2024

District of West Vancouver

CLIMATE ACTION STRATEGY

westvancouver

OUTLINE

CONTRIBUTORS

DISTRICT OF WEST VANCOUVER LEAD STAFF

Heather Keith, *Senior Manager of Climate Action & Environment*
Meghan Wise, *Climate Action Coordinator*
Jim Bailey, *Director of Planning & Development Services*
Isabel Gordon, *Director of Financial Services*
John Wong, *Acting Director of Corporate Services*
Jenn Moller, *Director of Engineering & Transportation Services*
Emily Willobee, *Senior Manager of Engineering Services*
David Hawkins, *Senior Manager of Community Planning & Sustainability*

COMMITTEE

District Environment Committee

PREPARATION

Energy and emissions modelling, financial analysis, and report preparation was led by an external consulting team, Sustainability Solutions Group (SSG). This report was designed by the District of West Vancouver.

Line drawings throughout this document are from freepik.com.

LAND ACKNOWLEDGEMENT

We acknowledge that what is now known as West Vancouver is on the traditional, ancestral, and unceded territory of the Sḵwx̱wú7mesh Úxwumixw (Squamish Nation), səlílwətaɬ (Tsleil-Waututh Nation), and xʷməθkʷy̓əm (Musqueam Nation). We recognize and respect them as nations in this territory, as well as their historic connection to the lands and waters around us since time immemorial. To fully explore the importance of climate action for the community's low carbon resilience and well-being, we must also address the historical and ongoing displacement of Indigenous communities from traditional lands and land access. Climate change is fundamentally an issue of relationships to land and land practices such as local and regional Indigenous knowledge, leadership, caretaking, and relational ontologies. Collaborating with Indigenous communities to advance problem solving and idea building for the future is a critical part of climate action.

PURPOSE OF DOCUMENT

THE DISTRICT OF WEST VANCOUVER'S *CLIMATE ACTION STRATEGY* ENDEAVORS TO:

1. Update the municipal corporate and community greenhouse gas (GHG) emissions inventory for the current year;
2. Perform GHG emissions modelling to determine projected business-as-usual emissions to 2030 and 2050 as well as GHG emission reduction trajectories of various climate investment scenarios over these time periods; and
3. Develop a carbon budget and accounting framework that will inform District operating and budget decisions.

The *Climate Action Strategy* details action and investment recommendations to meet the District's emissions reduction targets of -45% of 2010 levels by 2030, and net zero emissions by 2050.

This strategy is accompanied by a carbon budget and GHG calculator that have been developed as information and decision-making tools. In addition to providing a determination of annual GHG emissions volume maximums, it will act as a climate lens through which to assess municipal project decisions.

DISCLAIMER

Reasonable skill, care, and diligence have been exercised to assess the information acquired during the preparation of this analysis, but no guarantees or warranties are made regarding the accuracy or completeness of this information. This document, the information it contains, the information and basis on which it relies, and the associated factors are subject to changes that are beyond the control of the authors. The information provided by others is believed to be accurate but has not necessarily been verified.

This analysis includes strategic-level estimates that should not be relied upon for design or other purposes without verification. The authors do not accept responsibility for the use of this analysis for any purpose other than that stated above or for any third-party use, in whole or in part, of the contents of this document. The findings of this study cannot be applied to other jurisdictions without analysis. Any use or any reliance on or decisions based on this document, are the responsibility of the user or third party.

ABBREVIATIONS

BAP	Business-as-Planned scenario
BAU	Business-as-Usual scenario
CAS	Climate Action Strategy
CDD	cooling degree days
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent(s)
CNG	compressed natural gas
CRNG	compressed renewable natural gas
CEEP	Community Energy & Emissions Plan
DE	District energy
DWV	District of West Vancouver
EV	electric vehicle
GHG	greenhouse gas
GPC	Global Protocol for Community-scale Greenhouse Gas Emissions Inventories
GWP	global warming potential
HDD	heating degree days
HDV	heavy-duty vehicle(s)
HWH	hot water heater
ICE	internal combustion engine
ICI	industrial, commercial, and institutional buildings
IPCC	Intergovernmental Panel on Climate Change
LAP	Local Area Plan
LC	low-carbon
LCS	low-carbon scenario
LDV	light-duty vehicle(s)
LNG	liquid natural gas
OCP	Official Community Plan
PV	photovoltaic(s) (solar photovoltaic energy generation)
RCP	representative concentration pathway
RNG	renewable natural gas
VKT	vehicle kilometres travelled
ZEV	zero emissions vehicle

UNITS

m^3	cubic metre	
tCO_2e	metric tonnes of carbon dioxide equivalent	
$ktCO_2e$	kilotonnes of carbon dioxide equivalent	1 $ktCO_2e$ = 1,000 tCO_2e
$MtCO_2e$	megatonnes of carbon dioxide equivalent	1 $MtCO_2e$ = 1,000,000 tCO_2e
GJ	gigajoules	
TJ	terajoules	1 TJ = 1,000GJ
PJ	petajoules	1 PJ = 1,000,000GJ
kWh	kilowatt hour	1 kWh = 0.0036 GJ
kW	kilowatt	
MW	megawatt	1 MW = 1,000,000 kW

To compare fuels on an equivalent basis, all energy is reported as units of energy content primarily as petajoules (PJ) or sometimes as gigajoules (GJ). Emissions are characterized as kilotonnes of carbon dioxide equivalent ($ktCO_2e$). These measures can be characterized as follows*:

- An average house uses about 100 GJ of energy in a year.
- 100 liters of gasoline provides about 3.5 GJ of energy.
- Burning 50,000 tonnes of wood produces 1 PJ energy.
- A typical passenger vehicle emits about 4.7 metric tons of carbon dioxide per year.

SCOPE 1, 2, 3 EMISSIONS:

Scope 1: Covers emissions from sources that a community owns or controls directly.

Scope 2: Covers emissions that a community causes indirectly from the energy it uses that is imported from outside the community boundary.

Scope 3: Encompasses emissions that are not produced in the community itself and that are not the result of activities from assets owned or controlled in the community, but those that it is indirectly responsible for across its supply chain.

** Data provided by the United States Environmental Protection Agency.*

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

CONTEXT

The District of West Vancouver's *Climate Action Strategy* (CAS) details a pathway to near-net-zero emissions by 2050 and achieving 45% emission reductions under 2010 levels by 2030. These targets follow from the District's 2016 Community Energy & Emissions Plan, Official Community Plan policy, and its 2019 climate emergency declaration, and are aligned with what the global scientific community has determined necessary to avoid catastrophic climate change impacts.

GHG EMISSIONS INVENTORY AND EMISSIONS LEVELS BY 2050

In 2021 (the most recent census year), West Vancouver's community-wide GHG emissions totalled 268 $ktCO_2e$ with 57% from buildings, 41% from transportation, and 2% from solid waste and wastewater. Without any further mitigation effort, the community's emissions are expected to grow 11% by 2050 (business-as-usual scenario, BAU).

PLANNED EMISSION REDUCTION MEASURES

The provincial government's CleanBC Plan and CleanBC Roadmap to 2030 commit to reducing emissions across the province through various measures in the building, transportation, and waste sectors. In addition, *BC's Clean Energy Strategy** outlines the actions to accelerate the shift to clean energy and the best use of each type of energy across sectors (e.g. using electricity for buildings and transportation in urban and temperate-climate regions while directing fossil fuel use toward sectors that are more difficult to decarbonize such as shipping, some industrial practices, long-haul transport, home heating in rural or northern community heating).

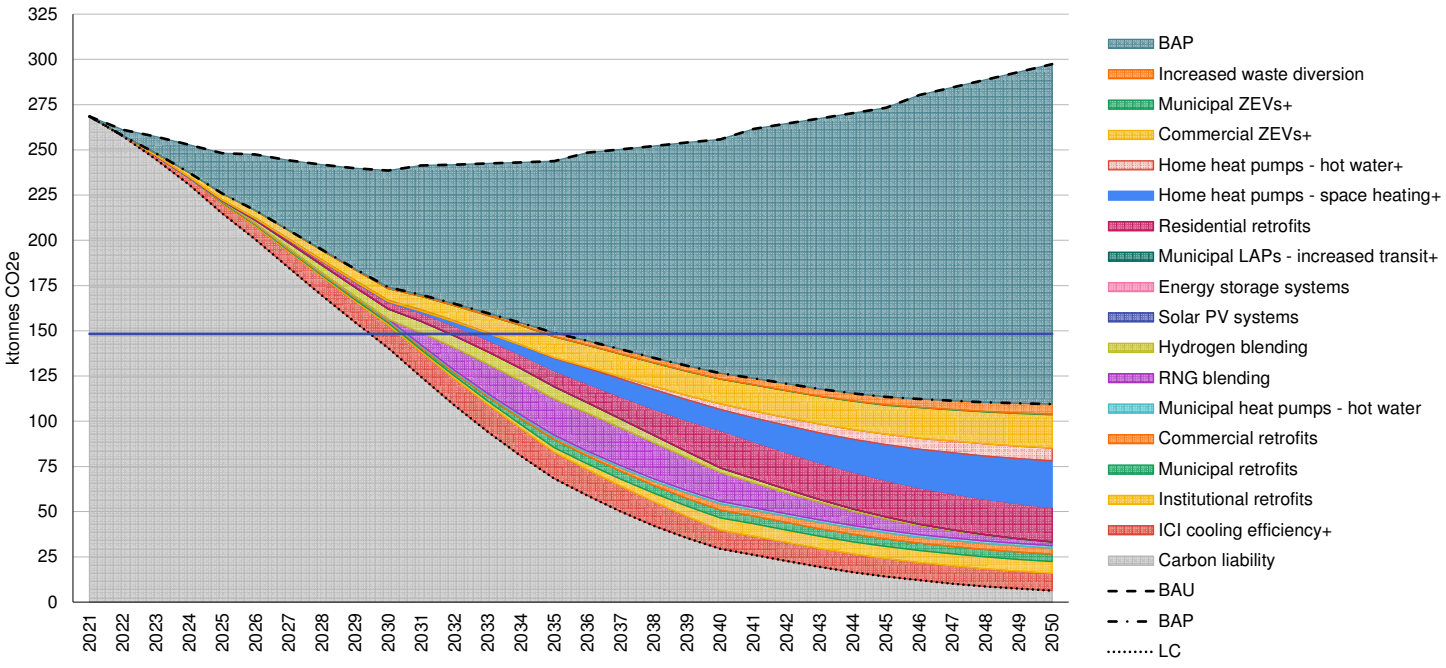
West Vancouver also has some emission-reducing measures underway, such as sustainable building and transportation requirements for new developments and local area plan (LAP) implementation, which will create more compact, complete neighbourhoods. Implementing the LAPs under the LCS and BAP scenarios will result in a greater decrease in building and transportation emissions compared to the BAU scenario. Community-wide energy and emissions modelling performed for the CAS demonstrates that the potential of these provincial and local measures (business-as-planned scenario, BAP) are substantial, reducing emissions by 59% by 2050 from 2021 levels. Most reductions are in the transportation sector, as trips shift to active transportation and transit, and as electric vehicles (EVs) replace gas models.

** Powering Our Future: BC's Clean Energy Strategy. June 27, 2024.*
www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/2023_climate_change_accountability_report_supporting_materials.pdf

REQUIRED ADDITIONAL EMISSION REDUCTION MEASURES

Although effective, currently planned provincial and local measures fall short of achieving the District's 2030 and 2050 emission reduction targets. Additional local measures can be taken across all sectors to further reduce emissions to meet the targets. A variety of additional measures were assessed through modelling (low-carbon scenario, LCS, Figure 1) to determine the effort required to bridge the gap. These actions are categorized as those that reduce energy consumption (Reduce), improve energy efficiency (Improve), and/or fuel switch to low or zero carbon renewable energy sources (Switch). The modelling demonstrates that West Vancouver's emission reduction targets can be met by implementing these actions starting presently, with coordinated, equitable, and dedicated efforts. The greatest emission reductions from these measures will be in the buildings sector through building retrofits with improved insulation, windows, doors, and zero-emission energy systems for space and water heating. The District can lead by example by retrofitting municipal buildings and facilities and transitioning its vehicle fleet to zero-emission models.

FIGURE 1: Cumulative emission reductions by action for the LCS (low-carbon scenario) beyond the emissions reductions through the Business-as-Planned actions



LOW-CARBON FUTURE FINANCES

Financial modelling performed for the CAS shows the expenditures required to implement the measures, as well as the returns realized over the next 26 years across the community (i.e. not just those of the District, Figure 2). Savings and avoided costs are primarily realized by those making the expenditures: vehicle owners, home and building owners, the municipality, etc. The implementation of mitigation measures is expected to generate a net savings of $286.1M over the next 26 years (Table 1). Modelling also indicates that the expenditures made will provide 11,500 person-years of employment during this time within West Vancouver.

CARBON MITIGATION WILL PROVIDE:

- a net savings of $286.1M over the next 26 years
- 11,500 person-years of employment

TABLE 1: Summary of expenditure & savings for modelled emission reduction measures

	BAP MEASURES net present value	LCS MEASURES net present value	BAP+LCS MEASURES net present value
capital expenditures	$112.8M	$1,127.0M	$1,239.9M
operations & maintenance savings	-$48.9M	-$16.4M	-$65.3M
energy cost savings	-$416.2M	-$584.8M	-$1,001.0M
avoided carbon taxes	-$277.8M	-$181.9M	-$459.7M
TOTAL	**-$630.1M**	**-$343.9M**	**-286.1M**

FIGURE 2: Year-over-year incremental expenditures and savings for the implementation of community-wide LCS measures

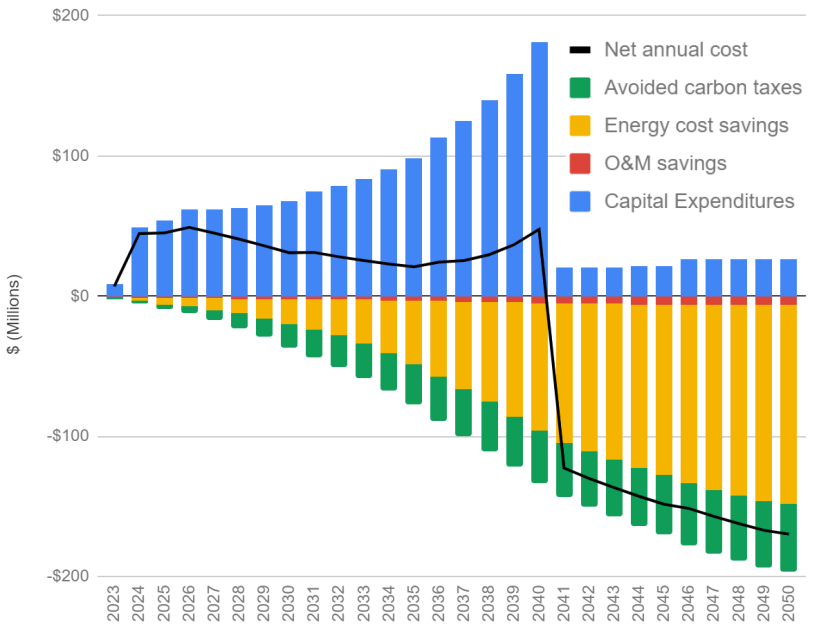


Table 2 provides a summary of the current and future states for West Vancouver based on planned and additional required emission reduction measures to chart West Vancouver's low-carbon pathway.

TABLE 2: West Vancouver by the numbers

	VALUE	CHANGE FROM 2021
2030 emissions target	148 $ktCO_2e$	-45% (of 2010 levels)
2050 emissions target	Net zero	
2021 to 2050 population	45,262 to 62,988	+39%
new dwellings by 2050	12,186	+41%
new non-residential floor space by 2050	1,170,000 m^2	+19%
2021 GHG emissions	268,475 $ktCO_2e$	
Business-as-Usual (BAU) 2050 GHG emissions	297 $ktCO_2e$	+11%
Business-as-Planned (BAP) 2050 GHG emissions	109 $ktCO_2e$	-59%
low-carbon scenario (LCS) 2050 GHG emissions	6 $ktCO_2e$	-98%
2021 per capita GHG emissions	5.93 tCO_2e	
BAU 2050 per capita GHG emissions	4.71 tCO_2e	-21%
BAP 2050 per capita GHG emissions	1.83 tCO_2e	-69%
LCS 2050 per capita GHG emissions	0.10 tCO_2e	-98%
2021 total energy consumption	5,864 TJ	
BAU future total energy consumption	6,852 TJ	+17%
BAP future total energy consumption	4,606 TJ	-21%
LCS future total energy consumption	2,806 TJ	-52%
net financial impact of implementing *Climate Action Strategy* measures (discounted @ 3%)	$286M savings over 26 years	

COMMUNITY CO-BENEFITS OF TAKING ACTION

Climate action measures improve tangible and intangible community services by providing cleaner air, improved energy efficiency and security, sustainable active transportation, and healthier walkable, inclusive, and livable communities, which are referred to as co-benefits. Climate co-benefits are additional, desirable health and social well-being, economic, and environmental outcomes from a given action that improve quality of life and community resiliency (Table 3).

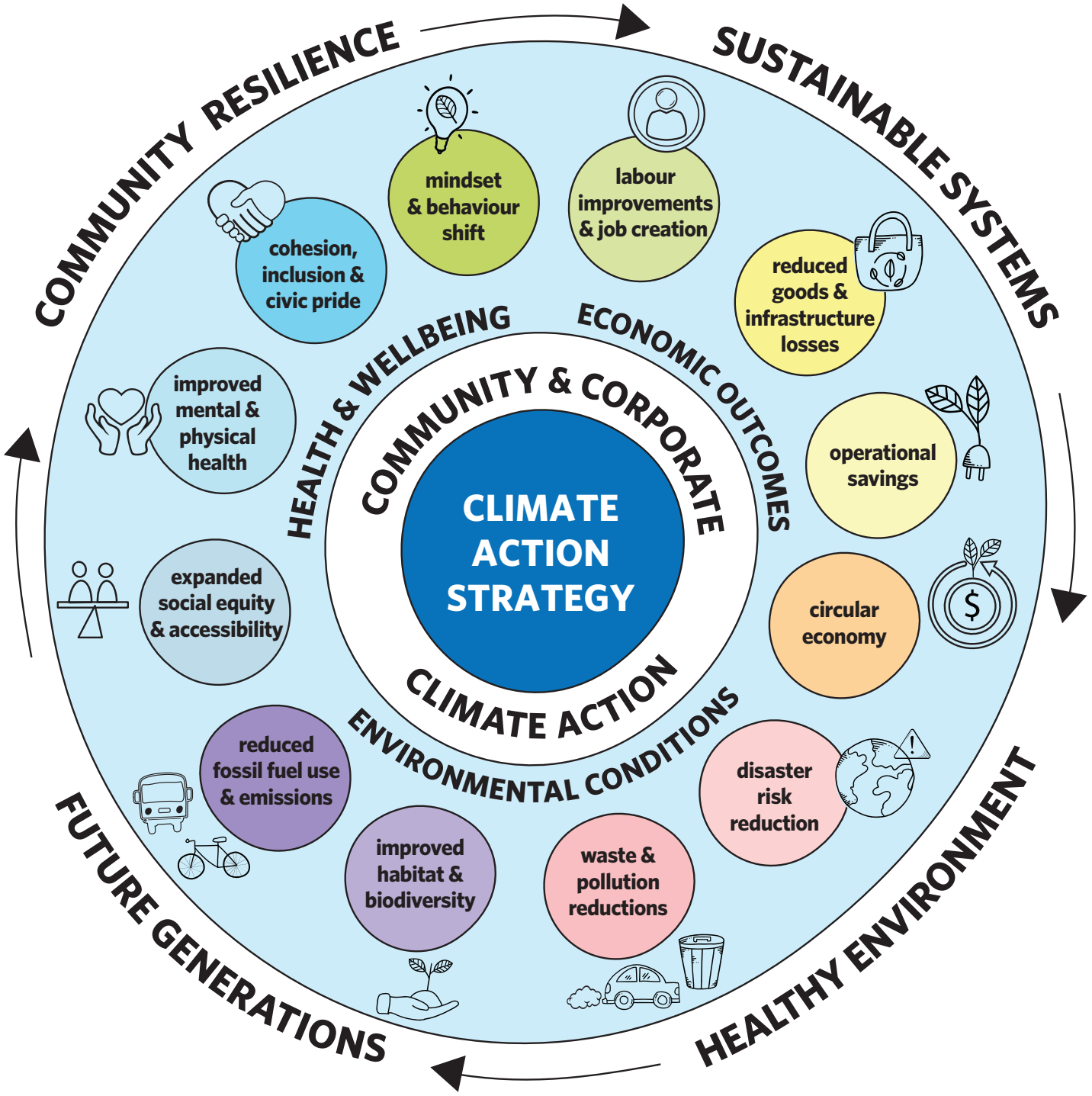
A variety of community co-benefits accompany the implementation of CAS measures. Planning climate actions that also deliver community co-benefits enable municipalities to strengthen key stakeholder support, mobilize capacity across municipal departments, and maximize opportunities to address multiple social, economic, and ecological challenges.

