrades over the past several years. Funds are not assured from this program.

- **Utility Incentives:** The energy utility companies provide incentives and rebates for energy conservation projects and electrification projects. This is a relatively small amount of funding and is typically used to fund energy audits and studies as well as the building optimization initiatives.

- **Seismic Mitigation Program (SMP):** The SMP is the largest of the funding opportunities – an order of magnitude greater than any of the other programs. Some SMP projects have been able to fund new school builds and while all of these have created more efficient schools, they have not all been able to properly resource low carbon mechanical systems.

- **Emerging Low Carbon Funding**: Provincial and Federal programs have been announced or launched to encourage low carbon buildings. At present these initiatives are in the category of 'incentives' – whereby the program provides a few percent of the capital cost to incentivize an outcome. To date, none of these programs provide substantive grant funding. There are also emerging sources of financing funds proposed but these are not grant capital and require a return on investment to eligible – they are loan and not grant programs. The return on low carbon investments in the District does not generate a competitive return on capital invested.

This analysis has identified the capital funding requirements to make substantive carbon reductions. However, availability of funding is highly dependent on Ministry of Education and Child Care (MECC) capital funding policies which vary from year to year.

Staff Roles and Responsibilities

Implementation of the SEMP will require the involvement of several different teams within the organization. These are summarized in Table 6. It is important to note that there are many participants and that coordination and communication between groups is required to ensure smooth implementation.

Table 6: Implementation Activities and Participants

Activity	Lead	Participants
Project List Review and Update	Energy Manager	▪ Operations ▪ Maintenance ▪ Seismic Project Office
Annual Project Planning	Energy Manager	▪ Operations ▪ Maintenance
Incentive & Funding Applications (e.g., Fortis, BC Hydro, CNCP)	Energy Manager	▪ Maintenance
Capital Plan Preparation	Facilities Director	▪ Operations ▪ Maintenance
Lighting Project Implementation	Maintenance (Electrical)	▪ Maintenance
Heating & DHW System Upgrades	Maintenance (Mechanical)	▪ Energy Manager ▪ Operations
Operational Improvements	Energy Manager	▪ Operations ▪ Maintenance
New Facility Criterion	Energy Manager	▪ Facilities Planning
Annual Reporting	Energy Manager	▪ Operations ▪ Maintenance

Reporting

Tracking and progress reporting happens through several internal and external mechanisms including:

- **BC Hydro Quarterly Meetings:** The EM program is a contractual relationship with BC Hydro. Annual conservation targets are set and are reviewed through quarterly progress meetings.
- **Internal Reporting:** The Energy Manager reports to the senior team through the Facilities Director. Routine briefing and internal reporting occur within the organization.
- **Board and Facilities Planning Standing Committee:** Updates are provided to the Facilities and Planning Committee of the Board on an as-needed basis.

6 Closing

This energy strategy has identified a multi-year project list for low-carbon electrification, electricity conservation, natural gas reduction, and greenhouse gas emissions reduction. This is in accordance with the requirements for funding through the BC Hydro Energy Management Program – achieving over 300,000 kWh annually of electricity savings and over 100,000 kWh of added load from electrification projects.

Additionally, substantial opportunities to reduce natural gas consumption – and associated carbon emissions are identified.

This strategy recognizes the need for action on climate change to reduce the District's carbon emissions. The Province has set emissions targets for public sector organizations with the intent to reduce their building-related carbon emissions from 2010 levels – heading towards significant carbon reduction by 2050.

Currently, the District's emissions are about 16% below baseline (2010) levels – partially due to weather factors, and partially due to conservation efforts.

To support the conservation objective, this plan identified scenarios for reducing carbon emissions from District facilities. A set of "low-medium-high" scenarios identified that reductions of 22% to 42% from baseline are possible by 2035. These reductions require substantial capital investment – ranging from $ 26 million to $ 98 million.

Appendix A: Future Project Opportunities

The table below presents a rolling three-year list of projects that are either recently completed (2022/23), underway (2023/24 projects) or being developed and planned (2024/25 projects and onward).

