

Climate Action Plan Modeling Report

Prepared for the District of Saanich
September, 2026



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Executive Summary

This report presents the results of modeling performed by Licker Geospatial Consulting Ltd. (LGeo) to assess the District of Saanich's (the District) progress towards Climate Action Targets under Business-As-Usual (BAU) and Policy Pathways (Pathways) scenarios. This modeling exercise offers an update and progress assessment of the District's 2020 Climate Plan.

The modeling is performed across all emitting sectors in the District, with a particular focus on passenger transportation and buildings (and to a lesser extent, waste). The other sectors (heavy-duty and off-road vehicles and industrial process and product use [IPPU]) are included for completeness, but they are typically¹ not the focus of work for municipal climate planning because BC municipalities have limited legislative influence over them, and - based on current technological and economic conditions - their pathway to emissions reductions is speculative.

A "Pathways" scenario was defined to understand in a best-case-scenario, with highly aggressive (but technically feasible assumptions), what progress the District can expect to see towards climate targets. The Business-as-Usual scenario reflects policies, programs and legislation that are currently in place and are considered to have a high chance of remaining in place over the long term, such as the Zero Carbon Step Code and the Low Carbon Fuel Standard.²

Figure 1 demonstrates emissions reductions across the aforementioned core sectors, while Figure 2 shows reductions across all sectors together. For both, the results include policies from all levels of government (municipal, provincial and federal).

¹ For instance, the City of Vancouver's Climate Emergency Action Plan includes only buildings and vehicles, and the Community Energy and Emissions Inventory (CEEI) only publishes community-level data for buildings, vehicles and waste.

² Note that 2022 was used as the baseline year because it was the inventory that was provided at project onset. 2023 was provided subsequently, but it was at a later stage in the project timeline, and would have involved an extensive update. The difference between 2022 and 2023 was evaluated and found to be minimal, so 2022 remains as the baseline.

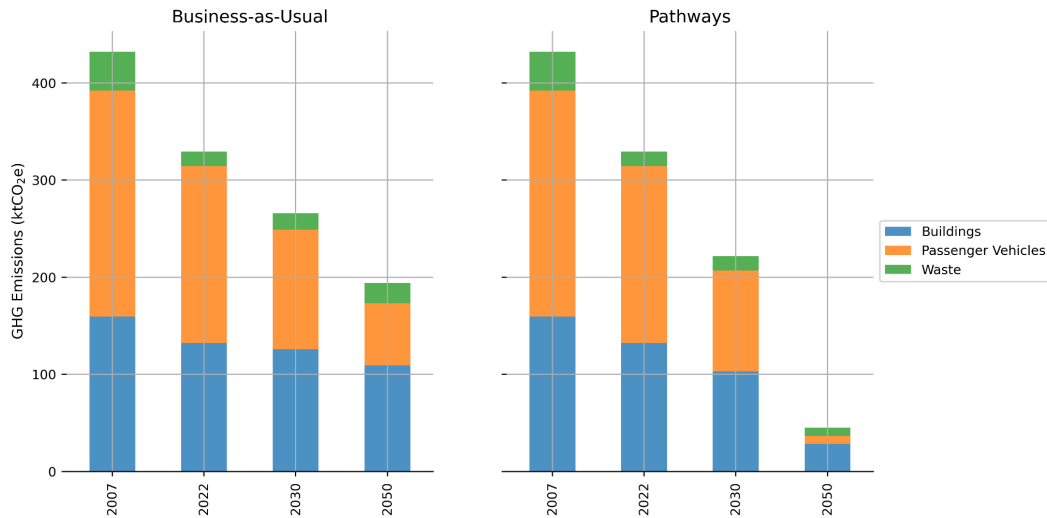


Figure 1. The results of the emissions forecast across core sectors for the BAU and Pathways scenarios.

Looking at only buildings, transportation and waste, the District sees progress towards net-zero in both the business-as-usual and pathways scenarios, but with significantly more progress in the latter.

- **BAU** - 38% reduction over 2007 by 2030, 55% reduction by 2050. The most significant reduction here comes from passenger transportation, driven by the Low Carbon Fuel Standard and an assumed default rate of electrification (even though the ZEV Act is not included in the BAU, increased EV proliferation is expected regardless).
- **Pathways** - 49% reduction over 2007 by 2030, 89% reduction by 2050. In this scenario, there are substantially more emissions reductions from buildings compared with the BAU, due primarily to aggressive assumptions around Provincial equipment turnover regulations. There are also further reductions in transportation emissions due to a variety of municipal / regional policies that encourage in part reduced driving, but also faster rates of electrification. By 2050, with these assumptions, there will be more emissions from waste than transportation, due to methane from compost and the low emissions factor on hydro electricity.

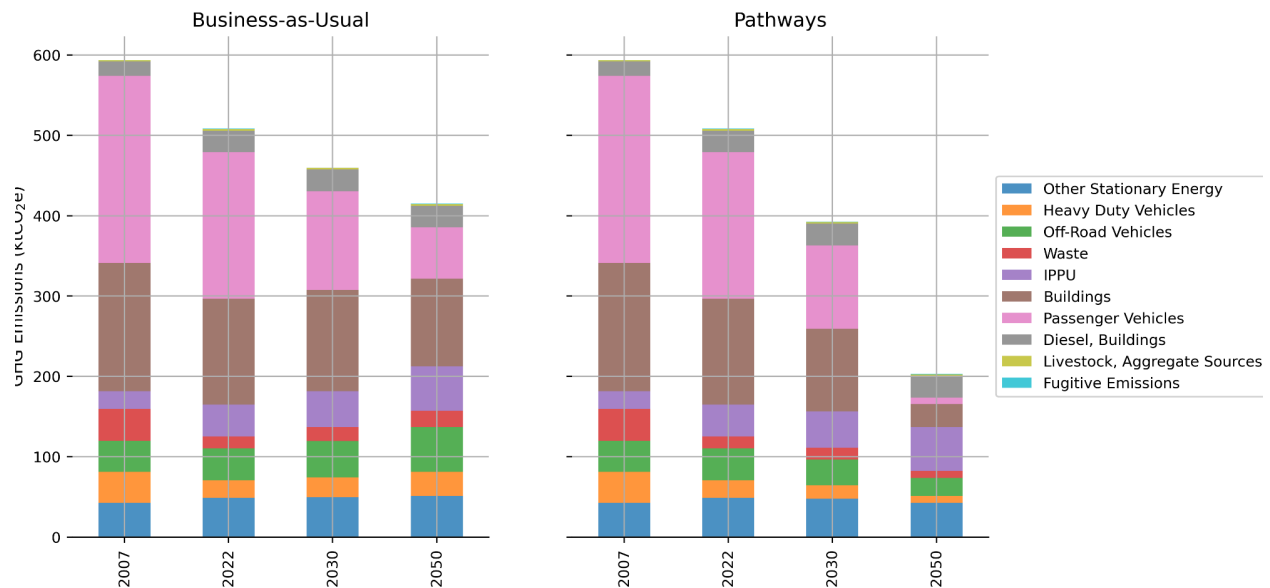


Figure 2. The results of the emissions forecast across all sectors for the BAU and Pathways scenarios.

Figure 2 includes not only buildings, transportation and waste, but also the other emitting sectors across the District. Although there is limited legislative authority for municipalities to influence the emissions in these sectors, there is still a role to play in education, advocacy and capacity building, so they are still worth modeling and understanding, even at a high-level.

- **BAU** - 22% reduction over 2007 by 2030, 30% reduction by 2050. In lieu of policy or technological change, emissions from the other sectors are expected to increase slightly by 2050 as population increases.
- **Pathways** - 33% reduction over 2007 by 2030, 65% reduction by 2050. The emissions from other sectors decrease in this scenario, driven by aggressive assumptions around renewable diesel use in heavy-duty and off-road vehicles.

For the transportation and buildings sectors, the modeling is bottom-up (i.e. it captures individual vehicles and buildings) and is based on the District's most recent Official Community Plan (OCP) update and forecast, which was completed by LGeo under a separate scope of work with the District's planning department.

The OCP growth management policies will help to concentrate new density into pre-defined Growth Areas and Transportation Corridors (shown in black on Figure 2), which supports Climate Action Goals by: (1) concentrating growth in areas with less driving; and (2) supporting higher density and thus more efficient use of residential floor area.

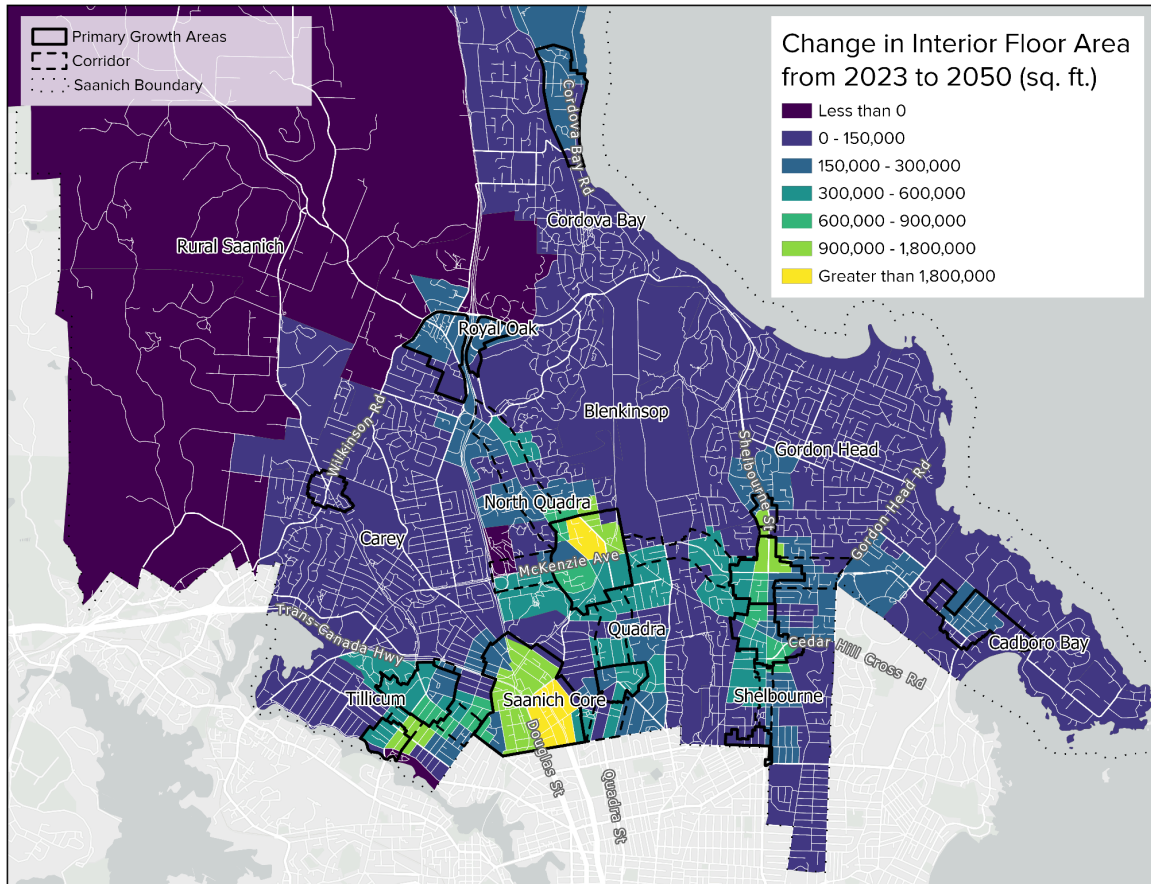


Figure 2. Net new floor area from 2023-2050 (sq. ft.) under the land use scenario. Positive numbers indicate an increase in interior floor area.

Modelling shows that the levers the municipality holds with regards to reducing vehicle use and related emissions are eclipsed by the impact of Provincial policy, even when very optimistic assumptions around municipal policies were included. In particular, electric vehicle adoption and clean fuel standards drive transportation emissions down significantly. That said, if EV adoption is slower than expected (for instance, if the Zero Emissions Vehicle [ZEV] Act - which sets requirements for the proportion of new car sales that must be electric - is not in place), then municipal policies will see a much greater impact by 2050.

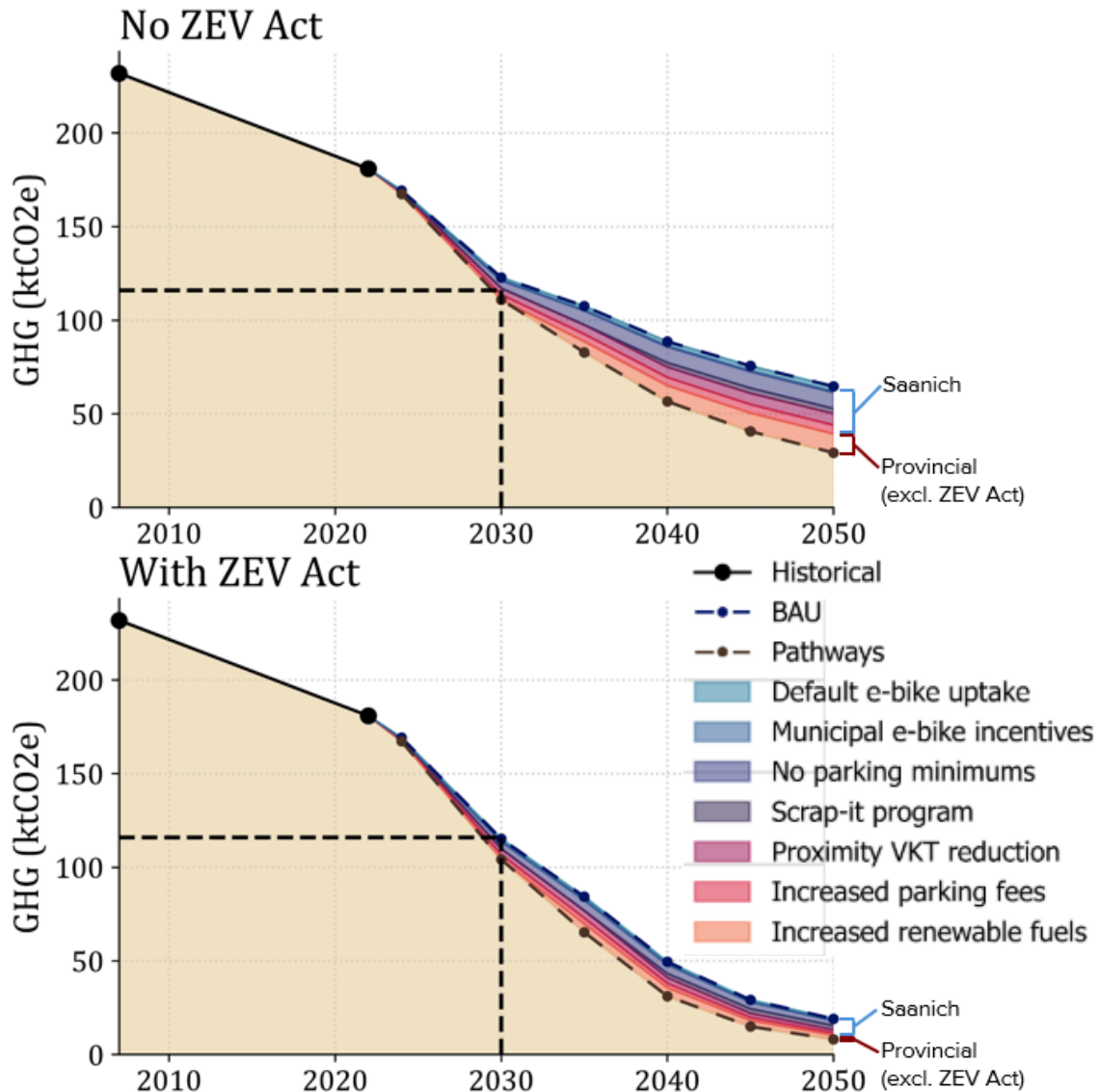


Figure 3. Forecast emissions reduction in the transportation sector, assuming (1) no ZEV Act with a slow EV uptake; and (2) EV uptake according to the CleanBC review. The top line of the wedge diagram represents the BAU scenario, and the colored wedges represent reductions from each of the modelled policies.

Due to uncertainty with regards to implementation of the Provincial ZEV Act at the time of writing, transportation emissions were modelled both with and without this policy package, for both the BAU and Policy modeling cases:

- **In a low EV adoption scenario**, transportation emissions will see a 47% reduction by 2030 and a 69% reduction by 2050 in the BAU, and 52% by 2030 and 79% by 2050 in

Pathways. In this case, municipal policy to reduce driving will have a correspondingly larger emissions impact.

- **Assuming strong ZEV Act implementation**, transportation emissions will see a 54% reduction by 2030 and a 96% reduction by 2050 in the BAU, and 58% by 2030 and 97% by 2050 in Pathways, and municipal policy to reduce driving shows a minimal impact on emissions as the carbon intensity of vehicular travel will be so low. That said, there are still multiple co-benefits (and increased affordability) to reducing driving, such as reduced congestion, increased community cohesion, pedestrian safety and improved health and air quality.

From their Active Transportation Plan, the District has a target sustainable mode share of 50% by 2050. The starting sustainable mode share in the District is 28%. Based on our assessment, in the BAU this increases to 30.5% and in the Pathways scenario this increases to 41% (assuming an optimistic best case) by 2050.

Other key indicators that are discussed in this report include vehicle kilometers travelled, vehicle ownership and share of electric vehicles.

In the buildings sector, we modeled the two core scenarios which include a forecasted change in space heating demand due to a warming climate:

- In the **BAU** scenario, buildings achieved a reduction in operational emissions below 2007 levels of 20% by 2030 and 32% by 2050.
- In the **Pathways** scenario, the achieved reductions are 34% by 2030 and 82% by 2050.

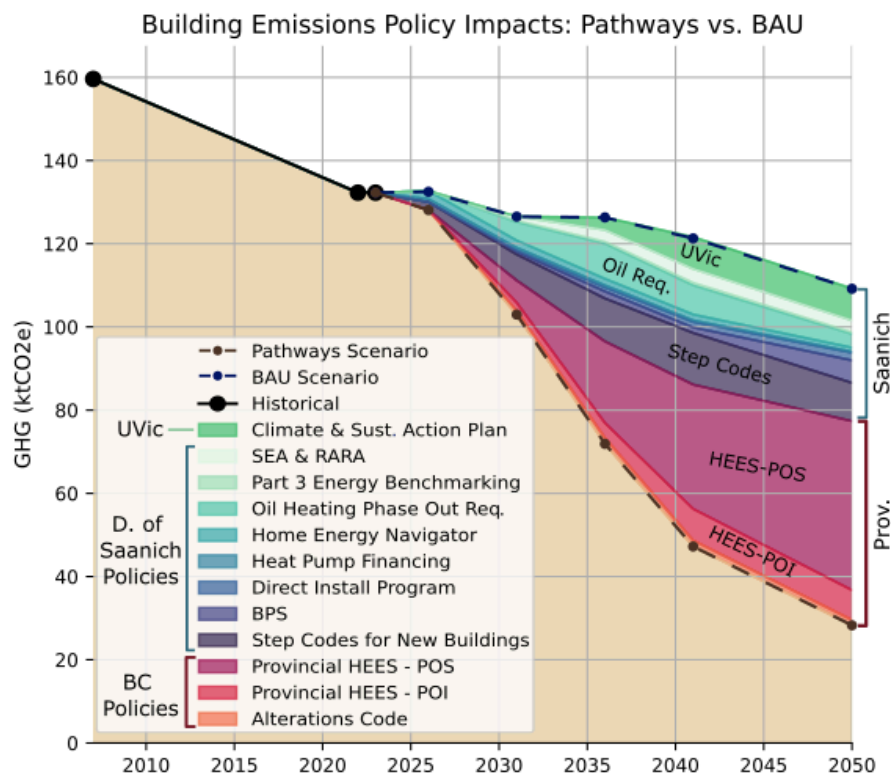


Figure 4. Policy impacts on annual GHG emissions from buildings, comparing the Pathways and BAU scenarios. Policies are grouped by jurisdiction among the District, the Province of BC, the University of Victoria, as well as an Overlapping Policies group where multiple policies impact buildings of the same type.

Among the total emissions abatement achieved by all policies in the high-ambition Pathways scenario by 2050, approximately 47% can be attributed directly to municipal level policies under Saanich jurisdiction, 45% can be attributed directly to Provincial policies, and 8% to the University of Victoria's Climate and Sustainability Action Plan. The two most impactful building policies by far are Provincial Highest Equipment Efficiency Standards (HEES)³, and implementing BC Zero Carbon Step Code for newly constructed buildings.

In the [Buildings Emissions Forecast](#) Section, we describe in detail the current state and forecasted emissions, with careful breakdowns of building type, geospatial location, and energy and emissions source. Included with this report is a Building Supporting Data Sheet file, which will frequently be referred to for additional information.

³ The HEES implementation in this report assumes all 90% electric systems and 10% dual fuel. Where more dual fuel to be included, this would likely significantly impact the reductions in GHG emissions.

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1. Introduction

The District of Saanich is a progressive community with ambitious climate goals and a rich context of climate planning. Its award winning 2020 Climate Plan used GHG assessment and modelled pathways to develop an implementation plan and a list of prioritized actions with the goal of achieving its 2030 and 2050 targets. 5 years have passed since the creation of that plan and we are halfway towards 2030, and the timing is appropriate for a reassessment of current and modelled progress towards targets.

To perform this assessment, two scenarios were defined:

1. A Business-As-Usual (BAU) scenario, that includes historical trends and policy that has been legislated to date; and
2. A Policy Pathways (Pathways) scenario, that includes best-case but *technically feasible* policy changes.

Based on the timeline of the modeling, the scenarios above were defined according to policies that were legislated or in the pipeline (across all levels of government) beginning-mid 2025, at which time the Provincial Clean BC legislation was undergoing review. Provincial policies have a significant impact on community emissions, so the outcome of this review will be highly relevant for the District's emissions trajectory. The review was not complete at time of writing this report, so this uncertainty is addressed via discussion and in some cases modeling of multiple input parameters.

The focus of this work is placed on the two largest emitting sectors, over which the District has the most influence: passenger transportation and buildings. Municipal land use planning is an important lever via which a community can address emissions in these sectors, so the newest Official Community Plan (OCP) update and the associated land use forecast is the basis for all modelled results. The OCP focuses new density in concentrated "growth areas" so results are presented within and without these defined locations.

For sectors outside of transportation and buildings, the District has limited legislative jurisdiction, and the pathways to decarbonization are often speculative (i.e. the technology is either non-existent or prohibitively expensive). For this reason, these sectors are considered at a high level only.

For the two core sectors, this project used a different and more granular bottom-up approach to emissions forecasting, meaning that each building and vehicle are modelled individually, with unique considerations for where they are situated in the District (e.g. a vehicle in the Saanich

Core will drive less than one in rural Saanich, and the likelihood that a building is redeveloped will depend on its location).⁴

The outcome is a granular, geospatial analysis of equipment (i.e. heating systems and vehicles by fuel type), energy and emissions for each modelled year. In addition to estimating GHGs in future years, this is a useful tool for tasks that fall somewhat outside of the scope of this report, but warrant mentioning in any case:

- Collaborative planning with transportation and energy utilities. Indeed, Saanich Planning and BC Transit have shared and discussed predicted future densities, and BC Hydro is undergoing a parallel study to use the forecast for grid capacity assessment.
- Cost assessment and incentive design, since an estimate of the amount of incoming equipment is included in the data.
- Assessment and forecasting of demographic and other geographic attributes to inform localized policy design.

The Municipal Role in Climate Action

The modeling and analysis that is produced for the purposes of this report is in support of the District's municipal climate plan. Accordingly, part of the objective of this report is to ascertain the relative influence of municipal vs. provincial policy.

As we will see, key regulatory and policy changes that drive down emissions most substantially typically fall outside of municipal jurisdiction, and thus must come from higher levels of government. However, one must take caution not to underestimate the role of the municipality in achieving decarbonization objectives. Even outside of the direct actions available to the municipality - presented throughout this report as modelled policies - it has a key role in supporting provincial policy via aligned bylaws and streamlined processes (e.g. changing floor area calculation so as not to penalize thicker wall assemblies/insulation; clarifying and simplifying permitting and approval processes for EV chargers and solar installations; and requiring EV-ready new developments, etc); as well as education, advocacy and capacity building (e.g. retrofit accelerators and developing EV charging capacity).

⁴ It should be noted that the modelling doesn't account for the potential for transformative change - where a "tipping point" is reached and large societal shifts occur that have a tremendous impact on the outcomes (e.g. a disruptive technology and/or shifts in behaviour/norms, and/or changing economic circumstances such as persistent high price for oil and gas). These are difficult to predict, but ultimately will be required to some degree to meet science-based targets. Ensuring that the groundwork is laid to enable them when the time is right is part of the role of the municipality (e.g. having the active transportation and EV charging infrastructure in place).

1.1 Emissions in Saanich: Where are things now?

The District of Saanich is the largest community by population in the Capital Region District (CRD). With 28% of CRD's population, Saanich also emitted a similar share of emissions (~27%) in 2022⁵.

As discussed in the previous section, and shown in Table 1.1, passenger transportation and buildings are the two largest emitting sectors in the District (38% and 28% respectively). This is followed by: (1) Other Stationary Energy⁶, (2) Off-Road Vehicles and (3) Industrial Processes and Product Emissions (IPPU). Agriculture, Forestry and Other Land Use are reported in the inventory for disclosure purposes only, and are thus emitted from the counted totals.

Table 1.1 Sectors of primary emissions sources in the District of Saanich. Sectors that included in the “core sectors” are marked with **.

	2007 GHG Emissions (tCO ₂ e)	2022 GHG Emissions (tCO ₂ e)	% of 2007 emissions	% of 2022 emissions	% reduction over 2007
Buildings **	159,601	132,267	27.80%	28%	-17%
Other Stationary Energy	42,550	48,906	7.41%	10%	15%
Passenger Vehicles **	232,661	182,057	40.53%	38%	-22%
Heavy Duty Vehicles	38,485	21,764	6.70%	5%	-43%
Off-Road Vehicles	38,951	39,618	6.79%	8%	2%
Waste **	39,720	14,881	6.92%	3%	-63%
IPPU	22,042	39,504	3.84%	8%	79%
Provincial Oil and Gas	17,882	26,912	3.12%	6%	50%
AFOLU (reported for disclosure only)	8,497	-1,621	1.48%	0%	--
Total (excluding Provincial Oil and Gas & AFOLU)	574,010	478,997			-17%

Across all sectors in the District, emissions have decreased by 17% since 2007. The reductions are primarily from the three sectors over which Saanich has the most policy leverage (buildings,

⁵ According to the CRD emissions inventory.

⁶ This is primarily Agriculture, Forestry and Fishing Activities. According to the [Global Protocol for Community-scale Greenhouse Gas Inventories](#), this includes emissions from direct combustion of fuel that are related to these activities, such as farm equipment. This *does not* include land use change, or emissions from animal and plant waste.

transportation and waste). Perhaps unsurprisingly, the other sectors - for which there are limited decarbonization options - are increasing.⁷

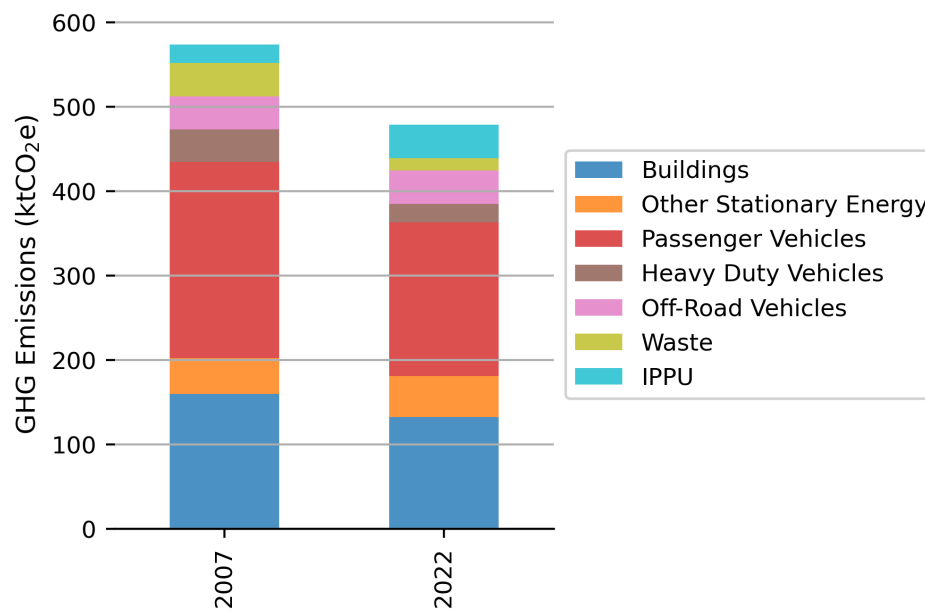


Figure 1.1. Historical Saanich emissions by Sector, 2007 and 2022.

⁷ One exception to this general trend is in heavy duty vehicles, which have seen a substantial drop in emissions since 2007.

2. Land Use Scenario Definition

The land use scenario, which is the basis of the emissions forecasting, is the result of detailed land use informed housing and employment projections for the District of Saanich that were completed using a buildout model. The model behaviour is as follows:

- The buildout creates a housing and employment projection by different residential building types and employment sectors, out to the year 2050. The housing portion is built out to the growth level specified by the housing needs report that was mandated by the Province and released by the District. The employment portion is built out to growth levels determined by LGeo's collaborator Vann Struth Consulting.
- The scenario is land use based, with different building archetypes and densities defined for each use. For the residential portion, the model builds out to the type that is deemed to be the most financially viable. For the non residential archetypes, the model builds out to a predefined type.
- The model determines residential viability using a financial analysis for different residential building types across different regions in the District and across different decades to the year 2050.

This land use modeling work was undertaken in a separate scope of work with LGeo and Saanich's planning department. This work was conducted over the course of several years, but the most recent version that was integrated into the modeling in this report was completed in the summer of 2025. Key results are presented in the subsections below.

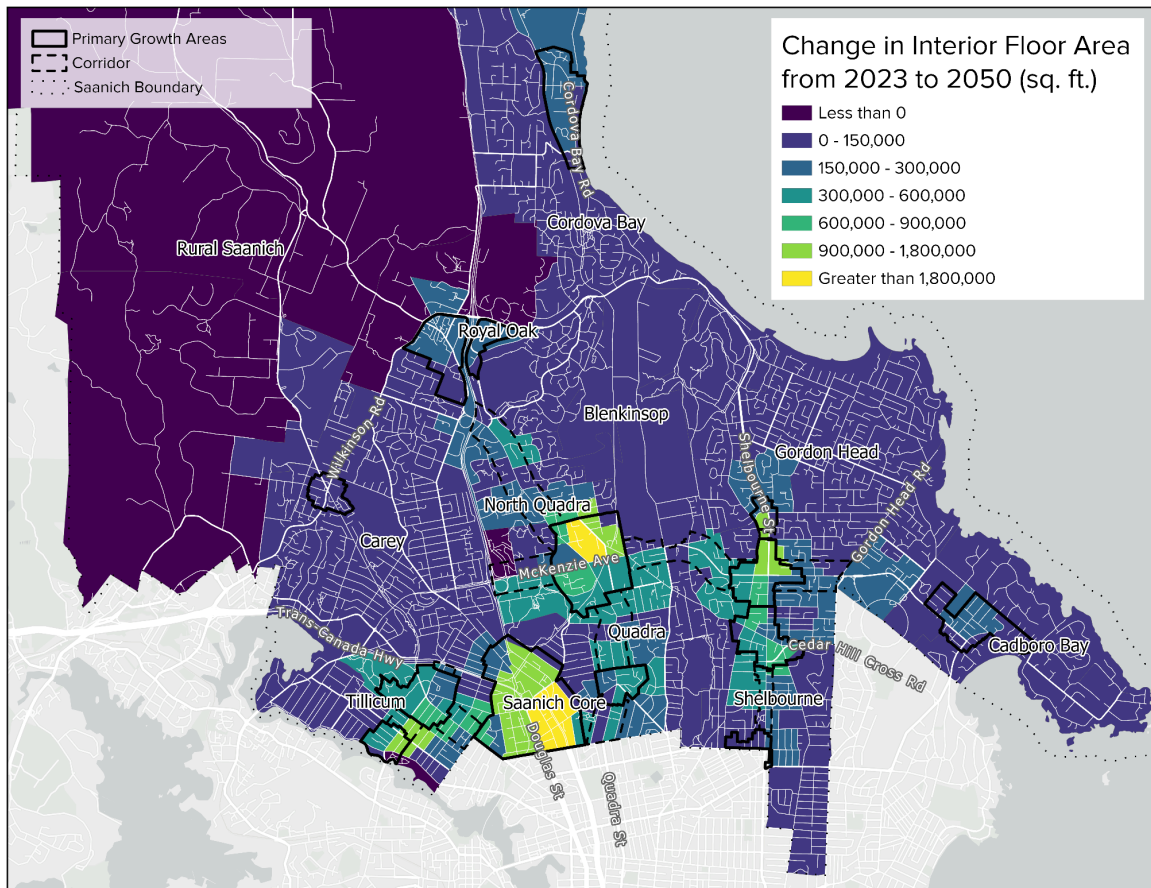


Figure 2.1. Net new floor area from 2023-2050 (sq. ft.) under the OCP land use scenario. Positive numbers indicate an increase in interior floor area.

Key Indicators: Floor Area

Table 2.1. Baseline (2023) Floor area by Building Archetype.

Part	Archetype	Floor Area (millions sq.ft.)	% of Total Floor Area
Part 3 Commercial	Education	13.47	11.66
	Government	0.44	0.38
	Healthcare & Other Institutional	1.36	1.18
	Industrial & Farm	3.14	2.72
	Office	2.19	1.9
	Other Commercial	4.68	4.05
	Retail	4.75	4.11
Part 3 Residential	MURB Condo	5.94	5.14
	MURB Rental	2.52	2.18
Part 9	Single Family Attached	25.28	21.88
	Single Family Detached	51.77	44.8
Totals		115.56	100

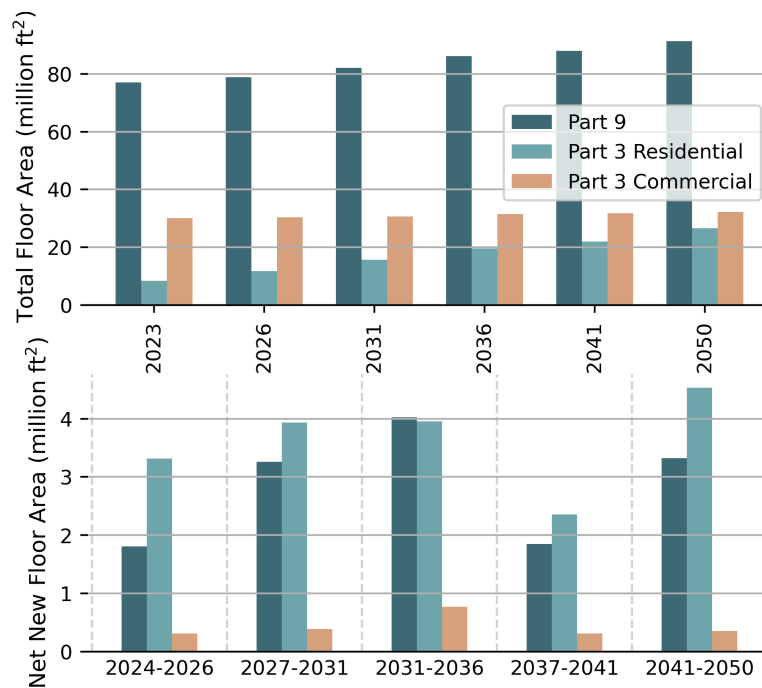


Figure 2.2. Land use scenario building floor areas for all of Saanich, by building category. Total forecast floor area (top) and net new floor area (bottom) - note the different scale of the y-axis.