These co-benefits—combined with energy consumption and emissions reduction outcomes—make a very compelling case for implementing the measures outlined in the CAS.

TABLE 3: Examples of co-benefits associated with climate action strategies that reduce GHG emissions

HEALTH & SOCIAL WELL-BEING	ECONOMIC OUTCOMES	ENVIRONMENTAL CONDITIONS
• improved mental/physical health • expanded social equity • community cohesion & civic pride • reduced air pollution • reduced extreme heat exposure • shift to sustainable behaviours • social inclusion	• higher employment & job creation • reduced goods & infrastructure losses • operational savings • reduced climate impacts on businesses & local economy • labour & work improvements • shift to circular economy	• reduced fossil fuel dependence & emissions • improved habitat & biodiversity • green space access • waste stream reduction • improved air, water, soil quality • disaster risk reduction • reduced traffic congestion

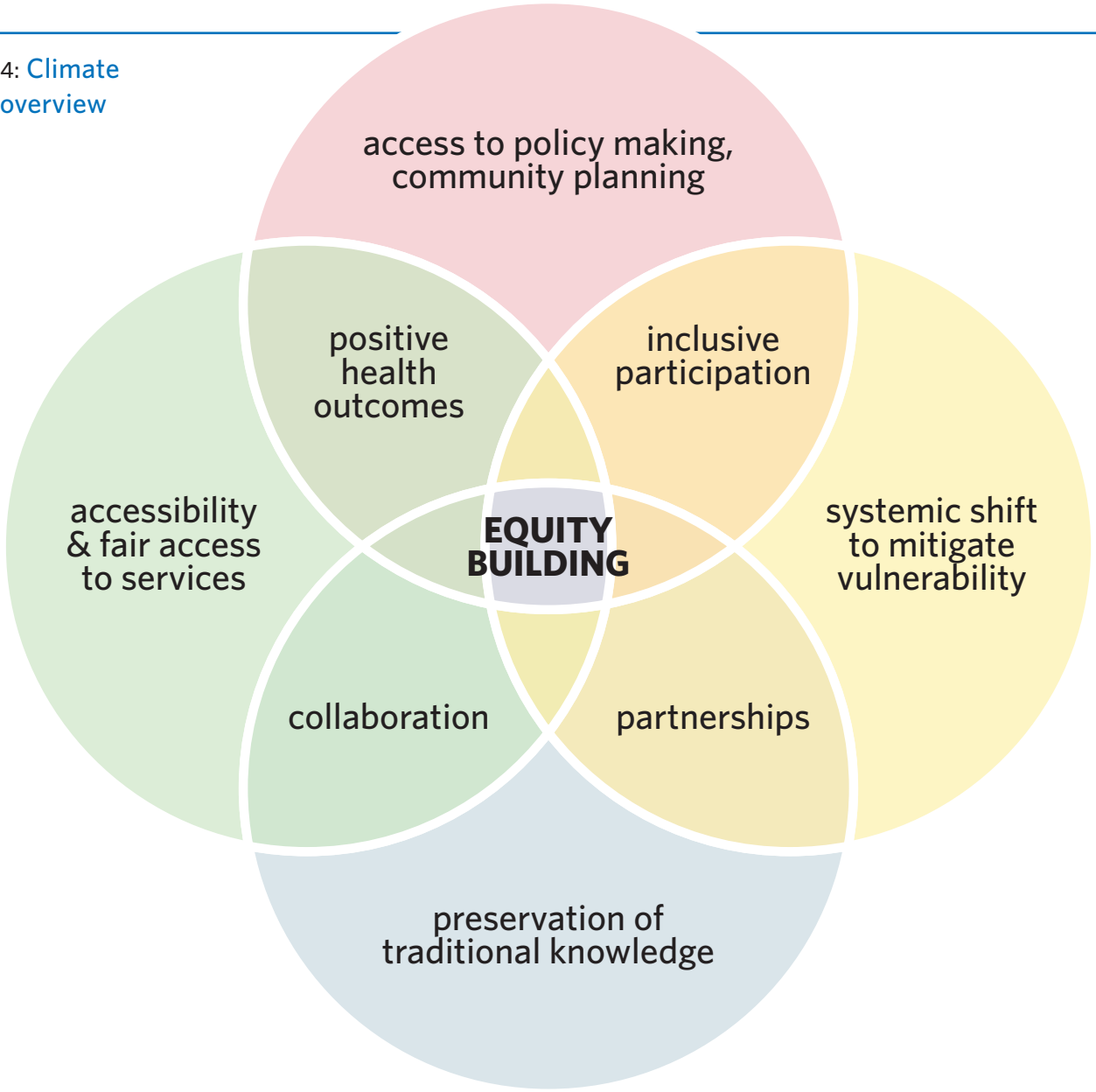
FIGURE 3: Climate action co-benefits overview



COMMUNITY CLIMATE EQUITY

The District is developing a DEI (Diversity, Equity, and Inclusion) strategy and action plan for the organization. It will help ensure that all staff know and feel they belong, they are valued, and their thoughts, ideas, and talents are not only welcomed but are needed to make a difference now and into the future. This strategy will provide the District's foundation on which to support and provide services to the community, including climate action initiatives. The initiatives identified in this CAS will be implemented through a DEI lens. Implementation will account for diverse identities and needs and prioritize the well-being of populations especially vulnerable to climate change impacts.

FIGURE 4: Climate equity overview



PART 1: INTRODUCTION

PART 1: INTRODUCTION

Human-caused global warming[1] is changing global climate functions with large-scale changes to weather patterns, including increases in the severity and frequency of storms, flooding, droughts, wildfire, air pollution, and other extreme weather events.[2] These changes are impacting our, health, infrastructure, buildings, natural ecosystems, and can magnify existing community inequities. The Intergovernmental Panel on Climate Change (IPCC) estimates that human activities have caused approximately 1.0°C of global warming above pre-industrial levels. Warming is likely to reach 1.5°C in the next several years. According to the IPCC, limiting warming to 1.5°C requires achieving net zero GHG emissions globally by 2050.[3] According to many scientists contributing to the IPCC reports, achieving net-zero global emissions much sooner—by 2030—is critical to limiting warming to 1.5°C.

Environment Canada's automatic weather station in West Vancouver has historically experienced an annual average temperature of 10.5°C and average annual precipitation of 1,593 mm.[4] Under current emission trajectories, annual average temperatures are projected to be 12.3°C for the 2021–2050 period, 13.7°C for the 2051–2080 period, and 15.2°C for the last 30 years of this century. Average annual precipitation is projected to be 7% higher for the 2051–2080 period and 10% higher for the last 30 years of this century. Average annual precipitation is projected to be 7% higher for the 2051–2080 period and 10% higher for the last 30 years of this century.[5]

EMISSIONS REDUCTIONS PLAN

To play its part in equitably addressing the challenges of climate change, and to lessen anticipated local climate change impacts, West Vancouver's CAS details a pathway to near net-zero emissions by 2050 and achieving 45% emission reductions under 2010 levels by 2030.

1 Global warming is the long-term warming of the planet's overall temperature. It occurs when excess heat-trapping particles collect in the atmosphere and absorb greater amounts of sunlight and solar radiation than is natural. Human activity has dangerously increased the presence of these atmospheric particles (known as anthropogenic global warming).

2 ibid.

3 Intergovernmental Panel for Climate Change. Special Report: Global Warming of 1.5°C. ipcc.ch/sr15

4 The historical period used for the West Vancouver automatic weather station was the 30-year period from 1994–2023 and the climate indicator projections were based on the period from 1971–2000.

5 McKenney, D. W., M. F. Hutchinson, P. Papadopol, K. Lawrence, J. Pedlar, K. Campbell, E. Milewska, R. F. Hopkinson, D. Price, and T. Owen, 2011: Customized Spatial Climate Models for North America. Bull. Amer. Meteor. Soc., 92 12, 1611-1622. Accessed January 2024. climatedata.ca

A GLOBAL & LOCAL IMPERATIVE

CANADA'S NATIONAL & INTERNATIONAL COMMITMENTS

Canada is a signatory to the Paris Agreement (2015), under which it has committed to achieving a 30% reduction in emissions below 2005 levels by 2030, and 80% below 2005 levels by 2050. The Paris Agreement aims to strengthen the global climate change response by keeping the global temperature rise this century well below 2.0°C relative to pre-industrial levels, and to pursue efforts to limit temperature increase even further to 1.5°C, to avoid the severe climate change impacts projected to occur if 1.5°C of warming is surpassed.

CARBON PRICING

Following direction in the Pan Canadian Framework, the *Greenhouse Gas Pollution Pricing Act* (2018) established a Canadian benchmark carbon price that began at $20/tCO$_2$e in 2019 and increased to $65/tCO$_2$e in 2023. The tax will increase by $15/tCO$_2$e every year until it reaches $170/tCO$_2$e in 2030. The federal carbon pollution pricing system has two parts:

- a trading system for large industry, known as the output-based pricing system; and
- a regulatory charge on fuel (fuel charge).

Provinces and territories can implement their own carbon pricing that meets or exceeds this national benchmark.

ZERO EMISSIONS VEHICLES

2019's Zero Emission Vehicle Infrastructure Program is supporting the transition to zero-emissions vehicles by helping to address the required investments and upgrades to the EV charging network.[8] The program targets public, on-street, workplace, multi-unit residential buildings, and commercial and public fleet charging infrastructure improvements. As of June 2021, the federal government has established a mandatory target for all new light-duty cars and passenger truck sales to be zero-emission by 2035.[9]

BUILDING ENERGY EFFICIENCY

The federal government's Canada Greener Homes Loan Program was launched mid-2021, providing homeowners with federal loan funding for energy efficiency upgrades and EnerGuide evaluations.[10] There are several related federal government efforts supporting green building programs including Local Energy Efficiency Partnerships[11] for new construction and Integrated Community Energy Solutions[12] for built community environments.

6 Natural Resources Canada. Zero Emission Vehicle Infrastructure Program. 16 Apr. 2019.
natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/20996

7 Transport Canada. "Building a Green Economy: Government of Canada to Require 100% of Car and Passenger Truck Sales Be Zero-Emission by 2035 in Canada."
tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/canada-s-zero-emission-vehicle-sales-targets

8 Natural Resources Canada. Canada Greener Homes Grant. 17 Mar. 2021.
natural-resources.canada.ca/energy-efficiency/homes/canada-greener-homes-initiative/canada-greener-homes-loan/24286

9 Natural Resources Canada. Local Energy Efficiency Partnerships (LEEP). 22 Apr. 2015.
natural-resources.canada.ca/energy-efficiency/homes/local-energy-efficiency-partnerships-leep/17338

10 Natural Resources Canada. Integrated Community Energy Solutions. 9 Oct. 2009.
natural-resources.canada.ca/homes/about-integrated-community-energy-solutions/4369

PROVINCIAL DIRECTION

In 2007 BC legislated the *Climate Change Accountability Act* to reduce province-wide emissions. GHG reduction targets are set to 40%, 60%, and 80% below 2007 levels by 2030, 2040, and 2050 respectively. In 2021, the Province released its *CleanBC Roadmap* to 2030, a plan to put BC on the path to net-zero emissions by 2050, with a focus on near-term actions to 2030. The plan details directions and targets from the Province, including:

- a zero-emission vehicle law achieving 26% of new light-duty vehicle sales by 2026, 90% by 2030, and 100% by 2035
- a target of 10,000 public EV charging stations by 2030
- actions supporting mode-shift toward active transportation and public transit
- nearly eliminating all industrial methane emissions by 2035
- enhancing the CleanBC Program for industrial emissions reductions
- a cap on emissions for natural gas utilities
- new requirements for all new buildings to be zero carbon and new space and water heating equipment to be highest efficiency by 2030
- implementing a 100% Clean Electricity Delivery Standard for the BC Hydro grid
- a new program to support local government climate and resiliency goals with predictable funding

Under the *Climate Change Accountability Act*, the Province is required to submit a report to the legislature each year outlining progress on climate action. The *2023 Climate Change Accountability Report** is the most recent report and focuses on BC's progress on climate actions across a range of policies, programs, and legislation implemented during the 2022–23 year (April 1, 2022, to March 31, 2023).

BC ENERGY STEP CODE

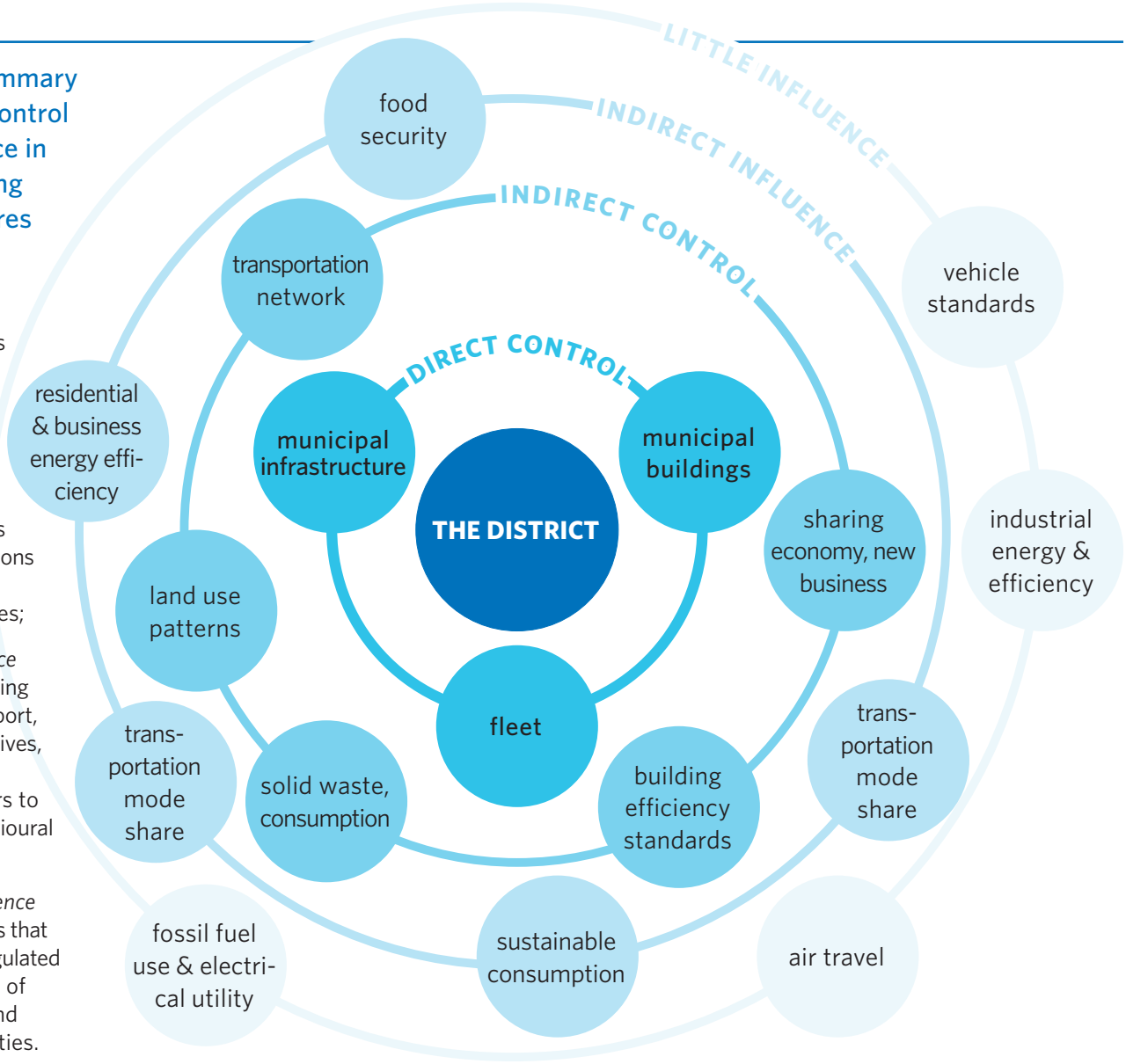
The BC Energy Step Code is a compliance path in the BC Building Code that local governments may use to incentivize or require increasing levels of energy efficiency in new construction that goes above and beyond the requirements of the BC Building Code. By 2032, the target is net-zero ready where the BC Building Code will move toward the Step Code's highest steps, as a minimum requirement. Many municipal governments are increasingly adopting more stringent Step Code levels as well as the currently optional Zero Carbon Step Code, in advance of their provincially planned implementation dates to achieve improved energy efficiency in new buildings sooner.

** 2023 Climate Change Accountability Report: Supporting Material.*
www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/2023_climate_change_accountability_report_supporting_materials.pdf

MUNICIPAL EFFORTS

Approximately 70% of global emissions are under the direct or indirect control or influence of municipal governments (Figure 5)*. Municipalities are taking action and enacting policies to reduce greenhouse gas emissions within their borders. Dozens of municipalities across Canada have adopted 100% renewable energy by 2050 (or sooner) targets. Dozens more have declared climate emergencies, identifying climate change impact mitigation as a critical, top priority issue alongside adaptation measures.

FIGURE 5: Summary of District control and influence in implementing CAS measures



Direct control refers to actions related to changes in municipal operations;

Indirect control refers to actions such as regulations and policies to achieve changes;

Indirect influence refers to providing resources, support, financial incentives, and actions to remove barriers to promote behavioural changes;

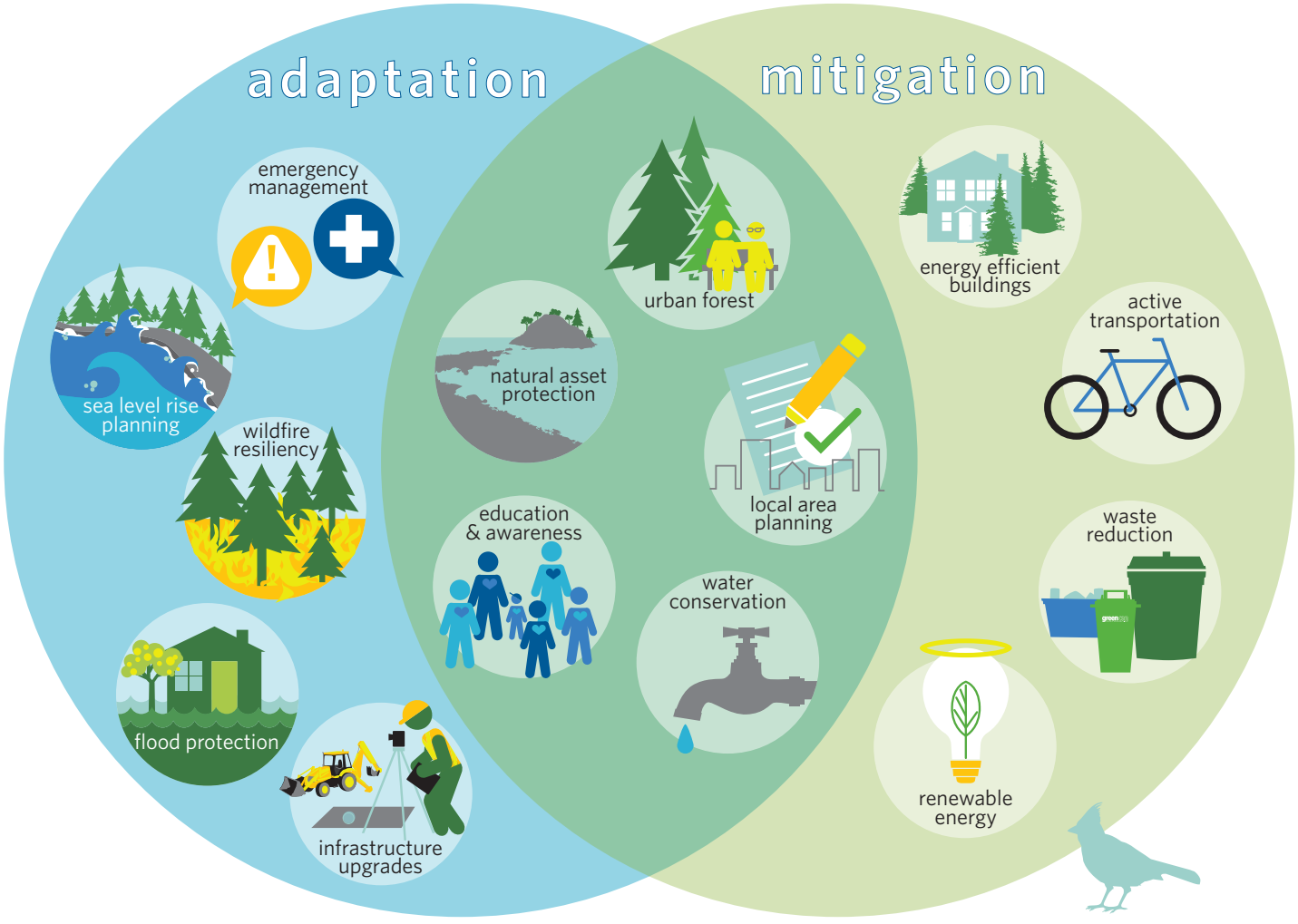
and *Little influence* refers to sectors that are typically regulated by other levels of government and not municipalities.