Table A-1: Retrofit Opportunities

Action	Year	Project Opportunities	Savings
Action 1: **Lighting Upgrades**	**2022/23** (completed) 2023 AFG budget	Queen Alexandra & Southlands Oppenheimer & Tecumseh Ax Xpey' & Tyee Carnarvon, Waverly Annex & Laurier Strathcona (A Bldg), Thompson (Gym), Killarney (various) (PE)	48,000 kWh 29,200 kWh 29,000 kWh 33,000 kWh 44,200 kWh
	2023/24 (underway) Project funding beginning with 2024 AFG year	Selkirk Sexsmith Moberly Kitchener Douglas (various) (PE) Killarney (various) (PE)	41,800 kWh 40,200 kWh 34,200 kWh 37,800 kWh TBD
	2024/25 and beyond Project funding beginning with 2025 AFG year	Champlain Heights Elementary Champlain Heights Annex Douglas Annex Tillicum Lord Elementary Britannia Elementary John Oliver Secondary ~35 sites TLED opportunities	TBD
Action	Year	Project Opportunities	Savings
Action 2: **Heating Plant Upgrades**	**2022/23** (completed)	Education Centre Lloyd George Bayview Weir wəkʷaʔəs tə syaqʷəm Hamber	~5,000 - 15,000 GJ
	2023/24 (underway)	Magee Beaconsfield	~1,200 GJ

	2024/25 and beyond School sites with aging atmospheric boilers	Britannia Elementary University Hill Elementary Wolfe (frame) Kerrisdale Laurier Tecumseh Cavell Dickens Annex	~5,000 - ~15,000 GJ
Action	Year	Project Opportunities	Savings
Action 3: **Building Systems Upgrades**	**2022/23** (completed)	Dickens Annex Unit Ventilator upgrades Furnace Upgrades: Waverly Ax Selkirk Quilchena Carr Kerrisdale	50 GJ ~1000 GJ
	2023/24 (underway)	Dickens Annex Unit Ventilator upgrades	100 GJ
	2024/25 and beyond	Mt Pleasant Rooftop unit replacements Possible Steam to Hot Water plant conversions Jamieson, Kingsford Smith, Oppenheimer Education Centre Chiller upgrade	160,000 kWh (added load) 1,800 GJ (savings) ~1,500 GJ N/A
Action	Year	Project Opportunities	Savings/Added Load
Action 4: **Building Optimization**	**2022/23** (completed)	Kitsilano	75,500 kWh 1,500 GJ 71,800 kWh (added load)
	2023/24 (underway)	Sexsmith Dickens Douglas Trafalgar Norma Rose Maple Grove Tennyson Queen Mary L'Ecole Bilingue	~250,000 kWh ~3,000 GJ ~160,000 kWh (added load)

	2024/25 and beyond	Elementary: Kitchener Bayview Weir Wolfe Fleming Cavell Crosstown Gordon Jamieson Quesnel Strathcona Kingsford-Smith Livingstone Lloyd George Nelson Secord wəkʷaʔəs tə syaqʷəm Secondary/Other: Hamber Byng Churchill Education Centre Tupper	300,000 - 800,000 kWh 5,000–10,000 GJ
Action	Year	Project Opportunities	Savings/Added Load
Action 5: **Low-Carbon features in the Seismic Mitigation Program and Electrification**	**2022/23** (completed thru SMP)	Heat Pump Installation at: • Bayview and Weir VRF system in childcare at: • Lloyd George	1,500 GJ savings 115,000 kWh (added load) TBD
	2023/24 (underway)	Heat Pump Installation at: • Hamber Secondary • Coal Harbour Low Carbon Electrification (LCE) Studies: Grenfell, Champlain Hgts Ax, Total Education Integrated Energy Audit (IEA) Studies: Dickens Annex Cavell	372,000 kWh (added load) 225,000 kWh (added load)
	2024/25 and beyond	Upcoming Seismic Project Opportunities: • Hudson Elementary • Grenfell Elementary	60,000 kWh (added load) TBD

	Capital Planning Submission: **2025-2030**	Olympic Village Elementary (non-seismic project) Dickens – water to water heat pump for force flow heaters and GYM AHU. Mt Pleasant – heat pump replacements Seismic Capital Plan Opportunities <u>Elementary</u>: Mackenzie Renfrew False Creek Waverley Nightingale Carr Franklin Osler Mt Pleasant Champlain Beaconsfield McCorkindale Grandview Southlands Seymour Roberts Annex UBC South Campus <u>Secondary:</u> Killarney Thompson Churchill John Oliver King George Windermere Templeton	TBD
	"Distant" Opportunities [Project will be dependent upon the scope of the seismic program beyond the projects identified in the current five-year capital planning horizon]	<u>Elementary</u> Queen Alex Quilchena Bruce Cunningham Xpey Brock Carnarvon Q. Elizabeth Henderson Nootka Thunderbird Lord Carleton	TBD
Action 6: Electric Vehicle Opportunities	**2023/24**	<u>Upgrade to networked EV chargers</u> Up to 37 chargers <u>Fleet Electrification</u> 1 Fleet electric vehicle (light duty)	Up to 185,000 kWh (added load) 5,000 kWh
	2024/25 and beyond	<u>Fleet Electrification</u> 80+ fleet vehicles (light and heavy duty)	

Note: electricity savings are shown in kWh, natural gas savings are shown in GJ

Appendix B: Scenario Methodology

For each type of action an archetype level of savings and expenditure was developed. This is based on a number of recent projects implement over the past decade within the district.