This section shows both the existing baseline and growth in floor area across the District for all building types. The vast majority of the growth occurs in residential buildings, and Part 3 residential buildings in particular. Relatively little change occurs for Part 3 commercial buildings.

Key Indicators: Residential Units

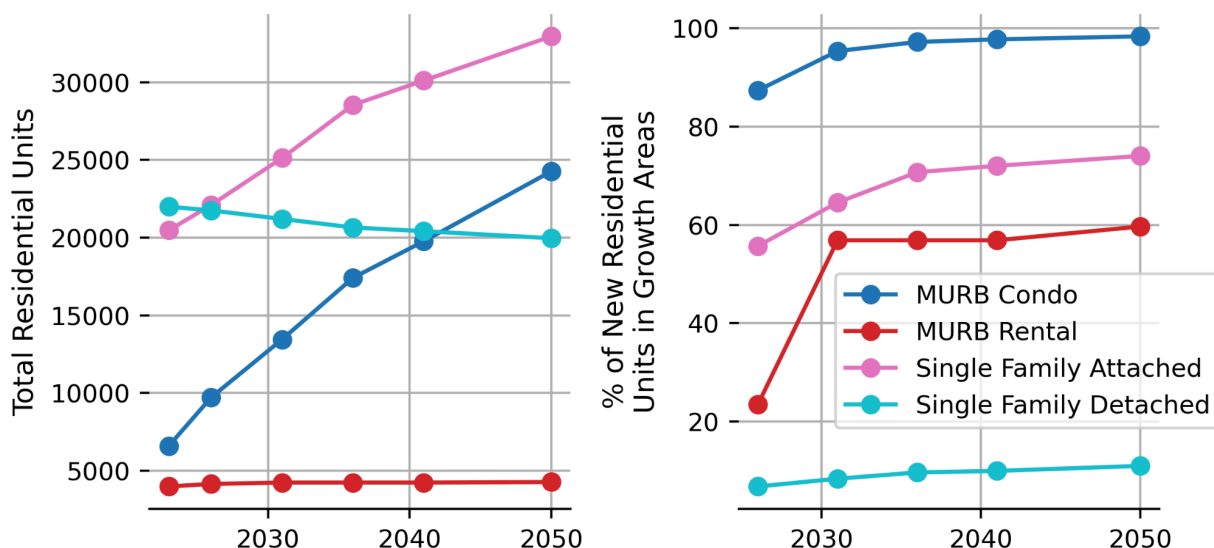


Figure 2.3. Total residential units by building archetype (left) and the percentage of new units in Primary Growth Areas (including Corridors).

Growth in total residential units in the land use forecast is almost entirely captured in MURB Condo and Single Family Attached (i.e. Townhomes and Small-scale Multi-Unit Housing, or SSMUH) buildings. There is a net reduction in Single Family Detached units, as many of these are displaced by redevelopment into multi-unit housing.

For all multi-unit housing, a significant majority of new units are developing inside the Primary Growth Areas and Corridors designated in the Official Community Plan (OCP), whereas nearly all new Single Family Detached dwellings are developed outside these areas.

Key Indicators: Population

The amount of incoming population for each Dissemination Area (DA) is estimated based on the number of units that are built out by the land use model. A regression model is built from existing data to model the amount of people that there will be for each unit type (e.g. apartments units will yield less people than single family homes).

Figure 2.4 and Table 2.2 illustrate the estimate for future population, and also display historical population numbers from BC Stats. From 2006-2021, there was a less than 1% increase in population per year on average, but based on the new OCP, from 2023 to 2050 growth will increase to 1.45% per year on average. By 2050, the population of the District will have increased by 39%, compared to what it is today.

Table 2.2. Historical Saanich population numbers from BC Stats, and forecast of total future population through 2050.

2006	2011	2016	2021	2023	2026	2031	2036	2041	2050
108,265	109,752	114,148	117,735	120,095	128,430	139,048	150,089	156,123	167,067

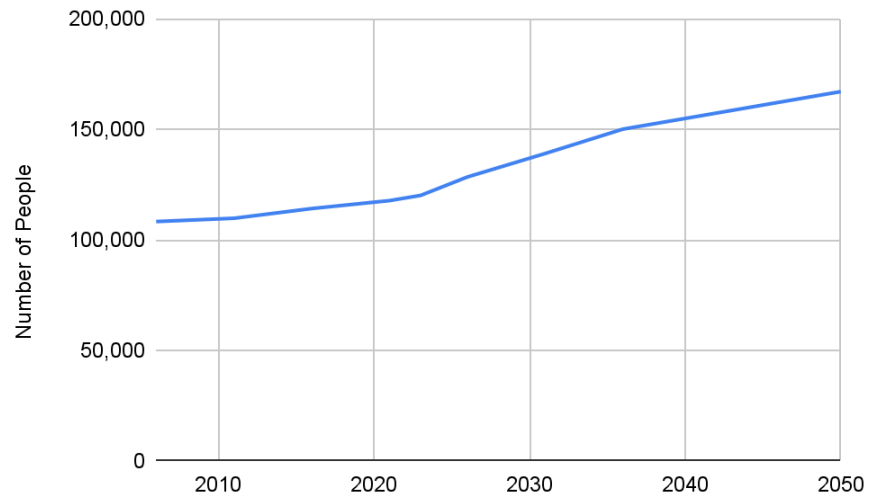


Figure 2.4. Forecast of total population for Saanich through 2050.

3. Passenger Transportation Emissions Forecast

The majority of transportation emissions in the District come from passenger vehicles. These are driven by three primary factors:

1. **The carbon content of vehicle fuels** - This is typically driven by Provincial and Federal policy, through EV regulations (e.g. the Zero Emissions Vehicle Act) and decarbonization of transportation fuels (e.g. the Low Carbon Fuel Standard). Municipalities provide a supportive role in implementation of these policies (i.e. by ensuring appropriate charging capacity).
2. **Amount of driving** - This is influenced much more closely by municipal policy, including via land use planning and investment in active transportation. Accordingly, the District has an [Active Transportation Plan](#) that sets out ambitious targets for sustainable mode-share (50% by 2050). This Plan includes a wide array of individual actions that the City can implement towards this target, acknowledging that shifting driving behaviour is very difficult, and depends on a confluence of coordinated factors.
3. **Vehicle ownership** - The District can influence the number of vehicles owned via parking policy in new buildings.

The modeling in this report explores all three of the key drivers of emissions, using the OCP forecast as the baseline for change. Uncertainties in Clean BC implementation are modelled to capture a breadth of electrification outcomes; locational factors are accounted for in the driving behavior model; and a reduction of new building parking is considered for incoming buildings.

It is worth noting upfront that the driving behaviour model in the Policy scenario can be seen to be very ambitious, and dependent on a confluence of successful factors. Still, it gives the District a sense of what can be accomplished regarding mode shift in the best case scenario.

This section of the report presents data sources, methodology, baseline state assessment and results for passenger vehicles. The beginning of the results section takes a deep-dive into currently available data, to help the District understand the present context. Heavy-duty vehicles are presented separately in [Section 5. Other Sectors](#).

3.1 Data Sources

Table 3.1. Data sources for transportation modeling and emissions forecasts

Data	Description	Source	Certainty Estimate
Emissions Inventory	Stantec CRD Municipal Emissions Inventory	Available Online	High
Passenger Vehicle Counts (current year)	Postal Code scale ICBC data, reported separately for ICE vs EVs	Provided by CRD. Contact: mgreeno@crd.bc.ca	High
Passenger Vehicle Counts (historical)	Municipal scale ICBC data by fuel type, from the Provincial CEEI	Available Online	High
Vehicles Per Unit	The vehicles are from the ICBC data, and the unit count is from BC Assessment data	Created Internally by LGeo	Medium
Vehicle Kilometres Travelled	EnviroNics reports fuel sales by DA, which can be used to extrapolate VKT by applying assumed fuel economies (L/100km)	Downloaded using ESRI	Medium
CRD Mode Share and Trip Count	CRD Trip Diaries data	CRD Online report	Medium
MVRD Mode Share, Trip Count and VKT	Translink Trip Diaries data	Translink Trip Diaries online portal	Medium
Emissions Factors	From the National Inventory Report (NIR) for the baseline year - with policy assumptions applied as appropriate (see Table 3.2)	National Inventory Report	High
CRD Bike Count Data	CRD records bike counts at a variety of counting stations, for years 2011 - 2025	CRD online source	High
Proximity Scores	Canada-wide, DA level data on the distance and amount of access to essential services and amenities. Used for VKT and modeshare modelling	StatsCan online source	Medium
Historical Population Counts	Historical population information, used to derive per-capita estimates of trip counts and other Saanich related outputs	StatsCan online source	High
Active Transportation Infrastructure	Network of transportation infrastructure in Saanich	Provided by the District of Saanich. Contact: Glenys.Verhulst@saanich.ca	High
E-Bike average cost	Used to derive the expected uptake of E-bikes from historical sales information	Cost per Bike	Low - Medium
E-bike historical sales	Historical trend in e-bike uptake, Canada wide	Market research	Low - Medium
E-Bike average VKT reduction	Used to derive the amount of reduced driving per new e-bike	E-bike Pilot Study	Low
Municipal e-bike incentive	Marginal e-bike uptake from municipal reductions	UBC REACT Lab	Medium
CleanBC Roadmap ZEV Act uptake	Used as an input into the stock-turnover model that specifies how many future vehicles will be electric	Light-Duty ZEV Act	High

Data	Description	Source	Certainty Estimate
No ZEV Act uptake assumptions	Considered as a scenario input in case of removal of the Clean BC ZEV Act	2017 study	Low
CleanBC Review	Revised ZEV Act targets	2025 CleanBC Review	Medium
Low Carbon Fuel Standard Assumptions	Provincial assumption on decarbonization of transportation fuels	BC Gov	High
Parking Minimums Assumptions	Applied to the Policy scenario, assumed reduction in parking for new buildings from removal of minimums in the zoning bylaw	Observations from Seattle	Medium
Parking Fees Assumptions	Assumed reduction in VKT from a well designed, regional parking strategy	Victoria Transit Policy Institute	Low
Low Carbon Fuel Standard Compliance	Used to split LCFS compliance credits by sub-type	LCFS Compliance	Medium
Ethanol blending cap	Upper limit on ethanol in light-duty vehicles	U.S. Department of Energy	High
Renewable naphtha projections	Naphtha market growth projections	Market insights	Low

3.2 Policy Scenarios: Definition and Assumptions

3.2.1 Scenarios Overview

In addition to the common land use forecast, the two policy scenarios, Business as Usual (BAU) and Pathways, have a handful of shared inputs and assumptions. Given uncertainty surrounding the CleanBC policy, the BAU and Pathways scenarios each simulate two possible cases for EV adoption:

- ZEV Act (with targets as defined by the Clean BC Review⁸): 55% of sales are EV by 2030, and 90% by 2035.
- No ZEV Act: 25% of sales are EV by 2030, and 65% by 2035.

These sales targets only determine the percentage of new cars adopted every year that are EVs. Changes in driving behaviour are captured via other policies.

Both the BAU and Policy scenarios assume implementation of the Low Carbon Fuel Standard (LCFS) and Tail Pipe Emissions Standards, because these have been legislated by Clean BC.

Scenario Summary: Business as Usual (BAU)

The BAU scenario directly simulates the following policies:

- Low Carbon Fuel Standards (LCFS)
- Continued buildout of the active transportation (ATP) network
- Tail pipe emissions standards

For topline reporting, the ZEV Act is not included in the BAU. This was decided due to implementation uncertainty at the time of writing the report.

Scenario Summary: Pathways

The Pathways scenario *includes all BAU policies*, plus the following additional policies and scenarios:

- Continued e-bike adoption in line with federal-level trends, along with a vehicle kilometers traveled (VKT) reduction due to e-bike adoption
- Reinstatement of the municipal e-bike incentive program
- Removal of vehicle parking minimums
- Introduction of a targeted scrap-it program to hit 90% EV ownership in 2050 under the ZEV Act sales targets

⁸ Appendix A, 2.d.ii on page 56 of November 2025 [CleanBC Review](#)

- Reduced VKT due to increased proximity to transit, amenities and services
- Reduced VKT due to increased parking fees
- Increased uptake of renewable fuels.

Table 3.2. Policy assumptions for transportation modeling, in the BAU and Pathways scenarios.

Policy Name	Policy Assumptions per Scenario		Jurisdiction	Source
	BAU (Worst Case)	Pathways		
Continued nation-wide e-bike adoption	Not included	Hold the 2023 e-bike adoption rate per-person static (see Table 3.7 for calculation and trends).	Federal	E-bikes sold: StatsCan Population: Cost per Bike
Municipal e-bike incentive	Not included	Introduce an additional 94 e-bikes annually, calculated as the marginal increase in e-bike from the e-bike pilot study	District of Saanich	UBC REACT Lab analysis
E-bike VKT Reduction	Not included	Reduction in emissions per bike derived from e-bike pilot study (2496 kms per bike per year, or 48 kms per bike per week)	District of Saanich	E-bike Pilot Study
ATP Network	Assume ongoing buildout of the ATP; medium-term buildout complete by 2045 and complete buildout by 2060. The impact of the ATP buildout is modeled by assuming that the current rate of per-capita increases in bike ridership continue through to 2050.	Same as BAU - with additional potential buildout to support the proximity measured that were modelled to match Victoria (see Section 3.3.3)	District of Saanich	BAU timeline from Saanich Engineering (Jason Hodgins)
Light Duty ZEV Act	Two cases modelled: - Roadmap Review: 55% sales are EV by 2030, 90% by 2035. All incentives are assumed to be supportive of this uptake, not in addition to. - No Roadmap: 25% sales are EV by 2030, 65% by 2035. This is a low-adoption case chosen to demonstrate the impact of the ZEV Act on emissions, not to provide a realistic forecast (which is difficult to do given the uncertainty of upcoming CleanBC policy). For topline reporting, the ZEV Act is not included.	Same as BAU, but for topline reporting the ZEV Act is included. Comparison against more aggressive CleanBC assumptions provided for reference.	Provincial	Roadmap: Light-Duty ZEV Act Review: CleanBC Review No-Roadmap: 2017 study
EV Ready Incentives	Superceded by ZEV Act targets.	Superceded by ZEV Act targets.	Cross - jurisdictional	n/a

Policy Name	Policy Assumptions per Scenario		Jurisdiction	Source
	BAU (Worst Case)	Pathways		
Go Electric	Superceded by ZEV Act targets.	Superceded by ZEV Act targets.	Provincial	n/a
Bus Electrification	not included	Wrapped into Heavy Duty electrification rates	BC Transit	n/a
Low Carbon Fuel Standard (LCFS)	30% renewables by 2030, 30% held steady out to 2050.	Same as BAU	Provincial	Reduction Schedule table from BC Gov
Public Transit Service	No change from baseline. Based on conversations with BC transit, all funding is currently going towards maintaining, as opposed to improving transit service levels.	Any increases in Transit service are wrapped into proximity measure modelling	BC Transit; CRD	BC Transit contact: levi_megenbir@bctransit.com
Tail pipe emissions standards	Engine efficiencies for heavy-duty vehicles are improved by 3.79% each year (non-compounded) from 2019-2030. (Calculated to approximate existing CleanBC policy modelling)	Same as BAU	Provincial	Previous modelling work
Scrap-it program	Not included	Scrap an additional 415 ICE vehicles (15 years and older) annually from 2035-2050 to achieve 90% EV ownership by 2050 under the ZEV Act.	Municipal	n/a
Provincial VKT Target	Not included	Not included	Provincial	n/a
Removal of parking minimums	Not included	50% reduction for all archetypes except SFDs	District of Saanich	Observed reductions post policy implementation in Seattle
Increased Proximity	Not included	Increased proximity within growth areas to match the proximity of present-day Victoria. Proximity of DAs adjacent to growth areas grows by half as much. Proximity increase is modelled as a linear increase from 2030 to 2050. It results in an increase in	District of Saanich	LGeo modelling

Policy Name	Policy Assumptions per Scenario		Jurisdiction	Source
	BAU (Worst Case)	Pathways		
		sustainable mode, which in turn decreases VKT.		
Increased parking fees	Not included	10% Reduction of VKTs per capita, modelled as a linear decrease from 2030 to 2050	District of Saanich	Study - Active Transportation and Micromode Emissions Reduction Potentials
Increased uptake of renewable fuels	Not included	From the 2030 baseline emissions established by the LCFS Act, target the following assumptions by 2050: 15% ethanol blending, 100% HDRD replacement of diesel, and 5% renewable naphtha replacement of gasoline	Provincial	Ethanol: Technical limit Naphtha: Market trends
100% Clean Electricity Standard	Included	Included	Provincial	BC Hydro Reporting states that the 100% Clean Electricity Standard has already been achieved

3.3 Emissions Estimation & Forecasting Methodology

3.3.1 Emissions Estimation

According to the IPCC standard methodology, emissions can be estimated for each year as follows:

$$\text{total emissions (tCO}_2\text{e)} = \text{Number of gas and electric vehicles} * \text{driving per vehicle (km)} * \text{engine efficiency (L/100km)} * \text{emissions factors (tCO}_2\text{e/L)}$$

For the baseline year, the data sources for each of these inputs is described in Table 3.1. In future years, the number of vehicles and driving behaviour must be forecasted, the methodology for which is described in the sections below.

The emissions were estimated at the DA level, which is the level of aggregation at which the Environics fuel sales data was provided (described in Section 3.3.3).

3.3.2 Forecasting the size and composition of the future vehicle stock

1. The current number of vehicles is determined from ICBC data provided from the CRD. The data includes postal-code level counts of electric and non-electric vehicles.
2. Future number of vehicles per postal code is estimated by using a vehicle/unit yield (Table 3.3) that is multiplied onto the future number of units from the land use forecast. Therefore, vehicle growth projections align with the number of apartments, SSMUHs and SFDs that are expected to be developed by 2050. If a reduction in parking is expected, this policy influences the future number of vehicles by applying an assumed reduction in ownership (see Table 3.3).

Table 3.3. Number of vehicles per unit type. These yields are derived by dividing ICBC data by the number of units. In future years, vehicle numbers are calculated by multiplying modelled numbers of units, treating these values as fixed in future years.

Residential Unit Type	Vehicles/Unit
Apartment	0.7
Apartment/Ground Oriented	0.9
Ground Oriented	1.3
Single Family Dwelling	2.1
Small Scale Multi Unit Housing	1.2
Mixed Use	0.7

3. In addition to the number of vehicles in the future, the proportion of trucks/SUVs vs. cars was also considered, because this has an impact on the fuel efficiency of the vehicles. Figure 3.1 below shows the historical proportion of light duty vehicles in the District that were trucks vs. vehicles, from the CEEI data. From 2008 to 2020, there were increasingly more trucks, but this trend reversed in 2020. Based on this information it is difficult to ascertain what might happen in the future (especially considering how things might change with road dieting/narrowing and increased congestion), so the proportion for 2022 was held static moving forward.

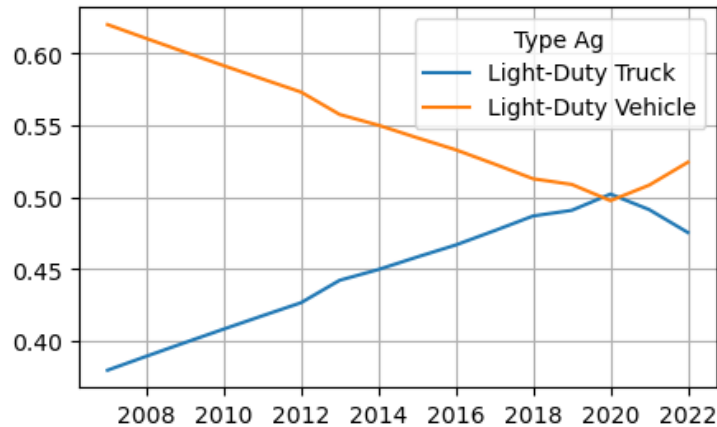


Figure 3.1. Proportion of light-duty vehicles in the District that are cars vs. trucks/SUVs.

4. A probabilistic retirement rate is applied to existing vehicles. The retirement rate is derived from historical vehicle data for British Columbia, shown in Figure 3.2.

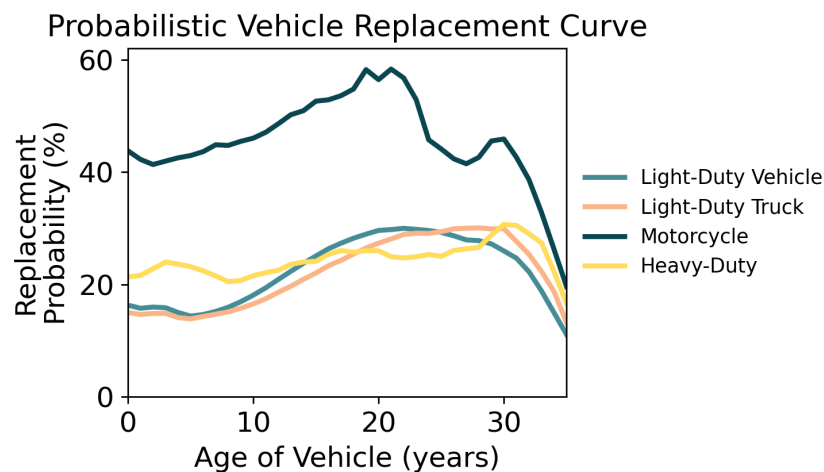


Figure 3.2. Probabilistic retirements rates from ICBC data used to derive future vehicle stock turnovers.

5. Based on the forecasted number of vehicles and the amount of vehicles that were retired, new vehicles are added into the stock, and a percentage of these newly added vehicles are electric. The target amount of new electric vehicles each year is defined according to the policy assumptions laid out in Table 3.2. It is assumed that all of the added vehicles will be ZEVs and not plug-in hybrids, and that enough charging capacity will be installed to meet the demands in the growth.

Scrap-it Program

Even under aggressive EV sales targets, fleet composition lags due to slow turnover of existing ICE vehicles. Under the CleanBC Review, EV sales are targeted to reach 90% by 2035. However, due to the lag in vehicle turnover, EV ownership forecasts using the above modelling projects only 83% EV ownership by 2050.

To expedite fleet turnover toward EV sales targets, a scrap-it program is modeled to retire ICE vehicles older than 15 years, with the aim of reaching 90% EV ownership by 2050. The modelled program begins in 2035 and assumes each retired ICE vehicle is replaced by an EV (although the replacement EV can be a used vehicle).

Achieving 90% EV ownership by 2050 requires retiring 415 ICE vehicles per year starting in 2035, for a total of 6,225 additional vehicles retired from 2035-2050 through the scrap-it program (accounting for an additional 15% of the natural retirement of ICE vehicles expected over the same period; 41,435 ICE vehicles). Although this policy was designed to hit targets under the CleanBC review, the same scrap-it policy (415 ICE vehicles) is modelled in the Pathways scenario with no ZEV Act for consistency.

3.3.3 Forecasting driving behaviour

A baseline estimate for VKT per DA is derived from Environics data, which is a source that is based on the amount spent on fuel (from credit card sales), household surveys, and Census data.

Several approaches were considered to estimate future VKT. Initially, the project team tried to find statistical relationships between VKT and demographics, land use attributes, transit usage and active transportation infrastructure for DAs **within** Saanich, but the only variable that

demonstrated a strong relationship was income. However, when **proximity**⁹ to services and amenities are evaluated **between** communities in the CRD, there is a strong relationship with auto mode share (see Figure 3.3).

Correlation between proximity and municipal auto mode share

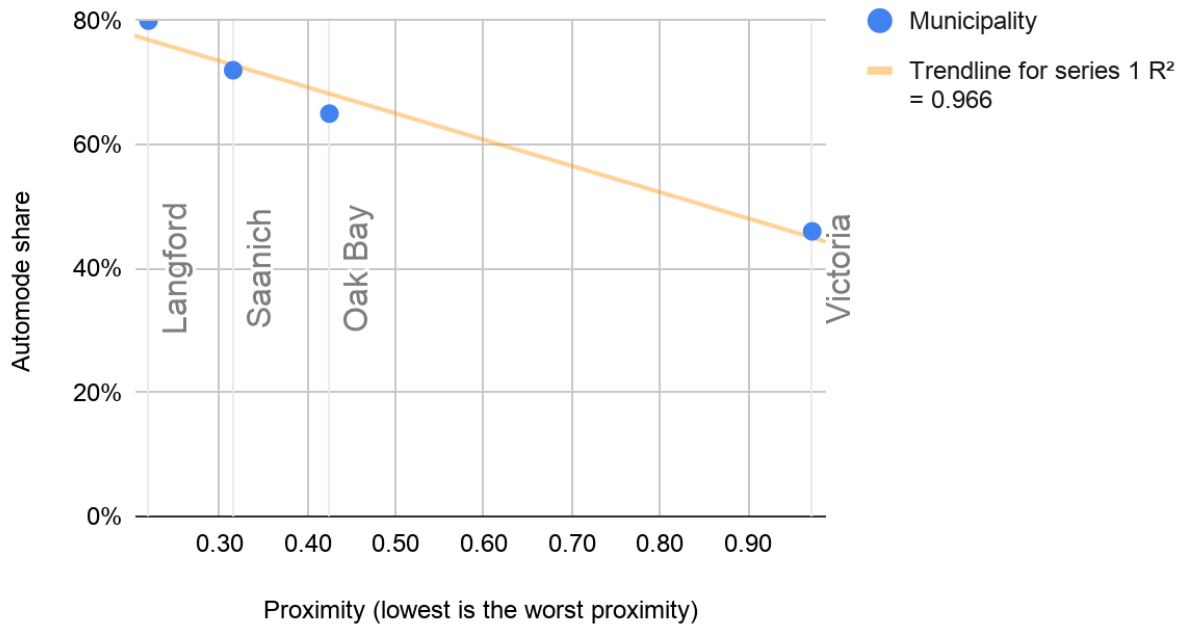


Figure 3.3: Relationship between proximity to services and auto mode share, for Victoria, Saanich, Oak Bay and Langford. Communities with lower proximity[1] have substantially higher auto mode share. This demonstrates the level of access that the District would need to achieve to reduce kms travelled.

Two conclusions can be drawn from this assessment:

1. The within-community analysis shows that (assuming that the local Environics data is representative), Saanich's size and demographics mean that income is one of the largest influences on driving behaviour;

⁹ The proximity metric used is reported by [Statistics Canada](https://www150.statcan.gc.ca/n1/pub/92-62-001-x/2021001/article/00001-eng.htm) in the 2021 census at a DA level, measuring the proximity to employment, grocery stores, pharmacies, health care, child care, primary and secondary education, public transit, neighbourhood parks, and libraries. Each proximity metric is reported from 0 to 1, with 0 representing the lowest proximity across Canada, and 1 representing the highest proximity across Canada. These 10 metrics are added together to get an overall proximity score for each DA, with higher scores indicating higher proximities.

Note that, while it is possible to calculate proximity scores directly from the baseline and land use forecast, this is a substantial chunk of work that falls outside the scope of this project.

2. The between-community analysis shows that on a broader scale, proximity to services has a significant impact on driving behaviour.

The influence of land use change on future VKT was thus modelled via the between-community assessment of proximity, mode share and VKT.

Increase in growth area proximity

To model future change in driving behaviour, the average proximity in Saanich's growth areas¹⁰ in 2050 is assumed to match the current average proximity in Victoria. Victoria was chosen because its current mode share aligns with the target in the District's Active Transportation Plan. By modeling proximity in this way, it is assumed that the Uptown Core, Centres, and Villages will develop into highly proximal city cores. In reality, this assumption is very ambitious, but it was modelled in any case to demonstrate a best-case scenario for VKT reduction. This increase is modelled as a gradual change from present day to 2050, shown in Figure 3.4.

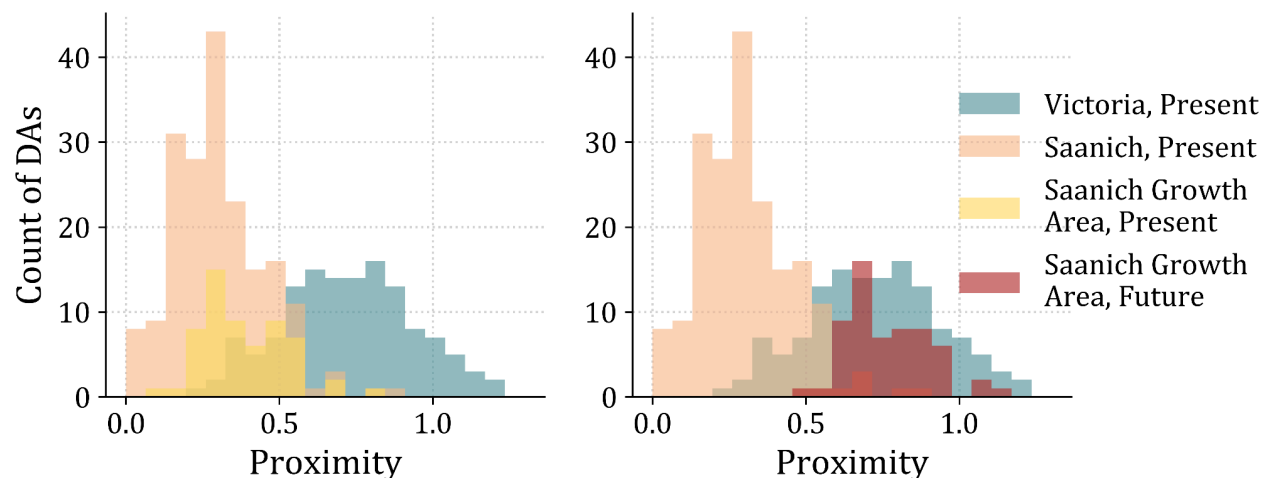


Figure 3.4. Histograms showing the number of DAs (y-axis) with a given proximity score. Teal and Orange show the present-day distributions in Victoria and Saanich, respectively. In the left panel, yellow shows the distributions of Saanich Dissemination Areas (DAs) within growth areas. In the right panel, red shows the projected future distribution of these DAs after adjusting their proximity to match present-day Victoria. Note that proximity scores might exceed 1 because these are summed across many distinct proximity metrics (e.g proximity to schools, transit, grocery, etc.)

¹⁰ A DA is considered to be within the growth area provided at least 10% of its area is contained within the boundaries defined within the OCP.

DAs neighbouring growth areas will also benefit as proximity increases nearby. DAs adjacent to growth areas are assumed to experience half the proximity increase as those within growth areas, while proximity in the other DAs unchanged.

Finally, to convert the increase in proximity to a reduction in VKT, a relationship is derived between proximity and VKT from the [CRD Trip Diaries](#). From this analysis, VKTs in DAs within growth zones are predicted to decrease by 20%, and VKTs within DAs adjacent to growth zones are predicted to decrease by 10%.

Increase in parking fees

The Victoria Transport Policy Institute [report](#) on Transportation Planning Principles, Distortions and Reforms states that an increase in parking fees can reduce VKTs by 10-30%, with a parking cost of \$1-5 per trip (see the report for full information). As these numbers were derived from American cities with differing socioeconomic conditions and population densities to the District of Saanich, a conservative estimate of a flat 10% reduction across all DAs is assumed.

E-bike uptake

Results from the [E-bike Pilot Study](#), indicate that e-bike ownership decreased VKTs by an annual average of 48km per week. Assuming this trend holds (i.e., no saturation of e-bike ownership through continued development of active transportation infrastructure) each additional e-bike modelled is assumed to decrease annual VKT by 2,496km.¹¹

In lieu of more localized data, the baseline amount of e-bike uptake matches Canada-wide trends (see Table 3.7).

In addition to this baseline e-bike uptake, municipally-incentivized e-bike uptake is modelled using results from the [E-bike Pilot Study](#), and associated [UBC REACT Lab analysis](#). This pilot program administered 180 rebates at \$350, 80 rebates at \$800, and 40 rebates at \$1,600. From survey data and the UBC REACT Lab analysis, the marginal uptake rate (no e-bike purchase without the rebate) is 20% for the \$350 rebate, 41% for the \$800 rebate, and 65% for the \$1,600 rebate, giving a total of 94 e-bikes purchased by Saanich residents who would have otherwise not purchased one. The reinstatement of the municipal e-bike program is modelled by introducing an additional 94 e-bikes annually, and reducing VKTs accordingly.

3.3.4 Increased uptake of renewable fuels

The B.C. Low Carbon Fuel Standards (LCFS) Act, is a crediting system that requires fuel suppliers to reduce the average lifecycle carbon intensity of the energy they supply, with a target of a 30% reduction in transportation carbon intensity from 2010 to 2030. When a fuel supplier provides

¹¹ Increased proximity will likely have the knock-on effect of also increasing e-bike uptake, but that is not modelled here directly. It is rather captured in the increase in sustainable mode share.

fuels below carbon intensity targets, they incur credits that can be sold to offset fuel suppliers who exceed carbon intensity targets across regulated transportation fuels (diesel, gasoline, and jet fuels) and uses (light-duty, heavy duty, marine, aviation).

Because LCFS compliance is achieved through a credit-based system, credit generation from one part of the fuel mix can be used to offset other parts of the fuel mix that are more difficult to decarbonize. For example, annual provincial LCFS reporting indicates that compliance is being primarily achieved through reductions in diesel-side emissions rather than gasoline-side decarbonization. In 2024, diesel replacement fuels accounted for nearly 70% of LCFS compliance¹², even though diesel accounts for only 47% of all transportation energy usage in the province. This imbalance is driven by both technical and supply-chain constraints on gasoline decarbonization, such as upper limits on ethanol blending, and limited production and distribution of renewable gasoline substitutes.

Electricity is also an LCFS compliance pathway, accounting for approximately 10% of all compliance credits in 2024. However, electricity-based crediting and emissions reductions modelling is excluded from LCFS renewable fuel uptake modelling to avoid double counting, since EV adoption and electricity use are modelled explicitly through the fleet turnover modelling.

In this report, the BAU scenario assumes the 30% LCFS targets are met in 2030 by extrapolating decarbonization, assuming that diesel replacement fuels continue to account for 70% of this compliance, and then holding the resulting fuel compositions constant from 2030-2050. In the Pathways scenario, fuel decarbonization continues from 2030 to 2050 through the following three renewable fuel uptake mechanisms:

1. Ethanol blending is increased to 15% (E15) by 2050, consistent with the technical limit in the majority of light-duty vehicles manufactured after 2001, as approved by the U.S. Department of Energy¹³.
2. Diesel is fully replaced by hydrogenation-derived renewable diesel (HDRD) - often referred to as Renewable Diesel or R100 - by 2050, which is typically treated as a drop-in diesel substitute with a fifth the carbon intensity of fossil-derived diesel. HDRD use tripled from 2022 and 2024, and currently represents the largest source of carbon compliance credits under LCFS, so continued uptake of HDRD is a reasonable assumption.
3. Renewable naphtha as a drop-in (or blend) for gasoline increased through to 2050 by extending current uptake trends. Historic and projected naphtha market growth from 2020 to 2035 in the United States is approximately 9% year-on-year¹⁴. Extrapolating this trend to 2050 predicts a 9.7-fold growth in naphtha uptake from 2024, corresponding to a 5% share of gasoline-side energy usage in 2050 (assuming a proportional translation from market growth into province-wide naphtha access).

