Town of CANMORE

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Climate Emergency Action Plan

Data, Methods, and Assumptions Manual for Mitigation Modelling

March 2024

Purpose of This Document

This Data, Methods, and Assumptions (DMA) Manual details the modelling approach used to provide community energy and emissions benchmarks and projections while providing a summary of the data and assumptions used in scenario modelling. The DMA makes the modelling elements fully transparent and illustrates the scope of data required for future modelling efforts.

Contents

Glossary

BAU	Business-as-Usual
BAP	Business-as-Planned
CBECS	Commercial Buildings Energy Consumption Survey
DMA	Data, Methods, and Assumptions Manual
EUI	Energy use intensity
GHG	Greenhouse gas
GIS	Geographic information systems
GPC	Global Protocol on Community-Scale GHG Emissions Inventories
LC	Low-carbon
IPCC	Intergovernmental Panel on Climate Change
VKT	Vehicle kilometres travelled

Accounting and Reporting Principles

The municipal greenhouse gas (GHG) inventory base year development and the scenario modelling approach correlate with the Global Protocol for Community-Scale GHG Emissions Inventories (GPC).[1] The GPC provides a fair and true account of emissions via the following principles:

Relevance: The reported GHG emissions appropriately reflect emissions occurring as a result of activities and consumption within the town boundary. The inventory will also serve the decision-making needs of the Town, taking into consideration relevant local, provincial, and national regulations. Relevance applies when selecting data sources and determining and prioritizing data collection improvements.

Completeness: All emissions sources within the inventory boundary shall be accounted for and any exclusions of sources shall be justified and explained.

Consistency: Emissions calculations shall be consistent in approach, boundary, and methodology.

Transparency: Activity data, emissions sources, emissions factors, and accounting methodologies require adequate documentation and disclosure to enable verification.

Accuracy: The calculation of GHG emissions should not systematically overstate or understate actual GHG emissions. Accuracy should be enough to give decision-makers and the public reasonable assurance of the integrity of the reported information. Uncertainties in the quantification process should be reduced to the extent possible and practical.

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[1] WRI, C40 and ICLEI (2014). Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories. Retrieved from: https://ghgprotocol.org/sites/default/files/standards/GHGP_GPC_0.pdf.

Scope

Geographic Boundary

Energy and emissions inventories and modelling for the project will be completed for the Town of Canmore's current boundary (Figure 1). The land-use and density targets modelled will be in line with what is identified in Canmore's Utility Master Plan and Offsite Levy Projections.