* *C40 Cities, and Arup. Deadline 2020: How Cities Get the Job Done. Analysis and Research, p. 59. c40.org/wp-content/uploads/2021/07/Deadline_2020.pdf*

WEST VANCOUVER'S *CLIMATE ACTION STRATEGY*

The District' Official Community Plan has policies and objectives to: (1) protect the natural environment; (2) reduce community and corporate GHGs; and (3) adapt to climate change. Recognizing that these three pillars are inter-connected, the strategy requires the integration of climate change adaptation and emission mitigation measures to minimize risk and generate community co-benefits (Figure 6). For example, reducing GHG emissions will provide a cleaner, healthier community and natural environment; the enhancement and maintenance of the natural environment will in turn help to reduce GHG emissions; early adaptation to the changing climate will help to build resilience in the community to reduce significant impacts on our well-being and daily life.

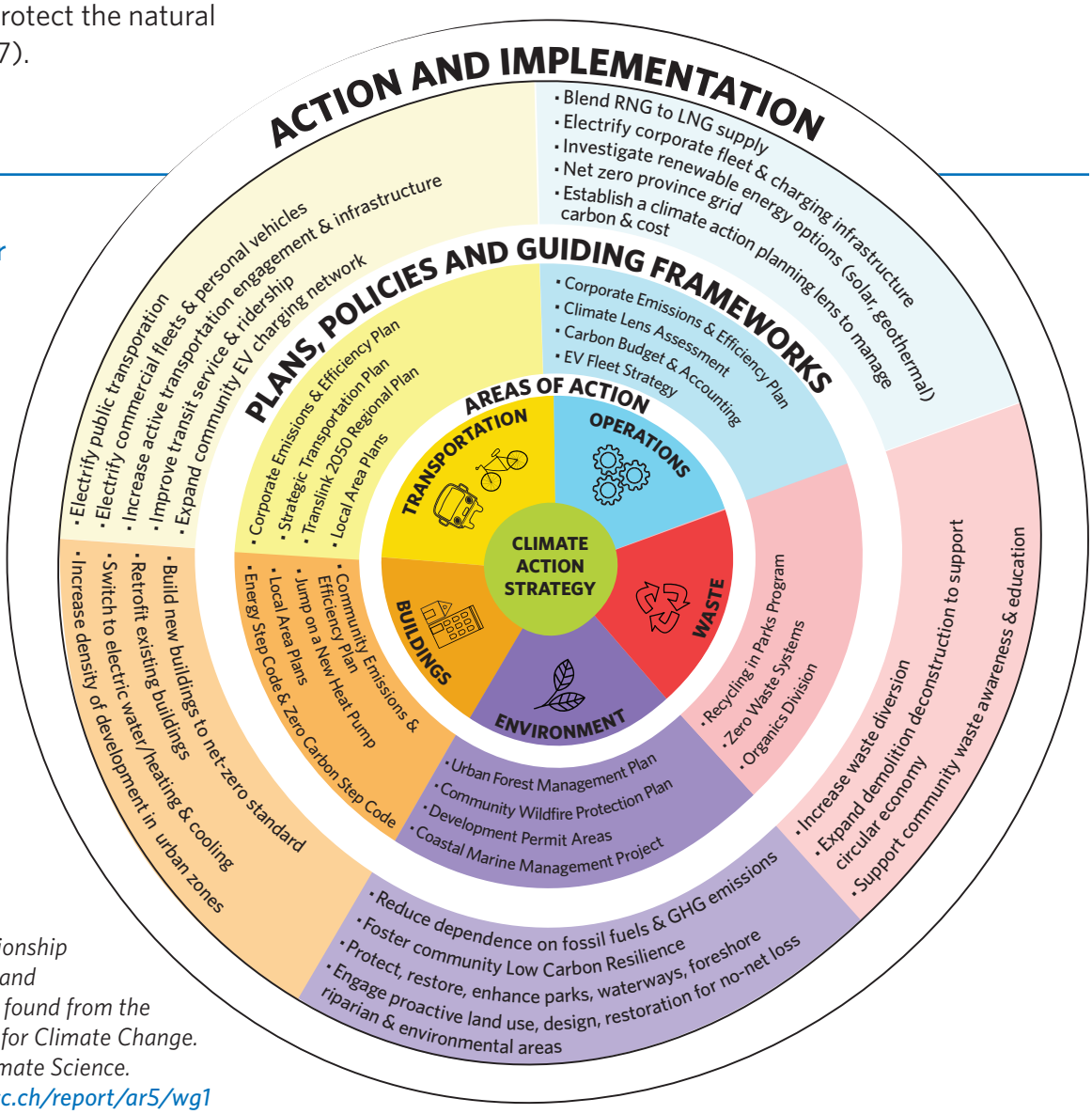
FIGURE 6: The connection between adaptation & mitigation efforts to achieve the District's goal of a low carbon resilient community



The CAS accounts for current and planned initiatives by the District to address the objective to reduce GHGs and a pathway to achieve its emission reduction targets. It acknowledges the global scientific consensus that identifies present and increasing ecosystems and climate impacts caused by increased greenhouse gas emissions from fossil fuel burning activities currently required to live our day-to-day lives*. West Vancouver's emission target seeks to reduce GHG emissions by 45% under 2010 levels by the year 2030 (a total of 148 $ktCO_2e$), and to achieve net zero emissions by the year 2050.

In 2016, West Vancouver coordinated climate action through the completion of a community and corporate emissions inventories known as the Community Energy & Emissions Plan (CEEP) and the Corporate Energy & Emissions Plan, respectively. Three years later, on July 8, 2019, the District of West Vancouver would join other Canadian and global municipalities in their declarations of a climate emergency. The CAS was built from these plans to prioritize actions to reduce GHGs and aligns with other District plans and policies to adapt to climate change and protect the natural environment (Figure 7).

FIGURE 7: Alignments of the CAS with other District plans and guiding frameworks



** More details on the relationship between climate change and greenhouse gases can be found from the Intergovernmental Panel for Climate Change. 1.2.2 Key Concepts in Climate Science. Assessment Report 5. ipcc.ch/report/ar5/wg1*

THE REDUCE-IMPROVE-SWITCH PARADIGM

Low-carbon community planning considers a wide variety of actions in transportation, buildings, energy use and generation, waste, and land-use. The actions can be classified under one or more categories of Reduce, Improve, and Switch: reducing energy consumption, improving the efficiency of the energy system (supply and demand), and fuel switching to low or zero carbon renewable sources (Figure 8).

The least wasteful and most cost-effective approach in transitioning to a low-carbon future is to first reduce the amount of energy needed as much as possible through energy efficiency and conservation, and then to switch to renewable energy sources to supply the remaining demand. The sequence of the approach is important: by avoiding energy consumption (Reduce), retrofit requirements (Improve), and the need to generate renewable energy (Switch) are both reduced. Table 4 explores some examples of measures in each of the paradigm's categories.

FIGURE 8: The Reduce/Improve/Switch model

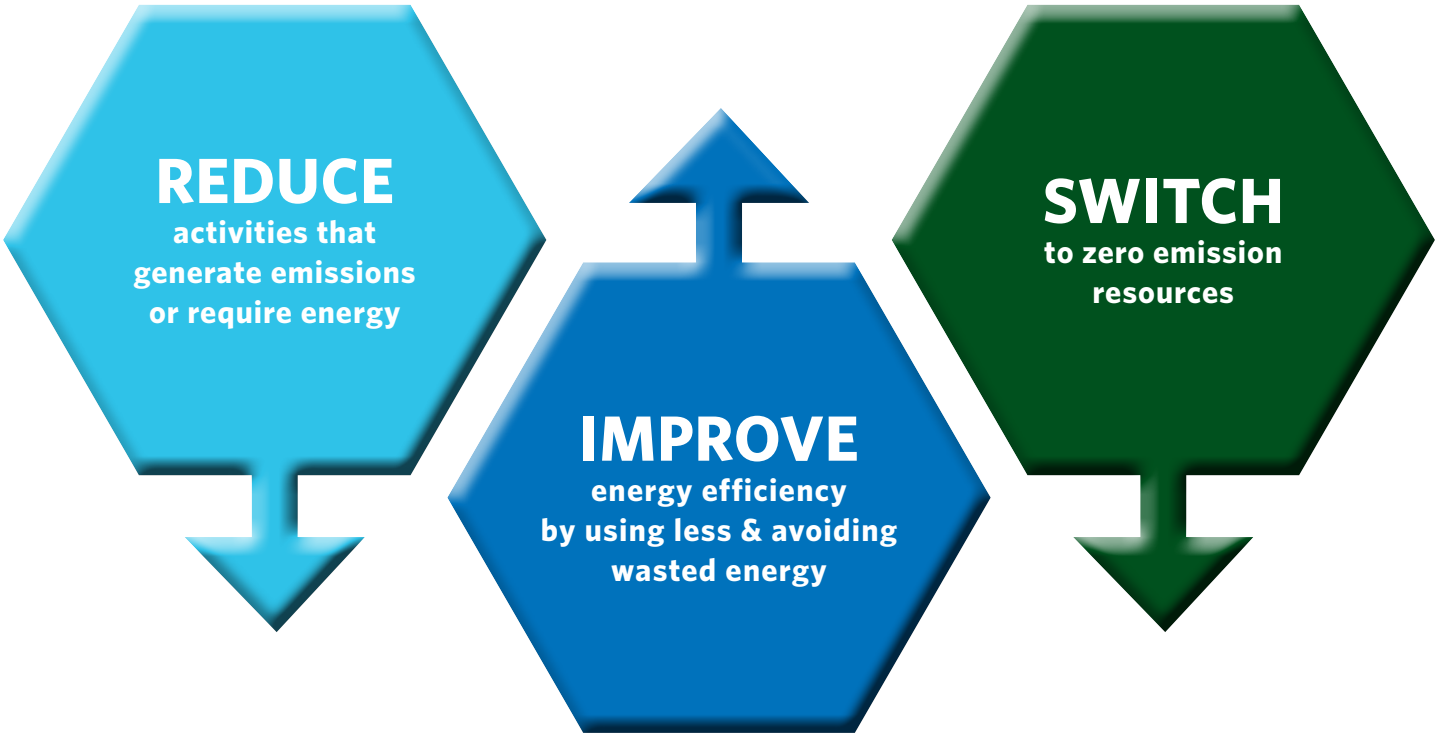


TABLE 4: Areas to explore using Reduce/Improve/Switch actions

SECTOR	ACTION NAME	APPROACH
URBAN FORM	increase urban density	reduce
BUILDINGS	raise standards to require reduced energy use & improved energy efficiency in new buildings	improve
ENERGY USE	decarbonize electricity	reduce, switch
	replace all natural gas for water heating and space heating with zero emissions fuels and/or waste heat	switch
TRANSPORTATION	vehicle energy efficiency	improve
	decarbonize vehicles	reduce, switch
	promote transit and active transportation	reduce, switch
WASTE & WASTEWATER	reduce generation of waste	reduce
WATER USE	decrease use of treated fresh water	reduce

PART 2:
COMMUNITY & CORPORATE GHG EMISSIONS INVENTORY

PART 2: COMMUNITY AND CORPORATE GHG EMISSIONS INVENTORY

WHICH ACTIVITIES ARE INCLUDED?

Emissions inventories use the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories (GPC), a standard ensuring consistency, transparency, and replicability. Emissions sectors and emissions-producing activities are well-defined. The BASIC+ level of GPC used in this report includes all emissions sources inside the municipal boundary, as well as some from activities occurring outside the boundary for which West Vancouver residents, visitors, and commuters are responsible.

Thus, West Vancouver's emissions inventory includes scope 1 emissions from stationary energy use (primarily buildings), transportation, waste, local industrial processes and product use, local agriculture, local forestry, and other land use. It includes scope 2 emissions from grid-supplied electricity use. It also includes scope 3 emissions from transboundary transportation, waste, and energy transmission and distribution. Figure 9 provides an overview of emissions sources for each scope.

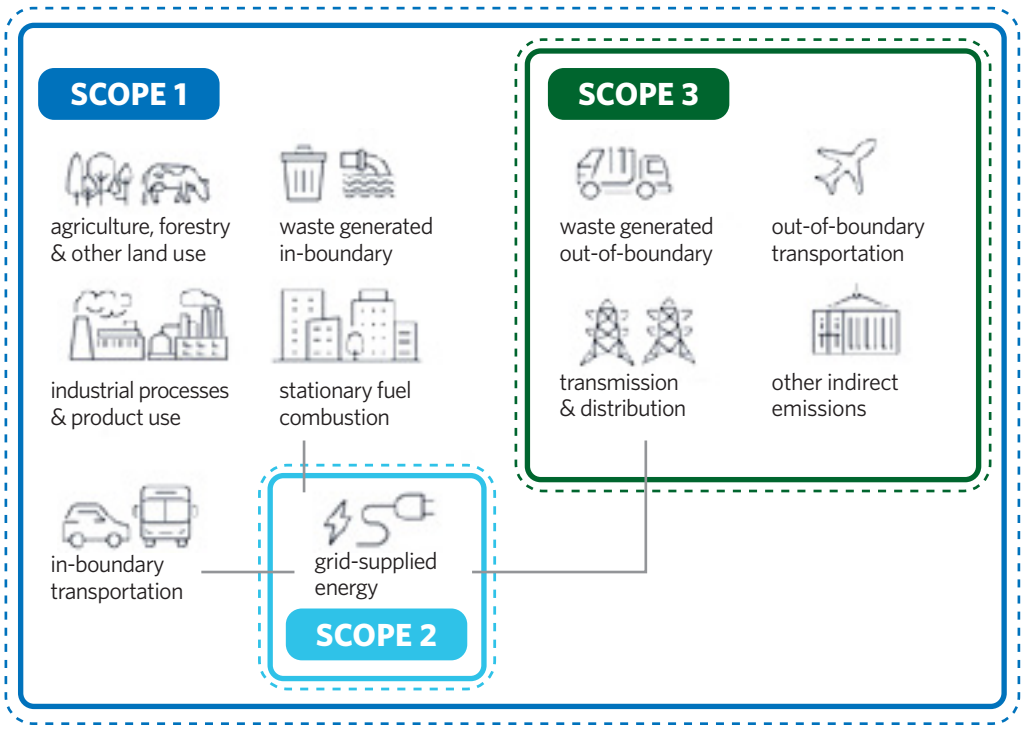


FIGURE 9: Illustration of GHG emission scopes

Note that this inventory does not include emissions associated with elements like embedded carbon for products created outside of the municipal boundary but consumed inside the boundary (e.g. construction materials, consumer products). In theory, these emissions are inventoried in the jurisdictions where the products are made.

WHICH GREENHOUSE GASES ARE INCLUDED?

GHG inventories typically focus on carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions—the greenhouse gases of highest presence.

Gases are measured in tonnes and converted into tonnes of carbon dioxide equivalents (tCO_2e). The conversion allows comparison of each gas' greenhouse gas effect—or global warming potential (GWP)—relative to the GWP of one unit of carbon dioxide (Table 5). For example, the global heating effect of one tonne of methane is 86 times that of one tonne of CO_2 over 20 years.

Acknowledging the different heating effects of the main GHGs allows appropriate action in mitigating their sources. For example, it is historically widely acknowledged that vehicle tailpipe emissions need to be eliminated, but only more recently has it been acknowledged that natural gas use needs to be eliminated, as its methane release poses direct public health risks[1] and severe global heating consequences.

TABLE 5: Greenhouse Gas Global Warming Potential Value[2]

GREENHOUSE GAS	OVER 20 YEARS	OVER 100 YEARS
carbon dioxide (CO_2)	1	1
methane (CH_4)	86	34
nitrous oxide (N_2O)	268	298

1 Examples: pubs.acs.org/doi/10.1021/acs.est.1c04707; cbc.ca/news/science/gas-stoves-air-pollution-1.6394514; ncbi.nlm.nih.gov/pmc/articles/PMC10901287/

2 Intergovernmental Panel on Climate Change IPCC Global Warming Potentials - 100-Year Time Horizon, Assessment Report 6, Synthesis Report, Table 7.SM.6 Tables of Greenhouse Gas Lifetimes, Radiative Efficiencies and Metrics. ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_07_Supplementary_Material

BASE YEAR INVENTORY

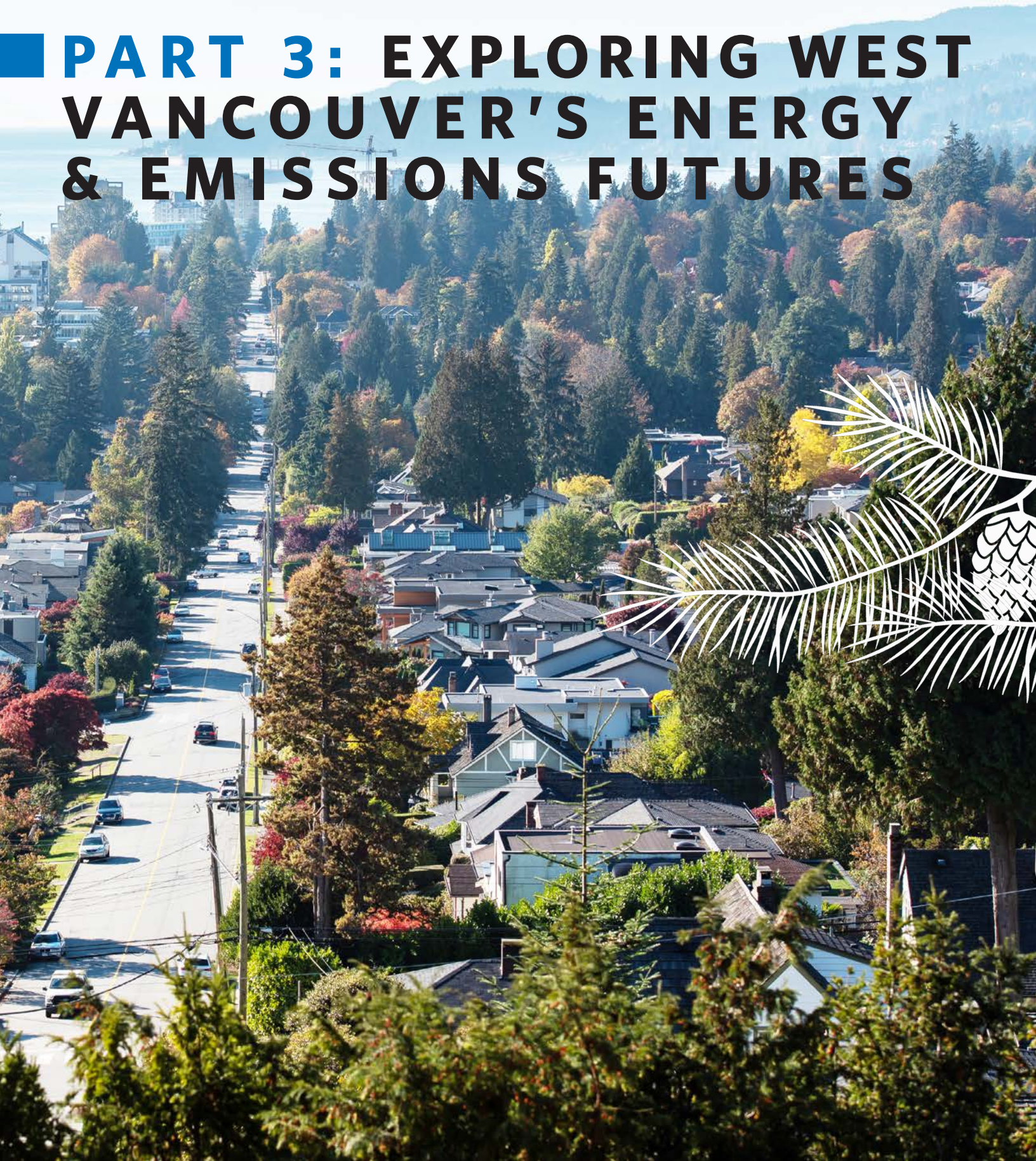
The base year inventory provides a recent catalogue of energy-using activities and their resulting emissions across the community. It describes where energy is currently sourced and how it is used, as well as the GHG emissions associated with its use. West Vancouver's total GHG emissions for the 2021 base year is 268 $ktCO_2e$ compared to 269 $ktCO_2e$ in 2010 (baseline year) (Table 6). The modelling in this report uses the 2021 base year as a reference point (as there is current and accurate data available across all sectors in this year) while the 2030 and 2050 emission reduction targets are compared to 2010 emission levels.