¹² [Renewable and Low Carbon Fuel Requirements Summary, 2010-2024](#).

¹³ See <https://afdc.energy.gov/fuels/ethanol-e15> for more details.

¹⁴ <https://www.futuremarketinsights.com/reports/renewable-naphtha-market>.

3.4 Results & Analysis

This section presents the results of the transportation modeling analysis, beginning with an assessment of the current state of emissions, mode share and active transportation, and VKT. The changes under the BAU and Pathway policy scenarios are then presented, but with and without the Provincial ZEV Act. **Recommendations** are provided bolded throughout the relevant sections for easy reference.

3.4.1 Where are things now?

Geospatial View of Emissions in the Baseline Year

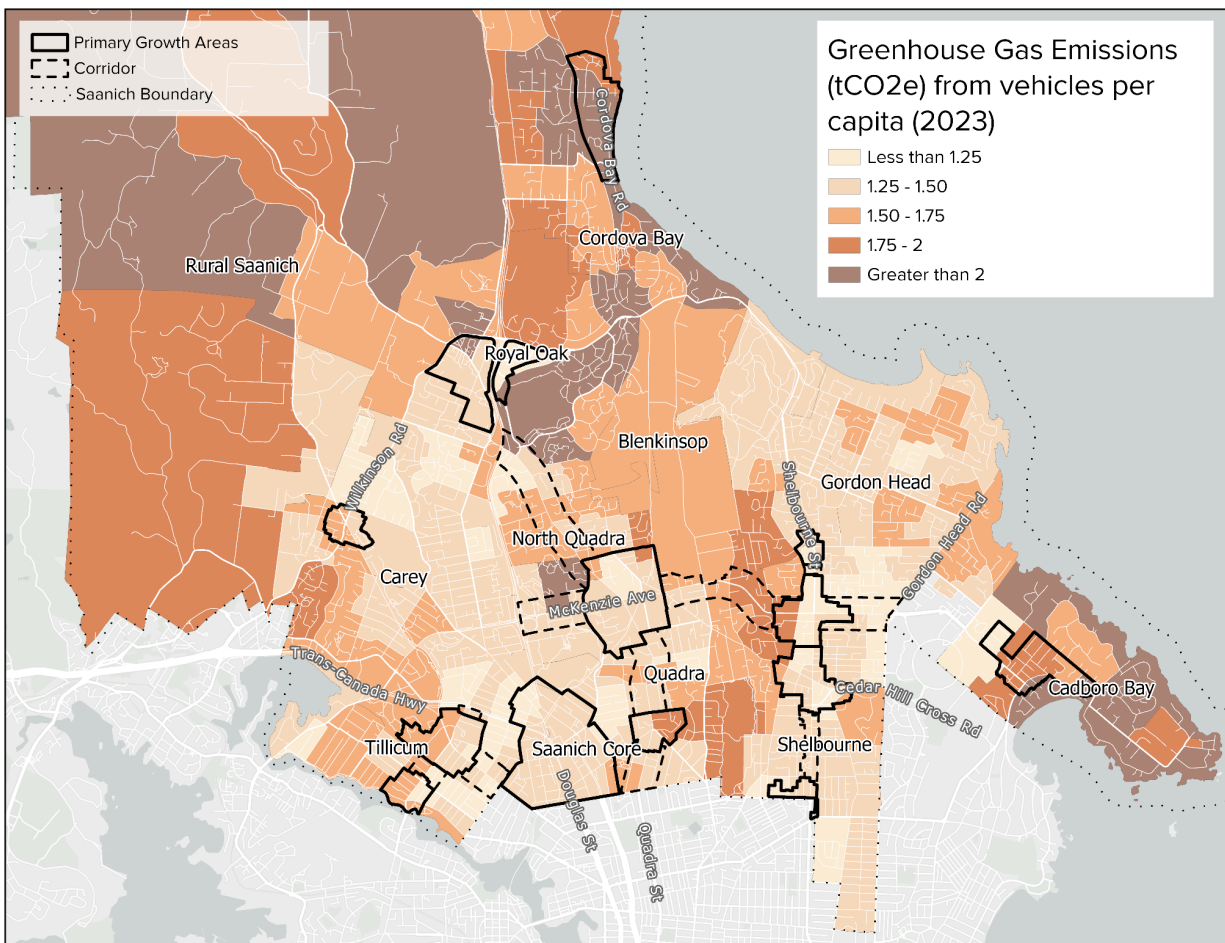


Figure 3.5. Greenhouse gas emissions (tonnes of CO₂, equivalent) per capita from vehicles in 2023, for each DA in the District.

In the transportation sector, GHG emissions are intrinsically related to location, since the area that you live in strongly dictates the amount that you will drive. Figure 3.5 illustrates per-capita light-duty transportation emissions at the DA scale across the District of Saanich in 2023.

High-level analysis of this figure suggests the following observations:

- In rural Saanich, Cordova Bay and Cardboro Bay, where distance to core services is the highest, emissions are also the highest.
- Growth areas are generally in low per-capita emitting areas, but there are some exceptions. Without an appropriate policy plan for those areas, growth there will result in emissions increases from transportation.

Drivers of Emissions Reductions since 2007

According to the CRD emissions inventory, light-duty vehicle emissions in Saanich dropped from 232 ktCO₂e in 2007 to 181 ktCO₂e in 2022 (**22%** drop), despite an **18%** increase in vehicle ownership in the same time period, and an associated increase in vehicles per capita (Table 3.4). The reduction in vehicle emissions could thus be driven by three other factors:

1. **Electrification** - However, as shown in Table 3.4, there are still more ICE vehicles in 2022/2023 than in 2007, so electrification will not yet have contributed to any reduction in emissions.
2. **Decarbonization of transportation fuels** - The Low Carbon Fuel Standard has reduced the carbon content of transportation fuels by approximately **9%** since 2007.
3. **Changes in driving behaviour** - The majority of the reduction in emissions in the District have been driven by a reduction in driving, however it is not possible to say whether the reduction in driving behaviour is directly related to the COVID19 pandemic and if there will be a bounce-back in kilometres travelled in coming years. For the purposes of forecasting, it is assumed that the current amount of driving persists moving forward.

Table 3.4: Total and per-capita ownership of ICE and EVs as reported by CEEI and ICBC.

	Total		Per Capita	
	2007	2022/2023	2007	2022/2023
EVs (CEEI)	48	2,366	0.00	0.02
ICE (CEEI)	67,425	77,552	0.62	0.66
Total (CEEI)	67473	79,918	0.62	0.68
EVs (ICBC)	n/a	2,245	n/a	0.02
ICE (ICBC)	n/a	77,627	n/a	0.66
Total (ICBC)	n/a	79,872	n/a	0.68

Mode Share and Proximity to Amenities and Services

According to the CRD Trip Diaries studies, the District has seen a reduction in both absolute and per capita vehicle trips, and transit trips since 2017 (Table 3.5). At the same time, there has been an increase in trips taken by walking, and other active modes. Taken together, the District has an estimated auto mode share of 72% in 2022.

Table 3.5. Trip counts and % mode share for Saanich, collected from the CRD trip diaries data.

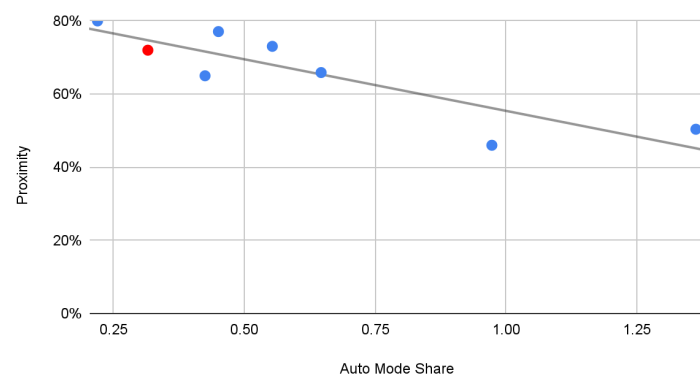
Trip Type	Total Trips (Thousands)		Per Capita Trips		% Mode Share	
	2017	2022	2017	2022	2017	2022/2023
Auto	94,481	77,153	828	655	74%	72%
Bike	15,321	11,787	134	100	12%	11%
Transit	10,214	7,501	89	64	8%	7%
Walk	6,384	11,787	56	100	5%	8%
Other	1,277	2,143	11	18	1%	2%
Total	127,677	107,157	1,119	910		

Proximity to amenities and services, which is a major contributing factor to mode share, was evaluated for the District¹⁵, as well as 7 additional communities across MVRD and CRD for the purposes of comparison. According to the analysis, there is a strong statistical relationship between proximity and mode share. Saanich has a high auto mode share but, relative to the other communities analyzed, it also has a low proximity to amenities and services.

Table 3.6 & Figure 3.6: Average proximity to amenities and services compared to auto mode share for eight communities across MVRD & CRD. In the regression plot, Saanich is highlighted in red.

CSD	Auto Mode Share	Proximity
Vancouver	50%	1.36
Victoria	46%	0.97
Burnaby	66%	0.65
Richmond	73%	0.55
Surrey	77%	0.45
Oak Bay	65%	0.42
Saanich	72%	0.32
Langford	80%	0.22

Proximity vs. Auto Mode Share



¹⁵ Proximity data described in Section 3.3.1., Forecasting Driving Behaviour

The District has a target in their [Active Transportation Plan](#) to reduce auto mode share to 50% by 2050. Increasing proximity to amenities and services via appropriate land use planning and retail development strategies will be a fundamental tool to achieving this target.

Although increasing proximity leads to a reduction in VKT, it does not alleviate the need for mobility. Those living in denser areas will tend to shift toward walking, cycling, and transit as supportive infrastructure is built. **Continued investment in Active Transportation Infrastructure** will thus be essential as the District aims to achieve its mode share reduction target.

As discussed in *Section 3.3.3 Forecasting Driving Behaviour*, future VKTs are derived from changes in mode share, which are determined by changes in proximity.

Recent Trends in Active Transportation

The CRD Trip Diaries data does show a decrease in bike trips since 2017, but the CRD bike count data tells a more complete story. Recent trends in cycling patterns across Saanich are calculated using automated cycling counts from [Eco-Counter](#). The total annual trips per person are calculated by summing together the total number of trips from six automated cycling counts operating continuously since 2021 (Figure 3.7):

- Galloping Goose West of McKenzie Ave,
- Interurban Rd North of Dumeresq St,
- Borden St Cycle Path North of McKenzie Ave,
- Galloping Goose West of Harriet St,
- Lochside South of Nigel Ave, and
- Galloping Goose South of Culduthal St.

Data are reported as trips per person. From 2023-2025, ridership has increased by **2.6%**. This increase is composed of a **2.1%** decrease on weekends, but a **4.2%** increase on weekdays.

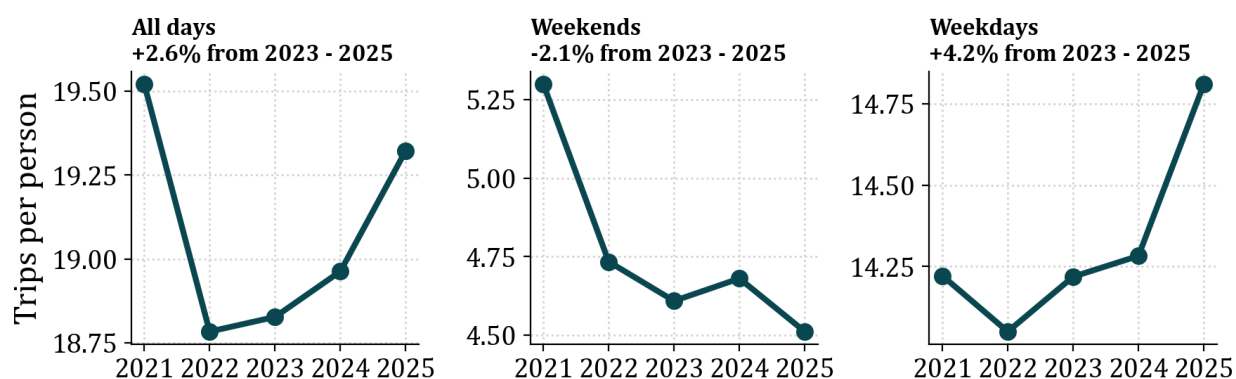


Figure 3.7. Annual bike trips per person from 2021 to 2025 compiled from six automated cycling counters throughout Saanich. Data are presented over all days of the week and separately on weekends and weekdays. (The trips per person on the y-axis are different scales so that the trend in weekend trips is visible to the reader.)

Part of the increase in per-capita biking trips per person can be attributed to the adoption of e-bikes. Table 3.7 demonstrates that, across Canada, e-bikes became increasingly popular between 2019 and 2022, although there was a drop in 2023.

Table 3.7. Canada-wide adoption of e-bikes from 2019-2023. More current data was not available at time of writing¹⁶.

	2019	2020	2021	2022 ¹⁷	2023
e-bikes sold (\$CAD)	\$ 131,045,000	\$ 232,240,000	\$ 409,774,000	\$ 530,560,000	\$ 360,312,000
cost per e-bike (CAD)	\$ 3,400	\$ 2,856	\$ 2,720	\$ 2,448	\$ 2,312
population (millions)	37.6	38	37	39	40.1
ebikes sold/bought per person	0.0010	0.0021	0.0041	0.0056	0.0039
estimated e-bikes sold/bought in Saanich (extrapolated from Canada-wide estimates, and not accounting for e-bike incentives)	119	250	479	661	467

Historic Trends in Transit Use

Per capita trips taken by public transit *decreased* by about **28%** between 2017 and 2022. This reduction in transit use is a trend that has been more broadly observed across MVRD and CRD and has largely been attributed to the pandemic; pre-pandemic transit usage numbers have largely still been unobtained.

As part of this project, BC Transit¹⁸ was engaged to develop an understanding of current transit use and expected trends for future use. According to BC Transit:

- The amount of dollars currently available are limited - at this point in time they are exclusively used for maintaining existing levels of service, as opposed to expansion.
 - The Victoria Regional Transit System is funded through a cost-sharing model split between the provincial government and the Victoria Regional Transit Commission (VRTC), traditionally resting at approximately a 31.7% provincial share and a 68.3% local/VRTC share. While local funding has been committed, Provincial funding has not been made available to enable service expansion. Therefore, any funding has

¹⁶ Although the CRD Origin-Destination survey suggests that Saanich has proportionally higher e-bike ownership than the rest of the country, it does not provide year-over-year adoption trends. It is also unknown how much of the higher local ownership is due to the 2021-2022 e-bike incentive pilot. Given uncertainty around current uptake, ownership saturation, and replacement cycles, national per-capita sales are used for projections.

¹⁷ 2022 is likely lower than 2023 due to a Covid-related uptick, but more research is required to confirm this.

¹⁸ LMegenbir@bctransit.com, EWren@bctransit.com,

been exclusively used for maintaining existing levels of service, as opposed to expansion.

- There is limited capacity to add additional buses to the road because they do not own a service yard that would allow for expansion. Any improvements to frequency would thus be from optimizing current transit routes.
 - BC Transit is actively developing new transit facilities in the region that would allow for future vehicle and service expansion, but this would still be subject to Provincial funding for service expansion.
- The majority of public transit users are students.

Table 3.8. *Transit mode share in eight communities across MVRD and CRD.*

CSD	Transit Mode Share
Vancouver	14%
Surrey	8%
Burnaby	14%
Richmond	9%
Victoria	9%
Saanich	7%
Oak Bay	6%
Langford	4%

Despite the above, and in the absence of significant funding commitments from the Province for transit service expansion, BC Transit has a goal of achieving 15% transit mode share by 2050. Table 3.8 demonstrates that this is extremely ambitious - even the communities with the highest transit use in both regions do not achieve this target; rather, transit mode share is most commonly under 10%.

Based on the above, there is likely going to be a limited improvement in BC Transit service over the course of the study horizon. That said, the CRD is in the process of developing a regional transportation service, which presents an opportunity to strongly advocate for provincial funding for service expansion, or explore alternative funding models that allow for greater transit service investments at the local level if Provincial funding commitments continue to fall short.

Vehicle Kilometers Travelled (VKT)

In addition to understanding mode share, a fundamental metric in tracking changes in driving behaviour is VKT, which is the number of kilometers travelled by vehicles in the District. VKT is calculated by multiplying the *number of trips* by the *distance of those trips*.

Despite its importance, data availability for VKT is limited. As part of this work, the project team tried to work with the CRD to get trip distances from their OD data, but unfortunately the dataset had been anonymized to the point where this was not possible. **It is highly recommended that the District advocate to the CRD to publish trip distances (at least on average) in future Trip Diaries reports.**

Other sources of VKT data that were considered for this project include:

- **Odometer readings from ICBC** - Data requests to ICBC were slow, and the only information for this project was vehicle counts. Through external work, the project team had analyzed odometer readings and found them to be unreliable.
- **Streetlight data** - A for-purchase dataset; too expensive to consider in this scope of work.
- **CEEI Values** - LGeo's work with the Climate Action Secretariat on the CEEI, and subsequent review with the CRD, indicated that the CEEI VKT values are over estimated when compared to the CRD Trip diaries estimates.
- **CRD Trip Diaries** - Since trip distances are not publicly provided and could not be obtained for this project, this source could not be used for VKT estimates.
- **Environics data** - Fuel sales data, which can be used alongside the cost of fuel and assume engine efficiencies to estimate driving. This is the data source that was used for this project.

Figure 3.8 illustrates the per-capita VKT from the Environics data. The Environics data is per-DA, so per-capita values were derived by using the number of people in each DA. Per-capita VKT is highly correlated to per-capita emissions, so the key geospatial observations that can be drawn from this image match those from Figure 3.4.

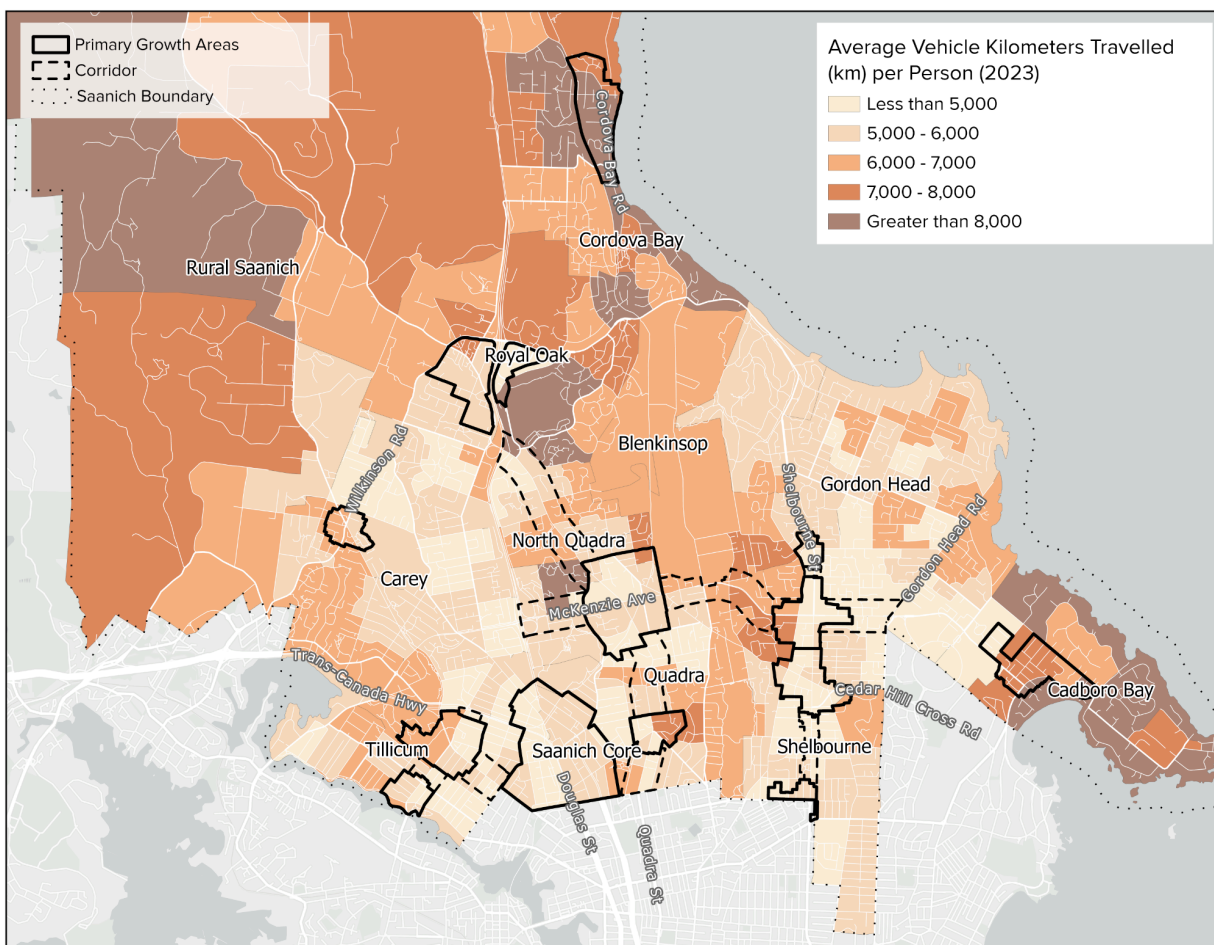


Figure 3.8. Average Vehicle Kilometres Travelled (VKT; km) per capita in 2023. VKTs are calculated from Environics data. Solid black lines denote growth areas, and dashed black lines denote transportation corridors.

According to the Environics data, the total VKT driven by ICE vehicles by residents of Saanich in 2023 was 711 million kilometres. From the CEEI data, this number was 728 million kilometres. The difference between these two data sources is only 3.4%, which provides a strong point of validation that the data is correct.^{19 20}

The average VKT per capita across all of Saanich is 5,950 km, and the highest DAs have an average VKT per person of around 15,000 km per year. Inside of growth zones, the annual

¹⁹As mentioned previously, the intention was also to compare this to the CRD Trip Diaries Origin Destination data, but trip distances were not available.

²⁰ That said, the Stantec inventory for CRD estimates lower passenger transportation emissions than the CEEI for the District. The Stantec inventory benefits from a local study done by Malatest, making it the preferred source over the CEEI. The VKT in the baseline year of the emissions forecast was calibrated to the former, so the starting VKT for the District is assumed to be 680 million for ICE vehicles.

per-capita average is 5,660 km, and outside of growth zones the average is 6,220 km (see Figure 3.9). This difference of 560 km is statistically significant (to a 5% confidence level, established through an ANOVA), indicating that residents of DAs outside of growth zones already drive more annually than residents of DAs within growth zones.

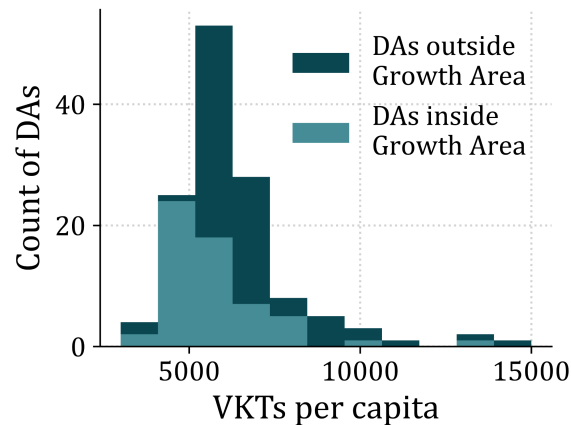


Figure 3.9. Vehicle Kilometres Travelled (VKT; km) per capita, presented at a DA level. The y-axis shows the total number of DAs within Saanich with a given number of VKTs. Dark green shows all DAs outside of growth areas, and teal shows the DAs within the growth areas. VKTs are calculated from EnviroNics data.

Mode share is the most common metric used to set targets and track progress in the transportation sector but, ideally, **VKT should be tracked in addition to mode share to ensure that driving behaviour is being reduced through time.** The EnviroNics is a publicly available data source via which this can be done and, should CRD start publishing trip distances, this could be used as well (acknowledging that the latter is survey-based and based on a fairly small sample size).

3.4.2 Where are Things Going?

Policy Impacts on Top-Line Emissions

Figure 3.10 shows the projected transportation emissions from 2007-2050 under the Business as Usual (BAU) scenario, as well as under the adoption of multiple policies designed to de-incentivize driving from Table 3.2. These scenarios are shown with and without the adoption of the Provincial ZEV Act to highlight the scale of emissions reductions attributed to province-wide vehicle electrification. In all scenarios, emissions decline primarily due to the increasing share of EVs, reduced emissions in transportation fuels through low carbon fuel standards and improved tail pipe emissions standards.

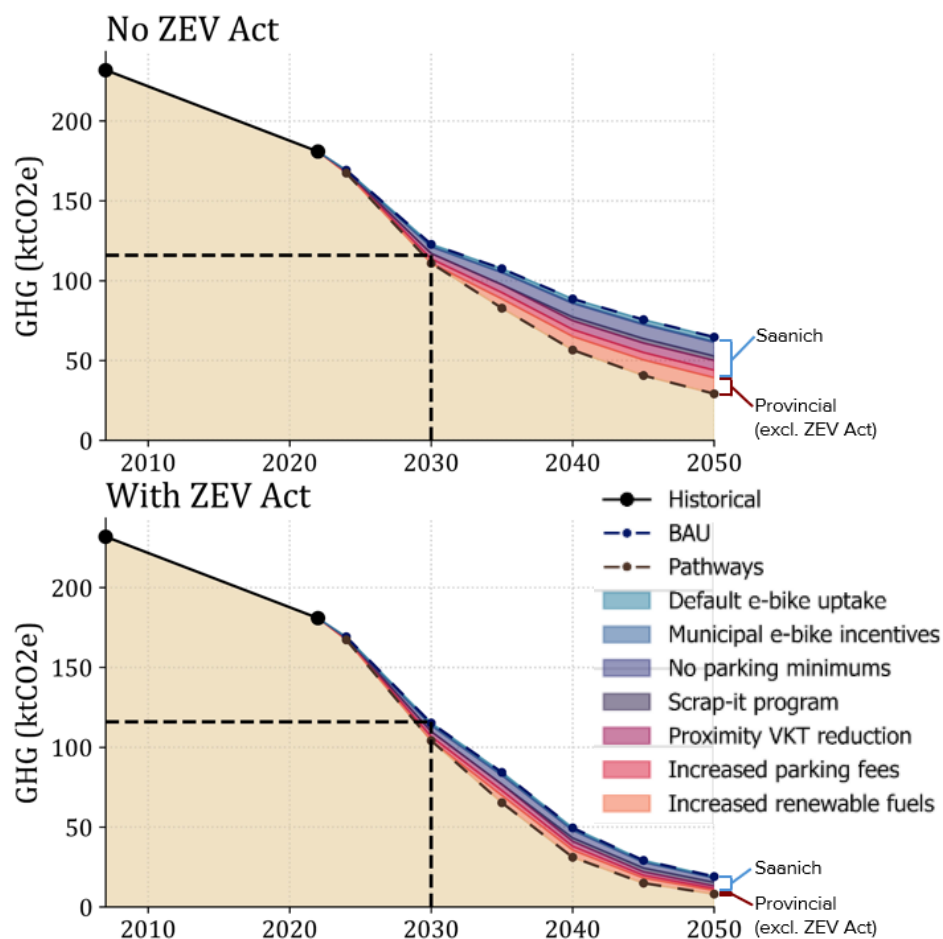


Figure 3.10. Forecast transportation emissions reductions, assuming (1) no ZEV Act with a slow EV uptake; and (2) EV uptake under the ZEV Act according to the CleanBC review. The top line of the wedge diagram represents the BAU scenario, and the colored wedges represent reductions from each of the modelled policies. Note that the Scrap-it program is represented as a local policy, but ideally it would be provincially funded and operated with local government input into design.

The impact of municipal policy on emissions depends on the rate of electrification: the faster vehicles electrify, the lower the perceived impact of municipal policy on emissions. This is because the low emissions factor of electricity means that the ZEV mandate is a highly effective policy tool for directly regulating emissions, so the incremental benefit of municipal policy is lower.

Table 3.9. Share of total BAU-to-Pathways Emissions reductions attributable to each policy, corresponding to individual wedges in Figure 3.10, with and without the ZEV Act

	Default E-bike uptake	Municipal e-bike incentives	No parking minimums	Scrap-it program	Proximity VKT reduction	Increased parking fees	Increased Renewable fuels
	No ZEV Act, share of reductions between BAU and Pathways (%)						
2030	11.5	2.2	34.8	0.0	28.3	23.2	0.0
2040	7.2	1.4	26.7	7.2	17.3	13.6	26.6
2050	7.5	1.5	24.3	7.6	17.3	13.3	28.5
	With ZEV Act, share of reductions between BAU and Pathways (%)						
2030	11.6	2.2	34.0	0.0	28.7	23.5	0.0
2040	7.0	1.4	25.8	11.8	26.5	16.5	24.6
2050	7.1	1.4	24.5	20.2	14.7	11.3	20.8

Referencing table 3.9, **removal of parking minimums in new buildings is the policy that requires the lowest overhead that also sees the largest reductions in emissions.** This is based on a fairly ambitious assumption for reduction in vehicle ownership that has been observed in larger communities like Seattle. In reality, the total reductions might be smaller based on the District's demographics, but this policy is well worth exploring none-the-less.

The reduction of emissions from increased parking fees is modelled from a research-based assumption, and would require thoughtful implementation and collaboration between CRD and its constituent municipalities, since there is a large amount of travel that occurs across community boundaries.

Table 3.10. Summary of total annual emissions from Figure 3.10 at key years under Business as usual (BAU) and Pathway scenarios. Percentage reductions are provided relative to 2007

Year	No ZEV Act				With ZEV Act			
	Emissions (ktCO2e)		Reduction from 2007 (%)		Emissions (ktCO2e)		Reduction from 2007 (%)	
	BAU	Pathway	BAU	Pathway	BAU	Pathway	BAU	Pathway
2007	232	232	0	0	232	232	0	0

Year	No ZEV Act				With ZEV Act			
	Emissions (ktCO ₂ e)		Reduction from 2007 (%)		Emissions (ktCO ₂ e)		Reduction from 2007 (%)	
	BAU	Pathway	BAU	Pathway	BAU	Pathway	BAU	Pathway
2023	182	182	22	22	182	182	22	22
2030	123	111	47	52	115	104	50	55
2040	87	57	63	75	50	31	78	87
2050	65	29	72	88	19	8	92	97

As shown in Figure 3.10 and Table 3.10, if the ZEV targets of the CleanBC Review are met, municipal-level policies will be largely overshadowed by the mass adoption of EVs (it is worth noting, however, that this analysis does not capture all co-benefits of reduced driving, such as reduced congestion, reduced noise, increased affordability and improved public health). Without the adoption of the ZEV Act, policies aimed to reduce VKT are more essential to meet the targeted 50% reduction in emissions relative to 2007. **Given these differences and uncertainties surrounding the ZEV Act, any municipal support for provincial policies or small-scale programs to incentivize EV adoption would be beneficial.**

Based on the outsized emissions-reduction impact of vehicle electrification, and the associated incoming charging demand, significant buildout of EV charging infrastructure will be required: if EV charging is not provided, it can hinder adoption. **The District has an important role to play in ensuring that there is enough EV charging infrastructure to support EV adoption.**

No selection of policies leads to net-zero emissions by 2050: a 100% reduction of emissions by 2050 is very difficult to achieve due to old ICE vehicles that do not retire out of the vehicle stock.²¹ Additionally, electricity use always emits a small amount of GHGs, even if it is 100% renewable, due to emissions released from hydroelectricity²². The remainder of emissions will need to be addressed through offsetting strategies and/or sequestration to achieve 100% reduction of emissions by 2050.

Key Indicators: Vehicle Kilometers Travelled

Reducing VKT from an assumed increase in proximity leads to significant VKT reduction within and adjacent to targeted growth areas. Cordova Bay, Cadboro Bay, and areas surrounding Royal Oak see per-capita VKT decreases in excess of 1500km per year (Figure 3.11). These regions currently have some of the highest VKTs across Saanich, so benefit most from increased

²¹ Reducing the cost of EVs (e.g. through the removal of tariffs) is not expected to accelerate significantly, unless it encourages drivers to trade out their vehicles before end of life. Further research is required to determine the cost at which retirement of old vehicles would be accelerated.

²² Primarily from submerged biomass that escapes due to displacement caused by dam turbines.

proximity to goods and services. (The methodology for changing the proximity is described in *Section 3.3.3 Forecasting driving behaviour.*)

Accordingly, all regions near growth areas see the largest per-capita differences in emissions between the BAU and Pathway scenarios, with Tillicum and Cadboro Bay showing the largest differences.

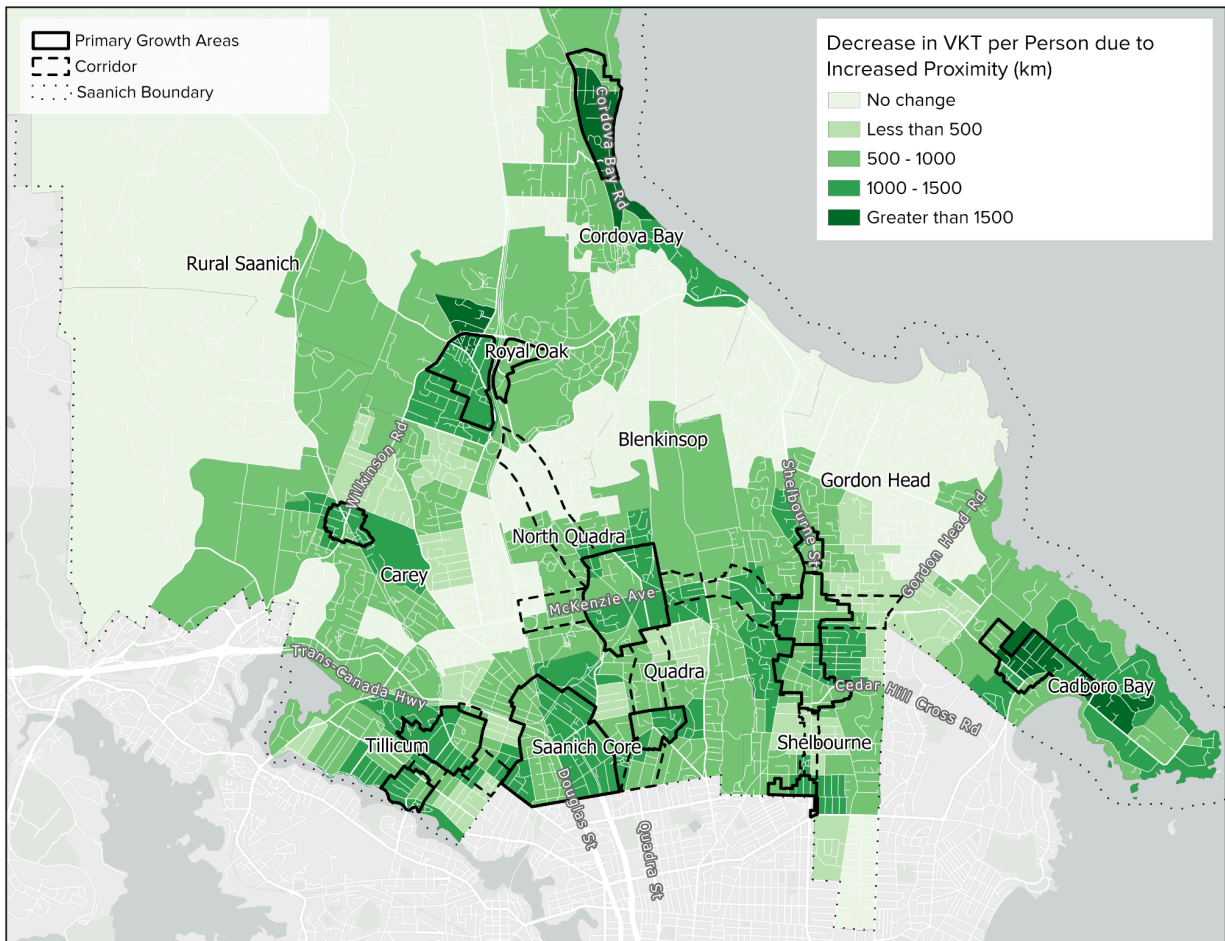


Figure 3.11. Decrease in average Vehicle Kilometres Travelled (VKT; km) per capita from 2023-2050 due to the modelled increase in proximity. Darker green indicates DAs with a larger decrease in VKT due to increased proximity.