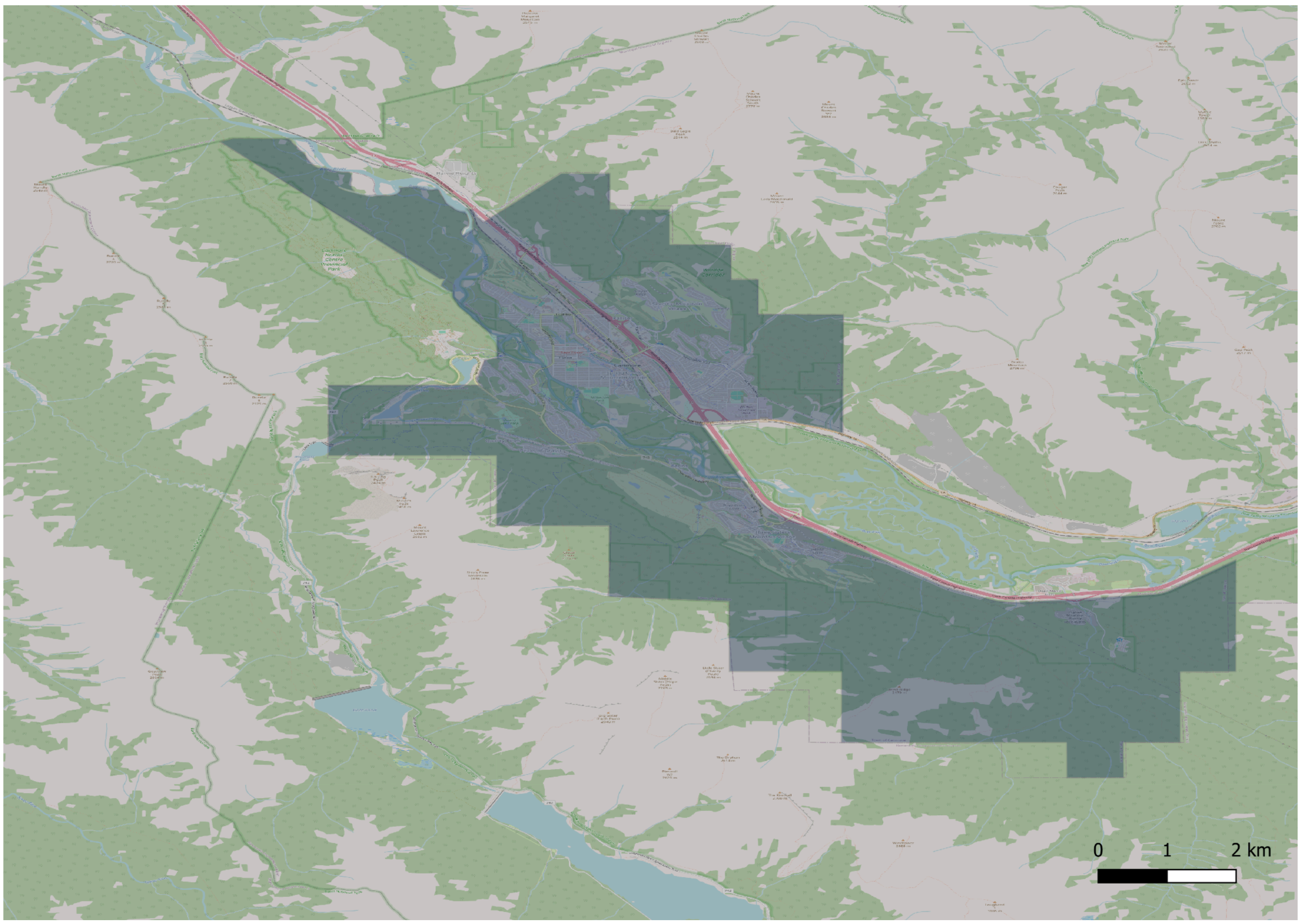

Figure 1. Geographical boundary for the town of Canmore.

Time Frame of Assessment

The model being developed is a time-bound model with the following parameters and rationale:

- The assessment will cover the years from 2022 to 2050.
- The year 2022 will be used as the base year within the model. The rationale for using this as the base year is that:
    - The model requires the calibration of a base-year system state (initial conditions) using as much observed data as possible in order to develop an internally consistent snapshot of the city, and
    - A key data source for the model is census data. At the time of modelling, 2021 is the most recent census year for which data is available.
- One-year increments are modelled from the 2022 base year. The first simulation period/year is 2023. This allowed the Town to use some of the most recent data available while still leveraging census data.
- Projections will extend to 2050.

Energy and Emissions Structure

The total energy for a community is defined as the sum of the energy from each of the aspects:

$$Energy_{community} = Energy_{transport} + Energy_{buildings}$$

Where:

$Energy_{transport}$ is the movement of goods and people.
$Energy_{buildings}$ is the generation of heating, cooling, and electricity.

The total GHG emissions for a community is defined as the sum of all in-scope emissions sources:

$$GHG_{landuse} = GHG_{transport} + GHG_{energygen} + GHG_{waste\&wastewate}$$

Where:

$GHG_{transport}$ is emissions generated by the movement of goods and people.
$GHG_{energygen}$ is emissions generated by the generation of heat and electricity.
$GHG_{waste\&wastewater}$ is emissions generated by solid and liquid waste produced.

Emissions Scope

The inventory will include emissions Scopes 1 and 2 and some aspects of Scope 3, as defined by GPC (Table 1 and Figure 2). Refer to Appendix 1 of this DMA for a list of included GHG emissions sources by scope.

Table 1. GPC scope definitions.

Scope	Definition
1	All GHG emissions from sources located within the municipal boundary.
2	All GHG emissions occurring from the use of grid-supplied electricity, heat, steam, and/or cooling within the municipal boundary.
3	All other GHG emissions that occur outside the municipal boundary as a result of activities taking place within the boundary.