TABLE 6: Summary of West Vancouver's base year (2021) emissions inventory

SECTOR		TOTAL BY SCOPE (tCO_2e)			TOTAL (2021)	2010 BASELINE EMISSIONS (tCO_2e)
		SCOPE 1	SCOPE 2	SCOPE 3		
stationary energy	energy use	151,950	3,221	107	155,278	133,132
	energy generation supplied to the grid	0			0	
transportation	all internal trips + fractions of outbound trips + fractions of inbound trips	73,848	85	35,093	109,027	101,862
waste	generated in the District	0		4,170	4,170	34,605
	generated outside the District			0	0	
TOTAL		**225,798**	**3,306**	**39,371**	**268,475**	**269,600**

57% of West Vancouver emissions are generated by stationary energy consumption (155 $ktCO_2e$). With no major manufacturing and industry present, this value comprises residential (112 $ktCO_2e$) and commercial (41 $ktCO_2e$) emissions from energy consumption. 41% of emissions are from the transportation sector (109 $ktCO_2e$), all from on-road transportation. Personal use vehicles (primarily gasoline) travelling short distances (under 4 kms) represent the largest portion of trips. The remaining 2% of emissions are generated from waste, composed of two major sources: solid waste landfill and wastewater treatment. This snapshot shows opportunities for emission reductions and priority areas to chart West Vancouver's low-carbon future.

PART 3: EXPLORING WEST VANCOUVER'S ENERGY & EMISSIONS FUTURES

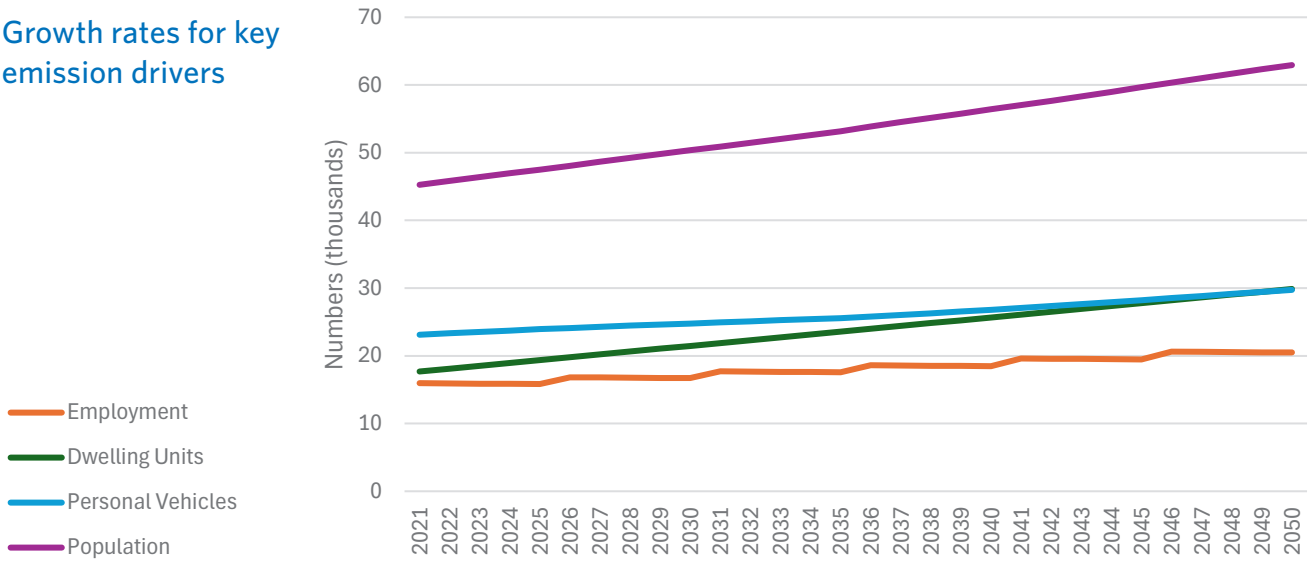


PART 3: EXPLORING WEST VANCOUVER'S ENERGY & EMISSIONS FUTURES

EMISSION DRIVERS*

Population and employment growth drive buildings and vehicles growth, which are the primary drivers of energy use and thus emissions production (Figure 10). West Vancouver was home to 45,262 residents in 2021 (adjusted for census undercount and student populations). The population is expected to grow by 39% by 2050 (62,988 people). Housing stocks are expected to grow almost proportionately by 41% by 2050 (29,876 total dwelling units). Vehicle stocks are expected to grow 29% over the same time period (29,739 total vehicles). Employment is expected to grow by 29% (20,360 total jobs), while commercial floorspace is expected to increase from 0.98 to 1.17 million m^2. Without major technology improvements (e.g. improved efficiency, fuel switching) and behavioural shifts, population growth is traditionally accompanied by additional GHG emissions. More buildings and vehicles using energy, more trips made, more waste and wastewater produced, and other growth-related emissions.

FIGURE 10: Growth rates for key emission drivers



** Population and employment projection numbers are from Translink modelling data (April 2023). Modelling necessarily requires making reasonable assumptions about the future. Figures provided here are projections that reflect trends, macro conditions, local, provincial, and federal government sources. These projections are subject to change and may be updated from time to time to reflect latest policies, demographic trends, household composition, as well as external factors. Actual growth will be influenced by market conditions and Council decisions. Irrespective of the exact amount of future population and household growth, the actions provided in the CAS provide a pathway to meet the District's emissions reduction targets of 45% from 2010 levels by 2030, and net zero emissions by 2050.*

SCENARIO MODELLING

West Vancouver seeks to reduce GHG emissions by 45% from 2010 levels by the year 2030 (a total reduction of 148 $ktCO_2e$ in that year) and achieve net zero annual GHG emissions by 2050. Energy and emissions scenario modelling was used to determine what measures the District, residents, businesses, and the community can take to achieve these targets. Scenario modelling assumptions are summarized in Table 7.

TABLE 7: Summary of modelled emission reduction scenarios

SCENARIO	DESCRIPTION	KEY ASSUMPTIONS
Business-as-Usual (BAU) 2021–2050	The BAU scenario forecasts the community's expected energy use and GHG emissions profile year-over-year until 2050. It assumes no emissions reduction interventions beyond those currently expected. The BAU represents current land use patterns and plans (e.g. Marine Drive LAP), and projects historical trends across all sectors.	• population growth • employment growth • new building growth • heating & cooling degree days • transportation fuel standards • electricity emissions factor
Business-as-Planned (BAP) (Clean BC + District Plans) 2021–2050	The BAP scenario accounts for measures implemented through Clean BC, the province's climate change action plan, plus planned District of West Vancouver land use planning and transportation measures.	BAU information and: • residential & commercial building heat pumps & hot water heaters • new personal ZEVs (prov/fed targets) • new commercial ZEVs • vehicle emissions intensity reduction • Provincial Step Code 4 in 2023 • improved electricity emissions factor • 95% waste diversion • District land use (OCP) policies and LAPs for Cypress Village, Horseshoe Bay & Ambleside • municipal fleet electrification • improved transit service • ZEV transit buses
Low-Carbon Scenario (LCS) 2021–2050	The LCS models deeper potential emission reduction measures that can be taken in each sector of the community to reach West Vancouver's 2050 emissions reduction target. Each action is defined by a set of assumptions and is modelled year-over-year until 2050.	BAU and BAP information and: • Taylor Way Future LAP • Provincial Step Code 5 by 2027 • ambitious building energy retrofits • home solar PV and heat pumps • RNG and hydrogen to replace natural gas • 100% waste diversion & methane capture • active transportation infrastructure

TOTAL ENERGY USE OUTLOOK

BAU

Energy use increases by 17% by 2050 from 2021 levels. The transportation sector energy use declines by 25% over this period as EVs replace gas models—although there are more vehicles, EVs are far more energy efficient than gas models. New homes push residential sector energy demand up 47% from 2021 levels, despite reduced heating demand expected as heating degree days decrease (due to climate change effects). This trend also results in a 1% energy use reduction in commercial sector buildings.

BAP

Energy use decreases by 21% from 2021 levels by 2050. More stringent vehicle efficiency regulations and federal and provincial EV uptake targets decrease transportation emissions by 58%. Heat pump installations, the BC Energy Step Code for new buildings, and an improved electricity emissions factor decrease building sector emissions by 4%, despite the increase in new homes. The same trends achieve 15% reductions in the commercial building sector.

LCS

Energy use decreases by 52% from 2021 levels by 2050. Improved transit and active transportation support decrease transportation emissions further, down 69%. The suite of residential measures decreases emissions by 35% including fuel switching, heat pumps, highest Step Code tiers, and performing energy efficiency retrofits in existing buildings. The same measures decrease commercial buildings' emissions by 73%.

FIGURE 11: BAU energy use outlook by sector

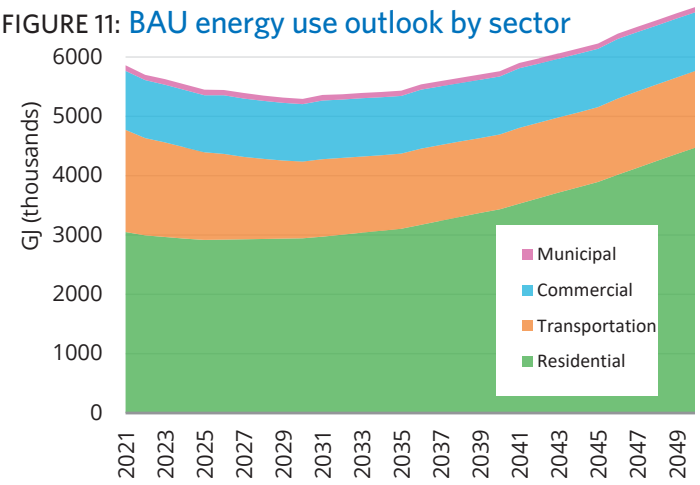


FIGURE 12: Modelled BAP energy use by sector

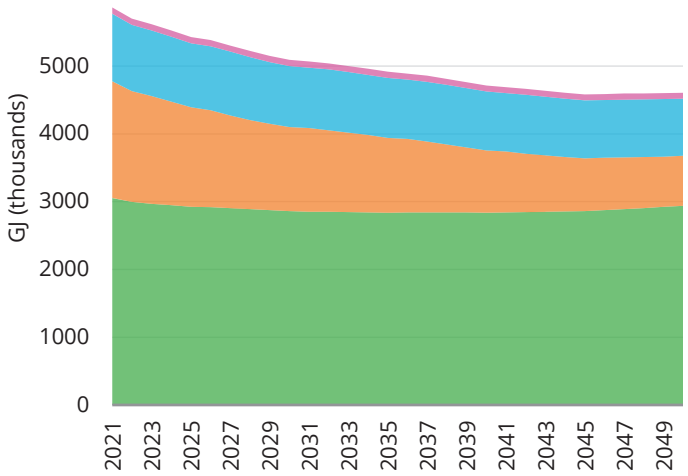
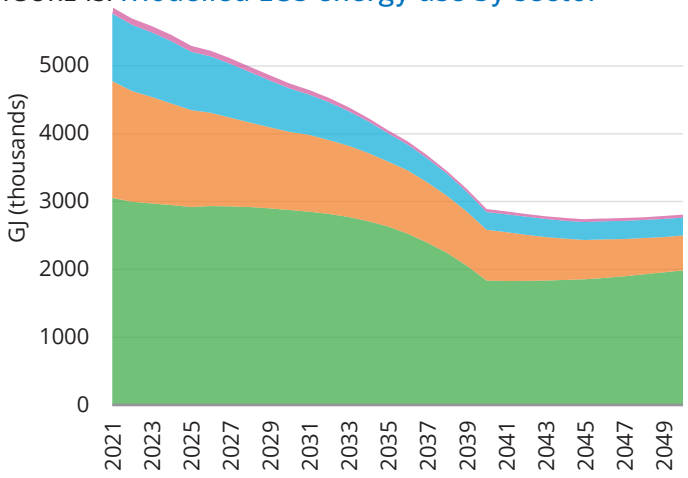


FIGURE 13: Modelled LCS energy use by sector



ENERGY SOURCES OUTLOOK

BAU

Mostly due to new homes, net electricity consumption increases 35% by 2050, while natural gas use increases 34%. As EVs replace internal combustion engine vehicles, diesel and gasoline use decreases by 3% and 30%, respectively.

BAP

More electricity is used in the BAP scenario as electricity-using technologies like EVs and heat pumps become more prevalent. Net electricity consumption increases 41% by 2050. Conversely, natural gas use decreases by 49%. Transportation measures implemented in the BAP scenario decrease diesel and gasoline use by 47% and 90%, respectively.

LCS

Despite more homes and EVs, net electricity use decreases by 15% from 2021 levels by 2050 in the LCS, primarily due to replacing baseboard heaters with heat pumps (increasing electric heating efficiency by at least 300%). Natural gas is eliminated as energy systems electrify, and the remainder of natural gas is switched to hydrogen and RNG. Diesel and gasoline are all but eliminated from the transportation sector.

FIGURE 14: BAU energy use by fuel type and sector

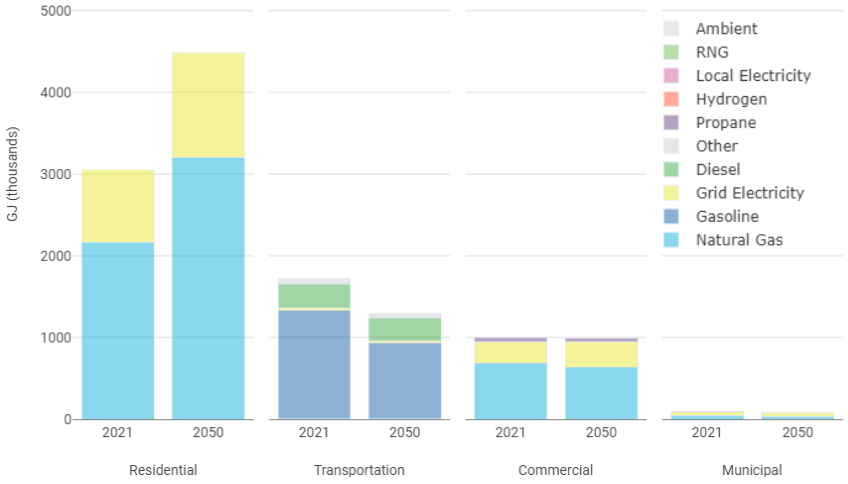


FIGURE 15: BAP energy use by fuel type and sector

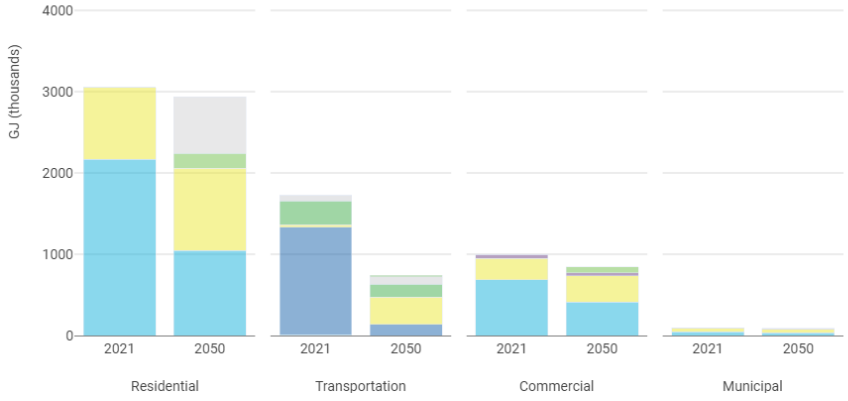
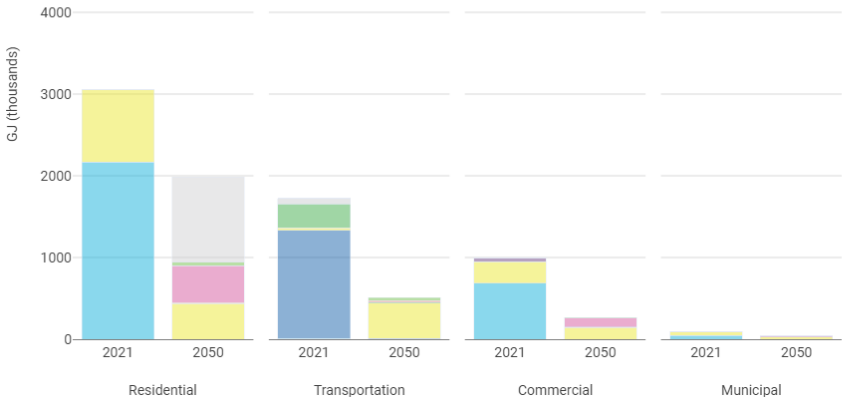


FIGURE 16: LCS energy use by fuel type and sector



TOTAL EMISSIONS OUTLOOK

BAU

Following from the energy outlook, BAU emissions decrease 11% from 2021 levels in 2030. Transportation emissions continue to decline by 24% by 2050. In other sectors, effects of emissions drivers' outpace reductions past 2030. Residential emissions dominate the future, increasing by 48%. Commercial buildings' emissions decrease 6% as less heating is required. The net emissions increase by 2050 is 11% from 2021 levels. Neither of West Vancouver's 2030 nor 2050 emission reduction targets are met under BAU.

BAP

In the BAP scenario, emissions decline 59% from 2021 levels by 2050. The fuel and technology switching measures taken under CleanBC and the compact complete communities developed under certain LAPs are effective at mitigating emissions. This is especially true in the transportation sector where emissions are down 81% by 2050. Residential, commercial, and municipal building emissions decrease by 53%, 40%, and 33%, respectively.

LCS

Additional measures taken in the LCS prove highly effective at reducing emissions, which are all but eliminated across all sectors by 2050. Remaining emissions in 2050 include those from residual fossil fuel use in the commercial and transportation sectors, and those from legacy waste in landfills.