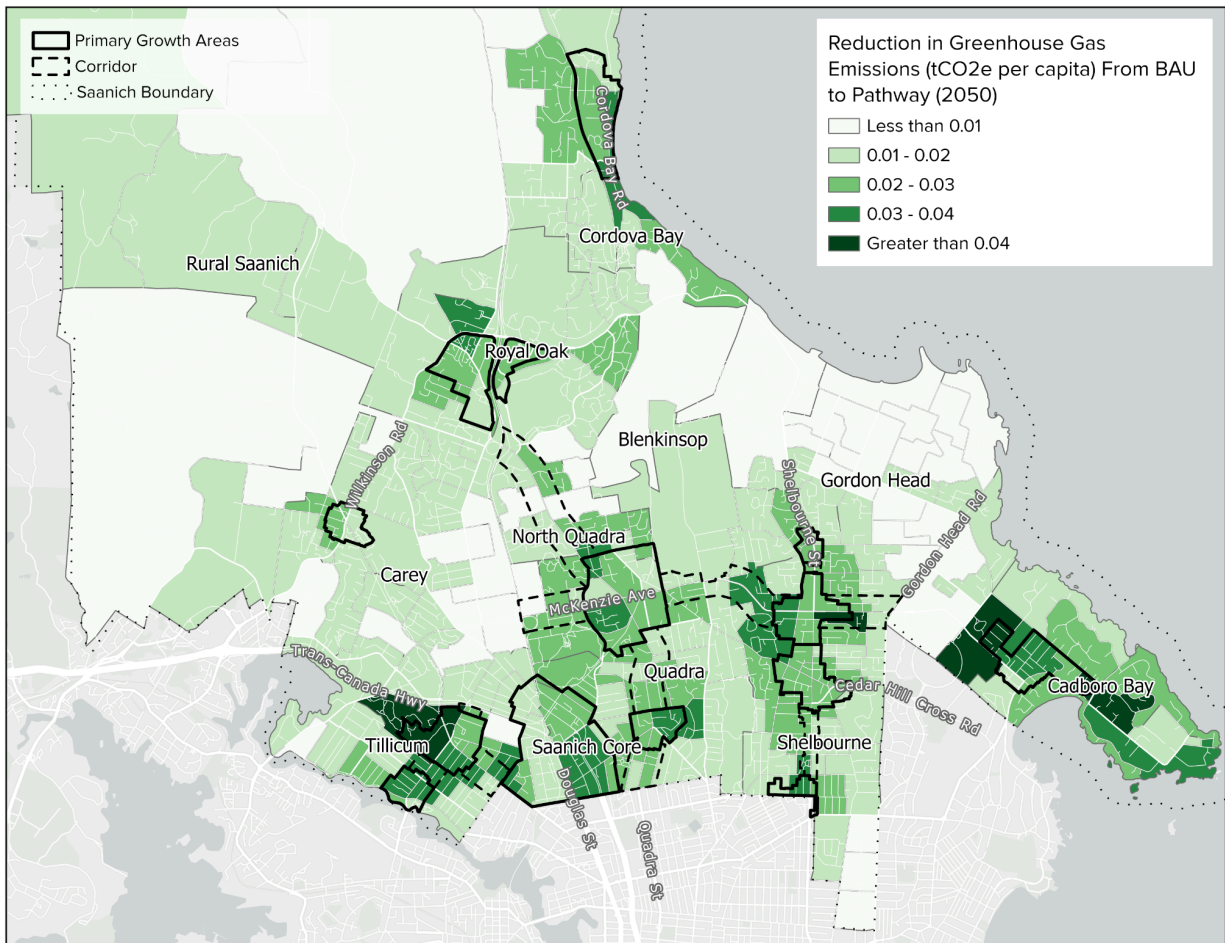


Figure 3.12. Reduction in greenhouse gas emissions (tonnes of CO₂, equivalent) per capita in 2050 under the adoption of the ZEV Act between the BAU scenario and the Pathway scenario with VKT-reducing policies. Darker green indicates fewer emissions in the Pathway scenario compared to the BAU scenario.

Figure 3.13 shows Total VKT and VKT per capita, split between DAs inside of growth areas and outside of growth areas (key years highlighted in Table 3.11). Although total emissions in 2050 under the ZEV Act are relatively similar between the BAU and Pathway scenarios, the change in travel patterns is more pronounced. Under BAU, total VKT climbs through to 2050 as the population grows, and per capita VKT does not vary by more than 20%. However, under the Pathway scenario, VKT per capita decreases by 50% within growth areas and by 30% outside of growth areas by 2050. These decreases translate into co-benefits associated with a reduction in driving, such as reduced noise and improved public health.

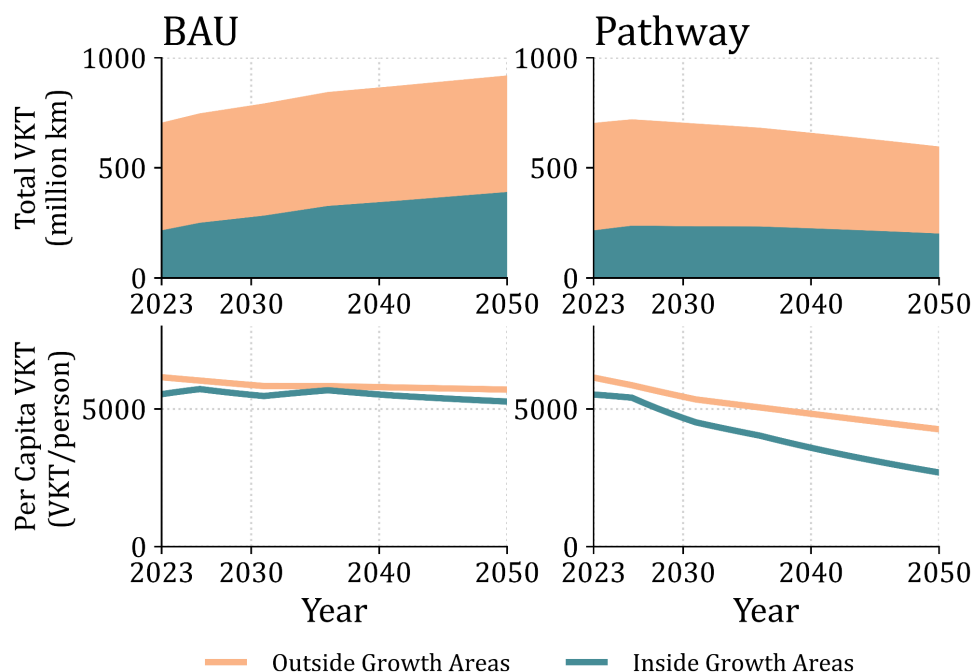


Figure 3.13. Vehicle Kilometers Travelled (VKT) under the ZEV Act in the business as usual (BAU; left) and Pathway (right) scenarios. Data are presented for DAs outside of growth areas (orange) and inside of growth areas (teal). Totals are shown in the top row, and per-capita are shown in the bottom row. Note that VKT is assumed to be the same between EVs and ICE vehicles, so electrification rates will not impact this result. However, some studies do show that EVs drive more, so electrification policy might result in increased VKT in reality.

Table 3.11. Vehicle Kilometers Travelled (VKT) under the ZEV Act in the business as usual (BAU; top) and Pathway (bottom) scenarios. Data highlighted in 2023, 2030, 2040, and 2050, as well as the change relative to 2023, with a negative number indicating a reduction.

Business as Usual								
Year	Total VKT (million km)		Total VKT Change from 2023 (%)		Per Capita VKT (km/person)		Per Capita VKT Change from 2023 (%)	
	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas
2023	211	489	0	0	5532	6148	0	0
2030	271	507	28	4	5509	5866	0	-5
2040	339	521	61	7	5521	5788	0	-6
2050	385	529	82	8	5265	5700	-5	-7

Pathway								
	Total VKT (million km)		Total VKT Change from 2023 (%)		Per Capita VKT (km/person)		Per Capita VKT Change from 2023 (%)	
	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas
2023	211	488	0	0	5520	6137	0	0
2030	230	470	9	-4	4668	5440	-15	-11
2040	220	434	4	-11	3585	4821	-35	-21
2050	197	395	-7	-19	2687	4258	-51	-31

Key Indicators: Vehicle Ownership

Under both scenarios, total vehicle ownership is expected to grow significantly, but in the Pathways scenario it is lower because of the removal of Parking Minimums in new buildings. This is particularly pronounced inside growth areas, in which the majority of buildings are Part 3 residential.

As with the VKT results, this has implications for road space demand and congestion: a near-doubling of vehicles in growth areas under the BAU would put significant pressure on the existing infrastructure and road network.²³

²³ Congestion data were not available at the time of writing, but should be factored into future analyses.

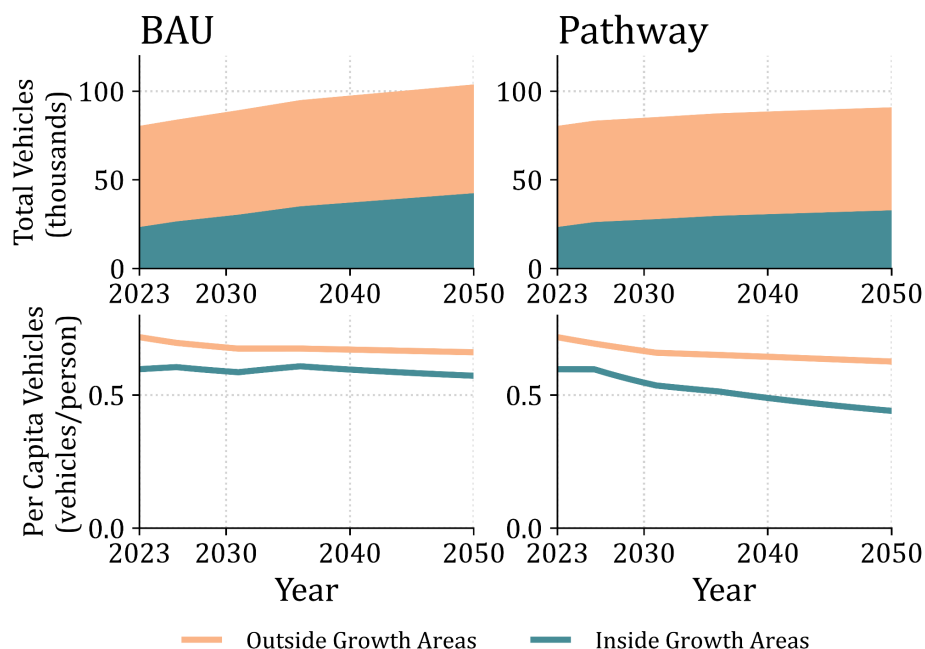


Figure 3.14. Total vehicle ownership under the ZEV Act in the business as usual (BAU; left) and Pathway (right) scenarios. Data are presented for DAs outside of growth areas (orange) and inside of growth areas (teal). Totals are shown in the top row, and per-capita are shown in the bottom row.

Table 3.12. Total vehicle ownership with the ZEV Act in the business as usual (BAU; top) and Pathway (bottom) scenarios. Data highlighted in 2023, 2030, 2040, and 2050, as well as the change relative to 2023, with a negative number indicating a reduction.

Business as Usual								
Year	Total Vehicles (thousands)		Total Vehicles Change from 2023 (%)		Per Capita Vehicles (vehicles/person)		Per Capita Vehicles Change from 2023 (%)	
	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas
2023	23	57	0	0	0.6	0.72	0	0
2030	29	59	26	4	0.59	0.68	-2	-6
2040	37	60	61	5	0.6	0.67	0	-7
2050	42	61	83	7	0.57	0.66	-5	-8
Pathway								

	Total Vehicles (thousands)		Total Vehicles Change from 2023 (%)		Per Capita Vehicles (vehicles/person)		Per Capita Vehicles Change from 2023 (%)	
	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas
2023	23	57	0	0	0.6	0.72	0	0
2030	27	58	17	2	0.55	0.67	-8	-7
2040	30	58	30	2	0.49	0.64	-18	-11
2050	32	58	39	2	0.44	0.63	-27	-13

Under the ZEV Act CleanBC Review targets, both the BAU and Pathway scenarios show substantial increases in EV ownership through to 2050, with over 3000 EVs per year projected to be sold outside of growth areas (Table 3.13). This modelled EV uptake, and the resulting reduction of emissions, assumes that there are no capacity-induced restrictions due to limited access to charging. **Early planning to accommodate appropriate charging stations and requisite grid capacity from BC Hydro will be essential to support continued EV adoption and to meet emissions reduction targets.** This will be particularly important in existing MURBs, which are expensive to retrofit for EV-Readiness.

Table 3.13. Counts of new EVs sold (55% by 2030 and 90% by 2035) and total EVs owned, assuming no ZEV Act in the BAU, and that the CleanBC Review targets are achieved in the pathway scenarios. Data highlighted in 2030, 2040, and 2050 inside and outside of growth areas. The total number of vehicles is lower in Pathways scenario due to the removal of Parking Minimum requirements in new buildings.

Year	BAU				Pathways			
	New EVs sold annually		Total EVs		New EVs sold annually		Total EVs	
	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas
2030	606	1,144	2,658	5,609	1,157	2,397	4,254	9,268
2040	1,569	2,657	11,197	19,614	2,489	4,745	19,491	37,984
2050	2,427	3,545	21,352	32,806	2,546	4,472	28,924	52,376

The percentage of EVs as the total share of the stock is the same inside and outside the growth areas, but this is a function of the assumption that EV uptake is not inhibited by limited access to charging.

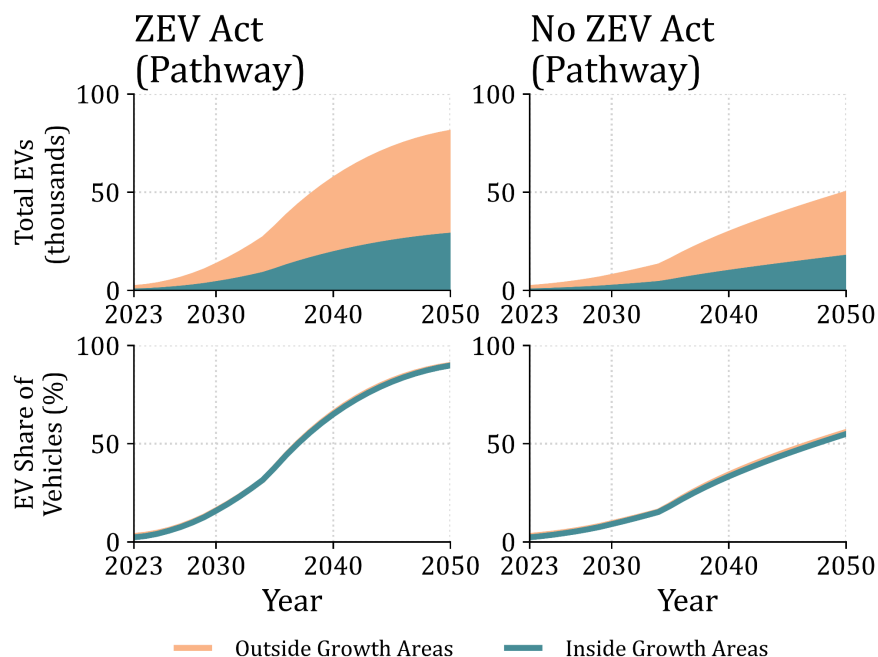


Figure 3.15. EV ownership under the Pathway scenario with (left) and without (right) the provincial ZEV Act. The top panels show the total number of EVs inside (teal) and outside (orange) of growth areas, and the bottom panels show the percentage of vehicles on the road that are EVs. The percentages of EV ownership inside and outside of growth areas are almost identical, leading to overlapping curves.

Key Indicators: % Mode Share

Under the BAU scenario, sustainable mode share (i.e. transit and active transportation) increases only modestly through to 2050, driven primarily by e-bike adoption and continued expansions to cycling infrastructure. With the increased proximity scenario model (in the pathways scenario), sustainable mode share reaches 36.4% by 2050. Increasing parking fees further shifts the sustainable projected mode share to 41.0% by 2050. These larger shifts occur because an increased proximity to goods and services means that car trips can more easily be replaced by walking, cycling, and transit.

Table 3.14. Projected percentage sustainable mode share under the BAU scenario and with both VKT disincentivization policies in place.

Year	BAU (%)	Proximity Increase Scenario(%)	Proximity Increase Scenario & Increased Parking Fees (%)
2023	28.0	28.0	28.0
2030	28.7	30.1	30.9
2040	29.5	33.2	36.0
2050	30.5	36.4	41.0

Energy Mix

In both the BAU scenario without the ZEV Act and Pathways scenario with the ZEV Act, there is a reduction in fossil fuel energy usage by 2050, due to the high efficiency of EVs, compared to ICE vehicles (Figure 3.16). This occurs both inside and outside of growth zones under both BAU and Pathways scenarios.

Inside growth areas, electricity demand is less under the Pathways scenario despite the higher uptake of EVs. This is due to the increasing proximity and associated VKT reductions.

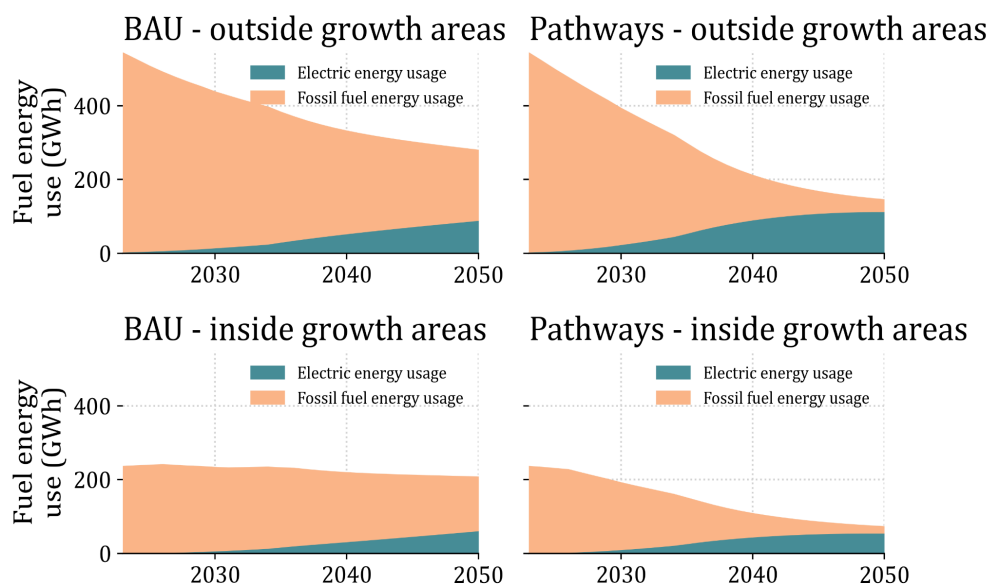


Figure 3.16. Total fuel energy use with no ZEV Act in the business as usual (BAU; left) and with Clean BC Review targets in Pathway (right) scenarios, separated by fossil fuel energy usage (orange) and electric energy usage (teal). Data are presented for DAs outside of growth areas (top) and inside of growth areas (bottom).

Table 3.15. Total fuel energy used by vehicles under the ZEV Act in the BAU and Pathway scenarios, separated by fossil fuel energy use and electric energy use, split inside and outside growth areas.

Year	BAU				Pathways			
	Fossil fuel energy use (GWh)		Electric energy use (GWh)		Fossil fuel energy use (GWh)		Electric energy use (GWh)	
	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas	Inside Growth Areas	Outside Growth Areas
2023	234	537	2	5	234	537	2	5
2030	224	420	8	16	179	367	12	25
2040	185	276	33	55	62	119	46	92
2050	144	188	63	91	15	30	57	115

Table 3.16. Renewable fuel energy use, split between ethanol, renewable gasoline, and renewable naphtha, between the BAU and Pathways scenarios.

Year	BAU renewable energy use (GWh)			Pathways renewable energy use (GWh)		
	Ethanol	Renewable gasoline	Renewable naphtha	Ethanol	Renewable gasoline	Renewable naphtha
2023	53	10	2	53	10	2
2030	45	31	10	38	26	8
2040	32	22	7	15	9	6
2050	23	16	5	4	2	2

Gap Assessment

The amount of remaining emissions in the transportation sector by 2050 depends highly on the rate of electrification of passenger vehicles. Changes in driving behaviour and vehicle ownership are also important factors, but the vast majority of emissions reductions come from electrification. For this reason, it is vital that the District focus on policy that ensures the appropriate amount of EV charging is made available both for public and private EV charging.

Assuming a high-rate of electrification, emissions by 2050 are very close to zero, but a full reduction is not achieved due to the turnover rate of existing vehicles and a small emissions factor on electricity. Due to many factors and policy uncertainty, we assume electricity decarbonization by BC Hydro and trading partners will not be 100% net-zero by 2050, which is consistent with BC Hydro assumptions. Remaining emissions will need to be addressed via carbon sequestration and offsetting strategies.

If electrification rates are lower, there are more emissions remaining by 2050 and policies that address vehicle ownership and driving behaviour become more impactful (in terms of GHG reductions, these policies are always impactful on other co-benefits such as improved health and liveability, and reduced congestion). That said, as mentioned throughout this report, reducing driving behaviour is challenging and the amount of reductions present here are highly optimistic. A well defined strategy that considers a variety of inter-related factors will be required.

4. Buildings Emissions Forecast

The District of Saanich has already made a fair bit of progress on addressing building emissions via policies from the [Building Retrofit Strategy](#) and implementation of Zero Carbon Step Code for new buildings.

In the aforementioned Retrofit Strategy, building emissions out to 2050 were modelled under BAU and policy scenarios. The modeling that was subsequently undertaken in this scope of work augments that in the Retrofit Strategy by:

- Including the considerations of the land use model as the baseline driving factor of development. This allows for a model that is more closely inline with the OCP, and also allows for a geospatial representation of the results;
- Incorporating a more detailed picture of the starting state equipment distribution in buildings;
- Splitting out the building energy archetypes so they are presented individually by equipment fuel type, as opposed to as a blended archetype across equipment fuel types;
- Updating policy assumptions to incorporate more recent uptake observations by the District; and
- Adding a Heating Degree Day (HDD) correction to account for reduced heating demand under future climate change²⁴.

Based on the above, the final modelled emissions will not line up directly with those in the Retrofit Strategy. In Appendix 4, a comparison between the two results is provided.

The sections below outline the key data sources for numerical inputs and policy assumptions, the building emissions forecast methodology, scenario definitions, forecast results, and policy impact analysis. The results and analysis sections outline the current state of building energy and emissions, the scenario forecast results, and analysis of both the key policy drivers of change and the major remaining emissions sources which could be addressed with further policy design.

The building emissions forecast is highly dependent on the land use forecast, so see also the [Land Use Scenario Definition](#) section as needed for additional details on emissions impacts due to land use. As a final note, data tables in the buildings section are drawn from a more comprehensive supplementary data sheet which will be included with this report, which will be referred to at various points.

²⁴ Note that we do include a corresponding increase in cooling energy demand, however cooling demand will have a relatively minor impact on GHG emissions so it was excluded from the modelling.

4.1 Data Sources

Data	Description	Source	Certainty Estimate
Emissions Inventory	Stantec CRD Municipal Emissions Inventory	Available Online	High
2024 BC Assessment Building Inventory Report	Parcel data for all Saanich buildings, used for land use and building emissions forecast	District of Saanich. Contact: glenys.verhulst@saanich.ca	High
Saanich Oil Tank Inventory	Database of historical oil tanks with address locations. Used to locate buildings that are heated by oil.	District of Saanich. Contact: glenys.verhulst@saanich.ca	Medium
Technical Safety BC (TSBC) Permit Data	Technical Safety BC Gas and Propane permits. Used to locate buildings that are heated by natural gas.	District of Saanich. Contact: glenys.verhulst@saanich.ca	High
BC Hydro FSA Proportions	BC Hydro estimated proportions of Electric Heating by FSA and by building Archetype	District of Saanich. Contact: glenys.verhulst@saanich.ca	Medium
Building energy use archetypes	Used to estimate emissions from buildings per sqft, by building archetype. A combination of LGeo's internal archetypes and archetypes published in the Retrofit Pathways report were used.	Licker Geospatial Consulting	Medium
NRCan EnerGuide Audits	Data on retrofitted buildings, including their equipment type. Address was not provided so these could not be geospatialized. Hydro FSA proportions were used instead.	District of Saanich. Contact: glenys.verhulst@saanich.ca	
Zero Carbon Step Code archetypes	Calculated from existing building archetypes by applying Fuel Switching and EUI corrections to meet a GHGi limit of 2.0 kg/m2/yr.	Generated by LGeo	Medium
Introba Policy Assumptions and Equipment Proportions	From 2023 Saanich Building Retrofit Strategy report and appendix.	Available Online	Medium
HEES Policy assumptions	Used to predict rates of equipment turnover under HEES. Derived from previous studies done with City of Vancouver and their conversations with the Province	City of Vancouver Green Buildings Team	Low-Medium
Oil Tank Turnover Rates	Recent known rates of oil tank replacement from Clean BC and Saanich incentives	District of Saanich. Contact: maggie.baynham@saanich.ca	High
RARA/SEA/CATE Uptake Rates	Recent known rates of oil tank replacement from Clean BC and Saanich incentives	District of Saanich. Contact: maggie.baynham@saanich.ca	High
Emissions Factors	The emissions content of different fuel types.	Provincial	High

4.2 Policy Scenarios: Definition and Assumptions

4.2.1 Scenarios Overview

In addition to a common land use forecast, the two policy scenarios, BAU and Pathways, have a few additional inputs and assumptions which are common between them.

- Emissions Factors. The emissions intensity of the five modelled energy sources are assumed to be identical between scenarios. See [4.3.2 Emissions Factors](#).
- Heating Degree Day Corrections are applied with common assumptions on future climate change for both scenarios. See [4.3.7 Heating Degree Day Corrections](#).

Additionally, both scenarios assume de-facto space heating replacements (i.e. those performed by building owners regardless of policy)²⁵. However, in many cases these will be superseded by applied policies (see the Policy table below).

Scenario Summary: No Policy

Provided primarily to quantify the impact of Zero Carbon Step Code in the absence of gas backsliding (i.e. despite having requirements in place to limit the installation of natural gas furnaces and fireplaces though the Zero Carbon Step Code and associated modelling guidance, it is suspected that in many cases, builders or homeowners are installing this equipment after occupancy). This scenario is the land use scenario with default turnover rates and no changes to the building archetypes.

Scenario Summary: Business as Usual (BAU)

The BAU scenario directly simulates the following policies under Saanich Jurisdiction:

- BC Step Codes for New Buildings (with 50% backsliding to Gas on occupancy or equipment replacement)
- Mandatory Part 3 Energy Benchmarking
- Strata Energy Advisor Program
- Rental Apartment Retrofit Accelerator Program
- Heat Pump Financing Program Pilot

No buildings policies under Provincial jurisdiction are directly modelled for BAU.

Scenario Summary: Pathways

The Pathways scenario includes *upgrades or extensions* to the following BAU policies:

²⁵ DHW is assumed to match space heating for the purposes of this work.

- BC Step Codes for New Buildings - no backsliding to Gas permitted
- Mandatory Part 3 Energy Benchmarking - improved policy uptake through 2030
- Strata Energy Advisor Program - extended for years 2028-2050
- Rental Apartment Retrofit Accelerator Program - extended for years 2028-2050

In addition, the Pathways scenario includes the following *new policies not present in BAU*:

- Saanich Building Performance Standards
- Requirement to Phase Out Heating Oil
- Direct Install Heat Pump Program for Income-Qualified Households
- Expansion of Home Energy Navigator
- BC Highest Efficiency Equipment Standards (HEES) - *Provincial jurisdiction*
- BC Alterations Code - *Provincial jurisdiction*

Table 4.1. Policies in the table were not directly modelled because it made more sense to group their effects with already modelled policies, assumptions about their impact were difficult to establish a-priori, or their effects were expected to be negligible.

Policies Not Included	Further Notes
BC Step Codes for Major Renovations	Direction from District of Saanich.
Heat Pump Financing Program Expansion	Assumed superseded by HEES and Home Energy Navigator expansion.
Climate Action Tax Exemption (CATE - previously Revitalization Tax Exemption)	No direct impact except to support uptake of SEA and RARA policies - additional penetration rates are included in those definitions.
Default Envelope Retrofit Rate	Superseded by the Clean BC Alterations Code.
Energy efficiency / electric zoning	Exploratory policy that would help prevent backsliding to natural gas after Zero Carbon Step Code implementation
Step Code 2.0	This is a hypothetical policy discussed with the District wherein no new gas connections are permitted in new development. This effectively restricts any backsliding to gas as well as the use of natural gas for other ancillary uses such as cooking. This is covered by Step Code uptake assumptions in the Pathways scenario.
Decommissioning gas pipes	It is assumed that this is covered by Step Codes in Pathways scenario, because pruning of natural gas pipes would presumably only occur at newer developments. In this way, it is functionally similar to Steo Code 2.0, as discussed above. More detailed utility planning between Hydro and Fortis would be required to consider this policy in full.
LGCAP / CARIP	Funding assumed to cover spectrum of Saanich policies
Clean BC Incentives, including Saanich Top Ups	Addressed in post-facto analysis.
Provincial and Federal Rebates / Financing	Addressed in post-facto analysis.
BC Retrofit Accelerator	Only incremental additional benefit compared with the District's retrofit accelerators.

A Note on HEES Assumptions

One of the policies that has the highest potential to impact existing building emissions is the Provincial Highest Efficiency Equipment Standards (HEES). At the time of writing this report, there was not clear guidance from the Province on which building/equipment types would be included in this sales regulation. The understanding of Saanich staff was that the HEES would be inclusive of large, non-residential buildings. However, in a separate project scope undertaken with the City of Vancouver (CoV), LGeo and CoV staff undertook extensive efforts to define the scope of the HEES with the policy team at the Province, and it was determined that large pieces of building equipment would not be included in Point-of-Sale regulations. The HEES assumptions that were developed by the Province for the CoV work were used here for Point-of-Sale regulations.

At the time of writing, plans for HEES Point-of-Sale regulations have not yet been released by the province, so here we make broad assumptions of coverage. Point-of-Install regulations are assumed to capture all Part 3 Industrial, Commercial, and Institutional space heating equipment not covered by Point-of-Sale regulations, as well as Part 3 MURBs. For these archetypes and following City of Vancouver assumptions on equipment distributions, we have assumed a 10%/90% split between all electric and dual fuel (electric heat pump with natural gas furnace backup) replacement systems, respectively.

4.2.2 Table of Modelled Policy Definitions

Table 4.2. Modelled buildings policy definitions in the BAU and Pathways scenarios. ICI in the table refers to any non-commercial floor area (mixed use parcels are split between residential and non-residential categories by floor area).

Policy Name	Policy Assumptions per Scenario		Jurisdiction	Assumption Source
	BAU (Worst Case)	Pathways		
100% Clean Electricity Standard	Included	Included	Provincial	BC Hydro Reporting states that the 100% Clean Electricity Standard has already been achieved
BC Step Codes for New Buildings	Zero Carbon Step Code EL-4 applied to all new builds (fuel switching to electric resistance ²⁶ and energy efficiency upgrades). Part 9 starting in 2024, Part 3 starting in 2025. Includes backsliding of fuel switches: - 50% backsliding to Gas DHW at time of occupancy. - 50% backsliding to Gas Space Heating at Time-of-Replacement	Same as BAU, but no backsliding is permitted (e.g. via decommissioning of gas pipes).	District of Saanich	Direction from District of Saanich
Mandatory Part 3	10% total EUI reduction (assumed to result	Same as BAU, except 80% penetration by 2030. For the covered building	District of	2023 Saanich

²⁶ Electric resistance was chosen as the replacement system in discussion with the District of Saanich, on the assumption that developers would seek to minimize costs. Since that time, a new cooling requirement has been implemented such that a relatively high rate of heat pump installations are expected instead.