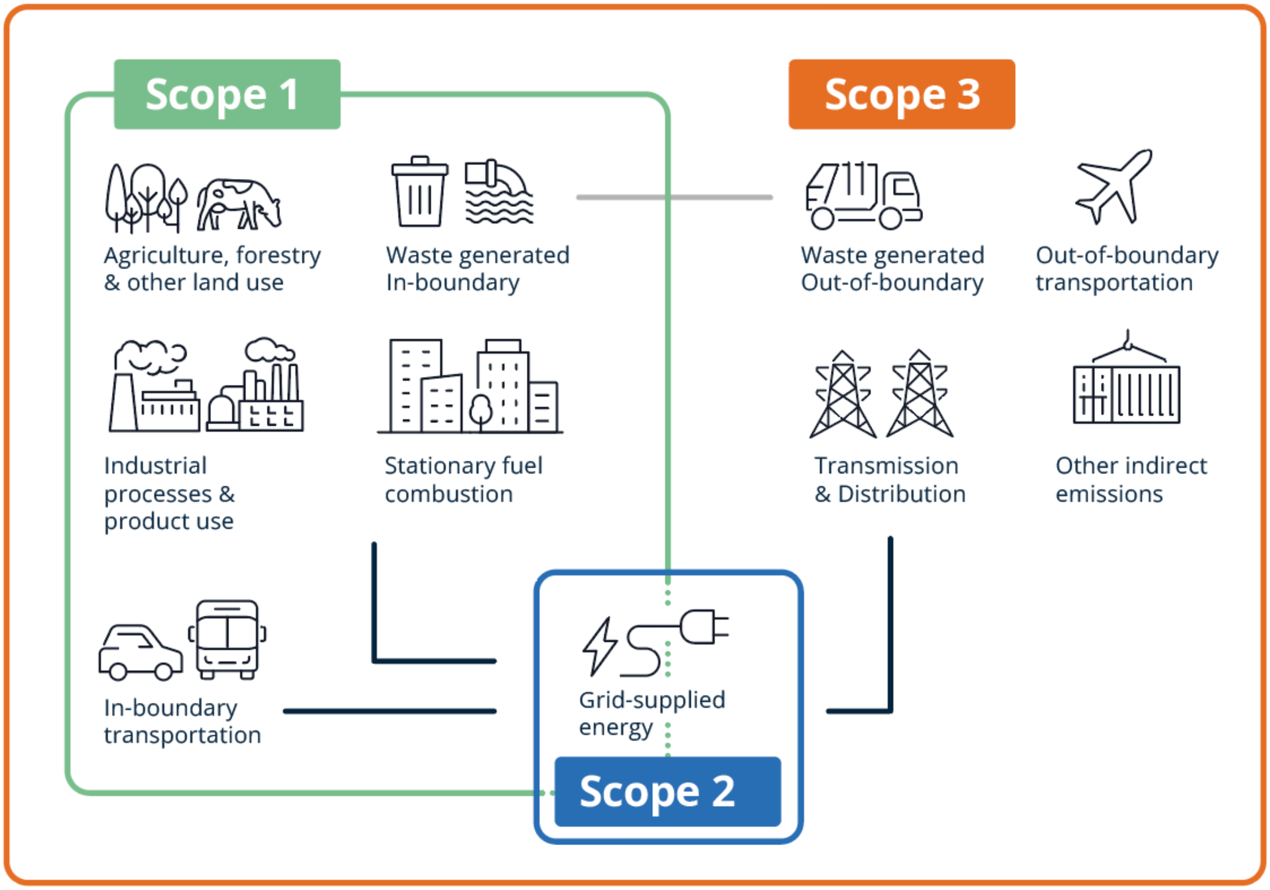

Figure 2. Diagram of GPC emissions scopes.

The Model

The model is an energy, emissions, and finance tool developed by Sustainability Solutions Group. The model integrates fuels, sectors, and land use in order to enable bottom-up accounting for energy supply and demand, including:

- Renewable resources;
- Conventional fuels;
- Energy-consuming technology stocks (e.g., vehicles, appliances, dwellings, buildings); and
- All intermediate energy flows (e.g., electricity and heat).

Energy and GHG emissions values are derived from a series of connected stock and flow models, evolving based on current and future geographic and technologic decisions/assumptions (e.g., EV uptake rates). The model accounts for physical flows (e.g., energy use, new vehicles by technology, vehicle kilometres travelled [VKT]) as determined by stocks (buildings, vehicles, heating equipment, etc.).

The model applies a system dynamics approach. For any given year, the model traces the flows and transformations of energy from sources through energy currencies (e.g., gasoline, electricity, hydrogen) to end uses (e.g., personal vehicle use, space heating) to energy costs and to GHG emissions. An energy balance is achieved by accounting for efficiencies, technology conversion, and trade and losses at each stage in the journey from source to end use. Table 2 describes in detail the model characteristics

Table 2. Model characteristics.

Characteristic	Rationale
Integrated	The tool models and accounts for all town-scale energy and emissions in relevant sectors and captures relationships between sectors. The demand for energy services is modelled independently of the fuels and technologies that provide the energy services. This decoupling enables exploration of fuel-switching scenarios. Feasible scenarios are established when energy demand and supply are balanced.
Scenario-based	Once calibrated with historical data, the model enables the creation of dozens of scenarios to explore different possible futures. Each scenario can consist of either one or a combination of policies, actions, and strategies. Historical calibration ensures that scenario projections are rooted in observed data.

Characteristic	Rationale
Spatial	Built environment configuration determines walkability and cyclability, accessibility to transit, feasibility of district energy, etc. Therefore, the model includes spatial dimensions that can include as many zones (the smallest areas of geographic analysis) as deemed appropriate. The spatial components can be integrated with geographic information systems (GIS), land-use projections, and transportation modelling.
GPC-compliant	The model is designed to report emissions according to the GPC framework and principles.
Economic impacts	The model incorporates a high-level financial analysis of costs related to energy (expenditures on energy) and emissions (carbon pricing, social cost of carbon), as well as operating and capital costs for policies, strategies, and actions. This allows for the generation of marginal abatement costs.

Model Structure

The major components of the model and the first level of their modelled relationships (influences) are represented by the blue arrows in Figure 3. Additional relationships may be modelled by modifying inputs and assumptions specified directly by users or in an automated fashion by code or scripts running "on top of" the base model structure. Feedback relationships are also possible, such as increasing the adoption rate of non-emitting vehicles in order to meet a GHG emissions constraint.

The model is spatially explicit. All buildings, transportation, and land-use data are tracked within the model through a GIS platform and by varying degrees of spatial resolution. A zone-type system is applied to divide the town into smaller configurations, based on its existing neighbourhood zones. This enables consideration of the impact of land-use patterns and urban form on energy use and emissions production from a base year to future dates using GIS-based platforms. The model's GIS outputs will be integrated with the Town's mapping systems.

For any given year, various factors shape the picture of energy and emissions flows, including the population and the energy services it requires, commercial floorspace, energy production and trade, the deployed technologies that deliver energy services (service technologies), and the deployed technologies that transform energy sources to currencies (harvesting technologies). The model is based on an explicit mathematical relationship between these factors—some contextual and some part of the energy consuming or producing infrastructure—and the energy flow picture.