FIGURE 17: BAU emissions by sector

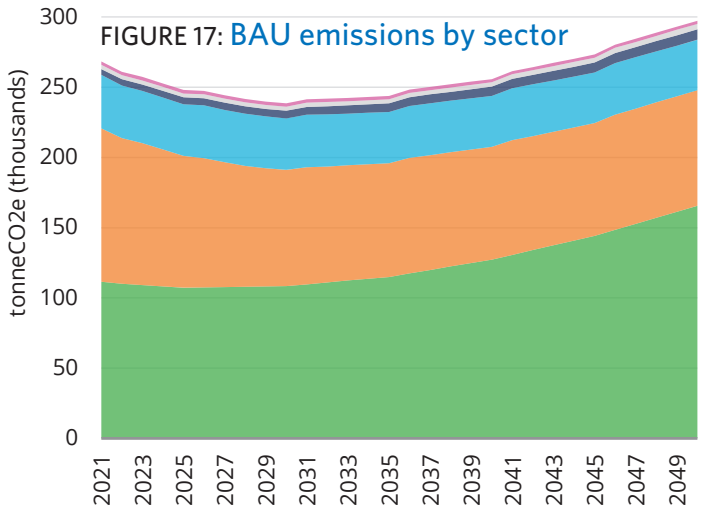


FIGURE 18: BAP emissions by sector

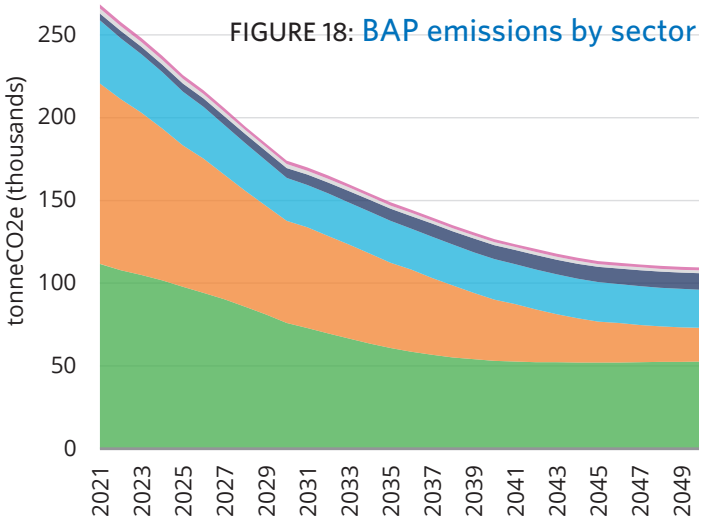
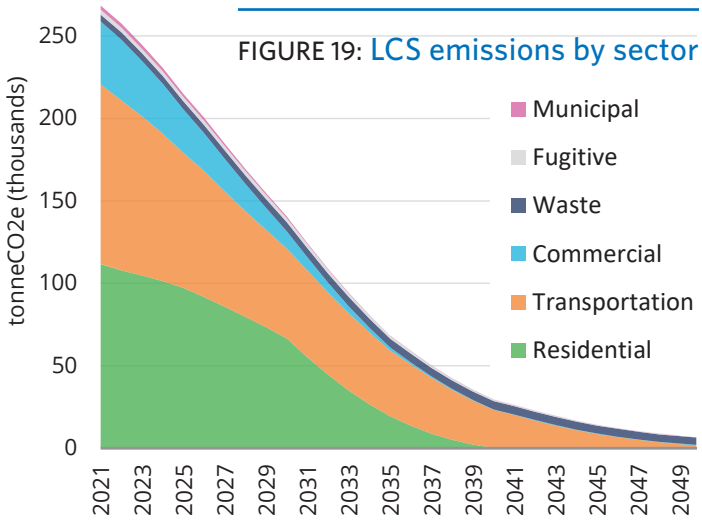


FIGURE 19: LCS emissions by sector



EMISSIONS SOURCES OUTLOOK

BAU

With no additional fuel switching and efficiency measures, natural gas use grows by 34% as buildings are developed to 2050, maintaining its place as the top emitter amongst all energy sources. Fugitive emissions from natural gas transmission increase in kind. Emissions from gasoline and diesel use decrease by 3% and 30%, respectively, in step with their decreased demand as mandated EV sales replace fossil fuel vehicles. Waste emissions increase 80%, as the growing population generates more waste.

BAP

As BAP measures decrease natural gas demand, emissions from its transmission and use decline by 39% and 49%, respectively. More ambitious ZEV targets and compact complete communities that encourage walking and biking trips decrease diesel and gasoline emissions by 46% and 90%, respectively. Although the total mass of solid waste produced is the same across scenarios, organic waste diversion in the BAP reduces landfill waste emissions by 12% from 2021 levels.

LCS

As almost all fossil fuel use is eliminated in the LCS, their emissions are nearly zero. Legacy landfilled waste continues to emit GHGs, making up the majority of remaining emissions by 2050 in this scenario.

FIGURE 20: BAU emissions by energy source

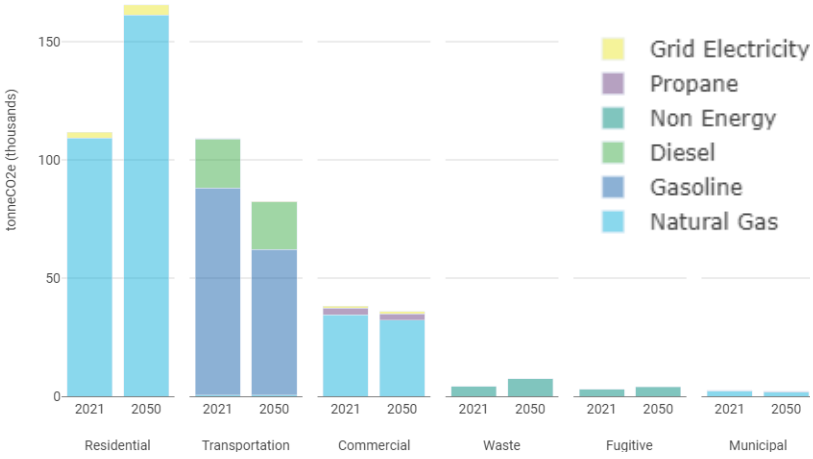


FIGURE 21: BAP emissions by energy source

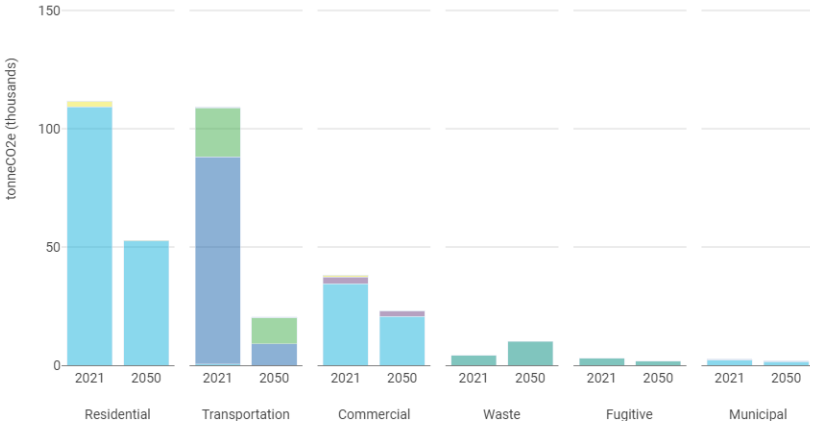
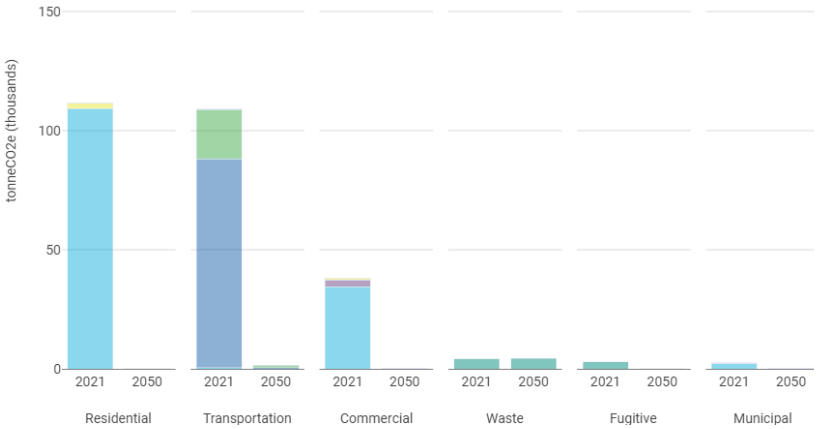


FIGURE 22: LCS emissions by energy source



OVERVIEW BY SECTOR

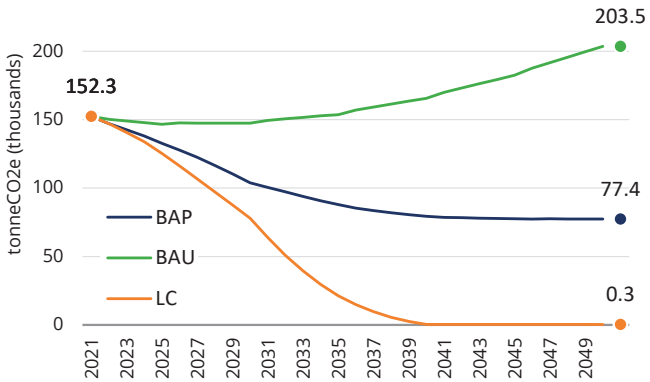
BUILDINGS EMISSIONS

The scenario modelling shows the significant emission reductions achievable by accelerating higher Energy Step Code level and Zero Carbon Step Code adoption, performing building energy efficiency retrofits, and switching natural gas heating and hot water systems for heat pumps (Table 8). By doing so, emissions from buildings are just 0.3 $ktCO_2e$ by 2050 in the LCS, a 99% reduction from 2021 levels (Figure 23). By 2050, building measures will reduce over 200 $ktCO_2e$ in the LCS compared to what they would be in that year without taking any actions (i.e. BAU scenario).

TABLE 8: Summary of key targets supporting building sector emission reductions

KEY TARGETS	BAU	BAP	LCS
new residential and non-residential building energy efficiency targets	no increase	by 2023, 40–80% more efficient	by 2027, net-zero emissions*
homes, commercial, and institutional buildings** retrofits	none included	none included	by 2040, achieve 50% thermal savings and 20% electrical savings in 95% of all existing buildings
municipal buildings retrofits	none included	none included	by 2035, 100% of municipal buildings are net zero
space heat pump installations	current uptake rate	by 2030, 1,412 residential buildings and 0.47 million m^2 of commercial floorspace served by electric heat pumps	by 2040 95% of residential and commercial buildings use electric heat pumps
hot water heat pump water installations	current uptake rate		

FIGURE 23: Total building sector emissions in each scenario



* *Step Code 5 for residential buildings and Step Code 4 for non-residential buildings.*

** *Institutional buildings include schools and churches.*

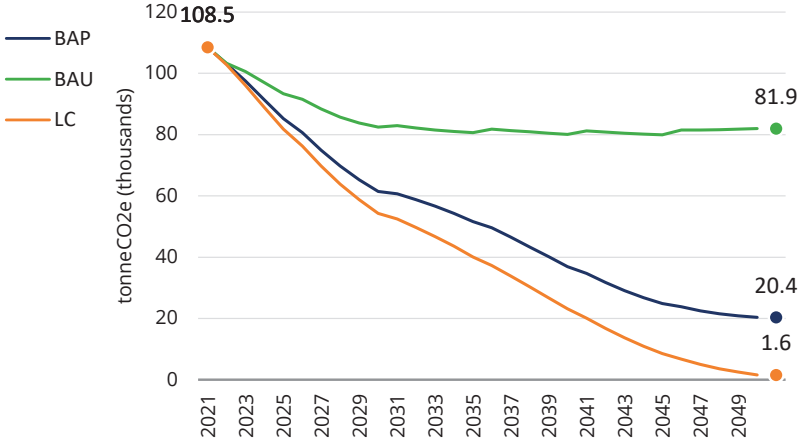
TRANSPORTATION EMISSIONS

Table 9 summarizes the transportation sector modelled targets. Vehicle electrification makes large contributions to emission reductions by 2050 in both the BAP scenario and LCS. Improved transit service and efforts to increase opportunities for active transportation across the District, especially in the LAP neighbourhoods, achieve substantial emission reductions as well*. Emissions from transportation are 2 $ktCO_2e$ by 2050 in the LCS, a 99% reduction from 2021 levels (Figure 24). By 2050, transportation measures will achieve over 80 $ktCO_2e$ of annual emissions reductions in the LCS compared to what they would be without taking any actions (i.e. BAU scenario)**.

TABLE 9: Summary of key targets supporting transportation sector emission reductions

	BAU	BAP	LCS
expand transit	service correlates with population and employment growth	Translink plans: expand transit through higher occupancy rates and added service	transit services increase in-line with LAP population and density growth
electrify transit	none	Follows Translink's Low-carbon Fleet Transition Plan	
municipal ZEVs	none	West Vancouver fleet strategy: 33–50% electric by 2030	West Vancouver fleet strategy: 100% ZEV by 2040
walking & rolling infrastructure	no additional efforts	Direction in LAPs provide new infrastructure for active transportation trips	
personal EVs	no change	2026: 26% of new vehicle sales (CleanBC Roadmap) 2030: 90% of new vehicle sales (CleanBC Roadmap) 2035: 100% of new vehicle sales (Federal)	
commercial EVs	no change	10% of new vehicles are EVs; 16% of new vehicles use CNG by 2030	100% of all new vehicles are zero-emissions by 2050
vehicle efficiencies	federal standard.	emissions intensity for new light duty vehicles declines 10% to 105g/km by 2030; for new HDV declines 20% by 2025 and 24% by 2030 (relative to 2015)	

FIGURE 24: Total transportation sector emissions in each scenario



* *These transportation mode switch actions are generally preferred over zero emission vehicle solutions as they have far greater socio-economic co-benefits.*

** *It is anticipated that by the 2030s, ZEV and renewable fuel solutions will be more widely available for medium and heavy duty vehicles.*

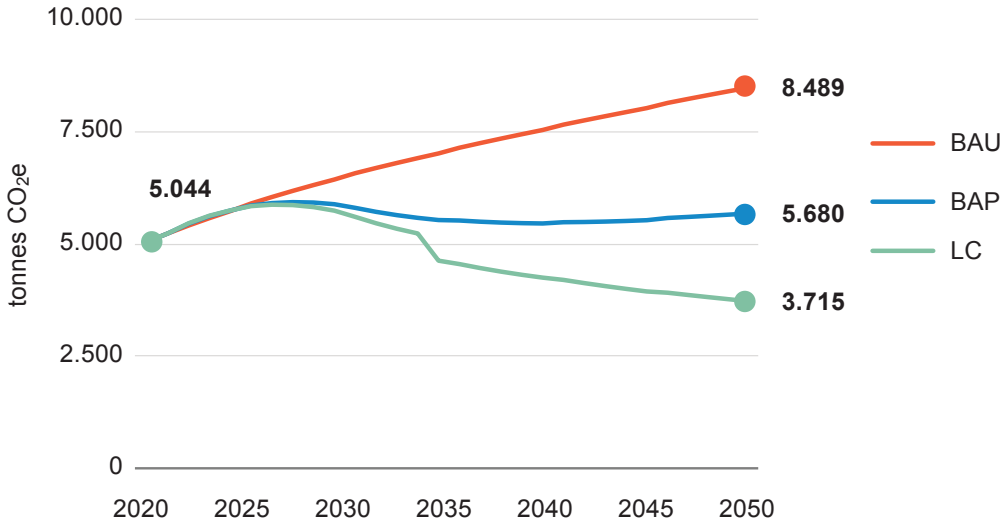
WASTE EMISSIONS

Waste relates to a number of environmental challenges, including emissions from upstream materials extraction, manufacturing and processing, and downstream pollution and environmental degradation. Emissions from waste (mostly from methane from landfills) represented less than 2% of total emissions in West Vancouver in 2021. Although this is a small portion of the emissions profile, one tonne of methane creates 86 times the global heating impact compared to one tonne of CO_2. As the population grows, emissions from waste are anticipated to increase by 68% by 2050, making waste reduction important for emissions reduction. Diversion of residential organic and wood waste, deeper reductions and diversion of construction and commercial waste, and increased landfill methane capture can greatly limit emissions from waste (Table 10). Emissions from waste are 3.7 $ktCO_2e$ by 2050 in the LCS, a 26% reduction from 2021 levels (Figure 25). By 2050, waste reduction and diversion measures will achieve almost 5 $ktCO_2e$ of annual emissions reductions in the LCS compared to what they would be without taking any actions (i.e. BAU scenario).

TABLE 10: Summary of key targets supporting solid waste sector emission reductions

	BAU	BAP	LCS
solid waste measures	waste generation scales with population growth no additional diversion efforts	waste generation scales with population growth 95% organics diversion (CleanBC)	• waste generation scales with population growth • 100% residential organics diversion • 100% methane capture from landfills • 50% of commercial & construction waste will be diverted by 2050 compared to 2016 levels • 100% wood waste diversion target by 2050

FIGURE 25: Total waste sector emissions in each scenario



ENERGY & EMISSIONS OUTLOOK SUMMARY

Despite a declining trend in energy use and GHG emissions by 2030, without substantial efforts to reduce energy demand, mode switch travel, and fuel switch, energy use (Figure 26), and GHG emissions (Figure 27) will increase substantially by 2050, as demonstrated in the BAU scenario. The BAP scenario shows the effectiveness of CleanBC measures implemented in West Vancouver, as well as the District's own land use planning measures. Total energy use and emissions decrease across the community, although the District's 2030 and 2050 emission reduction targets are not met. Additional measures and increased ambition in some measures achieve the 2030 and 2050 targets, as demonstrated by the LCS. Measures taken in the LCS result in 60% less energy consumption than in the BAU scenario in 2050.

FIGURE 26: Scenario modelling total energy use comparison

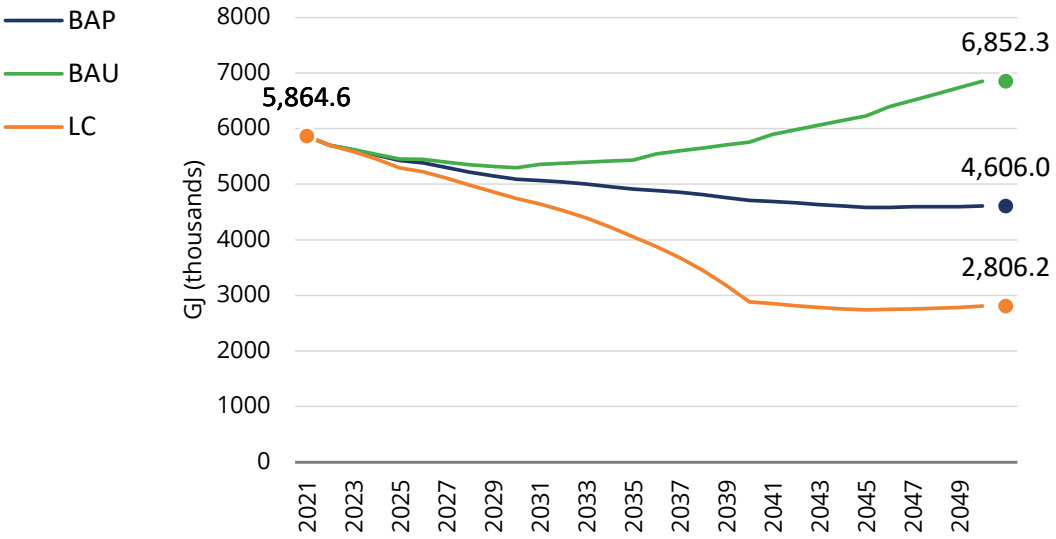
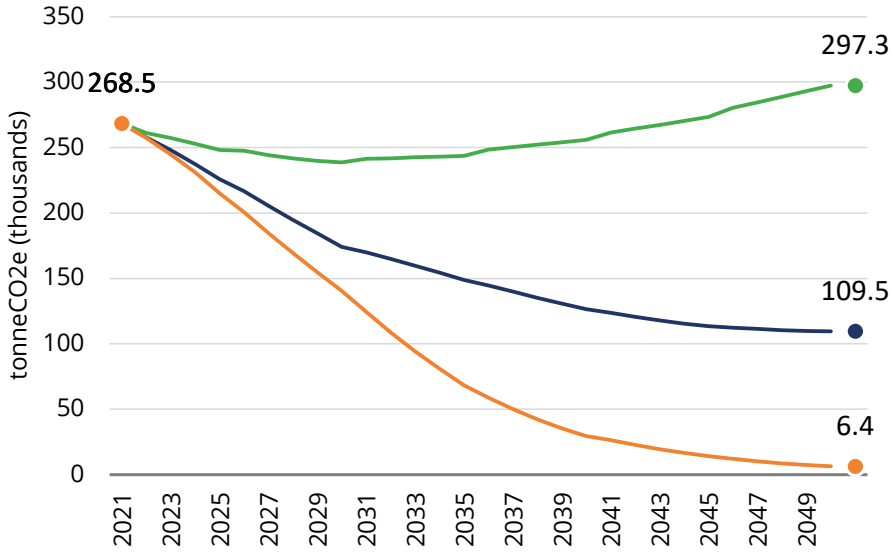


FIGURE 27: Scenario modelling total emissions comparison



The emission wedge diagrams (Figures 28 and 29) visualize how the modelled climate measures each reduce emissions over time in the BAP scenario versus the LCS. The grey area represents remaining carbon liability. As climate change impacts incur various social, economic, and environmental costs, the greater the remaining emissions, the greater the community's liability. The LCS wedge diagram demonstrates that although current local and provincial measures and commitments are effective at reducing emissions, additional measures are needed to meet the emission reduction targets required to avoid catastrophic climate change impacts.