Table B-1: Scenario Creation Methodology and Assumptions

Activity	Level 1) Low	Level 2) Med	Level 3) High
Boiler Replacement	Typically replace boilers in mechanical room with high efficiency wall mount (low mass) boilers. Remainder of school unchanged. Savings: -NG = ~30% -Electricity = ~2% Cap cost = ~$350,000	Level 1 *plus*: - replace hot water heater with on-demand system and - incorporate variable speed pumping units to control flow to zones within the school: Savings: -NG = ~40% -Electricity = ~4% Cap cost = ~$425,000	Level 2 *plus*: - incorporate room temperature and/or CO2 sensors to improve demand controlled ventilation and hot water reset strategies. Savings: -NG = ~50% -Electricity = ~6% Cap cost = ~$500,000
C.Op.	Recommission existing site with existing DDC controls and sensor set-up. Replace occasional sensor failure. Savings: -NG = ~5 % -Electricity = ~5% Cost = ~$50,000	Level 1 *plus*: - add in additional sensors temp or CO2 and enable HW Reset and DCV Savings: -NG = ~10% -Electricity = ~10% Cap cost = ~$100,000	Level 2 *plus*: - digitize the entire site – including DDC controls and replacement of pneumatic systems. Savings: -NG = ~10% -Electricity = ~15% Cap cost: ~$ 150,000 (elem) ~$ 450,000 (secondary)
Mech Upgrade	Minor upgrades to systems and mechanical alignment. (e.g.Re-piping or reconfiguring mech room). Savings: -NG = ~5 % -Electricity = ~5% Cost = ~$100,000	Mech upgrade or replacement of AHUs or a number of Unit Ventilators. Savings: -NG = ~10% -Electricity = ~10% Cap Cost: ~$500,000 (elem) ~ $2,500,000 (sec)	Major re-piping or steam to HW conversion of an entire site Savings: -NG = ~30% -Electricity = ~15% Cap cost: ~$ 1,500,000 (elem) ~$ 5 - $ 10 million (sec)
Seismic Project through the VPO	Seismic Upgrade that does not specifically replace mechanical systems but might include some minor components and lighting upgrades Savings: -NG = ~10 % -Electricity = ~15% Cost ~$ 150,000 (elem) ~$ 1,000,000 (secondary)	Major seismic rebuild or new site without low carbon technology Savings: -NG = ~45% -Electricity = ~+20% (incr) Cap cost: ~$ 600,000 (elem) ~$ 3,500,000 (sec)	Complete re-build including HVAC or new site with HP or other low carbon heating system. Savings: -NG = ~75% -Electricity = ~50% (incr) Cap cost: ~$ 1,000,000 (elem) ~$ 7,500,000 (secondary)