Some factors are modelled as stocks—counts of similar things classified by various properties. For example, population is modelled as a stock of people classified by age and gender. Population change over time is projected by accounting for the natural aging process, inflows (births, immigration), and outflows (deaths, emigration). The fleet of personal-use vehicles, an example of a service technology, is modelled as a stock of vehicles classified by size, engine type, and model year, with a similarly classified fuel consumption intensity. As with population, projecting change in the vehicle stock involves aging vehicles and accounting for major inflows (new vehicle sales) and major outflows (vehicle discards). This stock-turnover approach is applied to other service technologies (e.g., furnaces, water heaters) and harvesting technologies (e.g., electricity generating capacity).

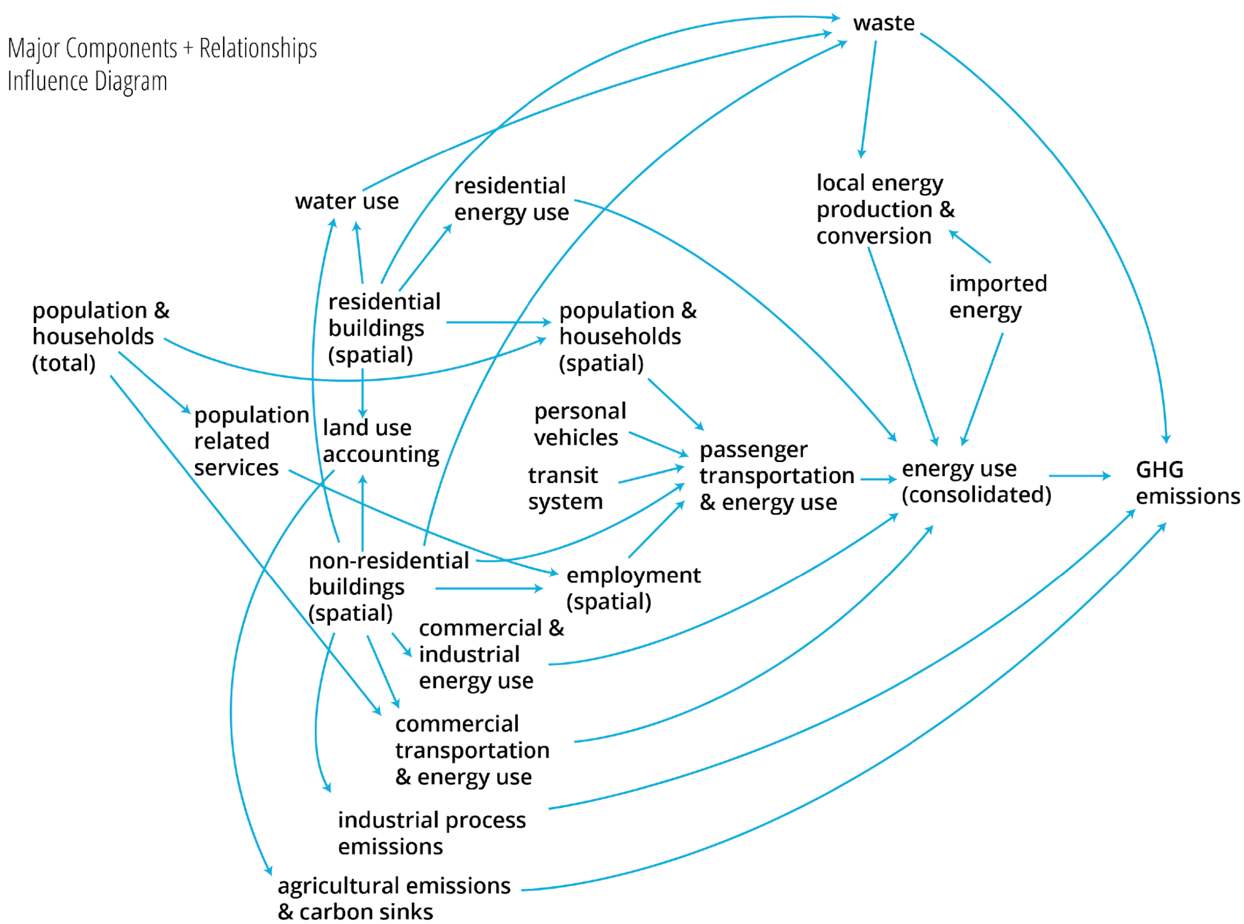

Figure 3. Representation of the energy and emission model structure.

Sub-Models

Population and Demographics

Town-wide population is modelled using the standard population cohort-survival method, disaggregated by single year of age and gender. It accounts for typical components of change: births, deaths, immigration, and emigration. The age-structured population is important for analyzing demographic trends, generational differences, and implications for shifting energy-use patterns. These numbers are calibrated against existing projections.

Residential Buildings

Residential buildings are spatially located and classified using a detailed set of building archetypes (see Appendix 2) capturing floorspace and type (single, double, row, apt. high, apt. low) and year of construction. This enables a “box” model of buildings that helps to estimate the surface area, model energy use, and simulate the impact of energy efficiency measures based on what we know about the characteristics of the building. Coupled with thermal envelope performance and degree-days, the model calculates space conditioning energy demand independent of any space heating or cooling technology and fuel. Energy service demand then drives stock levels of key service technologies, including heating systems, air conditioners, and water heaters. These stocks are modelled with a stock-turnover approach, which captures equipment age, retirements, and additions, exposing opportunities for efficiency gains and fuel switching but also showing the rate limits to new technology adoption and the effects of lock-in (obligation to use equipment/infrastructure/fuel type due to longevity of the system implemented). Residential building archetypes are also characterized by the number of contained dwelling units, allowing the model to capture the energy effects of shared walls but also the urban form and transportation implications of population density.