Policy Name	Policy Assumptions per Scenario		Jurisdiction	Assumption Source
	BAU (Worst Case)	Pathways		
Energy Benchmarking	from behavioural and management energy efficiency improvements). - Government buildings: 100% compliance, beginning in 2026 - Other Part 3 >30k sqft.: 30% compliance starting in 2026, 50% by 2030. - Other Part 3 >10k sqft.: 30% compliance starting in 2027, 50% by 2030	types, this will be superseded by the building performance standard.	Saanich	Building Retrofit Strategy report
Strata Energy Advisor Program (SEA)	Stratas only for both MURB Condo and ICI. Simple Support: 35% Energy Savings - MURB Condo: 9 parcels by 2027 - ICI: None Advanced Support: Fuel Switching to Heat Pumps - MURB Condo: 6 parcels by 2027 - ICI: 1 parcel by 2027	Stratas only for both MURB Condo and ICI - continuation of BAU policy with uptake from 2028 onwards. Simple Support: 35% Energy Savings - MURB Condo: 3% penetration per year - ICI: None Advanced Support: Fuel Switching to Heat Pumps - MURB Condo: 3 parcels per year - ICI: 4 parcels per year	District of Saanich	Direction from District of Saanich
Rental Apartment Retrofit Accelerator (RARA)	Matches SEA, but for Part 3 MURB Rentals	Matches SEA, but for Part 3 MURB Rentals	District of Saanich	Direction from District of Saanich
Saanich Building Performance Standard	Not Included.	Energy and emissions capping requirements applicable to all Part 3 buildings greater than 10,000 sqft, beginning in 2030. - Applied as an average of 43% EUI reduction, with a total penetration of 30% of buildings achieved over 21 years (average of 1.4% per year). - May include fuel switching due to overlap with BC Step Code, Provincial HEES, SEA, and RARA policies.	District of Saanich	2023 Saanich Building Retrofit Strategy report, further direction from District of Saanich

Policy Name	Policy Assumptions per Scenario		Jurisdiction	Assumption Source
	BAU (Worst Case)	Pathways		
Heat Pump Financing Program Pilot	Fuel Switching to Electric Heat Pump for existing Part 9 homes. Applied to 130 parcels in 2026.	Same as BAU ²⁷ .	District of Saanich	Direction from District of Saanich
Requirement to Phase out Oil Heating	Not Included.	Beginning in 2029, all oil heating must be phased out at end of life. - Applied as Time-of-Replacement fuel switching to electric heat pump (assuming high ambition scenario) - Oil phase outs must be complete by 2035.	District of Saanich	Direction from District of Saanich
Direct Install Program	Not Included.	A minimum of 300 median/low income P9 homes must see heat pump installs by 2030, and an additional 2200 by 2050. - applies to Part 9 homes. Low/median income is approximated by household floor area - policy applies if below the city-wide median per building type (2100 sqft for SFD, 1100 sqft for SFA). - Permitted to overlap with installs due to Provincial HEES, Heat Pump Financing Program, Home Energy Navigator, or Oil Phase Out Requirement, but ensures a minimum number of installs.	District of Saanich	Direction from District of Saanich
Highest Efficiency Equipment Standards - Point of Sale (HEES-POS)	Not Included.	Time-of-Replacement with 22 year equipment lifetime. All HEES replacements are assumed to be electric heat pumps at 100% compliance rate, replacing low efficiency fossil fuel systems (COP < 1). - All Part 9 buildings - No Part 3 MURB - Partial fuel switching coverage in Part 3 ICI based on Heating Percentages - Restaurants <50k sqft, average of 67.5% of heating, DHW EUIs - Retail <50k sqft, average of 85% of heating and DHW EUIs - Other ICI <50k sqft, average of 37.5% of heating and DHW EUIs - All ICI >50k sqft, average of 10% of heating and DHW EUIs	Provincial	Applications by building type were used with permission based on City of Vancouver assumptions.

²⁷ In consultation with the District of Saanich, it was agreed that expansion to the Heat Pump Financing Program would be left for future analysis.

Policy Name	Policy Assumptions per Scenario		Jurisdiction	Assumption Source
	BAU (Worst Case)	Pathways		
Highest Efficiency Equipment Standards - Point of Installation (HEES-POI)	Not Included.	Time-of-Replacement with 22 year equipment lifetime. All HEES replacements are assumed to be electric heat pumps at 100% compliance rate, replacing low efficiency fossil fuel systems (COP < 1). Covers all large systems in Part 3 buildings not covered by HEES-POS policies.	Provincial	Direction from District of Saanich
Alterations Code	Not Included.	Starting in 2026, energy savings applied as EUI reduction, based on building envelope and efficiency retrofits: - Part 9 - 25%; - Part 3 - average 43% (Introba Report: 35-49% based on previous modelling, but no further details provided) - Common annual penetration rate = 0.8%, excluding any EL-4 buildings - Considered to be mutually exclusive with BPS and SEA simple support upgrades, but P3 energy benchmarking buildings CAN have alterations code also apply.	Provincial	2023 Saanich Building Retrofit Strategy report
Expansion of Home Energy Navigator	Not Included.	Part 9 homes only with median-high income, applied as energy efficiency savings. Income proxied via household floor area, as with Direct Install Program. Energy Savings: - Annual Penetration: 0.75% - in addition to the alterations code - Average Energy Savings: 25% (based on Provincial data for rebates) Fuel Switching to Heat Pump (before 2030, at which point it is superseded by HEES) - Time-of-Replacement turnover: 40% compliance matches Introba 2.25% annual penetration	CRD and select other BC Communities	2023 Saanich Building Retrofit Strategy report
Default Time of Replacement	Time-of-Replacement equipment turnover in absence of policy. 18 year equipment life assumed in all cases. Gas:	Same as BAU, but superseded by HEES after 2030	n/a	Direction from District of Saanich

Policy Name	Policy Assumptions per Scenario		Jurisdiction	Assumption Source
	BAU (Worst Case)	Pathways		
	- 10% to dual fuel ; 90% stays gas Oil: - 10% dual fuel; 85% gas; 5% heat pump Electric: - 50% return to Gas			

4.3 Emissions Estimation & Forecasting Methodology

For the buildings forecast, annualized operational emissions²⁸ were estimated using a combination of the land use forecast, building energy archetypes, and emissions factors (emissions per unit of energy as a function of fuel type or energy source).

For each building parcel, operational emissions are estimated for each year as follows:

*total emissions (tCO₂e/yr) = building floor area (m²) * annualized Energy Use Intensity by archetype (kWh/m²/yr)²⁹ * emissions per unit energy (tCO₂e/kWh)*

The land use scenario forecast produces building floor areas by building use type for future years. The floor areas at each future year are multiplied by the emissions archetype (i.e. the average emissions per floor area for that building type) to estimate emissions.

The building emissions forecast does not include emissions due to embodied carbon of construction³⁰. Changes to cooling energy are not included but expected to be negligible in terms of emissions because they will all be electric³¹. Additional forecasting of changes to energy demand for space cooling are out of the current scope, but recommended for future work.

4.3.1 Defining average building archetypes for operational emissions

For operational emissions, building energy archetypes are defined for:

- Existing residential and commercial buildings using archetypes derived from the District's Retrofit Report, along with archetypes owned internally by LGeo. These archetypes have an initial energy base load divided among space heating, hot water, and cooling and other electrical end uses. For each initial building Archetype (e.g. Single Family Dwelling or MURB Condo - see archetypes table below), we procedurally generate archetypes for each type of modelled space heating equipment, which assigns a fuel type energy source (Electric, Natural Gas, Oil, Propane, or Wood) and equipment energy use efficiency (applied as a [Coefficient of Performance](#)). From these, we calculate the final annualized Energy Use Intensity (EUI, kWh/m²) for each Archetype:

²⁸ Operational emissions are the emissions produced from the energy used to operate the building through its life span (e.g. energy for heating, cooling, hot water, plug loads.).

²⁹ In almost all cases, we report annualized energy and emissions. Unless explicitly stated otherwise (e.g., for cumulative emissions), GHG units of kgCO₂e/m² should be considered equivalent to units of kgCO₂e/m²/yr. Similarly, ktCO₂e → ktCO₂e/yr, or kWh/m² → kWh/m²/yr.

³⁰ Embodied carbon emissions are the life-cycle emissions of the buildings' construction and material components (e.g. emissions from material extraction, creation and transport, building construction, end-of-life disposal).

³¹ Cooling energy loads are typically about 1 to 10% of total energy demand, with the higher range being more typical for ICI buildings and the lower range more typical for residential.

$$\text{Annualized Energy Use Intensity (kWh/m}^2\text{/yr)} = \text{SUM}(\text{end use load} / \text{coefficient of performance})$$

where the sum is performed over all end uses (e.g. Heating, Domestic Hot Water, Cooling, etc). See Table 4.3 for summary of the Coefficients of Performance (COP) used for each equipment type.

- New residential buildings according to Zero Carbon Step Code requirements, which apply limits to the annualized greenhouse gas intensity (GHGi, $\text{kgCO}_2\text{e/m}^2\text{/yr}$) of a building.

Starting from the above existing archetypes, we apply a limit of $2.0 \text{ kgCO}_2\text{e/m}^2\text{/yr}$. The building archetype is modified by applying the following steps, in order, until the GHGi limit is met.

- 1) Fuel switching to an Electric resistance system
- 2) Elimination remaining assumed gas or other fossil fuels use (i.e. due to kitchen equipment, fireplaces, etc.)
- 3) Reducing electricity demand (effectively assuming envelope or equipment efficiency upgrades)³².

Domestic Hot Water (DHW) equipment types were assumed to match those of Primary Space Heating in all cases, except for assumed backsliding of EL-4 buildings after occupancy (see the [4.2 Policy Scenarios: Definition and Assumptions](#) below). Table 4.4 shows example EUI's for various archetypes, comparing values for standard building envelopes against those for Zero Carbon Step Code level EL-4. For the complete list of archetypes applied in the scenarios, refer to the supplementary Results Data Sheets.

³² Low emissions intensity of electricity means large EUI reductions are necessary for some buildings. See EL-4 Archetypes table.

Table 4.3. COP values applied to Primary Space Heating based on equipment type.

Equipment	Fuel Type	Coefficient of Performance	Source
Gas Furnace	Natural Gas	0.87	Average FURSSEFF from NRCan Energuide
Oil Furnace	Oil	0.77	Average FURSSEFF from NRCan Energuide
Propane Furnace	Propane	0.86	Average FURSSEFF from NRCan Energuide
Electric Resistance	Electricity	1	Standard for Electric Resistance
Electric Heat Pump	Electricity	2	HP COP = 3, assumes Electric Resistance backup used 25% of the time ³³
Dual Fuel Heating System	Electricity, Gas backup	1.78	HP COP = 3, assumes Gas heating backup used 25% ²⁵ of the time
Wood Furnace	Wood	0.55	"A Guide to Residential Wood Heating", Canada Mortgage and Housing Corporation, 2008

Table 4.4. Examples of Archetypes and EUI's as applied in the model, comparing existing envelopes against Zero Carbon Step Code level EL-4.

Part	Introba Archetype	Envelope	Primary Space Heating	Total EUI (kWh/m ²)
Part 3 Commercial	Education	Existing	Gas	270.47
	Government	Existing	Gas	322.78
	Healthcare & Other Institutional	Existing	Gas	622.91
	Industrial & Farm	Existing	Gas	210.94
	Office	Existing	Gas	234.09
	Other Commercial	Existing	Gas	308.61
Part 3 Residential	Retail	Existing	Gas	307.38
	MURB Condo	Existing	Gas	151.04
	MURB Rental	Existing	Gas	151.04
Part 9	Single Family Attached	Existing	Gas	146.56
	Single Family Detached	Existing	Gas	146.56
Part 3 Commercial	Healthcare & Other Institutional	EL-4	Electric	176.98
	Industrial & Farm	EL-4	Electric	176.98
	Office	EL-4	Electric	132.74

³³ Similar to HEES policy assumptions, effective COP values for heat pumps were established by the City of Vancouver Green Buildings Team in collaboration with LGeo, and used here with permission.

Part	Introba Archetype	Envelope	Primary Space Heating	Total EUI (kWh/m2)
	Other Commercial	EL-4	Electric	176.98
	Retail	EL-4	Electric	176.98
Part 3 Residential	MURB Condo	EL-4	Electric	137.37
	MURB Rental	EL-4	Electric	137.37
	Single Family Attached	EL-4	Electric	127.9
Part 9	Single Family Detached	EL-4	Electric	127.9

4.3.2 Emissions Factors

Common emissions factors using Provincial best practices were applied across both BAU and Pathways scenarios. As a result, emissions for a given fuel type do not vary among the scenarios.

Table 4.5. Emissions factors (emissions per unit of energy) applied to both scenarios.

Year	Gas (tCO ₂ e/GJ)	RNG (tCO ₂ e/GJ)	Electric (tCO ₂ e/kWh)	Propane (tCO ₂ e/GJ)	Oil (tCO ₂ e/GJ)	Wood (tCO ₂ e/GJ)
2023	0.049873	0.000293	0.000011	0.061010	0.068353	0.025688
2024 onwards	0.049873	0.000293	0.000010	0.061010	0.068353	0.025688

4.3.4 Baseline Equipment Assignment

Overview

To initiate the emissions forecasts, it is necessary to assign equipment type for all parcels in Saanich in the baseline year (2023). For this assignment, direct data with resolution at the parcel level were used where available, and remaining parcels were filled in at random based on aggregated regional data sets or assumptions from other sources. The workflow is summarized below, and the resulting baseline equipment distribution is outlined in the results section [Equipment Distribution](#).

Saanich Oil Tanks Inventory

An inventory dataset of Oil Tanks from the District of Saanich was provided. It contained addresses presumed to be heated with oil tanks based on permit data. Based on a survey done by the municipality, approximately 2,537 of the identified 4,710 addresses were believed to still have oil heating as of 2022.

The inventory data set contained 370 addresses with *confirmed* oil tanks based on inspections, and a further 241 *suspected* oil tanks, which were inspected and replaced with new oil systems since 2000. These addresses were specifically assigned oil tanks for the baseline year in our model forecast. The remaining inventory addresses were considered *possible* oil tanks, and a subset of these were assigned at random to match the expected numbers based on Saanich data for the starting years.

Finally, a number of oil tanks were confirmed removed with the support of CleanBC and Saanich programs between 2023 and 2024. The table below summarizes the numbers of assigned tanks.

Table 4.6. Baseline numbers of assigned Oil tanks for space heating.

Year	Total Remaining Oil Tanks	Known/Suspected Oil Tanks	Randomly Assigned Oil Tanks
2022	2537		
2023	2129	611	1518
2024 (2026) ³⁴	1783	611	1172

Gas and Propane Permits

Technical Safety BC (TSBC) permit data were used to further assign known gas and propane hookups for space heating. This provided 737 known natural gas and 25 known propane heated parcels.

Electricity

BC Hydro supplied data based on their own modelling which indicates the percentage of buildings, grouped by archetype, which are heated by electricity in each Forward Sortation Area (FSA). After assignment of the known Oil, Propane, and Gas parcels above, parcels were grouped by archetype and FSA and then randomly assigned electric heating to match the percentages provided in the BC Hydro data. All are assumed to be electric resistance systems for simplicity, and because these will currently comprise the vast majority of the stock.

The same default electric space heating proportions by FSA are assumed to hold for new buildings built during forecast years, where they are not otherwise determined by model policies (e.g. in the No-Policy scenario).

Wood and Remaining Propane

Proportions of Part 9 homes heated with Wood (4%) and Propane (4.4%) were estimated in previous work by Introba for the 2023 Saanich Building Retrofit Strategy report. Following above assignments of known oil, propane, and electricity, we randomly assigned Wood and Propane proportions according to these percentages.

Remaining Gas

All remaining unassigned parcels were assigned Gas heating.

Table 4.7 below and Figure 4.3 in [Key Indicators: Equipment Distribution](#) show the resulting baseline distribution of heating across Saanich. It is worth noting the comparison between the electric heating proportions derived from BC Hydro data and the total number of gas connections

³⁴ Because 2024 is not in the model forecast years, we assign the value to 2026 instead. The final 2026 tally is lower than reported in the table here because of further assumed tank removals under policy scenarios for 2025 and 2026. See the results section [Key Indicators: Oil and Propane Heating](#).

as provided by FortisBC. The BC Hydro number as provided in the Table 4.7 below implies electric space heating is applied to about 64% (or about 20,000/30,000) of Saanich parcels. FortisBC, however, reports about 18,000 gas connections (though not all may be used for space heating). These numbers imply significant overlap between buildings with electric heating and gas use, and therefore some uncertainty in the starting proportions used here. However, to our understanding the BC Hydro estimates are explicitly for space heating, whereas the FortisBC connections are not (for example, for a house with gas cooking but electric heating), and as a result we have assumed the BC Hydro data to be the primary source of truth in our modelling.

Table 4.7. *Percentage of parcels assigned to each space heating type in the baseline year.*

Electric	Gas	Oil	Propane	Wood
63.7%	24.4%	5.8%	1.9%	4.2%

4.3.5 Application of Equipment Turnover and Envelope Retrofits

Most equipment turnover policies are applied as Time-of-Replacement (TOR), meaning that changeout of equipment occurs at the end of the equipment lifetime. For space heating equipment, we assume that equipment must be replaced, on average, every 22 years³⁵ starting from the first year a building is built. The year built comes either from the building inventory data or the year in which a new building is constructed in the land use forecast. Since the year in which a building is built is fixed in either the inventory or land use forecast, the assumed lifetime has a strong effect on the overall turnover rate. For instance, an assumed lifetime of 22 years implies that on average $1/22 = 4.5\%$ of buildings will replace equipment in a given year. Note that this gives only an approximate average estimate - actual model results vary because we use building age as a measure of when turnover happens, and the number of buildings built in any one year will vary in time and by building type.

In addition to turnover driven by equipment lifetime, policies may also have an assumed compliance rate, which is either a percentage compliance or a fixed number.

A percentage compliance indicates the fraction of buildings which will act on or be impacted by a given policy.

E.g. 1: Percent compliance: Under the BAU scenario, all new buildings built after 2024 are subject to Zero Carbon Step Code, but 50% of Part 9 buildings are assumed to revert to Gas DHW upon occupancy. The DHW compliance rate is therefore 50%.

A fixed number represents the maximum amount of turnover in a given year.

³⁵ According to [ASHREA](#) guidelines (slide 10).

E.g. 2: The Strata Energy Advisor Program is assumed to impact a fixed number of 3 Part 3 Residential Condos per year under the Pathways scenario forecast.

4.3.6 Policy Interaction

Several of the policies modelled under both the BAU and Pathways scenarios may overlap in impacting the same building type or the same retrofit pathway. For example, the *Part 3 Energy Benchmarking* policy impacts energy efficiency in a large percentage of all Part 3 buildings, many of which may also be impacted by retrofit policies under the *BC Highest Equipment Efficiency Standards (HEES)* or the *Strata Energy Advisor (SEA)* program. Similarly, the *Direct Install Program* supports fuel switching to electric heat pumps, which would also be mandated under HEES. These policies may variously support uptake of one another (e.g. HEES and the Direct Install Program) or be mutually exclusive (e.g. Alterations Code and Building Performance Standards).

Where possible, we have aligned policy uptake rates with assumptions on policy interaction as initially established under the Building Retrofit Report developed by Introba. In other cases, we have specified policy interactions as needed on a case-by-case basis and in discussion with the District of Saanich. Further details are provided in the policy assumptions table of [4.2 Policy Scenarios: Definition and Assumptions](#).

4.3.7 Heating Degree Day Corrections

For both scenarios, we apply a correction to space heating demand based on existing [climate projections in the CRD from the Pacific Climate Impacts Consortium](#). These heating degree day projections are derived from the [IPCC SSP8.5 climate scenario](#). Following from the PCIC report, we assume the following HDD values:

Table 4.8. Future Heating Degree Days assumed for BAU and Pathways scenarios.

Year	2023	2050
Heating Degree Days	2904	2164

Heating Degree Days (HDD) are calculated by summing the number of degrees that the daily mean temperature falls below 18°C for every day in a year³⁶. By assuming that space heating is only required when the temperature falls below 18°C, and that total annual space heating EUI is linearly proportional to the number of HDDs, we can correct building energy archetypes by adjusting the EUI. Since the buildings archetypes have explicit values for space heating EUI, we corrected them directly using the following equation for each year of the model forecast:

$$EUI_{corrected} = EUI_{base} \left[1 - \left(\frac{year - 2023}{2050 - 2023} \right) * \left(1 - \frac{2164}{2904} \right) \right]$$

³⁶ PCIC, 2024, Climate Projections for the Capital Region

The above correction was applied for the BAU and Pathways scenarios, and is included in all results presented here. For comparison to the non-corrected case, however, see [Topline Scenario Emissions](#).

4.4 Results & Analysis

4.4.1 Where are things now?

Emissions Decrease since 2007

Table 4.9 represents GHG emissions from residential and non-residential buildings, according to the Stantec CRD GHG inventory. According to this inventory, both residential and non-residential³⁷ building emissions have *decreased* on both an absolute and per capita basis.

Table 4.9. *Changes in historical building emissions in the District between 2007 and 2022.*

	Total GHG Emissions (tCO ₂ e)		
	2007	2022	% change over 2007
Residential Buildings	107,425	82,024	-24%
Commercial & Industrial Buildings	52,176	50,243	-4%
Total	159,601	132,267	-17%
	Per CapitaGHG Emissions (tCO ₂ e)		
	2007	2022	% change over 2007
Residential Buildings	0.99	0.70	-30%
Commercial & Industrial Buildings	0.48	0.43	-11%
Total	1.47	1.12	-24%

³⁷ Note that the non-residential decrease depends on the removal of the Diesel line item from the Stantec inventory, which was noted to be a non-building line item and thus is not included here.

Geospatial View of Emissions in the Baseline Year

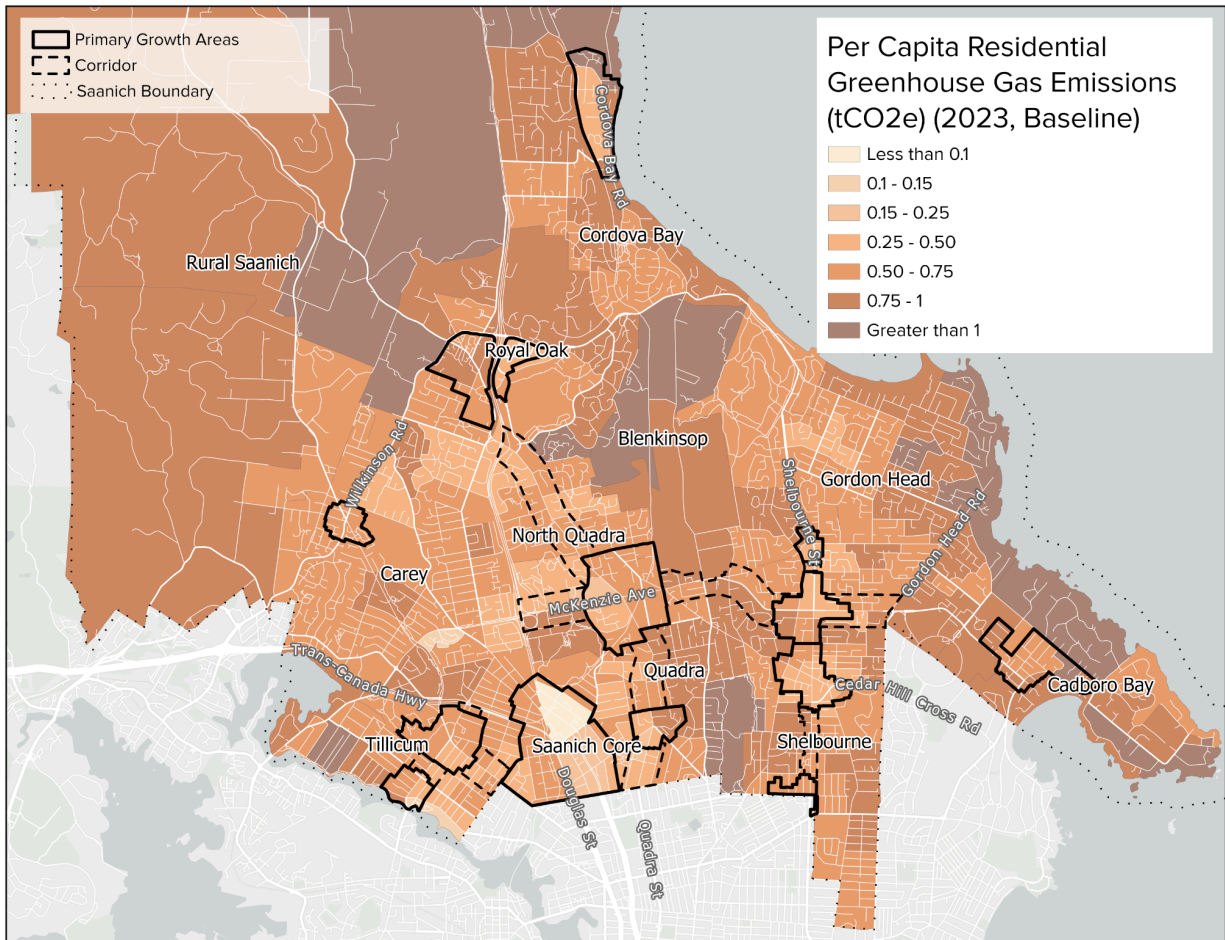


Figure 4.1. Per capita emissions from residential buildings in the baseline year (2023).

In the baseline year, we can draw the following broad observations:

- The highest intensity of per capita emissions among residential buildings is typically concentrated in low density neighborhoods with abundant, large single family dwellings. Such areas include Cadboro Bay, Cedar Hill, north Blenkinsop, and Rural Saanich
- Of these, rural areas such as north Blenkinsop and Rural Saanich are associated with low population density and agricultural areas, and are therefore low sources of total operational emissions, despite higher emissions per capita.
- Primary growth areas and corridors have the lowest emissions per capita, which can be attributed to high density (i.e. relatively low building floor area per capita). Some regions, such as the Saanich Uptown Core, have very low emissions intensity in this view, primarily because of combined very low residential floor area and residential population.

- For non-residential emissions, core commercial areas, golf courses, and agricultural lands have relatively high emissions, particularly when viewed per capita.
- Non-residential buildings in general have higher emissions intensity per floor area - they contain only 26% of floor area, but 38% of total emissions.

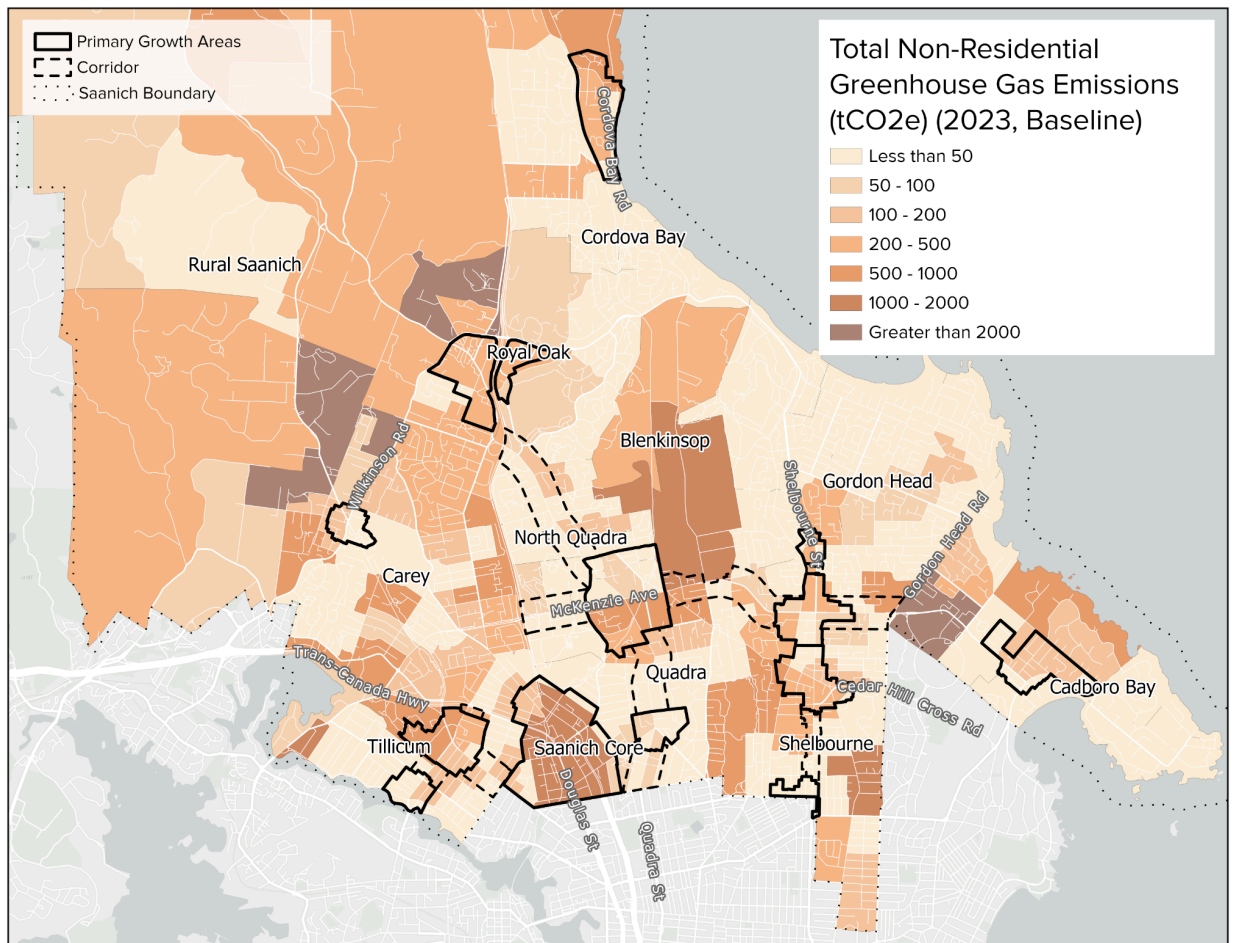


Figure 4.2. Total emissions from non-residential buildings in the baseline year (2023). These are not represented on a per-capita basis because non-residential buildings might not be co-located with population.

Table 4.10. Floor area, Residential Units, and GHGs by archetype in the model baseline year (2023)³⁸. Calculated from the parcel-level data from BC Assessment, the assigned equipment fuel types, and the building energy/emissions archetypes. It includes building energy only, so excludes greenhouses, power to run wells/irrigation, and other non-building sources.

Part	Archetype	Floor Area (millions sq.ft.)	Residential Units	GHG (ktCO ₂ e)	% of Total Floor Area	% of Total Residential Units	% of Total GHG's
Part 3 Commercial	Education	13.47	N/A	20.32	11.7%	N/A	15.4%
	Government	0.44	N/A	0.65	0.4%	N/A	0.4%
	Healthcare & Other Institutional	1.36	N/A	6.92	1.2%	N/A	3.6%
	Industrial & Farm	3.14	N/A	3.62	2.7%	N/A	1.9%
	Office	2.19	N/A	2.64	1.9%	N/A	1.4%
	Other Commercial	4.68	N/A	11.61	4.1%	N/A	6.4%
	Retail	4.75	N/A	4.67	4.1%	N/A	2.6%
Part 3 Residential	MURB Condo	5.94	6591	4.17	5.1%	12.4%	3.2%
	MURB Rental	2.52	3984	1.44	2.2%	7.5%	1.1%
Part 9	Single Family Attached	25.28	20466	23.52	21.9%	38.6%	17.8%
	Single Family Detached	51.77	21988	52.71	44.8%	41.5%	39.9%
		115.54	53029	132.27	100.0%	100.0%	100.0%

Floor Area and Residential Units

Table 4.10 above shows the distribution of floor area and residential units by archetype for the baseline year of 2023. The percentage columns provide clear measures of relative density and emissions impact for residential areas:

- Single family detached homes represent 45% of total floor area, but only 41% of residential households, and 64%³⁹ of all residential emissions.
- Part 3 MURBS, in contrast, are a combined 7.3% of floor area, 20% of households, and just 6.8% of total residential emissions.

Among commercial buildings, educational institutions represent the largest slice of floor area, and an even larger slice of emissions. The single largest parcel by floor area in the entire study is the University of Victoria (UVic), which has 10 times the floor area of the next largest parcel.

³⁸ See also the Buildings Supplementary Data Sheet - Floor_Energy_GHG_summary.

³⁹ From summing residential numbers from the table, i.e. $52.71 / (4.17 + 1.44 + 23.52 + 52.71)$

Because of its very large impact, we applied adjustments specific to UVic such that it aligns with current [reported emissions](#) in the baseline year.⁴⁰ For the Pathways scenario, we applied emissions reductions to UVic in line with the university's [Climate and Sustainability Action Plan](#), which targets net zero by 2040. In our model baseline year, UVic accounts for approximately 1/2 of the total emissions from educational buildings.

Other significant non-residential sources include healthcare buildings and the “Other Commercial” category, which includes a mix of buildings uses such as golf courses or recreational buildings. Because the “Other Commercial” category is quite varied, but are assigned a single energy archetype, the confidence level on reported emissions for those buildings should be considered relatively low.

Equipment Distribution

Figure 4.3, and Table 4.11, show baseline distributions of primary space heating equipment type geospatially, by parcel count, and as broken down by FSA, respectively. Note that equipment was assigned based on statistical proportions – overall distribution will be reasonably accurate by region (i.e. FSA) and by building archetype, however, detailed assignment of heating equipment will be inaccurate *for individual parcels in most cases* - see also [4.3.4 Baseline Equipment Assignment](#).

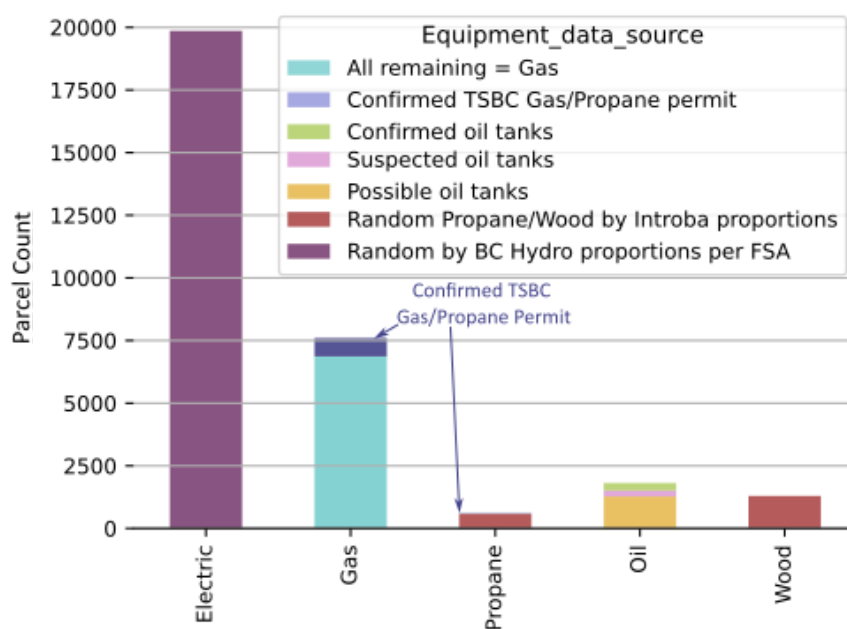


Figure 4.3. Data sources for assignment of present state Space Heating Equipment for all Saanich parcels.

⁴⁰ Although UVic is split between Saanich and Oak Bay, it is only on a single parcel so all of its floor area is included in this study.

Table 4.11. Primary space heating distribution as a percentage of parcels in each FSA, compared against the city-wide average. From Buildings Supplementary Data Sheet - Baseline Equipment by FSA.

FSA	Gas	Electric	Oil	Propane	Wood	Total Parcels
V8N	23.9%	64.3%	5.4%	1.9%	4.3%	7564
V8P	28.5%	55.5%	8.8%	2.1%	5.0%	4353
V8R	31.0%	52.8%	7.9%	3.4%	4.9%	680
V8X	21.8%	67.4%	5.1%	1.6%	4.0%	4763
V8Y	19.9%	71.8%	3.0%	1.9%	3.4%	3339
V8Z	25.4%	63.3%	5.8%	1.6%	3.9%	6766
V9A	29.8%	53.7%	7.6%	3.0%	5.8%	1882
V9B	50.0%	50.0%	0.0%	0.0%	0.0%	2
V9E	19.5%	71.9%	4.8%	1.7%	2.2%	1825
City-wide Average	24.4%	63.7%	5.8%	1.9%	4.2%	31174

Energy Mix

Table 4.12. Annual Energy Use (GWh) by archetype and primary space heating type in the baseline year (2023). This table excludes energy use by the University of Victoria.