Appendix C: Past Energy Conservation Projects

Table C-1: Historical Energy Management Actions: 2013/14 to 2023/24

Site(s)	Project	Project Status *[Year project was executed and claimed or completed]*	Savings *[kWh /yr unless otherwise noted]*	Electrification *[added kWh/yr load]*
Projects 2013/14				
Robert Ax / Byng / Shaughnessy / McBride	Lighting study 2011/12 – 2012/13	2014	146,000	
Tecumseh Ax / Mount Pleasant / Oppenheimer / Maquinna Ax	Lighting study 2011/12 – 2012/13	2014	176,000	
Tupper B Building	Lighting study 2012/13	2014	62,700	
Van Tech	Lighting study 2012/13	2014	101,000	
Macdonald	Lighting study 2012/13	2014	56,500	
Tyee / Selkirk / Laurier	Lighting study 2012/13	2014	74,000	
Sexsmith	Energy efficient lighting design (EELD)	2014	34,000	
Douglas	Energy efficient lighting design (EELD)	2014	28,000	
Projects 2014/15				
Moberly	Lighting study 2013/14	2015	51,000	
Carnarvon	Lighting study 2013/14	2015	52,400	
Champlain Heights	Lighting study 2013/14	2015	54.000	
Queen Elizabeth Ax / Total Education	Lighting study 2013/14	2015	50,000	
Champlain Heights Ax	Lighting study 2013/14	2015	58,000	
Laurier Ax / Garibaldi Ax	Lighting study 2013/14	2015	43,000	
U-Hill Secondary	Energy efficient lighting design (EELD)	2015	31,000	
Norma Rose	Whole Building Design	2015	158,000	
Fraser	Boiler Plant upgrade	2015	~95 GJ /yr	
Tyee	Boiler Plant upgrade	2015	~42 GJ / yr	
Moberly	Boiler Plant upgrade	2015	~400 GJ / yr	
Projects 2015/16				
Doug Ax / Kerr Gym / McKechnie Gym	Lighting study 2014/15	2016	55,000	
Lord A & B Buildings	Lighting study 2013/14	2016	56,000	
Workshop	Lighting study 2013/14	2016	47,000	
Magee	Lighting study 2014/15	2016	186,000	
Britannia	Lighting study 2014/15	2016	187,000	
Projects 2016/17				
Ed Center	Lighting study 2014/15	2017	228,000	
Queen Victoria Ax / South Hill / Byng (ext) / VanTech)	Lighting study 2014/15	2017	90,000	
Queen Mary	Energy efficient lighting design (EELD)	2017	42,500	
Kerrisdale / Hastings (ext) / Dickens (ext)	Lighting study 2015/16	2017	52,463	
McKechnie / Dickens Ax / Collingwood (ext) / Cook (ext)	Lighting study 2015/16	2017	57,176	
Elsie Roy / Maquinna / Collingwood(int)	Lighting study 2015/16	2017	109,534	
L'Ecole Seismic replacement	Replacement school	2017	~ 400 GJ	
Gordon Seismic Replacement	Replacement School	2017	~ 1,260 GJ	
Cook (int) / Hastings(int) / Cunnigham(ext)	Lighting study 2015/16	2017	75,796	
Projects 2017/18				
Cunningham (int) / Tillicum Ax	Lighting study 2016/17	PE File 2018	76,073	
Crosstown	Energy efficient lighting design (EELD)	2018	32,750	

Site(s)	**Project**	**Project Status** *[Year project was executed and claimed or completed]*	**Savings** *[kWh /yr unless otherwise noted]*	**Electrification** *[added kWh/yr load]*
McBride	Boiler Plant	2018	~500 GJ	
McBride	Lighting study 2016/17	PE File 2018	~74,801	
Strathcona	HVAC and Boiler upgrades	2018	~ 1000 GJ	
Strathcona	Lighting study 2017/18	2018	~50,000	
Roberts / Shaughnessy / Fraser / Ideal Mini	Lighting study 2016/17	2018	~133,800	
Tecumseh / Norquay	Lighting study 2016/17	2018	~96,600	
U-Hill Elementary	Lighting study 2016/17	2018	~50,325	
Van Horne / Nootka	Lighting study 2016/17	2018	~64,300	
Carr	Lighting study 2016/17	PE File 2018	~41,300	
Kitsilano	Whole Building Design	NCP/2018	~760,000	
Projects 2018/19				
Churchill	Lighting	2019	~150,000	
Henderson / Grandview	Lighting	2019	~76,000	
Beaconsfield / Kerrisdale Ax	Lighting	2019	~50,000	
Brock / MacCorkindale	Lighting	2019	~80,000	
Projects 2019/20				
Queen Elizabeth, Quesnel, Trafalgar	Lighting	2020	115,000	
Seymour, Thunderbird	Lighting	2020	85,000	
Nightingale, Secord	Lighting	2020	72,000	
McBride Ax, Selkirk Ax, Trudeau	Lighting	2020	61,000	
Killarney Gym	Lighting	2020	22,848	
Quilchena, Osler, Jamieson	Lighting	2020	111,000	
Van Tech	Continuous Optimization	Complete 2020	50,000 kWh	
U-Hill Sec	Continuous Optimization	Complete 2020	100,000 kWh	
Projects 2020/21				
Tupper	Lighting	2021	63,000	
Van Tech	Lighting	2021	117,500	
Mount Pleasant & Franklin	Lighting	2021	58,500	
Seymour (frame bldg.)	Lighting	2021	5,000	
Dickens (Gym)	Lighting	2021	5,443	
Hastings	Boiler Plant	2021	~ 1,000 GJ [note 1]	
Selkirk	Boiler Plant	2021	~1,000 GJ [note 1]	
Tennyson (new)	Boiler Plant	2021	~1,000 GJ [note 1]	
Maple Grove (new)	Heat Pump/Boiler Installation	2021	--	
Projects 2021/22				
Point Grey	Lighting	2022	104,789	
Prince of Wales	Lighting	2022	63,545	
Gladstone	Lighting	2022	87,259	
Bruce	Lighting	2022	41,725	
Norquay	Boiler Plant	2022	~ 1,000 GJ [note 1]	
Wolfe	Boiler Plant	2022	~1,000 GJ [note 1]	
Magee	Continuous Optimization	2022	54,000 1,230 GJ	
Various	Lighting Audits – 13 schools	2022		
Projects 2022/23				
Southlands	Lighting Upgrade	2023	36,068	
Queen Alexandra	Lighting Upgrade	2023	50,472	
Oppenheimer	Lighting Upgrade	2023	34,216	
Tecumseh Annex	Lighting Upgrade	2023	11,747	
Xpey	Lighting Upgrade	2023	18,977	
Tyee	Lighting Upgrade	2023	28,113	
Strathcona (A)	Lighting Upgrade	2023	27,000	
Thompson (Gym)	Lighting Upgrade	2023	21,139	