Non-Residential Buildings

These are spatially located and classified by a detailed use-/purpose-based set of archetypes. The floorspace of these archetypes can vary by location. Non-residential floorspace produces demand for energy and provides an anchor point for locating employment of various types.

Spatial Population and Employment

Town-wide population is made spatial through allocation to dwellings, using assumptions about persons per unit by dwelling type. Spatial employment is projected via two separate mechanisms:

- Population-related services and employment, which are allocated to corresponding building floorspace (e.g., teachers to school floorspace), and
- Floorspace-driven employment (e.g., retail employees per square foot).

Passenger Transportation

The model includes a spatially explicit passenger transportation sub-model that responds to changes in land use, transit infrastructure, vehicle technology, travel behaviour, etc. Trips are divided into four types (home-work, home-school, home-other, and non-home-based), each produced and attracted by different combinations of spatial drivers (population, employment, classrooms, non-residential floorspace). Trips are distributed and trip volumes are specified for each zone of origin and zone of destination pair. For each origin-destination pair, trips are shared over walk/bike (for trips within the walkable distance threshold), public transit (for trips whose origin and destination are serviced by transit), and automobile. A projection of total personal vehicle kilometres travelled and a network distance matrix are produced following the mode-share calculation. The energy use and emissions associated with personal vehicles are calculated by assigning VKT to a stock-turnover personal vehicle model. The GPC induced-activity approach is used to account for emissions. This approach accounts for all internal trips (within boundary), as well as half of the trips that terminate or originate within the town boundary. This approach allows the Town to understand its transportation impacts on its peripheries and the region. Figure 4 displays trip destination matrix conceptualization.

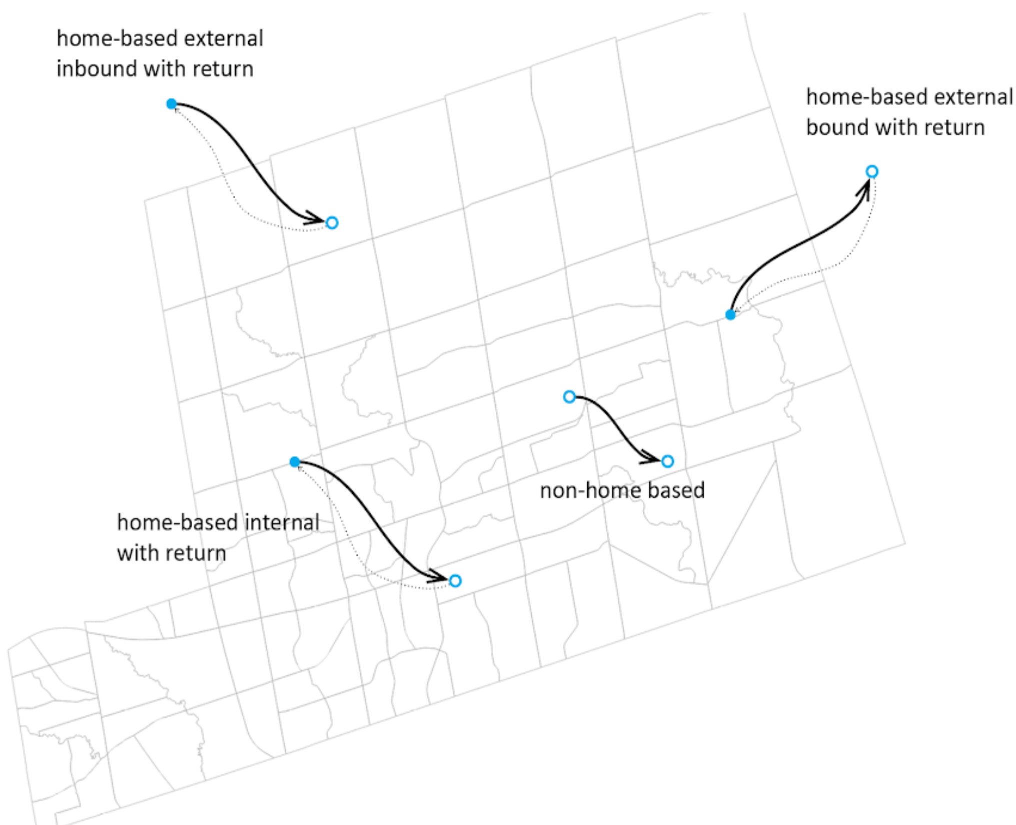

Figure 4. Conceptual diagram of trip categories.

Energy Flow and Local Energy Production

Energy produced from primary sources (e.g., solar, wind) is modelled alongside energy converted from imported fuels (e.g., electricity generation, district energy). As with the transportation sub-model, the district energy supply model has an explicit spatial dimension and can represent areas served by district energy networks.

Waste

Households and non-residential buildings generate solid waste and wastewater, and the model traces various pathways to disposal, compost, and sludge. If present in the town, the model can also capture energy recovery from incineration and biogas. Waste generation is translated to landfill emissions based on first-order decay models of carbon to methane.