FIGURE 28:
Cumulative emission reductions by action for the BAP

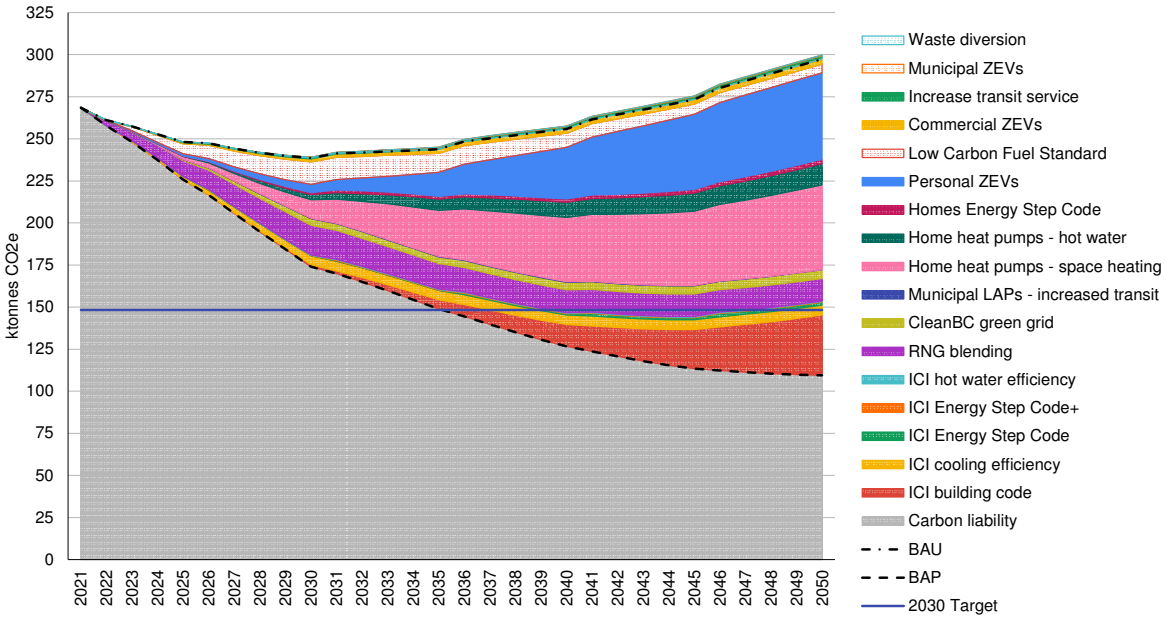
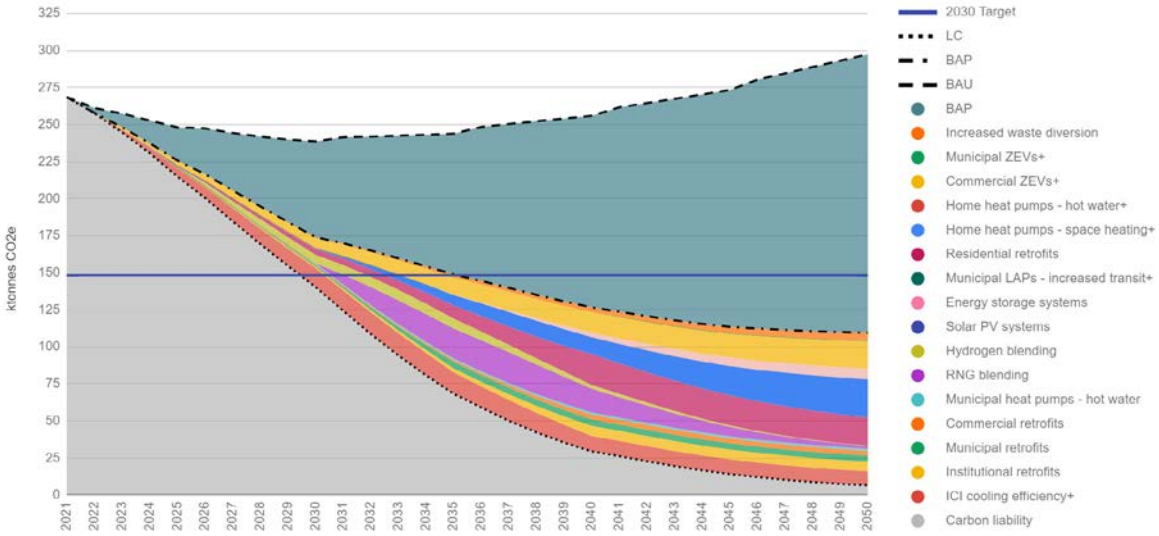


FIGURE 29:
Cumulative emission reductions by action for the LCS *(low-carbon scenario)* beyond the emissions reductions through the Business-as-Planned actions



PART 4: FINANCING THE LOW-CARBON TRANSITION

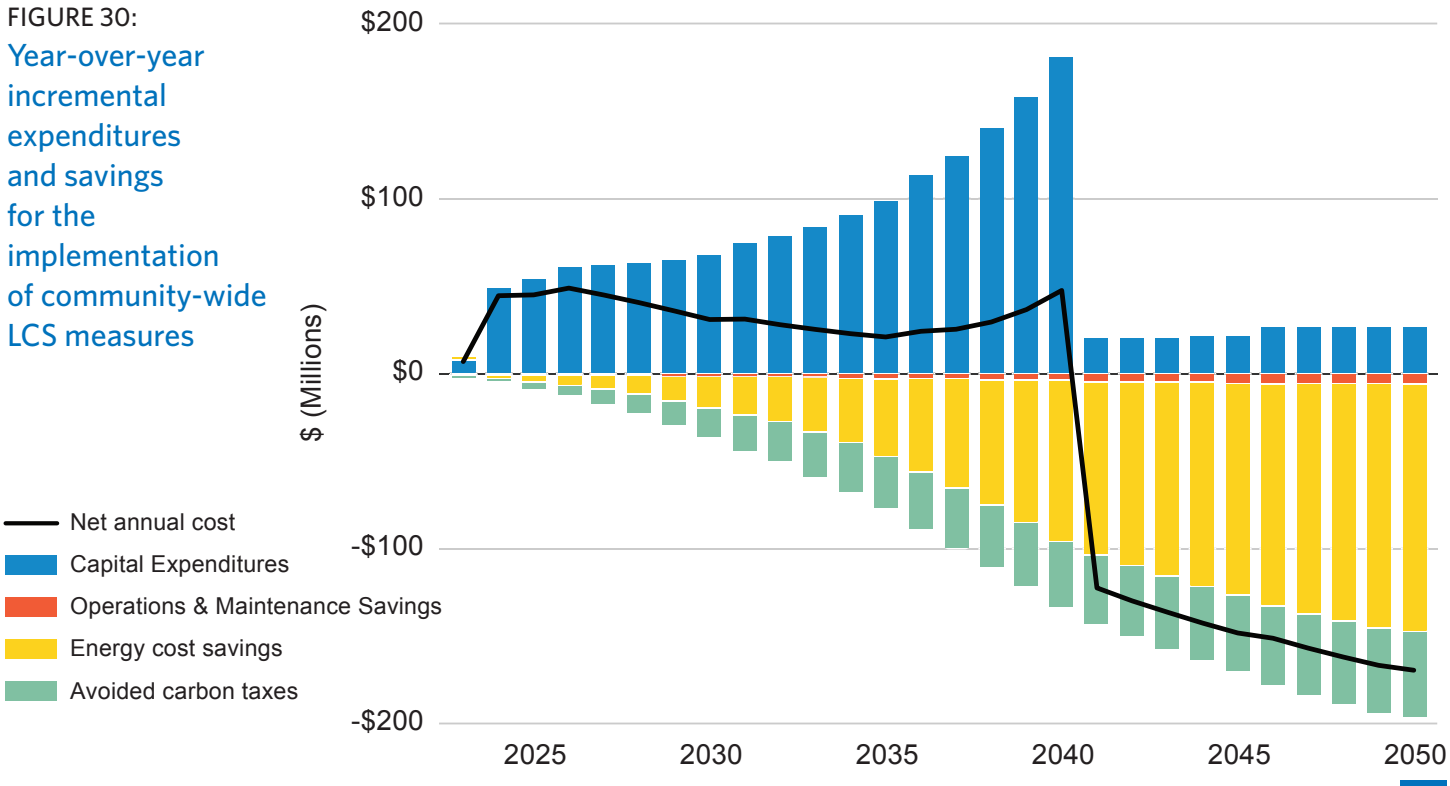
PART 4: FINANCING THE LOW-CARBON TRANSITION

What will the low-carbon transition of West Vancouver cost? High-level modelling reveals the financial implications of LCS measure implementation. Expenditures, savings, net present value, and employment were determined for LCS measures implementation as compared to the BAU scenario (i.e. expenditures, savings, and employment from BAP scenario and LCS measures are additional to those incurred in the BAU scenario). The expenditures and savings modelled represent those incurred across the municipal, private, and public sectors and not borne by the District alone. Savings consider capital expenditures, operating and maintenance costs (including fuel and electricity), and carbon pricing.

TOTAL EXPENDITURES & SAVINGS

Figure 30 summarizes modelled annual LCS measures costs and savings over those in the BAU scenario. Costs vary year-over-year as investments in transit vehicles, active transportation infrastructure, District fleet, building retrofits, and other elements are made. Expenditures fall dramatically after 2040 as most measures are completed by then.

FIGURE 30:
Year-over-year incremental expenditures and savings for the implementation of community-wide LCS measures



As building's energy systems electrify and vehicles become more efficient and powered by electricity, operations and maintenance savings grow (electric systems and vehicles require less maintenance). More efficient buildings and vehicles save on energy costs. Increased transit use and active transportation (more affordable trips than those made by car) also decrease transportation costs. Some energy generation sales are realized by solar PV installations.

Carbon pricing escalates from its current value of $65/tonne to $170/tonne in 2030. It is assumed this value stays constant to 2050. As the pricing escalates, decreasing natural gas use in homes and vehicles saves more and more.

The black trend line in Figure 30 shows the sum of expenditures and savings/avoided costs—the net annual cost. It indicates that the modelled break-even point across all actions investments is 2040, once most measures conclude. Some expenditures continue past 2040, but the overall savings and avoided costs of the measures significantly outweigh previous and continued investments. Savings and avoided costs are primarily realized by those making the expenditures: vehicle owners, home and building owners, the municipality, etc.

Total modelled expenditures and savings are summarized in Table 11. Modelled savings from reduced operations and maintenance costs, energy cost savings, and avoided carbon taxes demonstrate potential to achieve a net savings of $286.1 million over the next 26 years. BAP scenario measures save the majority in O&M costs and carbon taxes. This is mostly due to ZEV measures in that scenario —ZEVs are low-maintenance and greatly reduce fuel use (thus avoiding carbon taxes on fuel purchases). LCS measures achieve greater energy cost savings. This is primarily due to the increased ambition in energy efficiency measures in new and existing buildings.

TABLE 11: Summary of modelled emission reduction measures' expenditures & savings

	BAP MEASURES net present value	**LCS MEASURES** net present value	**BAP+LCS MEASURES** net present value
capital expenditures	$112.8M	$1,127.0M	$1,239.9M
O&M savings	-$48.9M	-$16.4M	-$65.3M
energy cost savings	-$416.2M	-$584.8M	-$1,001.0M
avoided carbon taxes	-$277.8M	-$181.9M	-$459.7M
TOTAL	**-$630.1M**	**-$343.9M**	**-286.1M**

CARBON BUDGET & ACCOUNTING FRAMEWORK

A carbon budget is an accounting system that municipalities can use to help ensure it is making progress toward its emission reduction targets while making decisions that are informed through a climate lens. The carbon budget embeds emission reduction targets, measures, and considerations into decision-making as part of a municipality's ordinary budgeting process.

Setting up a carbon budget involves establishing the limit of carbon emissions that can ever be produced by a community if we are to stay within +1.5°C of global heating (the scientifically-determined limit beyond which the climate emergency transitions into catastrophic climate impacts). This community emissions limit is the total carbon budget. It is assigned a timeline, for example to 2050, and the total carbon budget over this period is divided into annual limits. This is the carbon accounting framework: the year-over-year carbon limits the municipality must not exceed to meet its climate action commitments.

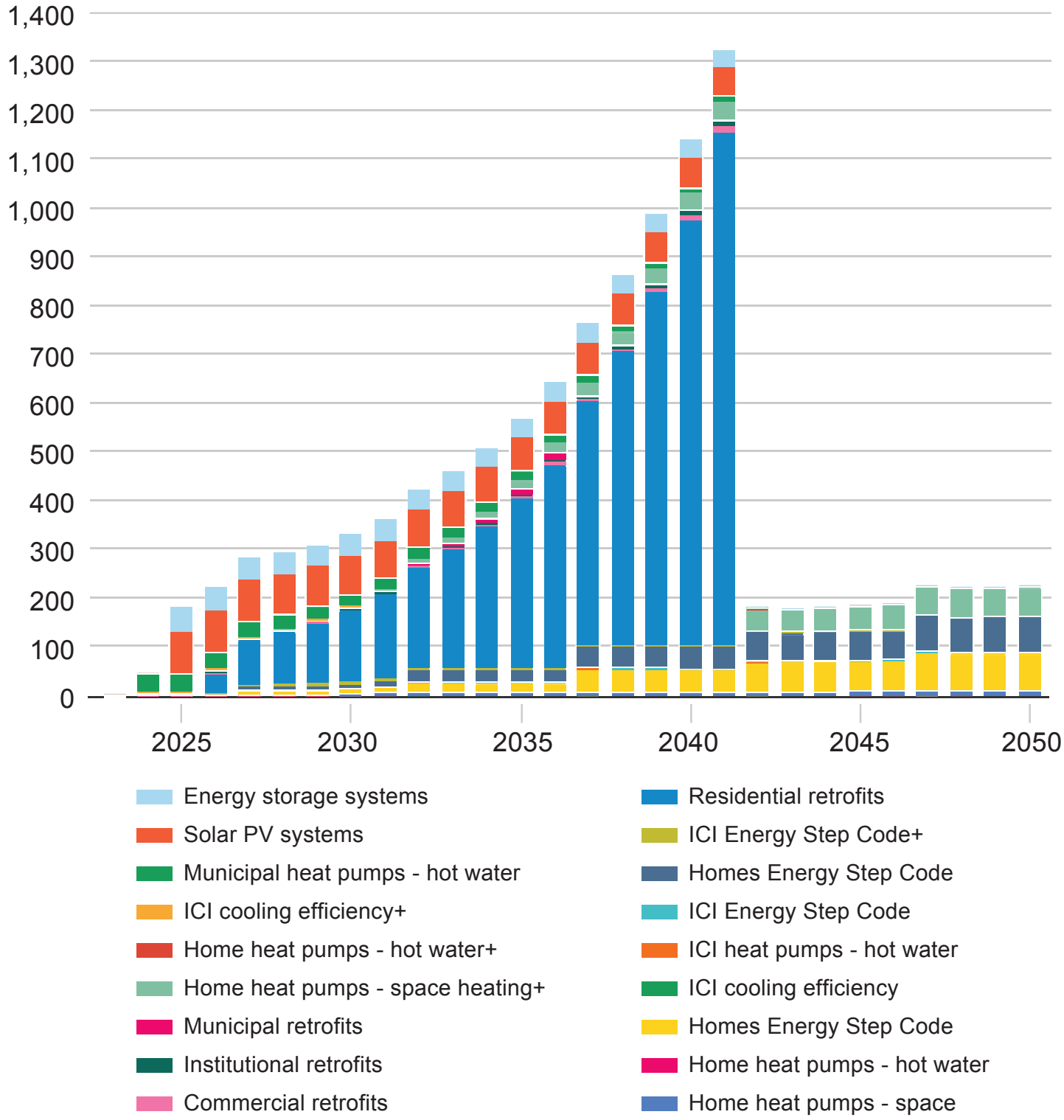
As part of staying within the annual and total carbon budget, proposed projects for buildings, transportation, infrastructure, waste, energy, etc. are assessed for their potential emissions production. The assessment determines the project parameters required to ensure its implementation does not exceed annual and total carbon budgets.

Such a framework is a critical tool to tracking municipal progress toward its emission reduction targets while ensuring new projects do not add to the emissions burden. Creating a carbon budget and accounting framework is an important next step in West Vancouver's climate action planning trajectory.

EMPLOYMENT

Many of the expenditures required to implement the measures are accompanied by employment gains. High-level employment modelling of LCS building sector measures indicates that 11,500 person-years employment will be generated in addition to any employment gains in the BAU reference scenario (Figure 31). New jobs are required to meet the demands of energy efficiency home construction, heat pump and solar PV system installations, and building retrofitting measures. The demand for most of these jobs declines as building measures are completed by 2040. Without these additional jobs, implementing the measures to the level of ambition sought will be very challenging. There is an amazing opportunity in West Vancouver to provide new jobs over the next few decades in the energy efficient building sector.

FIGURE 31: Person years of employment based on expenditures of LCS building sector measures



PART 5:
CO-BENEFITS TO ACTION

PART 5: CO-BENEFITS TO ACTION

This strategy focuses on measures that mitigate GHG emissions across the District of West Vancouver in an effort to do our part to meet scientifically determined GHG emission reduction targets that, if achieved, will help avoid the most dangerous impacts of human-caused climate change.

Evidence shows that carefully planned climate action can result in a snowball effect of positive outcomes, including reduced air pollution, expanded job creation, reduced inequality and improved public health and quality of life*. The District, Metro Vancouver, and the provincial government are working to enable the implementation of many emission reduction measures, with homeowners, commuters, residents, and businesses absorbing the benefits, including enhanced social health and well-being, economic outcomes, and environmental conditions.

SOCIAL HEALTH & WELL-BEING

The actions outlined in this strategy help to reduce GHG emissions through electrification of fleet vehicles, improvements to active public transportation and infrastructure, supporting high-efficiency building retrofits, electrification of heating and cooling systems, and climate-forward land use planning. These actions provide mental health, physical health, community cohesion, and sense of place and pride co-benefits. These can include, but are not limited to, reduction of harmful indoor and outdoor air pollution, improved community extreme heat preparedness, reduction in traffic congestion and noise pollution, expansion of equitable greenspace, as well as healthy, more social and accessible commuting options.

ECONOMIC OUTCOMES

Undertaking investments to reduce GHG emissions can help communities avoid and mitigate expensive physical damage and losses from climate impacts (e.g. extreme weather events, wildfire, flooding, sea level rise, heat strain on infrastructure). The benefits of transitioning to a low-carbon economy and high efficiency systems can foster economic generation through job creation, operational cost savings, as well as fostering leadership and influence toward circular economy practices that reduce resource demand and GHG emissions.

ENVIRONMENTAL CONDITIONS

Implementing the CAS will work to preserve, protect, and enhance our natural assets and air quality. Through urban forest management, foreshore planning, wildfire management, watercourse protection, switching to clean energy, and nature-based solutions, community exposure and vulnerability to extreme weather, urban heat island effects, and stormwater impacts are reduced.

Table 12 summarizes a variety of co-benefits associated with the measures identified in this strategy.

** Climate action has valuable health benefits. Journal of the International Society for Environmental Epidemiology. February 2024. journals.lww.com/environepidem/fulltext/2024/02000/climate_action_has_valuable_health_benefits.9.aspx*

These are just some of the key co-benefits to be realized through the implementation of measures in this strategy. The measures reduce climate change impacts, increase public health, equity and quality of life, save money, and avoid the high costs of inaction, making them highly compelling

TABLE 12: Some co-benefits of *Climate Action Strategy* measures

MEASURES	CO-BENEFITS
BUILDINGS & LAND USE	
• build new buildings to net-zero standards • retrofit existing buildings • switch to electric heating and cooling systems • switch to electric water heating systems	• improved housing quality and indoor and outdoor comfort • improved indoor air quality • reduced noise pollution due to improved building insulation and high-performance windows • reduced energy bills and vulnerability to energy price fluctuations • new investment opportunities in retrofits and new builds • job creation • improved comfort during heat waves, especially for vulnerable segments of the populations such as the elderly and young children
Local Area Plans	• improved extreme weather event resilience through equitable design for reduced urban heat island effects, stormwater infiltration (e.g. bioswales), and tree plantings • affordable housing options through a conscious mixture of housing types and tenancy options • increased amenities and shopping choices • increased social interaction opportunities • increased choice of transportation options *(walk, bike, roll, transit, vehicle, etc.)* • opportunity to create more greenspace through more condensed neighbourhoods

MEASURES	CO-BENEFITS
TRANSPORTATION	
• electrify public transit • electrify municipal fleet • electrify personal and commercial vehicles	• reduced nitrogen oxide and particulate matter pollution in the air • improved local air quality results in better respiratory health outcomes, especially for young children and elderly • reduced traffic-related noise pollution results in better mental health outcomes like lower stress levels • as fossil fuel prices increase, electricity use saves household and business costs • urban tree growth and health improves as air pollution is reduced
• increase active transportation infrastructure	• biking and walking paths that are well-lit and protected make it safer to move around in the community • increased physical activity and positive health outcomes • increased opportunities for social interaction • improved productivity and mental health outcomes with less time spent in traffic • reduced wear and tear on road infrastructure • increased choice for how to get around • reduced vehicle-related injury and fatality rates
• improve transit services • increase transit ridership	• commuting requires some physical activity to reach the closest transit stop, resulting in improved health outcomes • increased opportunities for social interaction • household transportation cost savings as transit use is cheaper than vehicle ownership/use • reduced time spent in traffic • reduced wear and tear on road infrastructure • potential to reclaim street space for green space
WASTE	
• increase waste diversion through recycling and composting	• improved outdoor air quality from less organic decay in landfills • innovation and new businesses from circular economy opportunities • reduced reliance on new, raw materials • job creation • encourages social responsibility • potential for households to reduce spending • improved habitat and biodiversity conservation

PART 6: CLIMATE EQUITY

PART 6: CLIMATE EQUITY

Community systems, planning, and policy can play an integral role in shaping community wide social determinants of health and community equity. As climate change impacts magnify across a community, existing inequities, vulnerabilities, and barriers that affect individuals' or community capacity to navigate climate challenges can intensify. Engaging a diversity, equity, and inclusion (DEI) lens in community climate planning can meaningfully mitigate and address root causes of community vulnerabilities amid climate change.