Site(s)	**Project**	**Project Status** *[Year project was executed and claimed or completed]*	**Savings** *[kWh /yr unless otherwise noted]*	**Electrification** *[added kWh/yr load]*
Killarney (partial)	Lighting Upgrade	2023	22,900	-
Ed Centre	Boiler	2023	720 GJ	-
wəkʷaṅəs tə syaqʷəm	Boiler	2023	300 GJ	-
Bayview	Heat Pump/Boiler Installation	2023	1000 GJ	66,386
Weir	Heat Pump/Boiler Installation	2023	800 GJ	41,960
Kitsilano	Continuous Optimization	2023	75,500 kWh and 1,500 GJ	71,800
Quilchena	Furnace Upgrade	2023	20 GJ	-
Waverly Annex	Furnace Upgrade	2023	20 GJ	-
Selkirk	Furnace Upgrade	2023	20 GJ	-
Carr	Furnace Upgrade	2023	20 GJ	-
MacCorkindale & Cavell	Pneumatic Conversion to DDC	2023	-	-
Projects 2023/24				
Laurier	Lighting	2024	24,500	-
Carnarvon	Lighting	2024	31,635	-
Waverly Annex	Lighting	2024	13,542	-
Selkirk	Lighting	2024	41,939	-
Kitchener	Lighting	2024	48,898	-
Moberly	Lighting	2024	48,559	-
Sexsmith	Lighting	2024	55,324	-
Douglas	Lighting	2024	32,601	-
Killarney (partial)	Lighting	2024	20,000	-
Beaconsfield	Boiler Installation	2024	460 GJ	-
Lloyd George (new)	Boiler Installation	2024	500 GJ	-
Point Grey	Furnace Upgrade	2024	20 GJ	-
Britannia (Portable)	Furnace Upgrade	2024	20 GJ	-
Kerrisdale	Furnace Upgrade	2024	20 GJ	-
Dickens	Continuous Optimization	2024	37,424	-
Sexsmith	Continuous Optimization	2024	28,118	72,622
Douglas	Continuous Optimization	2024	54,711	74,451
Trafalgar	Continuous Optimization	2024	6,200	37,700
Norma Rose Point	Continuous Optimization	2024	-	-
Maple Grove Elementary	Continuous Optimization	2024	-	-
Queen Mary, L'Ecole Bilingue, Tennyson	Continuous Optimization	2024	-	-
Various	Lighting Audits – 7 schools	2024	-	-
Cavell, Dickens Annex	Integrated Energy Audits (IEA)	2024	-	-
Grenfell	Low Carbon Electrification (LCE) Audits	2024	-	-
Various	Fortis Commercial Energy Assessments (CEAP)	2024	-	-
Jamieson, Kingsford Smith	Fortis Gas Heat Pump Studies	2024	-	-
Fleet Electrification	1 year trial of EV Transit Connect	2024	-	5,000

Notes:

1) *Natural gas savings for recent upgrade projects is estimated and observed changes will have been affected by COVID-19 closures and operational changes. Accurate savings evaluations will require further years of monitoring*

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