Finance and Employment

Energy-related financial flows and employment impacts are captured through an additional layer of model logic (not shown explicitly in Figure 2). Calculated financial flows include the capital, operating, and maintenance costs of energy-consuming stocks and energy-producing stocks, including fuel costs. Employment related to the construction of new buildings and energy infrastructure and the performance of retrofit activities is modelled. The financial impact on businesses and households of implementing the strategies is assessed. Local economic multipliers are also applied to investments.

Data Request and Collection

Local data was supplied by the Town. Assumptions were identified to supplement any gaps in observed data. The data and assumptions were applied in modelling per the process described below.

Zone System

The model is spatially explicit and operates on a zone system based on Canmore's informal neighbourhood boundaries (see purple boundaries in Figure 5). Population and employment and residential and non-residential floorspace are allocated and tracked spatially, and these elements drive stationary energy demand. The passenger transportation sub-model is also tracked within this zone system and drives transportation energy demand.

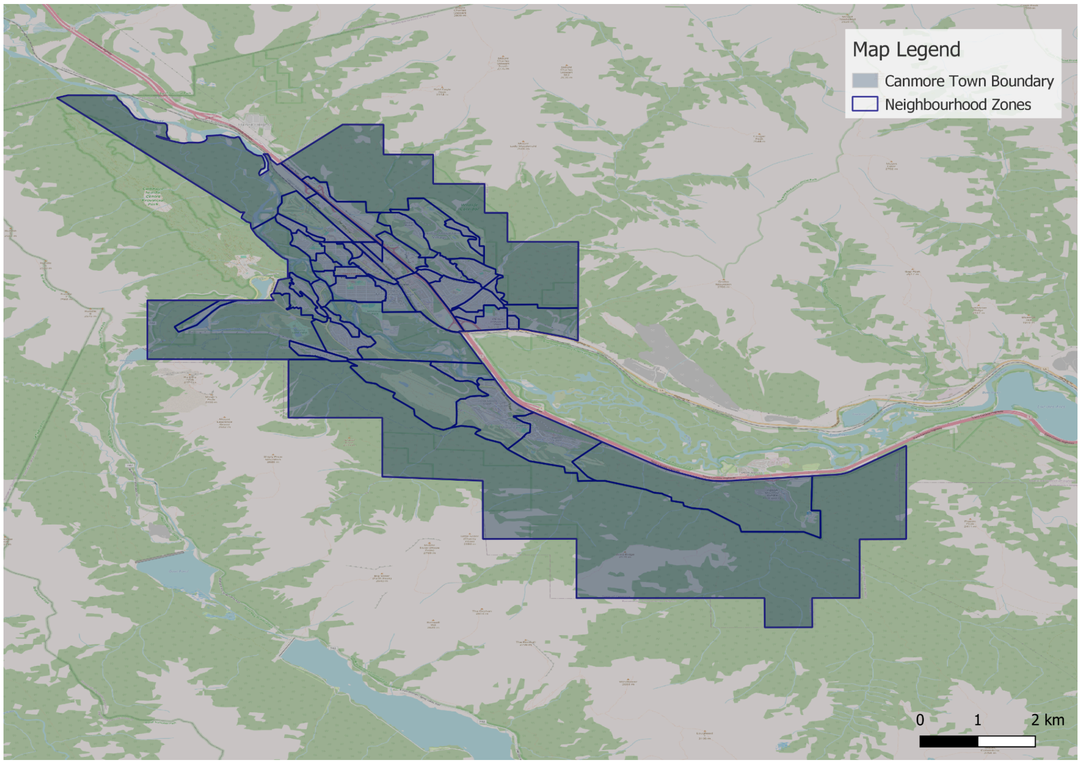

Figure 5. Zone systems used in modelling.

Buildings

Buildings data, including building type, building footprint area, number of stories, total floorspace area, number of units, and year built, was sourced from the Town of Canmore's property assessment data. Buildings were allocated to specific zones using their spatial attributes and based on the zone system. Buildings are classified using a detailed set of building archetypes (see Appendix 2).

Residential Buildings

The model multiplies the residential building surface area by an estimated thermal conductance (heat flow per unit surface area per degree-day) and the number of degree-days (heating and cooling) to derive the energy transferred out of the building during winter months and into the building during summer months. The energy transferred through the building envelope, the solar gain through the building windows, and the heat gains from equipment inside the building constitute the space conditioning load to be provided by the heat systems and the air conditioning. The initial thermal conductance estimate is a regional average by dwelling type and year built from the Office of Energy Efficiency, Natural Resources Canada. This initial estimate is adjusted through the calibration process such that the modelled energy consumption in the residential sector aligns with the target energy use. The calibration target for residential building energy use is the consumption data provided by the local natural gas and electricity utilities in the base year.

Non-Residential Buildings

The model calculates the space-conditioning load as it does for residential buildings, with two distinctions: the thermal conductance parameter for non-residential buildings is based on floorspace area instead of surface area, and it incorporates data from the Town of Canmore.

Starting values for output energy intensities and equipment efficiencies for non-residential end uses are taken from Natural Resources Canada's Comprehensive Energy Use Database, for Alberta. All parameter estimates are further adjusted during the calibration process. The calibration target for non-residential building energy use is the observed commercial and industrial fuel consumption in the base year.

Using assumptions for thermal envelope performance for each building type, the model calculates total energy demand for all buildings, independent of any space heating or cooling technology and fuel.