Implementing the CAS through this lens may look like expanding safe, affordable, energy efficient housing, providing support for heat pump installations, conserving and ensuring equitable access to public green space, building safe pedestrian and cycling infrastructure, increasing public transit access, growing community food gardens, creating accessible and purpose-built community spaces to foster community cohesion, and addressing governance and community systems that perpetuate inequity and oppression. With cultural, traditional and enduring linkages to land, air, water and living landscapes, Indigenous communities face historical, additional, and unique impacts from a changing climate that must be considered when taking action. The District will implement CAS measures that support vulnerable and disproportionately impacted communities to ensure equitable distribution of the measures' costs and benefits.

IDENTIFYING & BUILDING CLIMATE EQUITY

Disproportionately impacted and equity seeking communities can include but are not limited to the identified groups below, with an understanding that each community is unique and experiences marginalization differently, as do individuals within these communities*.

- Indigenous, Black, and other racialized peoples
- migrants and refugees
- people with limited English-speaking ability
- people with disabilities
- 2SLGBTQIA+ people
- children and youth
- women and girls
- and more

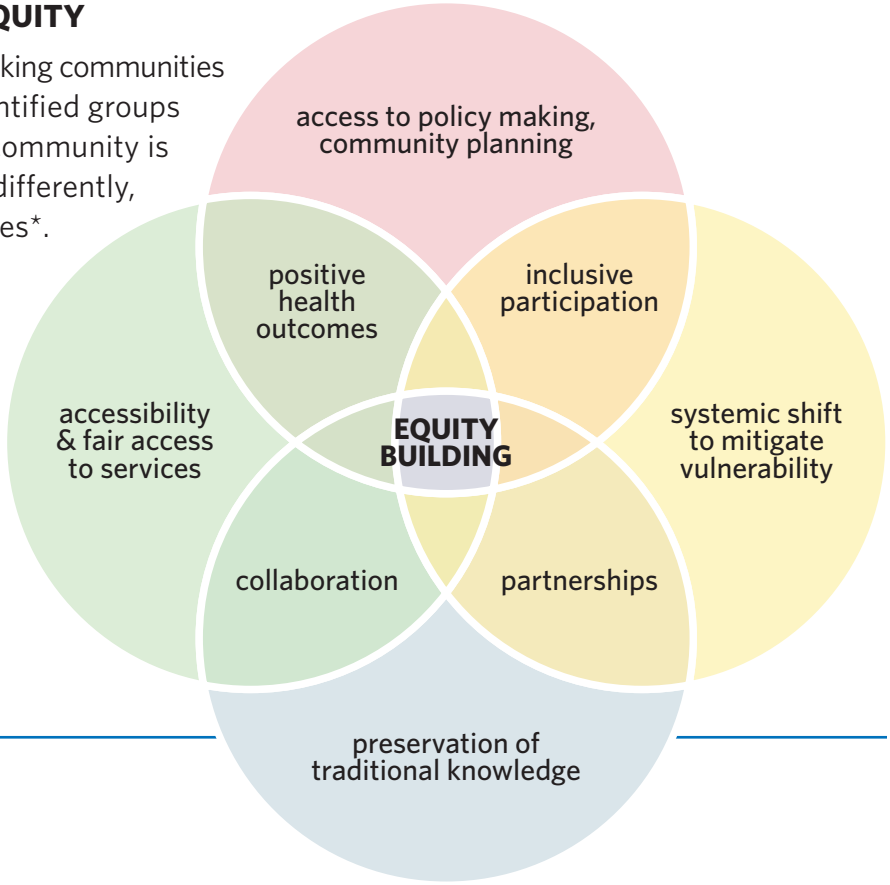


FIGURE 32: Climate equity overview

* *Vancouver Climate Justice Charter. vancouver.ca/files/cov/climate-justice-charter-vancouver.PDF*

UNDERSTANDING INEQUITY AND CLIMATE CHANGE

EXTREME HEAT

Extreme heat is a growing local issue, as shown with events like the 2021 heat dome resulting in 619 heat-related deaths within BC. Extreme heat events are predicted to magnify during summer months. High indoor temperatures, especially in homes without air conditioning, and on higher floors, are a major cause of negative health impacts during extreme heat events. Older adults, infants and young children, people who are pregnant, people with chronic conditions, people with disabilities, people on certain medications, people experiencing homelessness and/or poverty, people living alone, and people who work or exercise outdoor are especially sensitive and vulnerable to the health effects of heat.

WILDFIRE & AIR QUALITY

Over recent years, West Vancouver has endured wildfire threat and smoky air. A warmer, drier climate increases the frequency and severity of wildfire, as well as the length of fire season. Exposure to wildfire smoke is found to have increasing negative effects on population health. Additionally, air pollution from fossil fuel emissions has been identified as causing over 7 million premature deaths globally each year. Fossil fuel emissions like ground level ozone are found to have a wide array of public health impacts including asthma, lung disease, heart disease, stroke, cancer, dementia and more. Older adults, infants, young children, pregnant people, people with existing respiratory conditions, outdoor workers and the unhoused are especially susceptible to the health effects of poor air quality.

PART 7: IMPLEMENTATION

PART 7: IMPLEMENTATION

A detailed implementation framework is provided in Appendix 1, which includes priority measures, implementation timelines, associated costs, and possible external funding support to reduce corporate and community GHG emissions. The framework includes measures under the Business-As-Planned scenario and additional measures under the Low Carbon Scenario that will achieve the District's emission reduction targets. The following sections provide a summary of the priority measures, the District's influence of these measures, and the associated co-benefits.

DISTRICT POLICIES & REGULATIONS

The CAS provides direction on policy or regulatory updates that can support achieving the District's emission reduction targets. Municipal policies require review of, revision of, and updates to existing policies, which can take time, depending on the complexity of the policies. The Local Area Plans included in the measures assessment in this strategy are approved or underway. Other policy updates—including accelerated Energy Step Code and Zero Carbon Step adoption, retrofitting of existing buildings, and waste diversion policies—need to be expedited if they are to be implemented in time to achieve targets. Appropriate District departments will be coordinated in these efforts. Climate action commitments in regional government strategies like Metro Vancouver's Climate 2050 and provincial strategies like Clean BC have bearing on the District's climate action efforts. These directions can benefit West Vancouver if the contributions of these governments are specified. The District can work more closely with higher levels of government to establish how the District's climate action efforts can best be supported and expedited.

TYING IT ALL TOGETHER: social health & well-being: ♥ economic outcomes: $ environmental conditions: ♻

MEASURE	MEASURE TYPE	SCOPE OF INFLUENCE	CO-BENEFITS	♥ $ ♻
Energy Step Code and Zero Carbon Step Code	reduce improve	direct control	improved housing quality	♥
			improved air quality	♥ ♻
			reduced energy costs & vulnerability to energy price fluctuations	$
			job creation	$
			reduced fossil fuel use	♥ ♻
Existing building retrofits and heat pump installations	reduce improve switch	indirect control	improved indoor comfort and air quality	♥
			improved extreme heat preparedness	♥
			increased energy efficiency	$ ♻
			reduced fossil fuel use	♥ ♻
			job creation	$
expand intergovernmental partnerships to expedite climate action	improve	direct control	increased capacity for climate change action mobilization	$

DISTRICT MEASURES

The District can lead by example in its climate action efforts. Energy efficiency upgrades and electrification of District buildings and facilities can get underway immediately with energy assessments and retrofit planning, led by the Facilities & Assets Department. The West Vancouver Fleet Strategy can be updated with direction from the CAS and fleet transition to zero-emissions vehicles can be expedited, while understanding that market availability for larger fleet vehicles will influence the timing of full transition. A strategy or framework should also be developed to look at public EV charging needs to support residents with the transition to EVs, particularly those residents in multi-family buildings where charging capabilities may be limited. Similarly, the District's field equipment (e.g. lawn mowers, landscaping equipment) can transition to zero-emissions models. Fleet and equipment transitions can occur in concert with neighbouring and regional governments (Metro Vancouver), with procurement departments coordinating bulk purchases to reduce capital costs. The District's annual budget will need to be updated with these elements.

In some areas, West Vancouver's terrain provides a challenge to active transportation infrastructure. Luckily, increasingly efficient, compact, and inexpensive battery technologies are enabling micro mobility options like e-bikes, e-skateboards, e-scooters, and other vehicles. Electrified transportation options enable the community to diversify how people can get around, giving residents more choices, especially for the short trips that make up the majority of outings. The District can support these and other modes of active transportation by providing appropriate infrastructure. Separated bike lanes and sidewalks are invariably the top choice. The safety they provide is the key to increasing active transportation adoption.

TYING IT ALL TOGETHER: social health & well-being: ♥ economic outcomes: $ environmental conditions: ♻

MEASURE	MEASURE TYPE	SCOPE OF INFLUENCE	CO-BENEFITS	♥ $ ♻
energy efficiency upgrades on District buildings & facilities	reduce improve switch	direct control	decreased fossil fuel dependency	$ ♻
			operational savings due to lower energy use	$
			enhanced resiliency to disruption due to climate impacts	♥ $
			exhibits leadership for sustainability	$ ♻
fleet & equipment transition	improve switch	direct control	improved air quality	♥
			reduced noise pollution	♥
			reduced fossil fuel use	$ ♻
			labour improvements	♥
infrastructure upgrades for active and electrified transportation	improve	direct control	increased capacity for community mobilization	♥ $
			improved physical and mental health	♥
			improved air quality	♥ ♻
			savings associated with reduced vehicle use	$
			reduced fossil fuel dependency	$ ♻

HOME MEASURES

Market forces and federal and provincial programs are driving some energy efficiency upgrades in the housing sector, but District efforts can greatly accelerate the transition. Perhaps the most effective implementation measure would be to establish staff positions to coordinate District, provincial, and federal grant and incentive programs, as well as utility programs, for residents. These positions would provide navigation and coordination services to residents to maximize their support for home retrofits, removing barriers and inertia to access these programs. The staff could promote this service through a communications and education program (e.g. continuation and expansion of the Jump on a Heat Pump program). The program could include home envelope upgrades, HVAC system transitions, heat pump installation, energy generation systems (e.g. solar PV), and EV charging systems.

Improved recyclable materials and organics diversion requires expanding current waste collection practices and services. The District can coordinate with Metro Vancouver on delivering its Solid Waste Management Plan to improve curbside waste separation, engagement with Industrial, Commercial, and Institutional (ICI) entities, and engagement with multi-unit buildings in improving diversion rates. Strategizing with waste haulers and the regional landfill will also be required. In addition, demolition waste diversion and reuse practices could be improved to minimize waste going to landfills.

TYING IT ALL TOGETHER: social health & well-being: ♥ economic outcomes: $ environmental conditions: ♻

MEASURE	MEASURE TYPE	SCOPE OF INFLUENCE	CO-BENEFITS	♥ $ ♻
expand support and services to maximize existing home retrofits and heat pump uptake	improve	direct control	job creation	$
			exhibits leadership toward sustainability	$
			expands community climate equity and inclusion	♥
			builds awareness of energy efficiency strategies to reduce energy use	$ ♻
community and demolition waste diversion	reduce improve	indirect influence	reduced strain on landfills	♻
			increased circular economy	$
			increased resources efficiency	$ ♻
			reduced local waste pollution	♥ ♻

INDUSTRIAL, COMMERCIAL & INSTITUTIONAL SECTOR MEASURES

As housing makes up the majority of the District's land use footprint, attention to the institutional, commercial, and industrial sector is often low priority. Although West Vancouver has little in the way of industrial entities, it is one of the largest operators of ICI facilities (e.g. school district facilities) and many commercial and retail outfits serve the community. The District can coordinate with the West Vancouver Chamber of Commerce as well as business improvement associations and engage directly with businesses to support them with upgrading buildings, transitioning to ZEV fleets, and improving waste diversion. Evolving these relationships to encourage implementing actions through a climate lens will align the whole community in working toward a better, more secure, and sustainable future.

TYING IT ALL TOGETHER: social health & well-being: ♥ economic outcomes: $ environmental conditions: ☘

MEASURE	MEASURE TYPE	SCOPE OF INFLUENCE	CO-BENEFITS	♥ $ ☘
coordinate with businesses to support energy upgrades and building retrofits	improve	indirect influence	decreased fossil fuel dependency	$ ☘
			long term operational savings due to lower energy use	$
			enhanced resilience to climate impacts	♥ $
			exhibits leadership for sustainability	$ ☘
support transition of commercial fleets and equipment	improve switch	little influence	improved air quality	♥
			reduced noise pollution	♥
			reduced fossil fuel use	$ ☘
			labour improvements	♥

PART 8: IN CLOSING

PART 8: IN CLOSING

West Vancouver's CAS maps a pathway to reduce emissions to respond to the District's 2019 climate emergency declaration. The analysis presented here demonstrates that local climate measures are required in addition to those of higher-level governments to achieve the emission reductions targets necessary to avoid catastrophic climate change impacts.

In addition to their emissions reduction benefits, CAS measures reduce community-wide energy use while improving quality of life for all residents. Although ambitious, the measures offer few detriments. There are up-front costs to building owners and vehicle owners, but these are typically offset by grants and incentive programs as well as reduced operating and maintenance costs. Improved comfort, local economic development, and better health and well-being outcomes also accompany the measures.

In coordination with other levels of government, the District will lead and enable local action. District infrastructure upgrades, policy updates, and programs will usher in the low-carbon transition. Inter-departmental coordination and evaluating decisions through an equitable climate lens will ensure consistent, effective measure implementation. Tracking progress and updating approaches, when necessary, will keep the District on track to achieving its emission reduction targets. Through these efforts and those of residents and businesses, West Vancouver stands to foster a climate-safe, sustainable, and resilient future.

GLOSSARY

BC Step Code: The BC Energy Step Code sets building energy efficiency performance requirements for new construction and groups them into "steps." Each step requires increased energy efficiency over the last. Local governments can choose to require or incentivize builders to meet one or more steps of the BC Energy Step Code.

CAFE: Corporate Average Fuel Efficiency standards are US vehicle fuel efficiency requirements that become more stringent over time. Canada's Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations align with these standards.
See US CAFE standards: nhtsa.gov/laws-regulations/corporate-average-fuel-economy.
See Canada's Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations under the Environmental Protection Act: lois-laws.justice.gc.ca/eng/regulations/SOR-2010-201/FullText.html

Carbon dioxide (CO_2): A common gas that is a potent heat trapping agent in the atmosphere if present in high concentrations. CO_2 is emitted from combustion, fermentation, and respiration activities.

Carbon dioxide equivalents (CO_2e): The heat trapping ability of a given gas expressed in terms of how much CO_2 is essential to produce a similar warming effect over the chosen time. It is calculated by multiplying the amount of gas by its accompanying global warming potential. Expressed in tons as tCO_2e and kilotons ($ktCO_2e$). In the US, it is also expressed as metric tons ($MtCO_2e$).

Carbon neutral: Making no net release of greenhouse gasses into the atmosphere, either by reducing emissions to zero or by offsetting emissions.

Climate: The long-term weather patterns of a given location averaged over a period of time, typically 30 years.

Climate action planning: The act of identifying actions to take across socio-economic and community sectors (e.g. buildings, transportation, waste, industry, etc.) to mitigate greenhouse gas emissions, remove harmful emissions from the atmosphere, and adapt to current and anticipated climate change impacts.

Climate adaptation: The process by which built, natural, social, and human systems adjust to actual or expected climate change. Adaptation seeks to manage unavoidable harm.

Climate change: Changes in long-term weather patterns caused by natural phenomena and exacerbated by human activities that alter the chemical composition of the atmosphere by the buildup of greenhouse gasses, which trap heat and reflect it back to Earth's surface.

Climate equity: Ensuring the just distribution of the benefits of climate protection efforts and alleviating unequal burdens created by climate change.

Climate change mitigation: Any activities (e.g. policy, program, regulation, infrastructure, activity, or other project-based measures) that contribute to the reduction of greenhouse gas concentrations in the atmosphere.

Equity seeking communities: Communities and groups that experience significant collective barriers in participating in society. This could include but is not limited to attitudinal, historic, social and environmental barriers based on age, ethnicity, disability, economic status, Indigeneity, gender identity and gender expression, nationality, race, sexual orientation.

Fossil Fuels: Non-renewable, carbon-based fuels from hydrocarbon deposits, including coal, oil and natural gas which are burned as a source of energy.

Global warming potential (GWP): The measure of each greenhouse gas' ability to trap heat in the atmosphere compared to carbon dioxide (CO_2), measured over a specified time.

Greenhouse gas (GHG): A variety of gases whose presence in the atmosphere keeps the Earth's temperature stable. The increased presence of these gases over the past 200 years is causing more heat to be trapped inside the atmosphere, which is generating changes to Earth's climate.

Greenhouse gas intensity: The amount of emissions associated with a certain metric. For example, per the energy use of a square meter of a building; per liter of gasoline burned; per kilowatt-hour of electricity used.

Joules: A joule is a basic unit of energy, equal to the kinetic energy of a kilogram mass moving at one meter per second or the work done on an object by a force of one newton. It is expressed as one thousand joules (kJ), megajoules (one million joules, MJ), gigajoules (one billion joules, GJ), and terajoules (one trillion joules, TJ), and petajoules (one quadrillion joules, PJ).

Kilowatt hour (kWh): The energy delivered by one kilowatt of power for one hour, equal to 3.6 megajoules. Also expressed in megawatt hour (MWh) and gigawatt hour (GWh).

Low-carbon energy system: Energy systems that provide heating, cooling, and sometimes hot water, with limited GHG emissions, typically regulated through a maximum annual emissions per square meter basis.

Methane (CH_4): A colourless, odourless gas that occurs abundantly in nature and as a product of certain human activities. It is among the most potent of the greenhouse gases—28 times more potent than carbon dioxide over the long term (100 years) and 83 times more potent over the short term (20 years).

Net-zero emissions: As defined in the *Canadian Net-zero Emissions Accountability Act*: human caused or influenced (anthropogenic) emissions of greenhouse gasses into the atmosphere are balanced by anthropogenic removals of greenhouse gasses from the atmosphere over a specified period.

Nitrous oxide (N_2O): A colourless gas that is produced from fossil fuel combustion and many fertilizers. It is among the most potent greenhouse gases—265 times more potent than carbon dioxide over 100 years.

Representative concentration pathway: A measure of atmospheric greenhouse gas concentration ranging from stringent (RCP 2.6), intermediate (RCP 4.5), peaking in 2080 (RCP 6), and continuing to increase past 2080 (RCP 8.5).

Renewable natural gas (RNG): Biogas (the gaseous product of the decomposition of organic matter) that has been processed to purity standards and is interchangeable with conventional natural gas.

Social determinants of health: The broad range of personal, social, economic, and environmental factors that determine individual and population health.

Zero Carbon Step Code: A complement to the BC Energy Step Code, the Zero Carbon Step Code requires new buildings to achieve decreasing total GHG emissions production in their operation and heating systems, reaching zero emissions from all new buildings by 2030.