Part	Archetype	Total Energy Use (GWh)				
		Gas	Electric	Oil	Propane	Wood
Part 3 Commercial	Education	80.6	4.8	0.0	1.9	0.0
	Government	5.6	3.3	0.0	0.0	0.0
	Healthcare & Other Institutional	50.2	13.2	0.0	0.0	0.0
	Industrial & Farm	36.4	7.4	0.0	0.0	0.0
	Office	30.6	3.0	0.0	0.0	0.0
	Other Commercial	88.2	15.1	5.7	0.1	0.0
	Retail	72.0	13.4	0.0	0.4	0.0
Part 3 Residential	MURB Condo	31.6	38.0	0.0	0.0	0.0
	MURB Rental	10.4	18.3	0.0	0.0	0.0
Part 9	Single Family Attached	85.5	170.5	21.9	9.0	20.2
	Single Family Detached	162.2	342.3	66.0	25.8	49.4

In 2023, the majority of energy used from buildings is from gas (43%) and electricity (49%), with oil, wood and propane constituting the remainder. In commercial buildings there is more gas use than electricity, while this is the opposite for residential buildings. Across all energy sources, Part 3 commercial buildings used 562 GWh, Part 3 residential buildings used 113 GWh and Part 9 residential buildings used 1000 GWh, making Part 9 residential buildings the largest consumers of energy in this sector.

4.4.2 Where are things going?

Policy Impacts on Top-line Emissions

Table 4.13 and Figure 4.4 below show the overall building emissions results for both scenarios, including the impact of the HDD corrections. By 2050, the BAU and Pathways scenarios achieve a reduction in annual emissions of 32% and 82% below 2007 levels, respectively. For Pathways, the 2030 target of 50% reduction is not achieved until about 2034 to 2035. BAU emissions are approximately flat until 2036, after which modest reductions are achieved. The next section lays out, in detail, the impact breakdown by policy.

The HDD correction has a larger impact on BAU emissions than for Pathways; because most residential space heating is electrified in the Pathways scenario, and because we only apply HDD corrections to residential buildings, the overall emissions impact of reduced heating demand is fairly negligible. In contrast for BAU, the same reduction in heating degree days produces a reduction in emissions of approximately 20 ktCO₂e in 2050, because a larger portion of heating systems are powered by fossil fuels.

Figure 4.4 and Table 4.13 below show the detailed impacts of each modelled policy across the two scenarios. Figure 4.5 highlights the policies which drive reductions *between* the Pathways and BAU scenarios. That is, for policies present in both scenarios, it highlights only impacts beyond those present in BAU. Additionally, Table 4.14 shows the cumulative emissions abatement (i.e. total avoided emissions) for each policy by 2050, both as a difference between scenarios, and as a total policy impact. See also the Buildings Supplementary Data Sheet: Policy Impact-Pathways vs BAU.

Table 4.13. Total annual building emissions by scenario, with and without heating-degree-day corrections. All units other than % values are reported in ktCO₂e/yr. The 2007 inventory value is included as a reference.

Year	With HDD Correction					No HDD Correction	
	No Policy	BAU	Pathways	Reduction from 2007, BAU	Reduction from 2007, Pathways	BAU	Pathways
2007*	159.6	159.6	159.6				
2023	132.3	132.3	132.3	17%	17%	132.3	132.3
2026	134.5	131.7	128.1	17%	20%	133.5	129.8
2031	133.5	125.8	103	21%	35%	130.5	106.5
2036	130.9	125.8	71.9	21%	55%	133.6	75.7
2041	125.1	121.3	47.2	24%	70%	131.8	50.8
2050	118.3	109.2	28.3	32%	82%	122.7	30.7

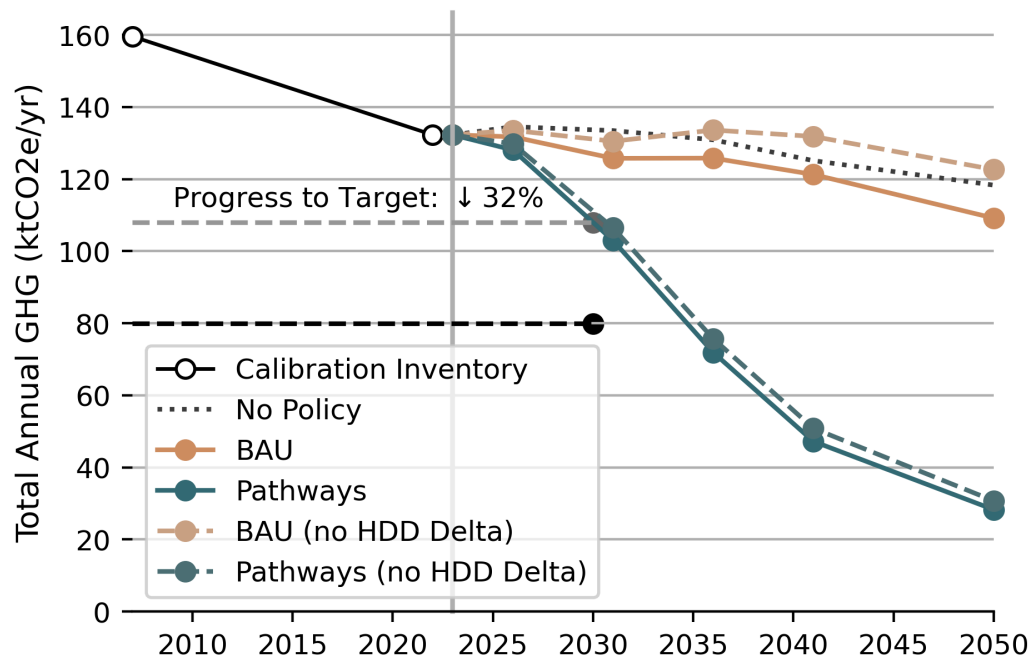


Figure 4.4. Total annual building emissions by scenario. The No Policy scenario includes an HDD correction, so it should be compared with the solid lines. The vertical grey shows the beginning of the model forecast period.

The Largest Drivers

Overall, the two most impactful policies are the Provincial HEES⁴¹ and BC Step Codes for New Buildings policies, with a combined impact of approximately 65% of the total emissions abatement over the study period for the Pathways scenario. These two policies are also the largest drivers of the difference between the BAU and Pathways scenarios.

Provincial HEES impacts nearly 30% of all parcels - which includes nearly all of the existing buildings (built before 2024) which have fossil fuel systems for primary space heating. Following the high-ambition approach of the scenario, new equipment replacements for the HEES-POS (Point-of-Sale) policy are assumed to be all electric heat pumps, driving significant reductions in both emissions and heating energy use. In contrast, the POI (Point-of-Installation) policy is assumed to include a high fraction of dual fuel heating systems covering the heating requirements (and preferences) of large buildings.

In the case of BC Step Codes, though it is present in both scenarios, a significant amount of backsliding to gas connections after initial construction is occurring for the BAU scenario - 50% of new Part 9 construction has DHW replaced with gas equipment upon occupancy, and a further 50% of new Part 9 buildings replaced their space heating equipment with gas at the end of equipment lifetime (this assumption is based upon anecdotal evidence that homeowners are switching back to natural gas). As a consequence, BC Step Codes have about 27% more impact for the Pathways scenario as compared to the BAU scenario in terms of total emissions abatement.

We note also that the emissions abatement for BC Step Codes reported here is relative to the assumed equipment which would *otherwise be installed* in new buildings in the absence of Step Codes, according to our land use model scenario. Relative to baseline (2023) emissions, Step Codes will cause a direct reduction of only about 4 - 5% of 2023 emissions, but account for up to 20% of abatement of *future emissions* under the Pathways scenario. For more details on parcel counts and floor area covered by BC Step Codes, see Appendix A3.

Finally, replacing old structures with new zero carbon buildings will eliminate substantial operational emissions. However, high rates of re-development would also be associated with high emissions from construction activities under current standards of practice, which would negatively impact the overall achieved reductions. **Additional care should therefore be applied for future developments to adopt practices minimizing the embodied carbon emissions of construction.**

⁴¹ Here, assuming 90% electric and 10% dual-fuel systems. More dual fuel proliferation could potentially impact the emissions trajectory significantly.

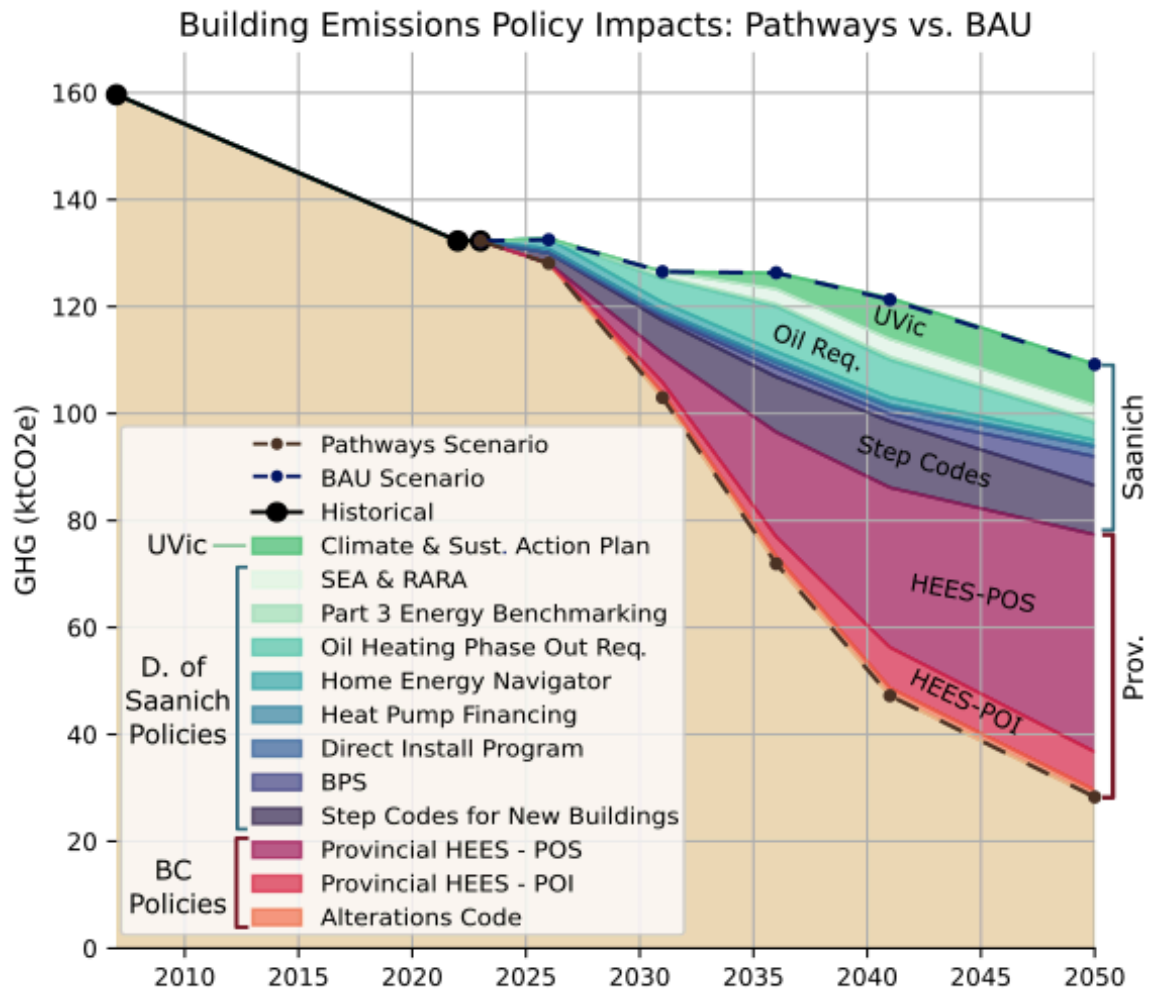


Figure 4.5. Policy impacts on annual GHG emissions for buildings, comparing the Pathways and BAU scenarios. Policies with relatively minor impact that are not directly labeled on the graph are (from top to bottom): Part 3 Energy Benchmarking, Home Energy Navigator, Heat Pump Financing, Direct Install Program, and Building Performance Standards.

Table 4.14. *Estimated cumulative emissions abatement contributions from policies between 2023 and 2050, comparing the Pathways and BAU scenarios (left columns), and Pathways against the No Policy case (right columns - indicated the total impact of all policies). NOTE that because some policies are present in both scenarios, their impact on the difference between scenarios may not be fully represented here (e.g. BC Step Code for New Buildings, Heat Pump Financing Pilot Program, SEA). See the text for a description of how policy interaction impacts the reported numbers.*

	Pathways vs. BAU		Pathways vs. No Policy		
	Cumulative Emissions Abatement (ktCO ₂ e)	% of Cumulative Abatement	Cumulative Emissions Abatement (ktCO ₂ e)	% of Cumulative Abatement	Jurisdiction
Alterations Code	-26.6	2.0%	-26.2	1.8%	Provincial
Provincial HEES - POI	-112.9	8.7%	-81.9	5.7%	Provincial
Provincial HEES - POS	-526.1	40.6%	-531.0	37.1%	Provincial
BC Step Codes for New Buildings	-221.8	17.1%	-279.9	19.6%	Saanich
BPS	-46.4	3.6%	-45.3	3.2%	Saanich
Direct Install Program	-24.7	1.9%	-25.0	1.7%	Saanich
Heat Pump Financing	-11.6	0.9%	-12.4	0.9%	Saanich
Home Energy Navigator	-36.9	2.8%	-37.3	2.6%	Saanich
Oil Heating Phase Out Requirement	-121.0	9.3%	-123.4	8.6%	Saanich
Part 3 Energy Benchmarking	-10.4	0.8%	-70.8	5.0%	Saanich
SEA & RARA	-57.0	4.4%	-82.4	5.8%	Saanich
Climate & Sustainability Action Plan	-100.9	7.8%	-114.6	8.0%	UVic
TOTAL	-1296.2	100.0%	-1430.1	100.0%	

Policy Interactions

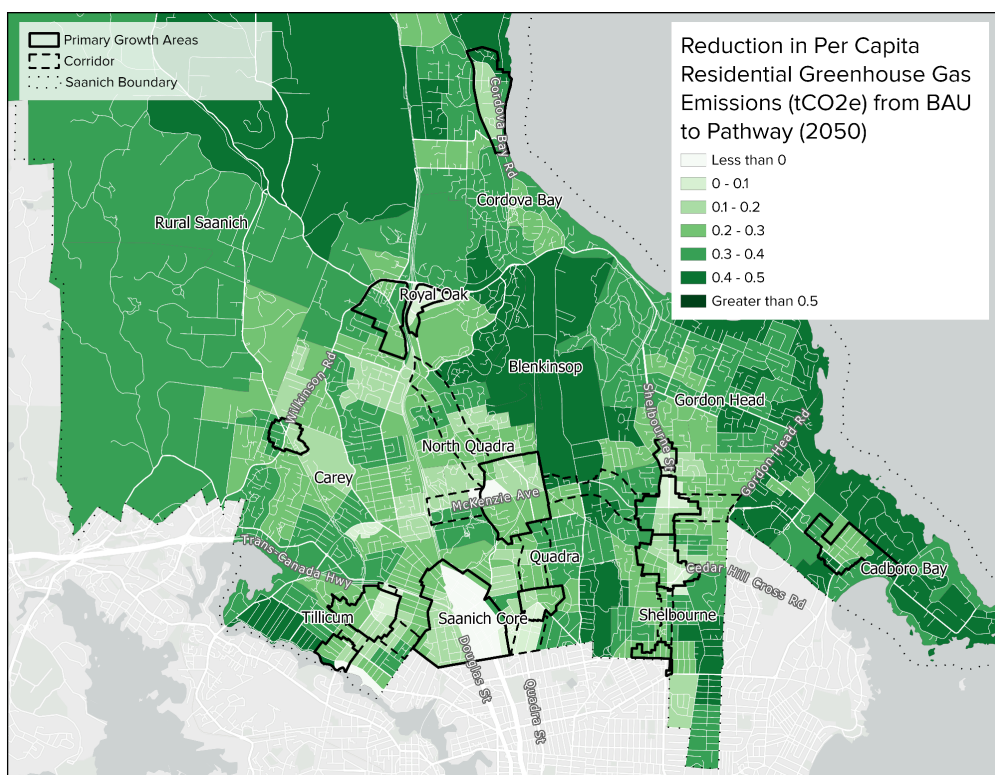
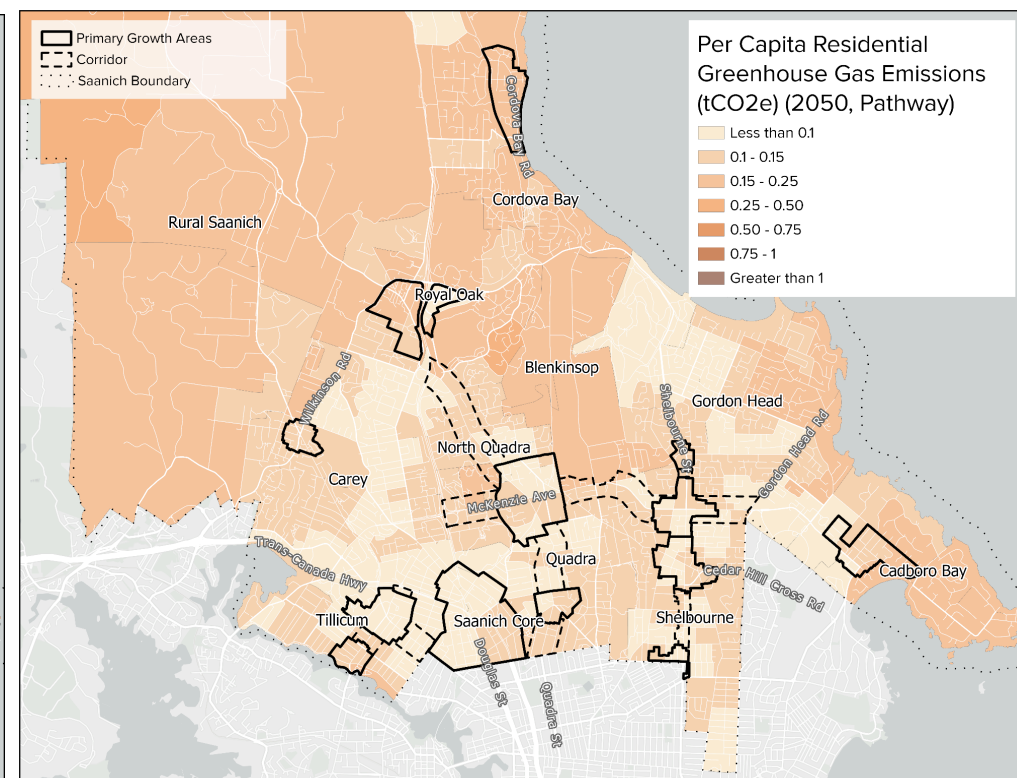
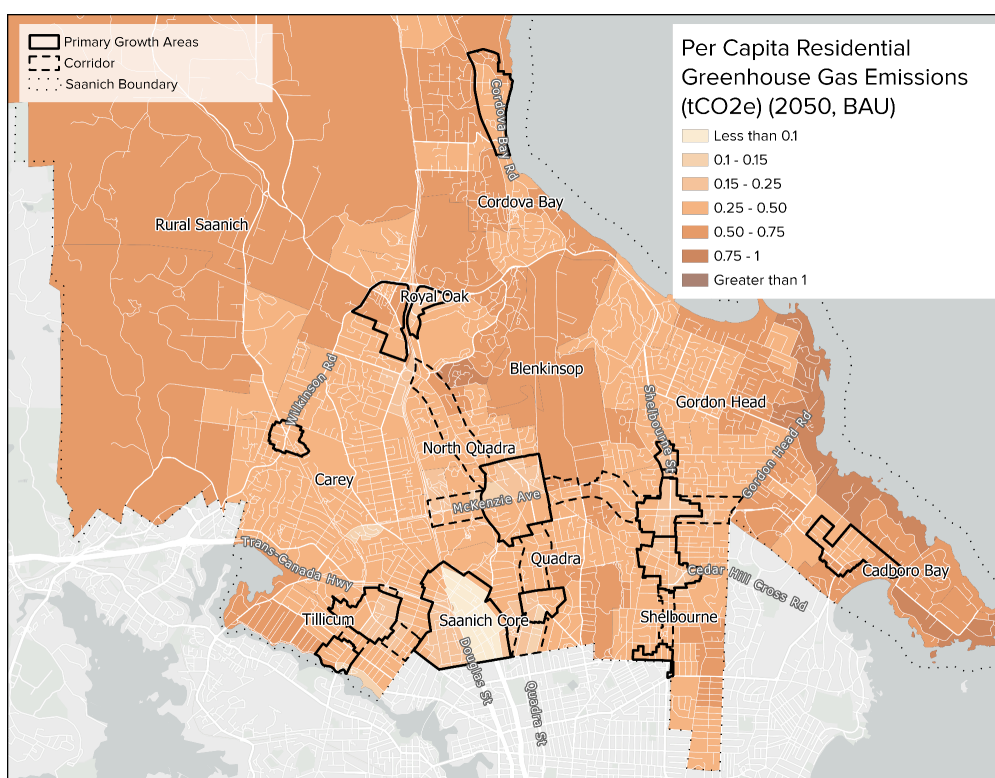
There is considerable overlap of policies, where multiple policies may impact energy and emissions on a given parcel simultaneously, or at varying times. In fact, about 44% of the total emissions abatement occurs for parcels impacted by multiple policies. In these cases and because of interacting effects, attributing emissions reductions directly to a specific policy is not always straightforward. The emissions contributions from each policy reported here are therefore accurate representations of average policy impacts city-wide, but not at the DA or parcel levels. As a general guide, it is reasonable to assume that the overall contributions within the “overlapping policies” amounts are similar to the relative contributions of the individual policies

(e.g. Provincial HEES and BC Step Codes are the two largest contributors to the overlapping policy impacts). To provide further information and clarification on policy overlap, we have included additional information on how often the different policies interact in Appendix 2: [Policy Interactions](#).

The most significant policy interaction to note for the Pathways scenario is that of the HEES-POI and Building Performance Standards. Both policies affect most of the same large Part 3 buildings. For the Pathways scenario, we assumed that HEES policies supercede BPS, except where BPS EUI limits require building efficiency improvements. As a result, BPS impact in the Pathways scenario is quite minor (see Figure 4.5 and Table 4.14. LGeo performed targeted analysis to assess BPS impact in the absence of HEES-POI, since BPS is intended as a strong backstop for this case. Cumulative emissions abatement attributed to BPS is -189.1 ktCO₂e by 2050. This contrasts with a BPS impact of -46.4 ktCO₂e in the Pathways, and -112.9 ktCO₂e for HEES-POI. In otherwords, absent HEES-POI, BPS is more effective than HEES-POI by about 50%, and is about 4 times more effective than when HEES-POI is present.

This is true even though the total floor area of buildings impacted by BPS would be less than that for HEES-POI. By assumption (following the Saanich Building Retrofit Strategy report), BPS impacts only ICI buildings greater than 20,000 sq.ft. in floor area, whereas HEES-POI limits are based only on the power usage of the installed systems. Nevertheless, BPS is about twice as impactful as HEES-POI, *per unit floor area* of impacted buildings. This impact results from the strong GHGi and EUI limits of BPS, which at minimum require electric heat pump systems with electric backup in order to achieve, and often building efficiency improvements as well. In contrast, HEES-POI requires no efficiency upgrades and allows for gas backup systems. Though the two policies are modeled here as mutually exclusive for fuel switching, in practice where both are present, BPS might ultimately take precedence by virtue of more strict GHGi limits.

For more details on policy impact in the case of no HEES-POI, see Supplementary Data Sheet: Cumulative Policy Impact.



Geospatial Distribution of Emissions

Figure 4.6. Per capita emissions from residential buildings in 2050 under the BAU (top-left) and Pathways (top right) scenarios, as well as the difference between BAU and Pathways in 2050 (bottom left).

The maps above demonstrate the geospatial, per-capita distribution of residential building emissions in the BAU and the policy Pathways scenario, and the differences between them. The following key observations can be made:

- Across the District, there is a substantial reduction in per-capita emissions in the policy scenario, as compared to the BAU.
- In both the BAU and the pathway scenarios, the highest per capita emissions are outside of the primary growth areas.
 - In the BAU, where this limited equipment turnover and a fair amount of back-sliding to natural gas even with Zero-Carbon Step Code, this is largely related to large home sizes per person (i.e. low density)
 - In the Policy Pathways scenario, more demolitions in the growth areas means even higher rates of electrification (due to Zero-Carbon Step Code).
- Even though the per-capita emissions are highest outside of growth areas in both scenarios, it is also the case that the biggest change in per-capita emissions between the scenarios happens in those areas. This is because these areas remain lower density than the higher-density growth areas, so retrofits and equipment turnover have a higher per-capita impact.
- As mentioned previously, the University of Victoria is an anomaly in comparison to other areas of Saanich due to its very high floor area and distinct climate plan. As a result, it may appear to have anomalously high emissions in these maps, especially when viewed on a per-capita basis. However, we emphasise that UVic emissions reductions as shown here are in line with its existing climate plan.

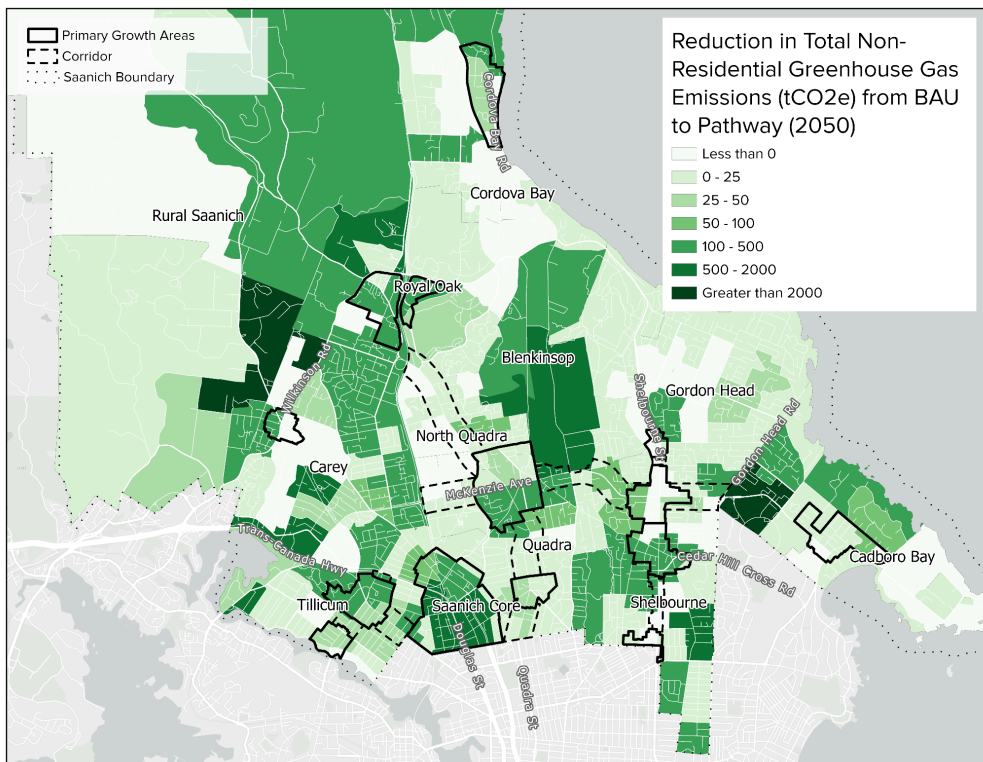
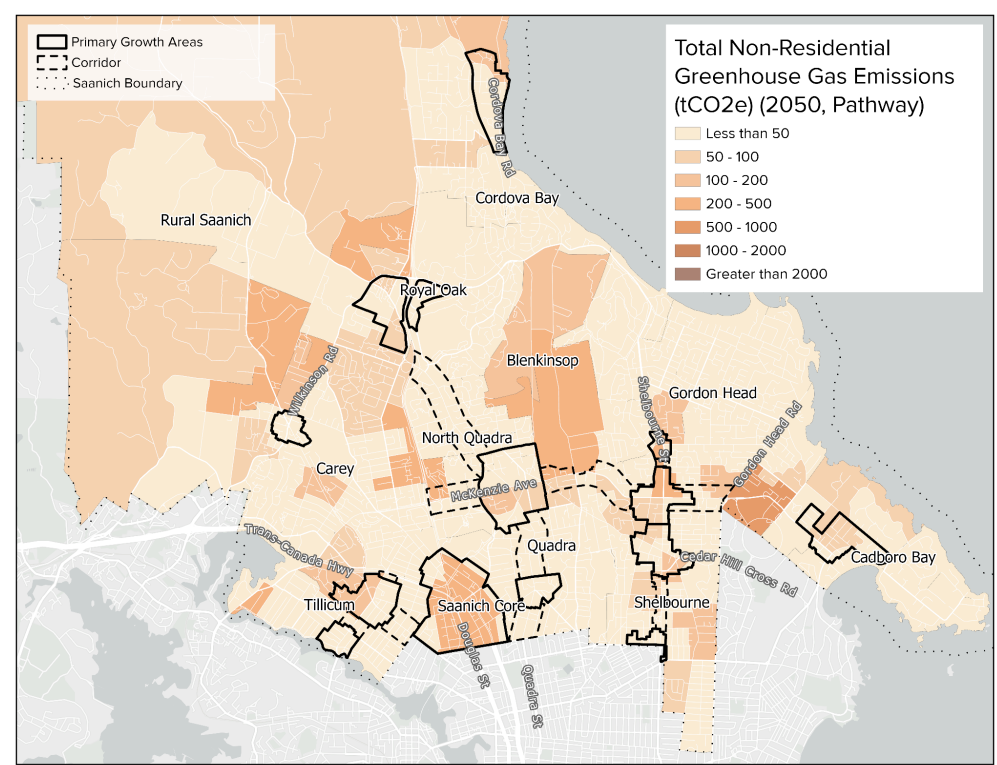
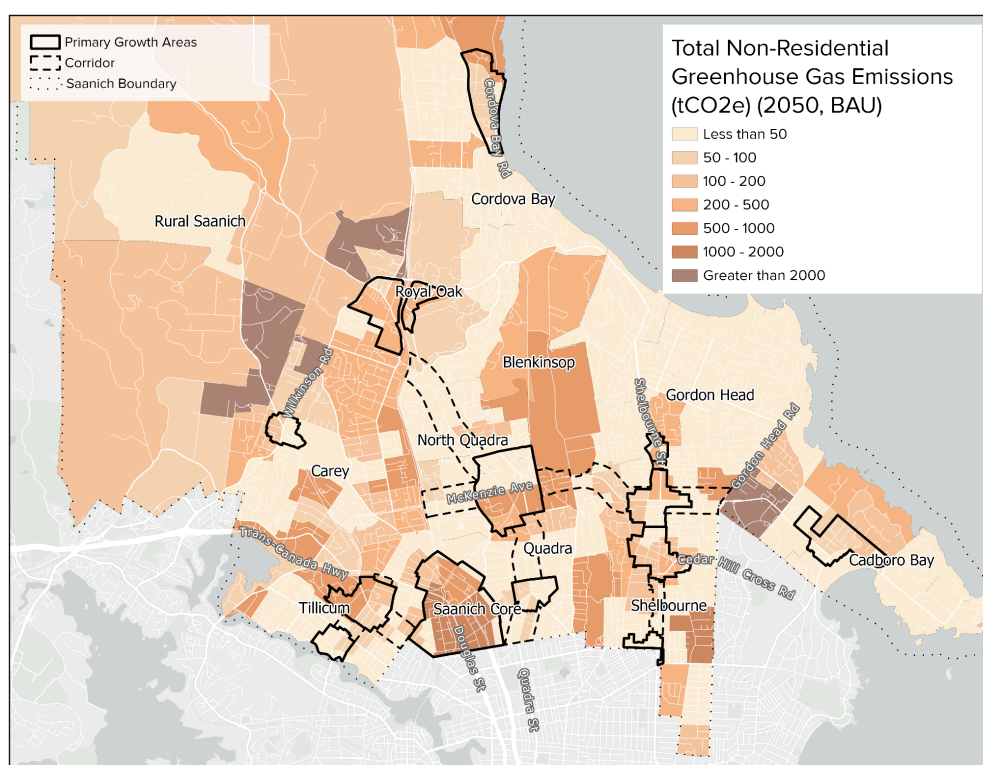


Figure 4.7. Total emissions from non-residential buildings in 2050 under the BAU (top-left) and Pathways (top right) scenarios, as well as the difference between BAU and Pathways in 2050 (bottom left). Non-residential buildings are not represented per-capita, because non-residential floor area and population are not necessarily co-located

For non-residential buildings, the following key observations can be made:

- Non-residential buildings and Part 3 MURBs see less overall change in emissions relative to residential. These buildings are omitted by the most impactful policies such as Provincial HEES-POS, but instead are targeted by HEES-POI. About 90% of the replacement systems are dual fuel heating systems (electric heat pumps with gas backup), resulting in somewhat less effective emissions reductions where present. In addition, relatively fewer Part 3 new developments occur as shown in the [Land Use Scenario Definition](#), providing fewer opportunities for implementation of Zero Carbon Step Codes. BPS policies are able to capture some of this remainder through efficiency upgrades, but do not eliminate all modelled emissions⁴².
- As a result, most areas with high non-residential emissions in the baseline year continue to be the highest sources in 2050.
- Despite the above points, significant progress is made in most of the major emitting areas, as shown by the map of differences between the scenarios - the largest changes occur at UVic, and major growth areas such as Saanich Core, and Tillicum. See also the comparison of emissions reductions inside and outside growth areas in [Appendix 2 - Other Key Building Indicators](#).

⁴² Following assumptions in City of Vancouver Building Performance Standards, the last 10-15% of building emissions, especially in large buildings, are virtually impossible to account for by fuel switching and efficiency upgrades alone and typically require some amount of RNG use, carbon offsetting, or other approach to reach Net Zero.

Geospatial Equipment Distribution and Fuel Mix

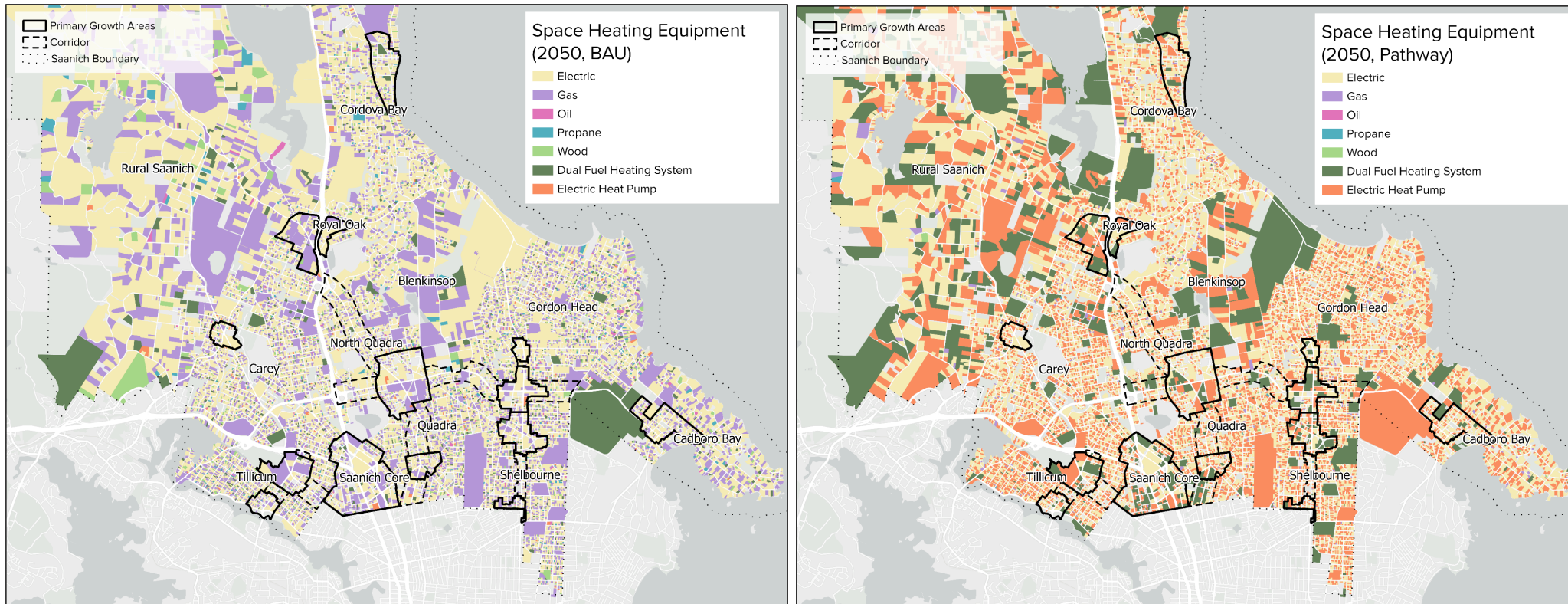


Figure 4.8. Forecasted distribution of Primary Space Heating equipment for all buildings in 2050 under the BAU (left) and Pathways (right) scenarios.