Population and Employment

Federal census population and employment data were spatially allocated to residential (population) and non-residential (employment) buildings. It is recognized that second homeowners may not be fully captured in the census data; however, for the purposes of this modelling exercise, this is acceptable. Emissions are driven by the town's total energy consumption and waste generation, which includes the contributions from both permanent residents and second homeowners alike. Indicators, such as emissions per household, are derived from this data and this drives the Business-as-Usual (BAU) energy and emissions projections.

Population for 2022 was spatially allocated to residential buildings using initial assumptions about persons per unit (PPU) by dwelling type. These initial PPUs were then adjusted so the total population in the model (which is driven by the number of residential units by type multiplied by PPU by type) matches the total population from census/regional data.

Employment for 2022 was spatially allocated to non-residential buildings using initial assumptions for two main categories: population-related services and employment allocated to corresponding building floorspace (e.g., teachers to school floorspace) and floorspace-driven employment (e.g., retail employees per square foot). Like population, these initial ratios were adjusted within the model so the total employment derived by the model matches the total employment from census/regional data.

Transportation

The passenger transportation model is anchored with origin-destination trip matrices by trip mode and purpose. Since Canmore has no formal transportation model, known trip generation rates from other Canadian municipalities were used as an initial starting point. These were then adjusted within the context of the town's zone system and other spatial drivers to meet indicators specific to the town, such as average annual VKT per vehicle and expected mode shares. Transit trips were spatially populated by considering where transit stops were located in the town boundary.

With Canmore being a visitor destination, the impact of visitor travel needed to be considered. Using traffic counts and hotel occupancy rates helped to estimate the single- and multi-day visitor population to account for visitor trips.

For medium- and heavy-duty commercial vehicle transportation, the ratio of local retail diesel fuel sales to provincial retail diesel fuel sales was applied to estimate non-retail diesel use.

The modelled stock of personal vehicles by size, fuel type, efficiency, and vintage was informed by regional vehicle registration statistics. The total number of personal-use and corporate vehicles is proportional to the projected number of households in the BAU.

Transit VKT and fuel consumption were modelled based on data provided by Roam Transit.

Financial and Employment Impacts

Energy-related financial flows and employment impacts are captured through an additional layer of model logic. Costs are calculated through energy flows (annual fuel costs) as well as other operating and maintenance costs as new stock is incorporated into the model. Costs are based on a suite of assumptions that are input into the model.

Employment is calculated based on non-residential building archetypes and their floor area. Employment related to investments is calculated using standard employment multipliers, often expressed as person-years of employment per million dollars of investment.

Data and Assumptions

Scenario Development

The model supports using scenarios as a mechanism to evaluate potential futures for communities. A scenario is an internally consistent view of what the future might turn out to be—not a forecast, but one possible future outcome. Scenarios must represent serious considerations defined by planning staff and community members. They are generated by identifying population projections into the future, identifying how many additional households are required, and then applying those additional households according to existing land-use plans and/or alternative scenarios. A simplified transportation model evaluates the impact of the new development on transportation behaviour, building types, agricultural and forest land, and other variables.

Base Year and Business-as-Usual Scenario

The Business-as-Usual (BAU) Scenario estimates energy use and emissions volumes from the base year (2022) to the target year (2050). It assumes an absence of substantially different policy measures from those currently in place.

Methodology

1. Calibrate model and develop 2022 base year using observed data and filling in gaps with assumptions where necessary.
2. Input existing projected quantitative data to 2050 where available:
    - Population, employment, and housing projections by neighbourhood zone
    - Build out (buildings) projections by neighbourhood zone
    - Planned renewable energy projects
3. Where quantitative projections are not carried through to 2050, extrapolate the projected trend to 2050.
4. Where specific quantitative projections are not available, develop projections through:
    - Analyzing current on-the-ground action (reviewing action plans, engagement with staff, etc.) and, where possible, quantifying the action, and
    - Analyzing existing policy that has potential impact and, where possible, quantifying the potential impact.

Assumptions

Baseline data sources can be found in Appendix 4. Table 3 describes the key assumptions and sources used in the Business-as-Usual Scenario.

Table 3: BAU assumptions.

Category	BAU Modelling Assumption	Source
Population	2022: 16,057 2050: 30,700 Population will increase 85% between 2022 and 2050.	Town of Canmore Assume 2.5 people for every residential unit.
Employment	Employment within the town boundary 2022: 4,325 2050: 8000 Employment will increase 85% between 2022 and 2050.	Discussion with the Town of Canmore. Assumed the employment sector ratio remains the same, but the labour force grows at the same rate as population to 2050.
Residential Buildings	2022: 8,748 dwelling units 2050: 16,538 dwelling units Over 1,500 new dwelling units will be built by 2030 and a further 6,200 will be added by 2050, for a total of 7,800 units. Of these, 16% will be low-density housing, while the remaining 84% will be medium-density units. New dwellings will be built to the current energy performance metrics. Energy-consuming equipment shares remain unchanged.	Town of Canmore Offsite Levy Modeling, Area Structure Plan for Smith Creek Area, and Area Structure Plan for Three Sisters Village.