APPENDIX 1: IMPLEMENTATION FRAMEWORK

A. BUSINESS AS PLANNED EMISSION REDUCTION MEASURES: COMMUNITY AND CORPORATE MEASURES IMPLEMENTATION

ACTION	SPECIFICATION	PRIORITY	KEY MEASURES to monitor & report	CUMULATIVE EMISSIONS REDUCTIONS ($ktCO_2e$)	CUMULATIVE ENERGY REDUCTIONS (million GJ)	START DATE	END DATE	RESPONSIBLE/ROLE
BUILDINGS								
New Residential Building Code Standards	Follow BC Step Code: By 2030, 20% more efficient By 2027, 40% more efficient By 2032, 80% more efficient	high	12,000 buildings	366	16	2024	2030	REGULATORY ROLE: DWV *(Planning, Development & Environmental Services)* IMPLEMENTATION ROLE: home and MURB owners, stratas
New Non-Residential Building Code Standards		moderate	1,010 buildings	31	1	2024	2030	REGULATORY ROLE: DWV *(Planning, Development & Environmental Services)* IMPLEMENTATION ROLE: business owners, business associations, Park Royal
Transition to heat pumps for residential space conditioning and water heating	160,000 new residential heat pumps installed province-wide (1,400 for West Vancouver).	high	12,000 heat pumps	950	4	2024	2030	FACILITATOR/SUPPORT ROLE: DWV *(Planning, Development & Environmental Services, Environment Committee)* IMPLEMENTATION ROLE: home and MURB owners, stratas
Transition to heat pumps for non-residential space conditioning and water heating	53 million m^2 commercial floorspace heated by heat pumps province wide (0.47 million m^2 heated by heat pumps in West Vancouver).	moderate	1,010 buildings	148	2	2024	2030	FACILITATOR/SUPPORT ROLE: DWV *(Planning, Development & Environmental Services, Environment Committee)* IMPLEMENTATION ROLE: business owners, business associations, Park Royal
TRANSPORTATION								
Increase transit ridership	Translink plans: expand transit through higher occupancy rates and extra service.	moderate	200,000 km	27	0.05	2024	2040	IMPLEMENTATION ROLE: DWV *(Engineering Services, West Vancouver Transit)*, Translink
Electrify personal use vehicles	By 2026, 26% of total sales By 2030, 90% of total sales By 2035, 100% of total sales	high	29,000 vehicles	635	6	2024	2035	ADVOCACY/FACILITATOR ROLE: DWV *(Planning, Development & Environmental Services, Environment Committee)* IMPLEMENTATION ROLE: Province, residents, local point of sale dealerships
Zero emission commercial use vehicles	By 2030, of total car sales: 10% are electric 16% are natural gas	low	N/A	65	0.5	2024	2035	ADVOCACY/FACILITATOR ROLE: DWV (*Planning, Development & Environmental Services, Engineering Services, Purchasing Department)* IMPLEMENTATION ROLE: Province, commercial companies, local point of sale dealerships
Electrify municipal vehicles	WestVan fleet strategy, 33-50% of fleet electric by 2030.	moderate	99 vehicles	7	0.05	2024	2030	IMPLEMENTATION ROLE: DWV (*Planning, Development & Environmental Services, Engineering Services -fleet, Facilities Department, Financial Services)*
Low Carbon Fuel Standard	Emissions intensity of new Light Duty Vehicle declines over 10% to 105g/km in 2030, relative to 2015. Emissions intensity of new Heavy Duty Vehicle declines 20% by 2025 and 24% by 2030, relative to 2015.	moderate	N/A	239	0	2024	2035	FACILITATOR ROLE: DWV *(Engineering Services)* IMPLEMENTATION ROLE: Province
ENERGY								
Net Zero Provincial Grid	Net-zero electricity generation by 2030.	low	N/A	104	0	2024	2030	ADVOCACY/FACILITATOR ROLE: DWV (*Planning, Development & Environmental Services, Purchasing Department, Facilities Department, Financial Services)* IMPLEMENTATION ROLE: BC Hydro
Blend RNG into NG	RNG in natural gas supply increases to 15% by 2030.	moderate	10,900 m^3	382	-0	2024	2030	ADVOCACY/FACILITATOR ROLE: DWV IMPLEMENTATION ROLE: utility companies
WASTE								
Waste Diversion Targets	CleanBC - 95% organics diversion.	low	6,400 tonnes composted	41	0	2024	2030	IMPLEMENTATION ROLE: DWV, MetroVancouver

B. BUSINESS AS PLANNED FINANCIAL IMPLICATIONS: COMMUNITY & CORPORATE MEASURES IMPLEMENTATION

ACTION	SPECIFICATION	TOTAL INVESTMENT in millions *(discounted @3%)*	TOTAL RETURN	NET PRESENT VALUE in millions *(cost is positive; savings are negative)*	LOCAL JOB YEARS CREATED	MARGINAL ABATEMENT COST ($/tCO$_2$e)	POTENTIAL FUNDING SOURCES
BUILDINGS							
New Residential Building Code Standards	Follow BC Step Code: By 2030, 20% more efficient By 2027, 40% more efficient By 2032, 80% more efficient	$69	-$344	-$275	935	-$857	
New Non-Residential Building Code Standards		$6	-$18	-$12	85	-$534	
Transition to heat pumps for residential space conditioning and water heating	160,000 new residential heat pumps installed province-wide (1,400 for West Vancouver).	$20	-$271	-$251	196	-$264	Canada Greener Homes Loan
Transition to heat pumps for non-residential space conditioning and water heating	53 million m^2 commercial floorspace heated by heat pumps province wide (0.47 million m^2 heated by heat pumps in West Vancouver).	$4	-$23	-$19	25	-$125	Business energy-saving incentives (bchydro.com)
TRANSPORTATION							
Increase transit ridership	Translink plans: expand transit through higher occupancy rates and extra service.	N/A	N/A	N/A	N/A	N/A	
Electrify personal use vehicles	By 2026, 26% of total sales By 2030, 90% of total sales By 2035, 100% of total sales	$39	-$470	-$431	0	-$679	BC Go Electric
Zero emission commercial use vehicles	By 2030, of total car sales: 10% are electric 16% are natural gas	$2	-$58	-$56	0	-$858	BC Go Electric
Electrify municipal vehicles	WestVan fleet strategy, 33-50% of fleet electric by 2030.	$0	-$8	-$8	0	-$1,155	Go Electric Fleet Charging Program - CleanBC
Low Carbon Fuel Standard	Emissions intensity of new Light Duty Vehicles declines over 10% to 105g/km in 2030, relative to 2015. Emissions intensity of new Heavy Duty Vehicles declines 20% by 2025 and 24% by 2030, relative to 2015.	N/A	-$25	-$25	0	-$105	
ENERGY							
Net Zero Provincial Grid	Net-zero electricity generation by 2030.	N/A	N/A	N/A	N/A	N/A	
Blend RNG into NG	RNG in natural gas supply increases to 15% by 2030.	$71	-$38	$33	0	$86	
WASTE							
Waste Diversion Targets	CleanBC - 95% organics diversion.	N/A	N/A	N/A	N/A	N/A	

C. LOW CARBON SCENARIO EMISSION REDUCTION MEASURES: COMMUNITY MEASURES IMPLEMENTATION

ACTION	SPECIFICATION	PRIORITY	KEY MEASURES to monitor & report	CUMULATIVE EMISSIONS REDUCTIONS ($ktCO_2e$)	CUMULATIVE ENERGY REDUCTIONS (million GJ)	START DATE	END DATE	RESPONSIBLE/ROLE
BUILDINGS								
Increase density of development in urban zones	Implementation of Taylor Way LAP by 2040, 600 new high density units.	high	N/A	0.2	0.006	2024	2040	IMPLEMENTATION ROLE: DWV *(Planning, Development & Environmental Services)*
Deep retrofits in the residential building stock	Retrofit 95% of existing buildings by 2040 to achieve a 50% reduction in space heating/cooling and a 20% reduction other non water heating energy use.	high	16,000 dwelling units	319	16	2025	2040	FACILITATOR/SUPPORT ROLE: DWV *(Planning, Development & Environmental Services, Environment Committee)* IMPLEMENTATION ROLE: home and MURB owners, stratas
Deep retrofits in the commercial and institutional building stock	Retrofit 95% of existing buildings by 2040 to achieve a 50% reduction in space heating/cooling and a 20% reduction other non water heating energy use.	moderate	670 buildings	156	2	2025	2040	FACILITATOR/SUPPORT ROLE: DWV *(Planning, Development & Environmental Services, Environment Committee)* IMPLEMENTATION ROLE: business owners, business associations, Park Royal
Deep retrofits in the municipal building stock	100% of municipal buildings use zero emissions energy by 2035.	moderate	48 buildings	77	2	2025	2035	IMPLEMENTATION ROLE: DWV *(Planning, Development & Environmental Services, Purchasing Department, Facilities Department, Financial Services)*
Transition to heat pumps for residential space conditioning and water heating	95% of existing buildings are equipped with electric heat pumps for space and water heating by 2040. Heat pumps are installed when existing equipment needs to be replaced.	high	16,000 heat pumps	341	6	2024	2040	FACILITATOR/SUPPORT ROLE: DWV *(Planning, Development & Environmental Services, Environment Committee)* IMPLEMENTATION ROLE: home and MURB owners, stratas
Transition to heat pumps for commercial space conditioning and water heating	95% of existing commercial buildings are equipped with electric heat pumps for space and water heating by 2040. Heat pumps are installed when existing equipment needs to be replaced.	moderate	718 buildings	326	6	2024	2040	FACILITATOR/SUPPORT ROLE: DWV *(Planning, Development & Environmental Services, Environment Committee)* IMPLEMENTATION ROLE: business owners, business associations, Park Royal
TRANSPORTATION								
Zero emission municipal vehicles	100% ZEV by 2040 includes light duty electric, renewable diesel, Compressed Renewable Natural Gas and hydrogen.	moderate	177 vehicles	3	0.02	2024	2040	IMPLEMENTATION ROLE: DWV *(Planning, Development & Environmental Services, Engineering Services -fleet, Facilities Department, Financial Services)*
Zero emission commercial use vehicles	100% of vehicle stock is zero emission by 2050, includes a mix of electricity, hydrogen and RNG.	low	N/A	315	4	2024	2050	FACILITATOR/SUPPORT ROLE: DWV *(Purchasing Department, Engineering Services)*, Province IMPLEMENTATION ROLE: commercial companies
ENERGY								
Enable distributed energy resources with Enhanced Energy Storage	Add 142 MW of rooftop solar capacity to residential and commercial buildings by 2040. Add 19 MW of energy storage to non apartment residential buildings equipped with rooftop solar by 2040. Assume each energy storage unit is 14 kWh.	low	161 MW	1	0	2024	2040	FACILITATOR/SUPPORT ROLE: DWV *(Planning, Development & Environmental Services, Environment Committee)* IMPLEMENTATION ROLE: home and MURB owners, stratas
Blend green hydrogen into the natural gas supply	Blend up to 15% hydrogen into the natural gas supply by 2035.	low	1,400,000 kg	86	0	2024	2033	ADVOCACY ROLE: DWV IMPLEMENTATION ROLE: utility companies
Blend RNG into the natural gas supply	Replace remaining natural gas with 100% RNG by 2040	low	19,000,000 m^3	235	0	2024	2033	ADVOCACY ROLE: DWV IMPLEMENTATION ROLE: utility companies
WASTE								
Waste Diversion Targets	100% residential organics diversion. 100% methane capture from landfills. 50% of commercial/construction waste by 2050 compared to 2016 levels.	moderate	10,200 tonnes composted 5,907 tonnes recycled	68	0	2024	2050	IMPLEMENTATION ROLE: DWV, Metro Vancouver

C. LOW CARBON SCENARIO EMISSION REDUCTION MEASURES: MUNICIPAL MEASURES IMPLEMENTATION

ACTION	SPECIFICATION	PRIORITY	KEY MEASURES to monitor & report	CUMULATIVE EMISSIONS REDUCTIONS ($ktCO_2e$)	CUMULATIVE ENERGY REDUCTIONS (million GJ)	START DATE	END DATE	RESPONSIBLE/ROLE
BUILDINGS								
Deep retrofits in the municipal building stock	100% of municipal buildings use zero emissions energy by 2035.	moderate	48 buildings	77	2	2025	2035	IMPLEMENTATION ROLE: DWV *(Planning, Development & Environmental Services, Purchasing Department, Facilities Department, Financial Services)*
Transition to heat pumps for space conditioning and water heating	95% of existing buildings are equipped with electric heat pumps for space and water heating by 2040. Heat pumps are installed when existing equipment needs to be replaced.	moderate	48 buildings	72	1	2024	2040	IMPLEMENTATION ROLE: DWV *(Planning, Development & Environmental Services, Purchasing Department, Facilities Department, Financial Services)*
TRANSPORTATION								
Zero emission municipal vehicles	100% ZEV by 2040 includes light duty electric, renewable diesel, Compressed Renewable Natural Gas and hydrogen.	moderate	177 vehicles	3	0.02	2024	2040	IMPLEMENTATION ROLE: DWV *(Planning, Development & Environmental Services, Engineering Services-fleet, Facilities Department, Financial Services)*
ENERGY								
Enable distributed energy resources	Add 5.6 MW of rooftop solar capacity to municipal buildings by 2040.	low	5.6 MW	0	0	2024	2040	IMLEMENTATION ROLE: DWV *(Planning, Development & Environmental Services, Purchasing Department, Facilities Department, Financial Services)*
Blend green hydrogen into the natural gas supply	Blend up to 15% hydrogen into the natural gas supply by 2035 and enacted a new round of standards for appliances and equipment beyond those codified in 2021 to support.	low	43,000 kg	19	0	2024	2031	IMLEMENTATION ROLE: DWV *(Planning, Development & Environmental Services, Purchasing Department, Facilities Department, Financial Services)*
Blend RNG into the natural gas supply	Replace remaining natural gas with 100% RNG by 2040.	low	510,000 m^3	3	0	2024	2032	IMLEMENTATION ROLE: DWV *(Planning, Development & Environmental Services, Purchasing Department, Facilities Department, Financial Services)*

D. LOW CARBON SCENARIO FINANCIAL IMPLICATIONS: COMMUNITY MEASURES IMPLEMENTATION

ACTION	SPECIFICATION	TOTAL INVESTMENT in millions *(discounted @3%)*	TOTAL RETURN	NET PRESENT VALUE in millions *(cost is positive; savings are negative)*	LOCAL JOB YEARS CREATED	MARGINAL ABATEMENT COST ($/tCO$_2$e)	POTENTIAL FUNDING SOURCES
BUILDINGS							
Increase density of development in urban zones	Implementation of Taylor Way LAP by 2040, 600 new high density units	N/A	N/A	N/A	N/A	N/A	FEDERAL: GST/HST New Residential Rental Property Incentive - Better Buildings (betterbuildingsbc.ca) PROVINCIAL: New Construction Market Transformation
Deep retrofits in the residential building stock	Retrofit 95% of existing buildings by 2040 to achieve a 50% reduction in space heating/cooling and a 20% reduction other non water heating energy use	$485	-$275	$210	5,936	$658	FEDERAL: CGAH: Canada Greener Affordable Housing Program [Umbrella Program] PROVINCIAL: Community Buildings Retrofit (CBR)
Deep retrofits in the commercial and institutional building stock	Retrofit 95% of existing buildings by 2040 to achieve a 50% reduction in space heating/cooling and a 20% reduction other non water heating energy use	$13	-$107	-$94	154	-$601	FEDERAL: News & Updates - Community Climate Funding (gov.bc.ca) Deep Retrofit Accelerator Initiative (DRAI) PROVINCIAL: CleanBC Commercial Express Program - Better Buildings
Deep retrofits in the municipal building stock	100% of municipal buildings use zero emissions energy by 2035	$6	-$45	-$39	63	-$508	FEDERAL:Capital project: GHG reduction pathway retrofit | Green Municipal Fund Capital project: GHG impact retrofit | Green Municipal Fund PROVINCIAL: Community Climate Funding (gov.bc.ca)
Transition to heat pumps for residential space conditioning and water heating	95% of existing buildings are equipped with electric heat pumps for space and water heating by 2040. Heat pumps are installed when existing equipment needs to be replaced.	$94	-$103	-$8	700	-$25	PROVINCIAL: Energy-efficiency Programs for Community Buildings Heat pump rebates Heat pump rebate > FortisBC
Transition to heat pumps for commercial space conditioning and water heating	95% of existing commercial buildings are equipped with electric heat pumps for space and water heating by 2040. Heat pumps are installed when existing equipment needs to be replaced.	$74	-$104	-$30	444	-$92	FEDERAL: Low Carbon Economy Challenge PROVINCIAL: Business Energy Savings Incentive Program
TRANSPORTATION							
Zero emission municipal vehicles	100% ZEV by 2040 includes light duty electric, renewable diesel, Compressed Renewable Natural Gas and hydrogen	$2	-$3	-$1	0	-$470	PROVINCIAL: CleanBC Go Electric Public Charger Program - Plug In BC
Zero emission commercial use vehicles	100% of vehicle stock is zero emission by 2050, includes a mix of electricity, hydrogen and RNG	$8	-$324	-$316	0	-$1,004	PROVINCIAL: CleanBC Go Electric Commercial Vehicle Pilots (CVP) Program
ENERGY							
Enable distributed energy resources with Enhanced Energy Storage	Add 142 MW of rooftop solar capacity to residential and commercial buildings by 2040. Add 19 MW of energy storage to non apartment residential buildings equipped with rooftop solar by 2040. Assume each energy storage unit is 14 kWh.	$421	-$226	$195	1,920	$186,583	FEDERAL: Community Climate Funding (gov.bc.ca) PROVINCIAL: Community Works Fund
Blend green hydrogen into the natural gas supply	Blend up to 15% hydrogen into the natural gas supply by 2035 and enacted a new round of standards for appliances and equipment beyond those codified in 2021 to support.	$18	-$10	$8	0	$90	
Blend RNG into the natural gas supply	Replace remaining natural gas with 100% RNG by 2040.	$82	-$25	$58	0	$246	
WASTE							
Waste Diversion Targets	100% residential organics diversion. 100% methane capture from landfills. 50% of commercial/construction waste by 2050 compared to 2016 levels.	N/A	N/A	N/A	N/A	N/A	FEDERAL: Study: Waste stream management | Green Municipal Fund

D. LOW CARBON SCENARIO FINANCIAL IMPLICATIONS: MUNICIPAL MEASURES IMPLEMENTATION

ACTION	SPECIFICATION	TOTAL INVESTMENT in millions *(discounted @3%)*	TOTAL RETURN	NET PRESENT VALUE in millions *(cost is positive; savings are negative)*	LOCAL JOB YEARS CREATED	MARGINAL ABATEMENT COST ($/tCO$_2$e)	POTENTIAL FUNDING SOURCES
BUILDINGS							
Deep retrofits in the municipal building stock	100% of municipal buildings use zero emissions energy by 2035	$6	-$45	-$39	63	-$508	FEDERAL: Smart Renewables and Electrification Pathways (SREPs) Program Capacity Building Stream Capital project: Retrofit of municipal facilities PROVINCIAL: Capital project: Retrofit of municipal facilities Community Buildings Retrofit (CBR) Net-Zero Transformation
Transition to heat pumps for space conditioning and water heating	95% of existing buildings are equipped with electric heat pumps for space and water heating by 2040. Heat pumps are installed when existing equipment needs to be replaced.	9	8	16	50	$224	FEDERAL: Pilot project: Retrofit of municipal facilities PROVINCIAL: Pilot project: Retrofit of municipal facilities
TRANSPORTATION							
Zero emission municipal vehicles	100% ZEV by 2040 includes light duty electric, renewable diesel, Compressed Renewable Natural Gas and hydrogen	$2	-$3	-$1	0	-$470	CAPITAL PROJECT: Reduce fossil fuel use in fleets | Green Municipal Fund PROVINCIAL: Community Climate Funding (gov.bc.ca)
ENERGY							
Enable distributed energy resources	Add 5.6 MW of rooftop solar capacity to municipal buildings by 2040.	1	-0.5	0.5	32	$26,486	PROVINCIAL: Community Climate Funding (gov.bc.ca) Energy-efficiency Programs for Community Buildings
Blend green hydrogen into the natural gas supply	Blend up to 15% hydrogen into the natural gas supply by 2035 and enacted a new round of standards for appliances and equipment beyond those codified in 2021 to support.	$0.5	-$0.2	$0.3	0	$13	
Blend RNG into the natural gas supply	Replace remaining natural gas with 100% RNG by 2040.	$2	-$0.4	$1	0	$451	

DEFINITIONS

high: high emissions reductions and have control over it and access to support/capacity to influence

moderate: high emissions reductions but lower ability to regulate and influence change

low: lower emissions reductions and limited control and capacity to influence