As shown in Figure 4.8, the distribution of space heating equipment for buildings in 2050 is quite different between the BAU and the Pathways scenario: in the latter, there is substantially more electrification and heat pump uptake due to less backsliding to natural gas for buildings subject to Zero-Carbon Step Code, and to aggressive retrofitting policy. The primary driver of fuel switching for BAU is Zero Carbon Step Codes, which are assumed to result in electric resistance systems⁴³, except where backsliding to gas occurs. This assumption is also the driver of increasing electric resistance coverage in Growth Areas shown in Figure 4.9. Only a few short term policies result in heat pump fuel switching (e.g. SEA/RARA, Heat Pump Financing), and as a result, these systems are rare, and backsliding to gas means there remains a continued significant presence of gas heating in the growth areas. As noted in the policy assumptions in Table 4.2, we expect a higher rate of heat pump installs for Zero Carbon Step Code than are modelled here.

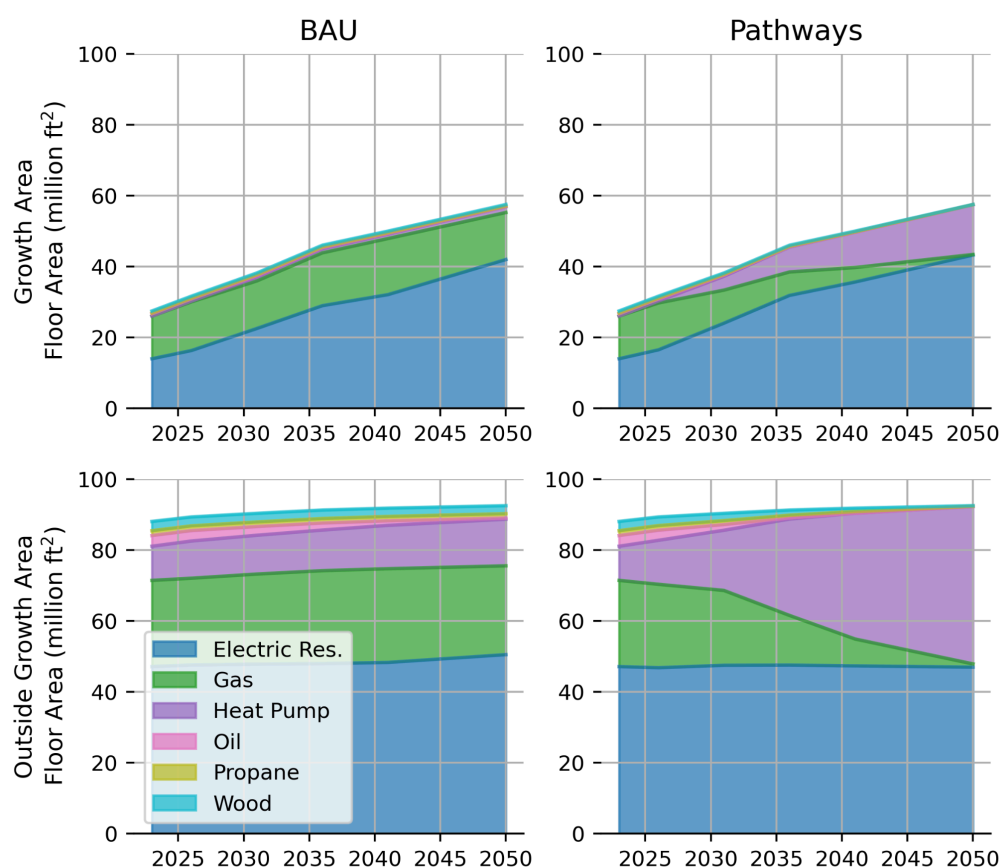


Figure 4.9. Space Heating distribution by floor area for all buildings, inside and outside Growth Areas.

⁴³ Based on LGeo energy archetype modeling, electric resistance systems are sufficient to achieve EL-4 GHGi limits for Zero Carbon Step Codes in *most* cases. This result rests on assumptions of (a) efficiency of building envelopes and (b) the emissions factor associated with grid electricity.

In both scenarios, there is more electrification in the growth areas than outside the growth areas, due to upcoming new buildings. In the BAU scenario, few buildings outside the growth areas are electrified, but in the Pathways scenario the majority are. Across all building end-uses (space heating, hot water, lighting and plug loads, etc), in the BAU scenario, the overall proportion of energy that comes from electricity remains nearly static from 2023-2050. The majority of emissions reductions in this scenario actually take place from the replacement of fuel oil systems, which have a very high emissions factor.

In the Pathways scenario, the proportion of energy used by natural gas will have been reduced by approximately half, compared to what is used today. In addition, the rate at which oil, propane, and wood heating are replaced is significantly faster in the Pathways scenario. A significant portion of remaining emissions in 2050 for the Pathways arise from emissions associated with grid electricity use, which we discuss further below.

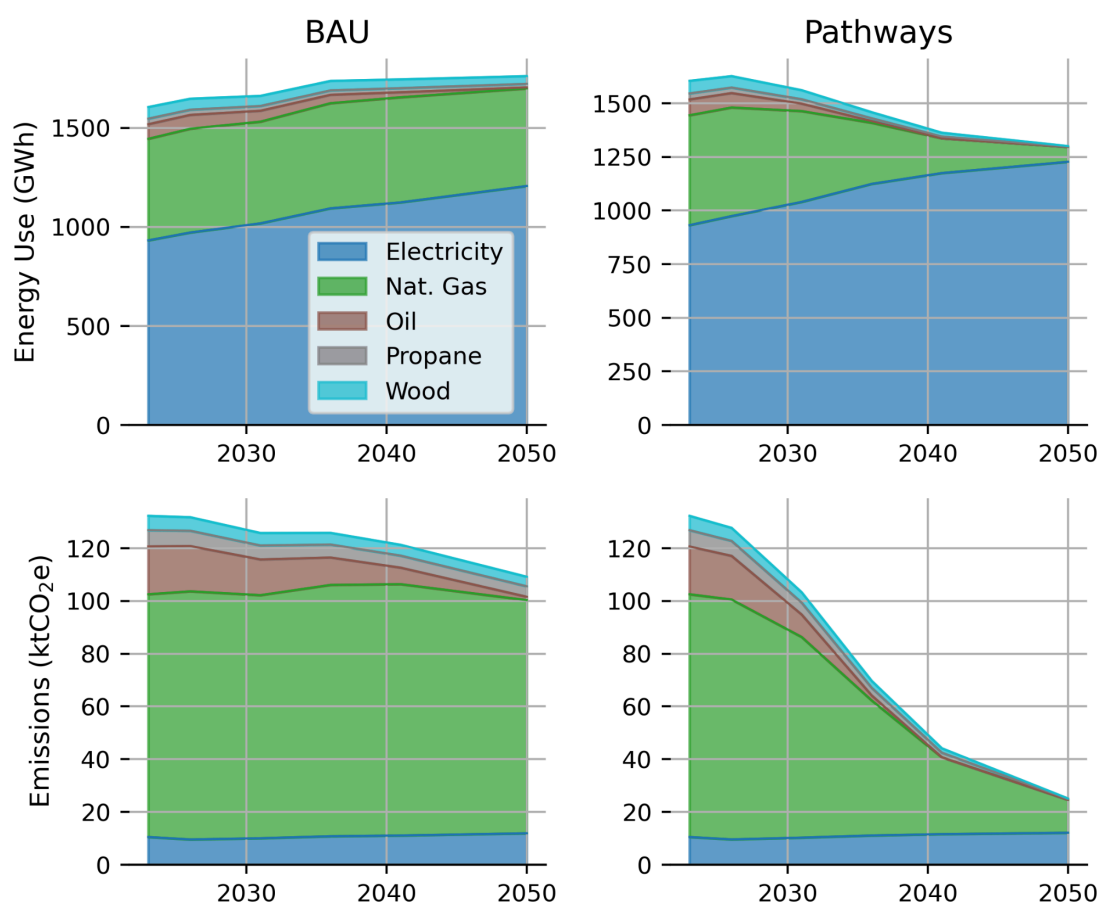


Figure 4.10. Energy and emissions mix by primary fuel type.⁴⁴

⁴⁴ Recall we assume that electricity generation and imports will not be 100% decarbonized by 2050.

Gap Assessment

Table 4.15. Floor area and GHGs by archetype in the Pathways Scenario, comparing 2023 and 2050⁴⁵.

Archetype	Pathways, 2023						Pathways, 2050					
	Floor Area (millions sq.ft.)	Energy Use (GWh)	GHG (ktCO ₂ e)	% of Total Floor Area	% of Total Energy	% of Total GHG's	Floor Area (millions sq.ft.)	Energy Use (GWh)	GHG (ktCO ₂ e)	% of Total Floor Area	% of Total Energy	% of Total GHG's
Education	13.5	209.8	20.3	11.7%	13.1%	15.4%	13.6	89.7	2.4	9.1%	6.9%	8.5%
Government	0.4	8.9	0.7	0.4%	0.6%	0.5%	0.4	6.0	0.3	0.3%	0.5%	1.1%
Healthcare & Other Institutional	1.4	63.4	6.9	1.2%	4.0%	5.2%	2.0	44.2	1.5	1.3%	3.4%	5.2%
Industrial & Farm	3.1	43.9	3.6	2.7%	2.7%	2.7%	3.4	29.0	0.9	2.3%	2.2%	3.3%
Office	2.2	33.6	2.6	1.9%	2.1%	2.0%	2.8	26.1	0.7	1.9%	2.0%	2.5%
Other Commercial	4.7	109.0	11.6	4.1%	6.8%	8.8%	4.7	46.0	2.1	3.1%	3.5%	7.4%
Retail	4.8	85.8	4.7	4.1%	5.4%	3.5%	5.3	75.9	0.9	3.6%	5.8%	3.1%
MURB Condo	5.9	69.6	4.2	5.1%	4.3%	3.2%	23.6	237.1	3.9	15.8%	18.1%	13.9%
MURB Rental	2.5	28.7	1.4	2.2%	1.8%	1.1%	2.9	22.1	0.7	2.0%	1.7%	2.5%
Single Family Attached	25.3	306.9	23.5	21.9%	19.1%	17.8%	43.7	377.6	6.6	29.1%	28.8%	23.4%
Single Family Detached	51.8	645.5	52.7	44.8%	40.2%	39.9%	47.6	356.3	8.2	31.7%	27.2%	29.1%
Totals	115.6	1605.1	132.3	100.0%	100.0%	100.0%	150.0	1310.0	28.3	100.0%	100.0%	100.0%

⁴⁵ See also the Buildings Supplementary Data Sheets : Floor_Energy_GHG_by_archetype and Floor_Energy_GHG_data

Table 4.16. Floor area and GHGs by building category and Primary Space Heating type in the Pathways Scenario, comparing 2023 and 2050⁴⁶.

		Pathways, 2023			Pathways, 2050					
		Floor Area (millions sq.ft.)	Energy Use (GWh)	GHG (ktCO2e)	Floor Area (millions sq.ft.)	Energy Use (GWh)	GHG (ktCO2e)	% of Total Floor Area	% of Total Energy	% of Total GHG's
Part 3 Commercial	Gas	16.3	363.53	38.92	0.09	1.23	0.12	0.1%	0.1%	0.4%
	Electric	3.98	60.19	0.68	3.59	54.88	0.54	2.4%	4.2%	1.9%
	Propane	0.01	5.69	1.39	0	0.06	0.01	0.0%	0.0%	0.0%
	Oil	0.13	2.45	0.33				0.0%	0.0%	0.0%
	Dual Fuel	9.64	122.48	9.11	11.07	120.59	6.74	7.4%	9.2%	23.8%
	Electric HP				17.43	140.05	1.39	11.6%	10.7%	4.9%
Part 3 Residential	Gas	3	42.03	4.97	0	0.02	0	0.0%	0.0%	0.0%
	Electric	5.46	56.29	0.64	16.41	190.58	1.89	10.9%	14.6%	6.7%
	Propane	0	0.02	0				0.0%	0.0%	0.0%
	Dual Fuel				7.74	52.92	2.58	5.2%	4.0%	9.1%
	Electric HP				2.42	15.7	0.16	1.6%	1.2%	0.6%
Part 9	Gas	17.06	247.63	35.94	1.11	12.79	1.76	0.7%	1.0%	6.2%
	Electric	51.68	512.74	9.47	64.23	572.47	9.25	42.8%	43.7%	32.7%
	Oil	3.66	87.83	18.46				0.0%	0.0%	0.0%
	Propane	1.47	34.76	6.58	0.1	1.78	0.32	0.1%	0.1%	1.1%
	Wood	3.19	69.5	5.78	0.18	3.09	0.25	0.1%	0.2%	0.9%
	Dual Fuel				0.28	1.89	0.14	0.2%	0.1%	0.5%
	Electric HP				25.41	141.89	3.14	16.9%	10.8%	11.1%
TOTALS		115.58	1605.14	132.27	150.06	1309.94	28.29	100.0%	100.0%	100.0%

⁴⁶ See also the Buildings Supplementary Data Sheets : Floor_Energy_GHG_by_equipment and Floor_Energy_GHG_data

Table 4.15 shows the floor area, energy and remaining emissions by building archetype in 2050 for both scenarios by building archetype. Table 4.16 shows the same floor area, energy, and emissions data, but divided by building category and primary space heating type. These tables show that the largest remaining use of fossil fuels in 2050 comes from dual fuel heating systems in Part 3 Commercial buildings (a result of HEES-POI policies), accounting for over 23.8% of remaining building emissions and a majority of remaining natural gas use. This remaining pool of emissions in both non-residential and MURB buildings comes from the assumed high proportion of dual fuel heating systems for this building group. For ICI, there are also relatively few replacements by new buildings.

Part 3 Non-residential

With regard to the results for Part 3 Non-residential buildings as the primary remaining source of building emissions, there are three critical caveats:

1. The Building Performance Standards as currently modelled have substantial overlap with HEES-POI, but BPS does still provide notable efficiency improvements due to EUI limits (see section on Policy Interaction).
2. In contrast, we have assumed a highly successful electrification of Part 3 Residential buildings, driven variously by Provincial HEES, Zero Carbon Step Codes, and extensions to the SEA and RARA policies, etc. 0% of Part 3 Residential floor area in 2050 remains powered by gas. However, in reality, many existing Part 3 Residential buildings operate with central gas furnaces and boilers, which may be difficult or very expensive to retrofit or electrify, so the Pathways forecast for Part 3 Residential buildings carries the risk of being overly optimistic, and it is reasonable to anticipate that these buildings will also be a source of persistent excess energy and fossil fuel use, despite what is shown in the modeling.
3. Though UVic has been assumed to follow its own robust and ambitious climate plan, the same assumption has not been applied to other educational buildings, and as a result they still constitute 20% of the total remaining building emissions in 2050. Aligning this forecast with other existing plans in educational institutions, or proposing additional pathways for them, is beyond the scope of this report but may have a significant impact.

Part 3 Non-residential

It is worth noting that in the absence of HEES-POI, Part 3 residential buildings may remain a substantial policy gap for electrification and emissions abatement. Implemented BPS policies should therefore include Part 3 residential MURBs, however we note that these building types have been identified as both technically and financially challenging to retrofit for electrification⁴⁷.

⁴⁷ [FRESCO Building Efficiency MURB Electrification Retrofits report](#) for BC.

Gas backsliding and decommissioning gas pipes

The very large difference in the impact of BC Zero Carbon Step Codes between BAU and Pathways scenarios (see [Policy Impacts on Top-Line Emissions](#)) highlights a key uncertainty in future emissions. Where gas connections are available for future use under existing regulation, building electrification policies may be *substantially* less efficient than would otherwise be the case, due to backsliding to gas. In our Pathways scenario, elimination of back sliding to gas heating and DHW for Zero Carbon Step Codes in Part 9 buildings improved the *total emissions abatement by about 60kt*. With careful policy design, decommissioning natural gas pipes in areas that are redeveloped is one viable option to ensure that electricity uptake remains persistent.

Emissions due to electricity use

As fossil fuel use is reduced, *electricity use* increases substantially and ends up contributing to emissions in 2050, especially in Part 9 homes. This is the case even with the 100% Clean Electricity Delivery Standard⁴⁸, because even clean Hydro electricity still emits GHGs (a combination of imported fossil fuel electricity from the North American grid, and land use change that causes methane to be released from bacteria at the bottom of reservoirs⁴⁹).

Incentive Analysis

The tables below report the total number of residential unit (i.e. household) heat pump installations under various Pathways policies. For residential units, the table reports the total units present in a given year which were installed under corresponding policies. Note that in many instances, numbers appear to decrease over time - this is a result of loss of building stock to new developments. Consequently, the simple calculations provided here are a slight underestimate of the total number of heat pump installations.

For policies which are intended to be incentivized, such as the Heat Pump Financing and the Direct Install Program, the values in the tables above can be used with heat pump cost estimates to provide reference values around which to design funding pools.

Table 4.17. Cumulative number of households with heat pump installs driven by various Pathways policies. These numbers are cumulative but may go down in certain cases because of building replacements.

	2026	2031	2036	2041	2050
--	------	------	------	------	------

⁴⁸ This standard specifies that the electricity produced by Hydro must be 100% clean, and does not pertain to imported electricity. Moreover, many factors influence changes in the electricity emissions factor over time, such as potential challenges to the decarbonization progress within BC and with our electricity trading partners in response to climate change impacting dam levels and growing demands for electricity for LNG exports, mining, and data centres as well as electrifying transport and buildings. We assume that the electricity grid in North America won't be 100% decarbonized by 2050.

⁴⁹ Note that biogenic emissions from reservoirs are not included in the scope for electricity emissions factors in BC.

SEA: Advanced	31	738	1167	1416	1416
RARA: Advanced		361	593	593	593
Heat Pump Financing	183	176	171	169	158
Home Energy Navigator Expansion	1061	1013	966	933	876
Direct Install Program		305	901	1462	2324
Oil Heating Phase Out Requirement		549	1237	1302	1185
Provincial HEES - POS		1452	3648	6171	9995
Provincial HEES - POI		800	3219	6142	10097

Table 4.18. Number of households with heat pump installs driven by various Pathways policies for each span of years. Unlike the table above, these represent the absolute number of installs, not cumulative amounts. These values can be used with costing data to estimate the household cost burden for heat pump installs across the District.

Years	2024 - 2026	2027 - 2031	2032 - 2036	2037 - 2041	2042 - 2050
Heat Pump Financing ⁵⁰	183	0	0	0	0
Home Energy Navigator Expansion ⁵¹	1061	0	0	0	0
Direct Install Program	0	305	596	561	862
Oil Heating Phase Out Requirement	0	549	688	65	0
Provincial HEES	0	1452	2196	2523	3824
Total	1244	2306	3480	3149	4686

⁵⁰ Note that Heat Pump Financing is assumed to be superseded by Home Energy Navigator Expansion and HEES beginning in 2027. It is retained here to ensure complete accounting of heat pump installs.

⁵¹ Because HEES compliance is assumed to be 100%, we do not directly attribute heat pump installs to this policy past 2026, but it is assumed to contribute as an incentive. It is retained here to ensure complete accounting of heat pump installs.

5. Other Sectors

5.1 Business-as-usual emissions forecast

Beyond transportation and buildings, the remaining emissions sectors are comprised of: (a) Agriculture, forestry, and fishing activities, (b) marine, aviation, and other off-road vehicles, (c) process use emissions (IPPU), (d) heavy duty vehicles, (e) solid waste, (f) energy industries, (g) composting, and (h) wastewater. Agriculture, forestry, and other land use (AFOLU) is mentioned at the end of the section, but is not included in the emissions model to align with the 2022 Stantec report on GHG emissions in the CRD.

Current emissions from these sectors are presented in the 2022 Stantec report on GHG emissions in the CRD. Projecting emissions from these sectors can be difficult due to limited data and uncertainties in future trends. As a result, the BAU scenario is modeled by assuming that the per capita emissions will remain constant into the future, with the exception of agriculture, forestry, and fishing activities, which is held constant into the future (the 2022 Stantec report showed almost no change from 2007 to 2022 despite the population growing; Figure 5.1).

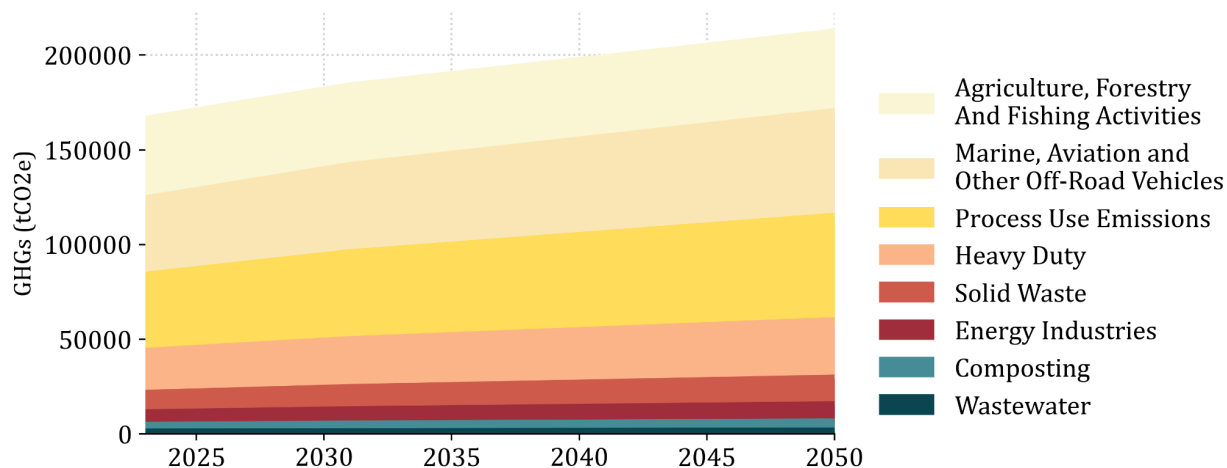


Figure 5.1. Projections of non-transportation and non-building emissions from 2023-2050 under the BAU scenario.

5.2 Reductions pathways

Estimating possible emissions reductions in these sectors is highly uncertain. The theoretical maximum emissions reductions assume widespread and immediate adoption of technologies and fuels that may be economically, logistically, technically and/or politically challenging. This turnover

to modernized equipment and technologies is likely to be slow, even with concerted provincial and federal incentives, as demonstrated by the ongoing pushback from industry on new technology adoption. Moreover, without a detailed breakdown of emissions sources within each sub-sector, it is difficult to assign possible reductions to specific decarbonization strategies.

There are clear pathways to emissions changes in heavy duty transportation, solid waste, energy industries, composting, and marine, aviation, and other off-road vehicles. Figure 5.2 shows the results of the best-case emissions reductions in these sectors, with methods supplied in the following sections. Decarbonization of the other sectors remains speculative and any estimate provided is likely to be an overestimation, so the BAU scenario is assumed for these hard-to-decarbonize sectors. For these sectors, some of the most promising decarbonization pathways are presented below, along with potential barriers to adoption.

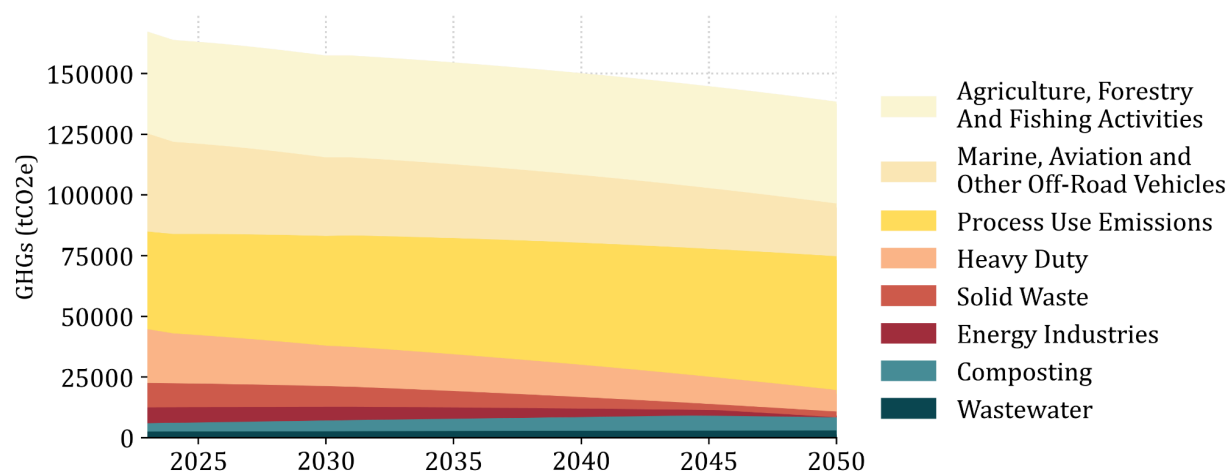


Figure 5.2. Projections of non-transportation and non-building emissions from 2023-2050 with electrification of heavy duty vehicles under the ZEV act and diversion of 95% organic waste from landfills by 2050.

Stationary Energy

Agriculture, Forestry, and Fishing Activities

Full or partial electrification of agricultural equipment could provide over 50% reduction in operational emissions (CEMA 2022). However, while the operational costs of electric farming equipment are cheaper, the upfront costs of replacing existing machinery is likely prohibitive for most farmers in the absence of subsidies or incentive programs. Many agricultural operations continue to use and maintain decades-old farming equipment, and there is likely uncertainty surrounding battery longevity and supportive infrastructure for these upgrades. CNG/LNG/RNG could be used to fuel agricultural equipment in lieu of electrification, but the reduction in emissions would only be 10-20% compared to diesel (CEMA 2022), and significant refueling

infrastructure would be required. Further, engagement with farmers has indicated a strong resistance to electrification due to distrust in current technology and very high risk (lost crop yields) if there is potential failure.

Greenhouses are run on natural gas primarily because the cost of electricity is currently prohibitive.⁵² That said, the Province is currently undergoing an agri-voltaic feasibility study which should be complete mid 2026. The results of this study should be reviewed to determine if they indicate possible pathways for reduction.

Energy Industries

Stationary energy emissions from energy industries due to flaring of gasses from the Hartland Landfill, providing energy back to the grid (from the 2022 Stantec report on GHG emissions). Increasing the diversion of organic waste would reduce the amount of flaring that is possible. See the section on Waste for a forecast of Energy Industry emissions under more organic waste diversion.

Fossil fuel extraction, venting, and flaring that occurs elsewhere in the province assigned to Saanich on a per capita basis. It is important to acknowledge here that increasing oil and gas exports from BC is contrary to us reaching climate targets.

Transportation

Marine, Aviation, and Other Off-Road Vehicles

Marine, aviation, rail, and off-road vehicles are challenging to electrify due to weight limitations associated with lower energy density of batteries, and operational range requirements, and refueling infrastructure requirements. Biofuels are a promising alternative to decarbonize these transportation sectors, with the possibility to reduce lifecycle marine emissions by up to 40% (Stathatou et al. 2022), lifecycle aviation emissions by up to 80% (IATA 2025), and off-road emissions by up to 80% (NRCAN 2025). However:

- The projected rate of current biofuel availability through to 2040 is not sufficient to meet these targets (Thornton et al. 2022, Reid et al. 2020);
- Biofuels derived from crops can drive land use change, partially reducing some of the emissions reduction benefits.

⁵² The CO₂ from natural gas also aids in growing, although it is known to be a benefit and not a strict requirement.

- They are currently more expensive than fossil fuels, and their adoption would require expensive engine retrofits or fuel-blending infrastructure (IEA Bioenergy, 2013).⁵³
- Marine, aviation, and some off-road vehicles have long life spans and therefore a low turnover rate.

Based on the above, the 40-80% lifecycle emissions reductions are the maximum possible under ideal conditions. The real emissions reductions possible by 2050 are likely substantially lower.

Instead, an extension of the LCFS is modelled that assumes a 100% drop-in replacement of diesel by HDRD (see Section 3.3.4) by 2050 using the [2023 GHG Emissions Inventory Report](#) (Table 40). Following LCFS targets, jet fuel is assumed to reach 3% renewable content by 2030, and is held constant thereafter. These assumptions lead to significant reductions, as HDRD has approximately a fifth the carbon intensity of fossil-derived diesel, and marine and off-road diesel usage account for 23% and 62% of sector emissions, respectively. Under this policy assumption in 2050, approximately half of remaining emissions are from HDRD and half are from jet fuel, both of which are challenging to electrify or reduce further for the reasons described above.

Heavy Duty

Recent studies (CEMA 2022) found operational and process efficiencies – selecting the optimal machine for each task, and logistical optimizations (e.g. with satellite organization of multiple machines) – could lead to an average reduction of process-based emissions of 25-40%. However, these operational efficiencies are task- and resource-specific. It remains unclear how generally accessible these technologies are and how expensive they would be to implement.

CleanBC is targeting that 44% of on-road heavy-duty vehicles sold in BC are zero-emission by 2030. It is assumed that 44% of all heavy duty vehicles sold between 2030 and 2050 are EVs, and a fleet turnover model similar to the light vehicle model is applied. Furthermore, an extension of the LCFS is modelled that assumes a 100% drop-in replacement of diesel by HDRD by 2050 (see Section 3.3.4).

Waste

Solid Waste and Composting

Emissions from solid waste can be reduced by diverting organic waste. We model a very ambitious target of 100% waste diversion. First, the current diversion rate needs to be determined. From the [Saanich Garbage & Organics](#) page, 28% of current landfill waste is organic matter, and 8,000 tonnes of organic matter are currently composted. From the [BC CEEI](#), 45,250

⁵³ [Harbour air has used electricity](#) for short flights between Vancouver and Victoria, but these transboundary trips represent only a small proportion of off-road vehicles in the District and are likely to be negligible towards the emissions total. Based on previous studies and experience, the majority of these emissions are likely from construction equipment, however, there is not enough detail in provided inventories to conclude this with certainty.

tonnes of total waste were disposed in 2022, implying that 12,670 tonnes of organic matter are in the landfill, leading to a current diversion rate of 38.7%.

The current per capita emissions of solid waste is 0.0845 tCO₂e/person, and current per capita emissions from flaring is 0.0545 tCO₂e/person (data from the 2022 Stantec report). If the diversion rate is increased from 38.7% to 100%, these per capita emissions will decrease to 0.0 tCO₂e/person. At the same time, the increase in diverted compost will lead to a per capita increase in composting emissions from 0.0291 tCO₂e/person to 0.0423 tCO₂e/person. The change in organic matter diversions are modelled as a gradual transition from 2023 to 2050.

Wastewater

Improvements in process design, energy and recovery can reduce wastewater plant emissions by up to 40% (Li et al. 2025). This is accomplished through process optimizations to reduce downstream nitrous oxide emissions, RNG recovery, and reducing raw wastewater diversion.

Industrial Product and Process Use (IPPU)

IPPU include emissions from non-energy related industrial emissions, such as chemical processes (e.g. in cement production) or refrigerant use.⁵⁴

Low temperature heating processes (e.g. food processing, wood drying, light manufacturing) can be electrified, offering potential emissions reductions of 50-90%. However, this would require new, expensive infrastructure (e.g. boilers, kilns, driers), and may require additional grid capacity in rural locations where this processing often occurs. High temperature processes remain challenging to decarbonize as hydrogen fuel solutions are cost-prohibitive (IEA Material Efficiency, 2019).

A significant portion of IPPU emissions in Saanich is likely due to consumer product use of appliances, electronics, and chemical products. Reducing these emissions would likely involve improving product energy efficiency and redesigning/retrofitting products. However, the scale of possible emissions reductions is very challenging to estimate given uncertainties surrounding product innovations and market penetration.

Agriculture, Forestry, and Other Land Use (AFOLU)

Livestock, Aggregate Sources and Non-CO₂ Emissions Sources on Land

Switching cattle feed to asparagopsis (red seaweed) reduces GHG emissions by up to 82% in feedlot cattle (Roque et al. 2021) and 50% in dairy cows (Roque et al. 2019), assuming they are

⁵⁴ Energy use (often natural gas) in industry is not captured here, but under the stationary energy category. For industrial natural gas, targeted RNG deployment is one possible pathway for decarbonization, however, there are fundamental but unanswered questions from the Province about the amount of sustainable RNG supply and how it is intended to be used in the future. Moreover, the emissions factor of RNG is currently under review by the BCUC.

currently fed concentrated feed. However, these numbers are from controlled trials, and timelines for widespread commercial availability are speculative. Improved manure management through anaerobic digestion can also cut methane emission from manure storage by up to 40%, but requires significant infrastructure investment (Miranda et al. 2015).⁵⁵

Improved fertilizer practices can also lead to a reduction in N₂O emissions (up to 50%, in one study in Saskatchewan; Ferland et al. 2024). Specifically, this entails optimizing the timing and rate of fertilizer delivery, adopting enhanced efficiency fertilizers with slower-releasing nitrogen, and rotating more nitrogen-fixing cover crops, such as vetch, alfalfa, and legumes. Without a clear inventory of current fertilizer practices in Saanich, it is challenging to estimate what emissions reductions might be possible. These practices may also not be financially feasible without additional incentivization. For example, increased cover crop rotations might reduce nitrous oxide emissions at the cost of reduced annual profits.

Land Use Change

Emissions from changes in land use are not modeled, because projections would require detailed information on biomass and soil carbon distributions, as well as future land-management decisions. Any estimates would carry substantial uncertainties.

References:

- Roque et al. 2021: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0247820>
- Roque et al. 2019: <https://www.sciencedirect.com/science/article/pii/S0959652619321559?via%3Dihub>
- Miranda et al. 2015: <https://pubs.acs.org/doi/10.1021/acs.est.5b00018>
- Thornton et al 2022: <https://docs.nrel.gov/docs/fy22osti/83525.pdf>
- Stathatou et al 2022: <https://pubs.rsc.org/en/content/articlelanding/2022/se/d1se01495a>
- IATA 2025: <https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet-sustainable-aviation-fuels/>
- CEMA 2022: https://www.cema-agri.org/images/publications/position-papers/CEMA_decarbonising_agriculture_27-04-22.pdf
- NRCAN 2025: <https://natural-resources.canada.ca/energy-efficiency/transportation-energy-efficiency/biodiesel/>
- Reid et al. 2020: <https://onlinelibrary.wiley.com/doi/full/10.1111/qcb.14883>
- IEA Bioenergy 2013: <https://www.ieabioenergy.com/wp-content/uploads/2013/10/Bioenergy-Land-Use-Change-and-Climate-Change-Mitigation-Background-Technical-Report.pdf> IEA Bioenergy 2013
- IEA Material Efficiency 2019: https://iea.blob.core.windows.net/assets/52cb5782-b6ed-4757-809f-928fd6c3384d/Material_Efficiency_in_Clean_Energy_Transitions.pdf
- Ferland et al. 2024: <https://www.sciencedirect.com/science/article/pii/S0048969724073686>
- Le et al. 2025: <https://www.sciencedirect.com/science/article/pii/S2589914725000271>

⁵⁵ Based on the carbon intensity of meat production, plant based diets will always be the more sustainable option, but it is very difficult to promote this switch.

6. Summary & Conclusion

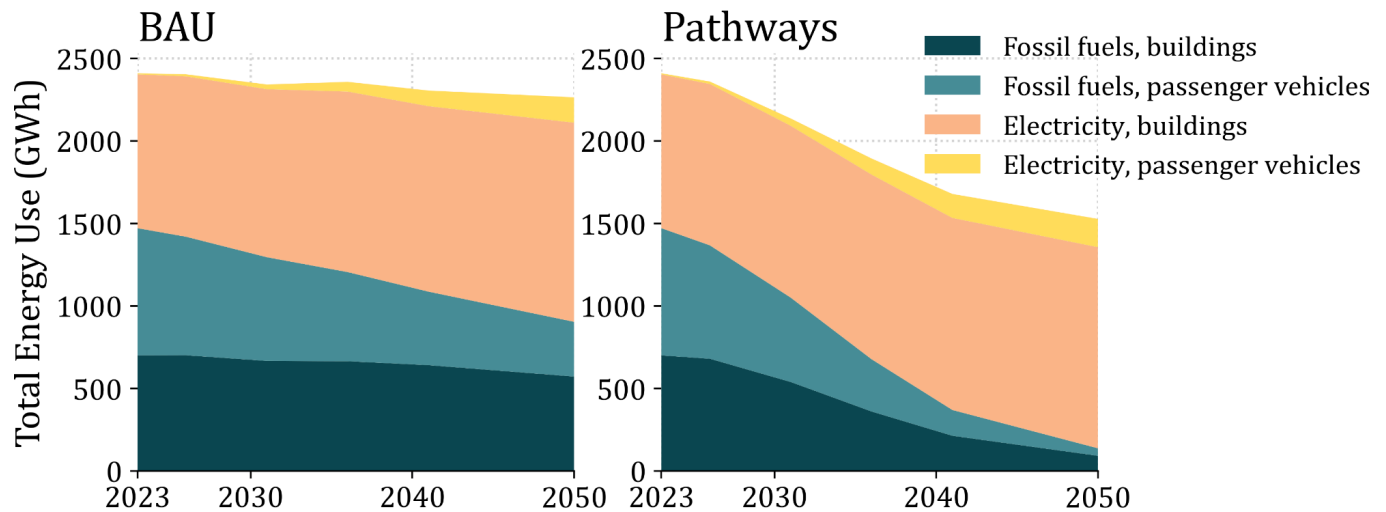


Figure 6.1. The results of the energy use forecast across only the core sectors for the BAU and Pathways scenarios.

This report presents a baseline state assessment and results of emissions forecasting across sectors in the District of Saanich. The District is a highly progressive community with a well defined OCP and Climate Plan, but additional work is required to increase progress towards climate targets.

For the passenger transportation sector, the OCP has already been defined to locate density in higher proximity areas, and to increase access to transit, but shifting travel behaviour is very *challenging* and, even in the best case VKT reduction, the majority of emissions reductions come from the Provincial ZEV Act. Continued effort to improve proximity and access to active transportation infrastructure should be taken, but it is also vital to ensure the appropriate access to EV charging infrastructure is available to support incoming demand. Collaborating with the Province and BC Hydro will be required, along with appropriate incentive structure design.

For buildings, the implementation of the Zero Carbon Step Code helps to control for new emissions from incoming increases in density, floor area and residential units. That said, there is still a substantial amount of emissions remaining for existing buildings, that will have to be targeted via retrofits. The Provincial HEES regulation will encourage both efficiency upgrades and switching away from fossil fuels in nearly $\frac{1}{3}$ of all buildings, and produces up to a quarter of all

emissions reduction for buildings in the high-ambition Pathways scenario, assuming that only 10% of HEES regulated equipment turnover goes to dual fuel systems. As mentioned earlier, introduction of more dual fuel systems will reduce the progress to emissions targets.

Across both buildings and transportations sectors, progress to emissions reductions is highly dependent on Provincial policy; the Light Duty ZEV Act and the HEES in particular. CleanBC is currently undergoing review and these policies are at risk, especially based on push back from industry. Continued advocacy to the Province will therefore be paramount.

Across passenger transportation and buildings, energy use is decreasing in both the BAU and the Policy Pathways scenario (Figure 6.1). This is because of the high efficiency of electric vehicles; the amount of electricity required per vehicle is substantially less than the amount of fossil fuel. So, even in the BAU where the background rate of adoption excludes the ZEV Act, energy use goes down.

The other sectors outside of transportation and buildings see less progress towards climate targets. For most of these, the pathways to emissions reductions remains speculative and depends on technologies that are either unproven or prohibitively expensive. Even with advocacy work, the District has limited purview to reduce emissions in these sectors.

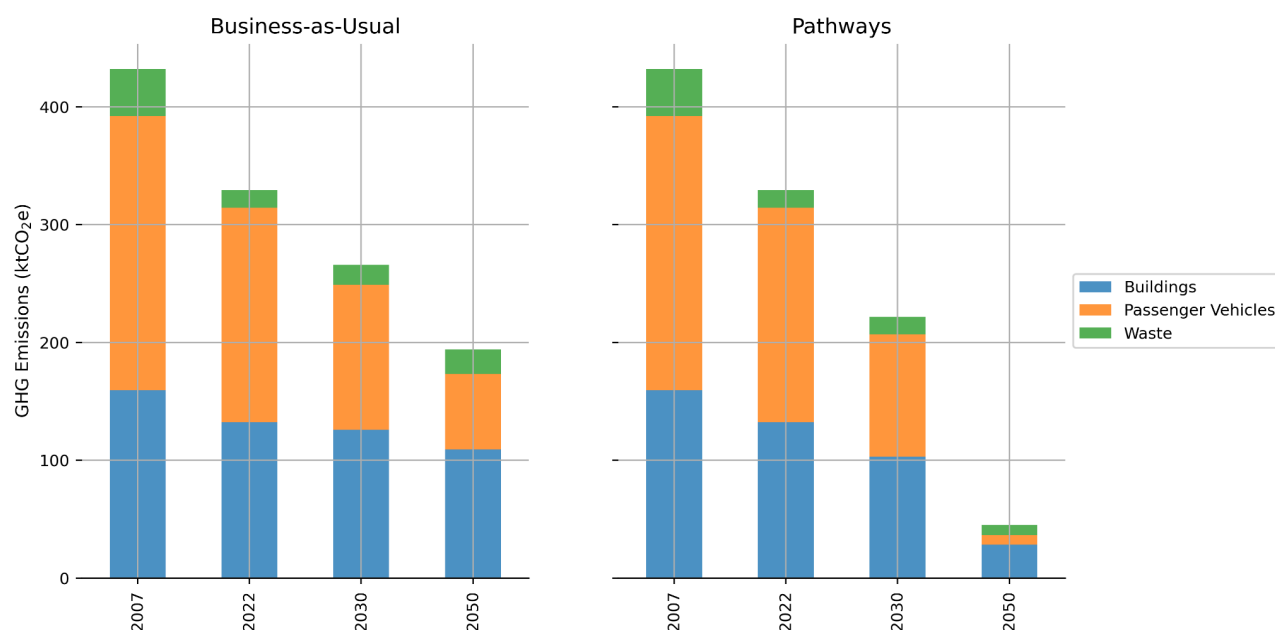


Figure 6.2. The results of the emissions forecast across only the core sectors for the BAU and Pathways scenarios.

As shown in Figure 6.2, the ambitious policy scenario gets us to 49% and 89% reduction (by 2030 and 2050, respectively) and more work is required by the District and all other sectors to develop actions to meet the remainder of reductions. This should not be discouraging; but rather

a call to action. Sectors with feasible pathways to emissions reduction (transportation and buildings) still require substantial policy implementation, capacity building, education, and collaboration with key stakeholders, and the District of Saanich plays a vital role in ensuring that this happens. Further progress to reduction may be supported by global technological and economic innovation, but shared political will and action at the municipal, provincial, and federal levels in Canada encompass the largest opportunities for emissions mitigation.

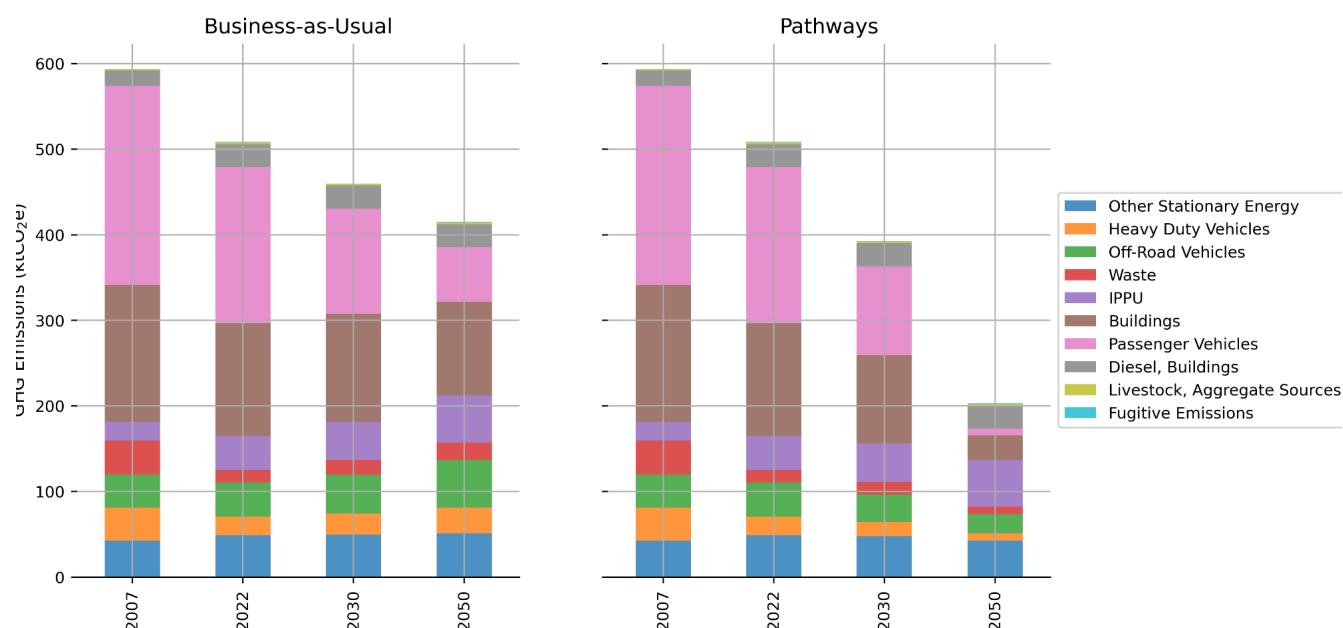


Figure 6.3. The results of the emissions forecast across all sectors for the BAU and Pathways scenarios.

Suggested Next Steps

Given the context of this project and the findings presented in this report, we have identified several potential next steps that can extend this project, refine modeling or provide additional policy support to Saanich over the coming years. These are presented below:

- Co-planning with Saanich utilities, transportation and energy utilities.** Saanich Planning and BC Transit have shared and discussed predicted future densities, but ongoing integration should be discussed (note that CRD is also considering a regional transportation strategy). BC Hydro is undergoing a parallel study to use the forecast for grid capacity assessment. Further efforts to integrate Fortis into energy planning for the community could prove highly beneficial. For instance, future RNG use should be considered exclusively for difficult to decarbonize sectors.
- Cost assessment and incentive design** should be modeled in future iterations of this work, since an estimate of the amount of incoming equipment is included in the data. Further, it may be beneficial to develop a cost-responsive econometric model which

would be responsive to individual policy levers as well as broader economic trends and inputs.

- **Assessment and forecasting of demographic and other geographic attributes to inform localized policy design** should be incorporated into future iterations of this work. Specifically, urban design should be explored in more detail as a method by which emissions can be reduced at a highly localized level. Other localized levers that should be explored could include provision of micro-mobility services, virtual power plants, localized energy productions and thermal energy networks.
- **Re-assessment of progress to targets to reflect updates to CleanBC policies as well as federal policies** will be very important as the National / Provincial policy landscape is shifting on a rapid basis.
- **Sensitivity analysis on the land use forecast results** - especially regarding the future population and employment targets.
- **Building cooling uptake** should be modelled in future versions, to capture the impact on energy use.

Appendix 1 - Other Key Building Indicators

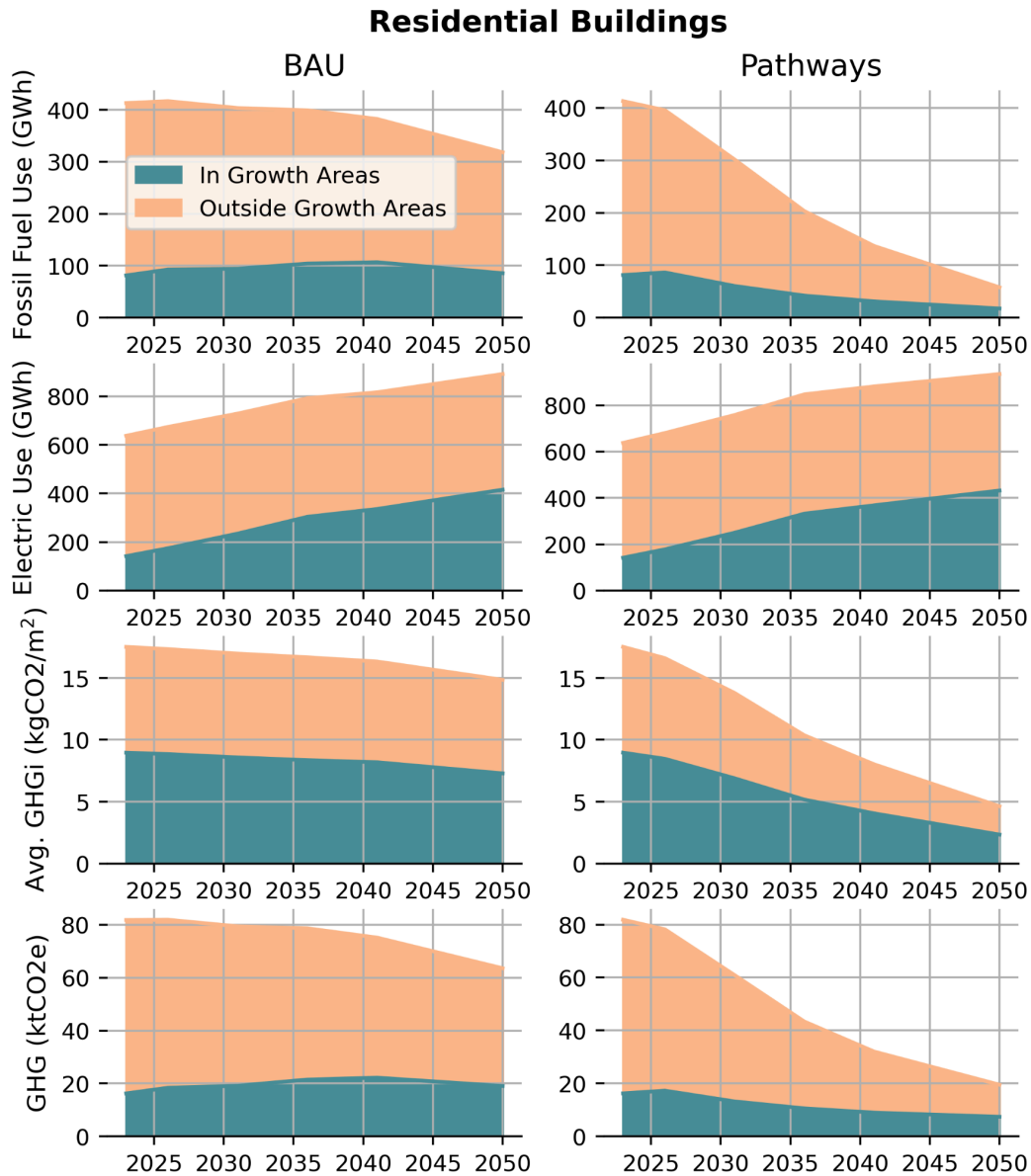


Figure A1.1. Key indicators across energy use, emissions intensity, and total emissions for Residential buildings, divided between parcels inside and outside of Growth Areas. Left column shows the BAU scenario results, and the right column shows the Pathways scenario results. For additional indicators, see the land use and floor area summaries above.

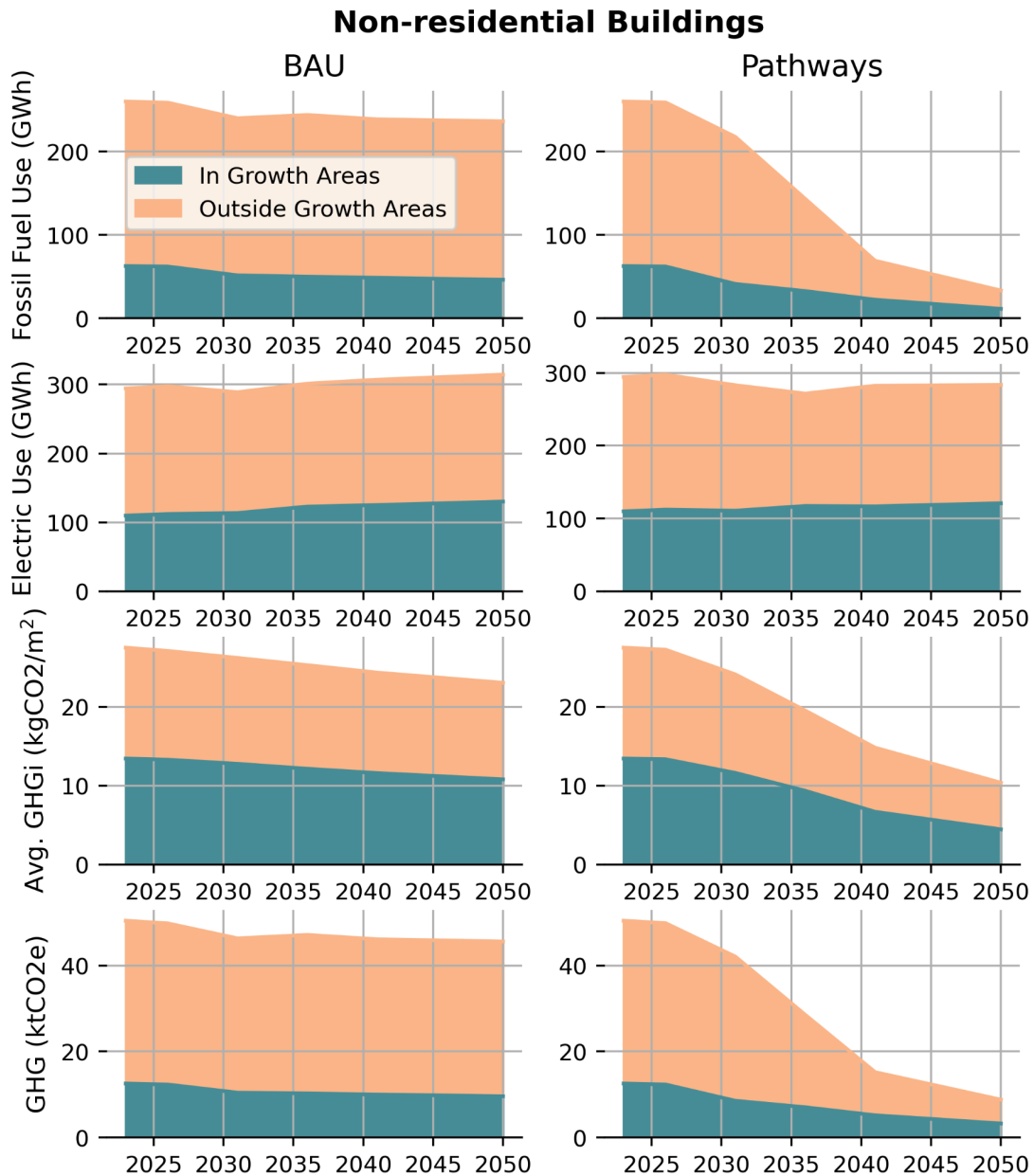


Figure A1.2. Key indicators across energy use, emissions intensity, and total emissions for Non-residential buildings, divided between parcels inside and outside of Growth Areas. The left column shows the BAU scenario results, and the right column shows the Pathways scenario results. For additional indicators, see the land use and floor area summaries above.

See also the Buildings Supplementary Data Sheets “Fuel Energy Use by Growth Area” and “Fuel Emissions by Growth Area” for data associated with the above figures.

Appendix 2 - Building Policy Interactions

This section provides some additional insight into how much of a policy's impact may be by “masked” in the Overlapping Policies reported in [Policy Impacts on Top-Line Emissions](#).

The charts below summarize policy interactions in the Pathways scenario as percentage values, over the entire study period. The top chart shows where policies overlap as a percentage of *all* parcels in Saanich, and gives a picture of the overall amount of parcels impacted by a given policy or pair of policies. The bottom chart shows, for a parcel impacted by a given policy, how often other policies act simultaneously (“act” means that a building has been impacted by a given policy).

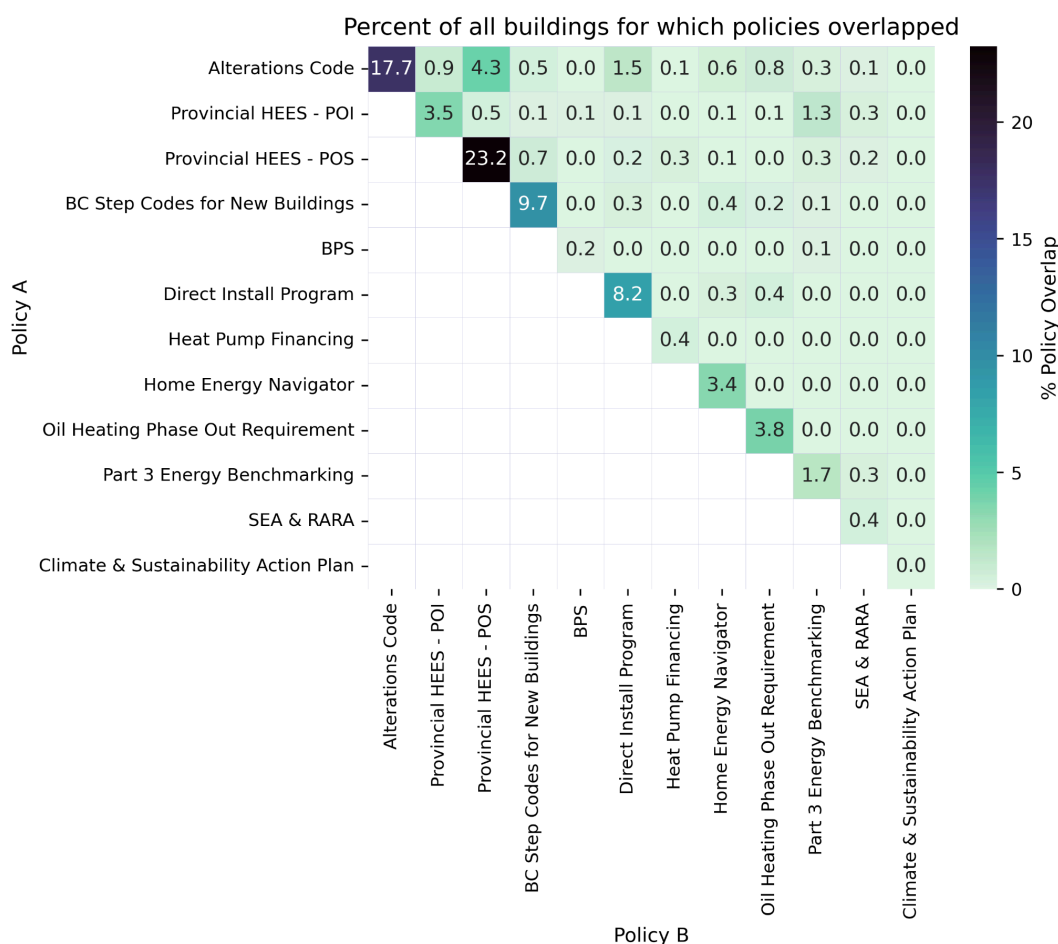


Figure A2.1. Policy interactions as a percentage of all parcels in Saanich in 2050. The main diagonal (Policy A on the left = Policy B on the bottom) shows the percentage of all parcels for which the corresponding policy was applied over the study period. Off the main diagonal (numbers in the top right of the chart), values give the percentage of all parcels which were impacted by both Policy A and Policy B.

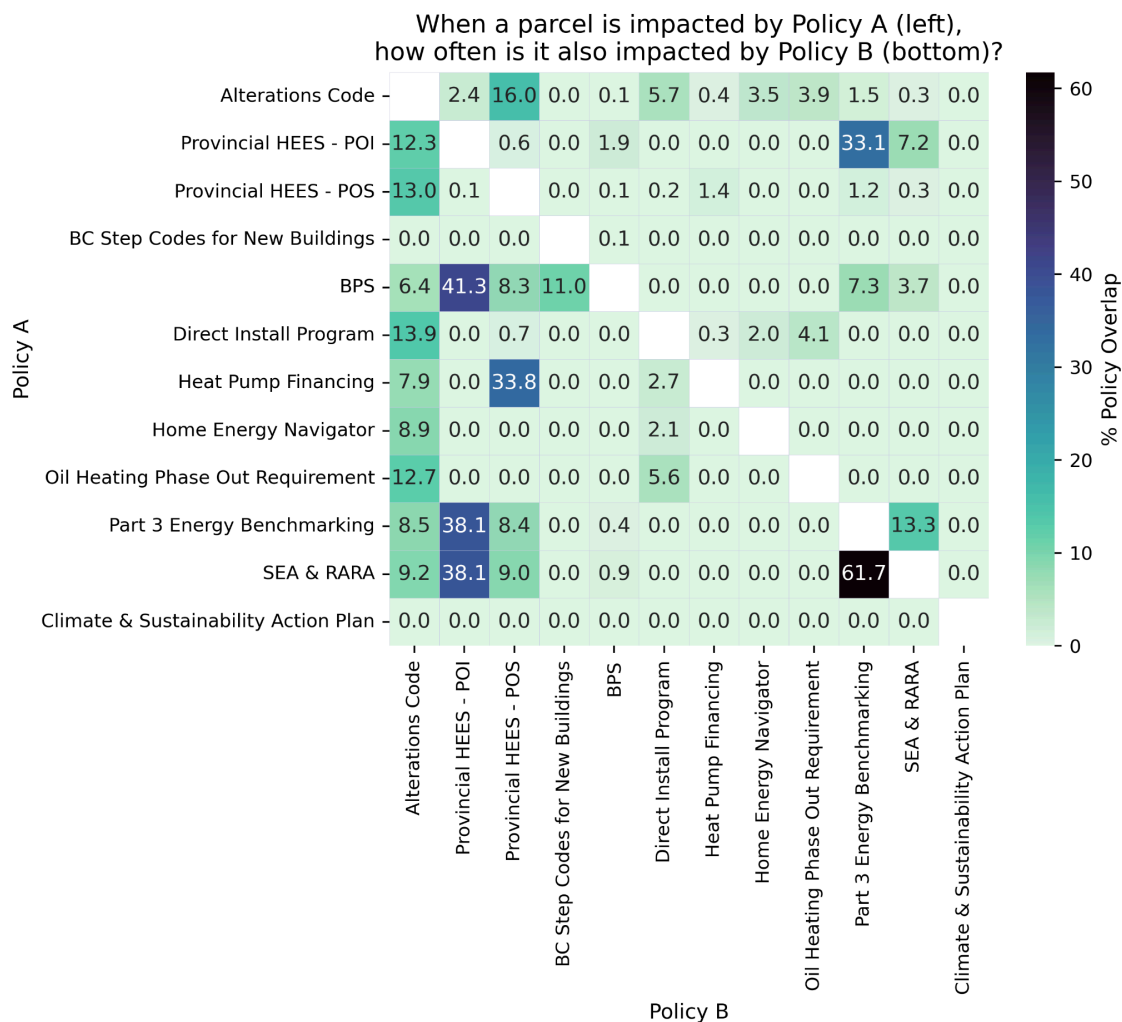


Figure A2.2. Policy interactions, as a breakdown for each policy. Read this chart as follows: for a given Policy A on the left, values show how often other policies (Policy B on the bottom) are also present, as a percentage of all cases where Policy A is acting. E.g. reading from the top row, for buildings impacted by the Alterations Code, Provincial HEES has also impacted those same buildings 19.9% of the time.

Appendix 3 - BC Step Codes: Parcel Counts and Floor Areas

Table A3.1. Total Saanich parcel counts by archetype and year (left), and total parcels impacted by BC Zero Carbon Step Codes (right).

Archetype	Total Parcel Count						Step Code Impacted Parcel Count				
	2023	2026	2031	2036	2041	2050	2026	2031	2036	2041	2050
Education	68	68	68	68	68	68	0	0	0	0	0
Government	15	15	15	15	14	14	0	0	0	0	0
Healthcare & Other Institutional	16	16	16	16	16	16	0	0	0	1	1
Industrial & Farm	304	304	304	304	304	304	1	2	10	15	20
MURB Condo	161	183	233	295	319	365	9	60	123	146	192
MURB Rental	70	72	73	73	73	74	2	6	6	6	7
Office	109	109	109	108	109	109	2	2	10	12	18
Other Commercial	678	678	678	678	678	678	3	20	30	37	54
Retail	206	206	206	210	211	211	1	10	20	28	46
Single Family Attached	8118	8360	8702	8979	9086	9302	193	553	870	1019	1320
Single Family Detached	21429	21152	20606	20098	19861	19412	171	438	700	967	1401
TOTAL	31174	31163	31010	30844	30739	30553	382	1091	1769	2231	3059

Table A3.1. Total Saanich floor area by archetype and year (left), and total floor area impacted by BC Zero Carbon Step Codes (right).

Archetype	Total Building Floor Area (millions sqft)						Step Code Impacted Floor Area (millions sqft)				
	2023	2026	2031	2036	2041	2050	2026	2031	2036	2041	2050
Education	13.47	13.48	13.52	13.55	13.58	13.6	0	0	0	0	0
Government	0.44	0.46	0.46	0.46	0.43	0.43	0	0	0	0	0
Healthcare & Other Institutional	1.36	1.42	1.53	1.7	1.85	1.97	0	0	0	0.15	0.18
Industrial & Farm	3.14	3.22	3.28	3.33	3.37	3.39	0.01	0.01	0.12	0.13	0.16
MURB Condo	5.94	9.08	12.82	16.78	19.13	23.63	1.19	4.99	8.95	11.3	15.8
MURB Rental	2.52	2.71	2.9	2.9	2.9	2.93	0.17	0.45	0.45	0.45	0.48
Office	2.19	2.29	2.38	2.67	2.72	2.78	0.01	0.01	0.4	0.44	0.53
Other Commercial	4.68	4.68	4.68	4.68	4.68	4.68	0.01	0.2	0.24	0.29	0.34
Retail	4.75	4.81	4.89	5.13	5.2	5.33	0.08	1.06	1.39	1.57	2.32
Single Family Attached	25.28	27.69	32.08	37.12	39.43	43.68	1.89	6.31	11.43	13.83	18.32
Single Family Detached	51.77	51.16	50.03	49.02	48.55	47.62	0.38	1	1.63	2.26	3.3
TOTAL	115.56	120.99	128.57	137.32	141.84	150.05	3.74	14.03	24.6	30.42	41.43

Appendix 4 - Comparison to Introba Retrofit Report Results

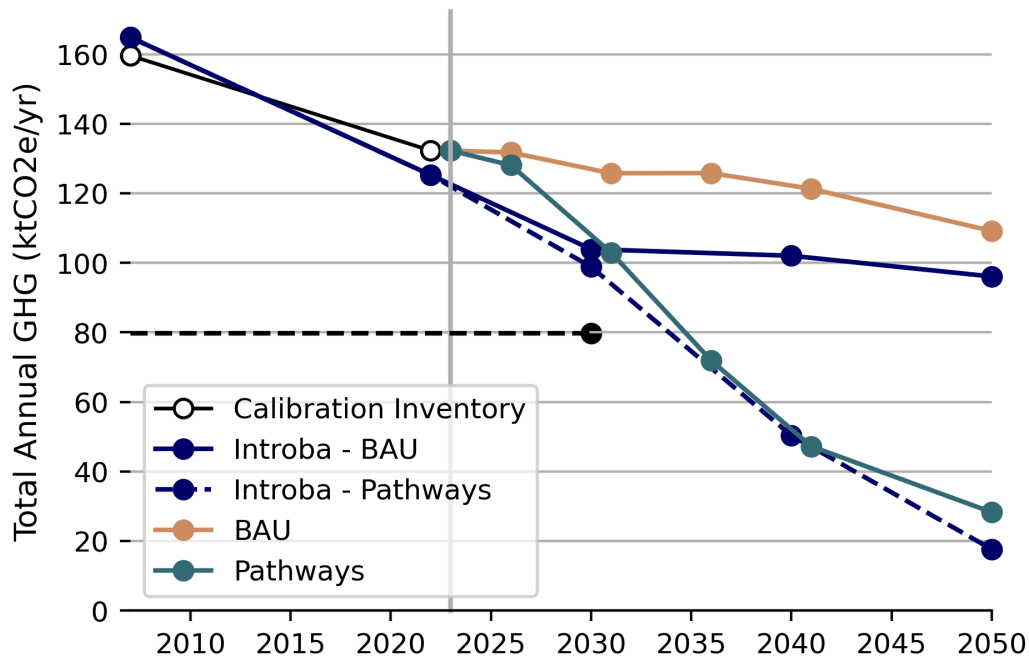


Figure A4.1. Comparison of core scenario results against results from previous Introba scenario forecasts.

In general, the geospatialized nature of the model, updated emissions inventory, and redefined or updated policy assumptions will necessarily create differences between the previous forecast and that in the present report. Nevertheless, our results broadly align well with trends in the Building Retrofit Report. The difference between the BAU scenarios is significantly larger than that for Pathways. Our process and results differ in the following key ways:

- Distinct land use scenario and redevelopment rates
- Higher starting baseline - 132 ktCO₂e (this report) vs. 125 ktCO₂e (Introba)
- The current report does not include forecasted use of RNG for buildings, because it is a limited resource with controversial carbon reductions
- Inclusion of heating degree day corrections
- Various minor differences in modelled policy definitions