Category	BAU Modelling Assumption	Source
Non-Residential Buildings	An additional 3500 hotel units and 930 commercial units over the next 25 years. This relates to a commercial and hotel floorspace increase of 85% to 728,000 sqm. New non-residential buildings will be built to the current energy performance metrics. Energy-consuming equipment shares remain unchanged.	Town of Canmore Offsite Levy Modeling, Area Structure Plan for Smith Creek Area, and Area Structure Plan for Three Sisters Village.
Grid Electricity	The electricity emission factor is projected to decrease from 502 gCO2e/kWh in 2022 to 229 gCO2e/kWh in 2050.	Canada's Energy Future: Current Measures.

Category	BAU Modelling Assumption	Source
On-Road Transportati on	New passenger vehicles become more energy efficient between 2022 and 2032 due to Federal Corporate Average Fuel Economy (CAFE) standards. The total 2050 vehicle kilometres travelled is calculated in the model based on trips produced and attracted and the network distance matrix. As the population grows, kilometres travelled will increase.	U.S Environmental Protection Agency. (2012). The U.S Environmental Protection Agency and the U.S. National Highway Traffic Safety Administration set standards to reduce greenhouse gases and improve fuel economy for model years 2017–2025 cars and light trucks. Retrieved from https://www3.epa.gov/otaq/climate/documents/420f12050.pdf http://www.nhtsa.gov/fuel-economy SOR/2010-201. Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations. Available from: http://laws-lois.justice.gc.ca SOR/2018-98. Regulations Amending the Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations and other Regulations Made Under the Canadian Environmental Protection Act, 1999. Available from: https://pollution-waste.canada.ca
Vehicle Stock	2022: 13,000 2050: 24,200 Standard vehicle stock turnover rates. Stock class and power source share remain unchanged through 2050.	Personal and commercial vehicle stock grows in line with assumed population and employment growth.
Town Vehicle Fleet	2022: 52 vehicles 2050: 76 vehicles Standard vehicle stock turnover rates. Fleet class and power source share remain unchanged through 2050.	Fleet grows in line with assumed population growth.

Category	BAU Modelling Assumption	Source
Transit Vehicle Fleet	2022: Three busses service Canmore 2050: Unchanged	ROAM Transit
Sustainable Transportati on	Internal Trips: ● 2022 Mode Share ○ Transit: 3% ○ Walk: 10% ○ Bike: 4% ● 2050: Unchanged External Trips ● 2022 Mode Share ○ Transit: 5% ● 2050: Unchanged	Town of Canmore 2018 Integrated Transportation Plan Update
Rooftop Solar	2022: 2.87 MW 2050: 12.8 MW As a result of current federal incentives, it is expected that residential installations increase by 595 kW/year and commercial installations increase by 637.5 kW/year to 2030.	Town of Canmore Community Solar Program Assessment, 2023—Baseline Scenario
Waste, Wastewater, and Water	Waste generation and water consumption will match population and employment growth in the town.	

Category	BAU Modelling Assumption	Source
Temperature Change	Due to climate change, there will be approximately 22 more cooling degree- days[2] and 308 fewer heating degree-days[3] in 2050 than in 2022. Observed and projected heating and cooling degree-days for the Town of Canmore were used to assess projected changes in space heating and space cooling energy demand over time.	ClimateData.ca, Year Accessed 2023 Dataset, BCCAQv2: Cannon, A.J., S.R. Sobie, and T.Q. Murdock, 2015: Precipitation by Quantile Mapping: How Well Do Methods Preserve Changes in Quantiles and Extremes? Journal of Climate, 28(17), 6938-6959, doi:10.1175/JCLI-D-14-00754.1.

Business-as-Planned Scenario

The Business-as-Planned (BAP) Scenario estimates energy use and emissions volumes from the base year (2022) to the target year (2050), incorporating assumptions about the likely effects of planned policies and programs. In order to be considered part of the BAP an action must be:

- In rule or in officially adopted plans;
- Funded;
- Legislatively required; or
- Following well-established market or sectoral trends.

Methodology

- Create BAU (see steps above)
- Create BAP
    - Add additional assumptions to the BAU to capture known policies and plans that are or will be implemented in the coming years.

[2] The number of cooling degree-days describes how much buildings will need to be cooled in a year. An increase in cooling degree-days indicates that the town will experience hotter, longer summers.

[3] The number of heating degree-days describes how much buildings will need to be heated in a year. A decrease in heating degree-days indicates that the town will experience warmer or shorter winters.

    - In all cases: Where quantitative projections are not carried through to 2050, historical trends are extrapolated to 2050.
- Where specific quantitative projections are not available, identify assumptions by:
    - Analyzing current on-the-ground action (reviewing action plans, engagement with staff, etc.) and, where possible, quantifying the action.
    - Analyzing existing policy that has potential impact and, where possible, quantifying the potential impact.

Assumptions

The BAP Scenario is built upon the BAUl Scenario. Unless otherwise stated, assumptions from the BAU were carried forward into the BAP. Key assumptions in the BAP Scenario are outlined in Table 4.

Table 4: BAP assumptions.

Category	BAP Modelling Assumption	Source
Population, Employment, and Building Growth	Same as the BAU.	Table 3: BAU Assumptions
New Building Energy Performance	By 2030, all new construction meets the Tier 1 requirements of the National Building Code of Canada (2020). This translates to all new construction meeting a 10% reduction in annual net energy demand. Energy-consuming equipment shares remain unchanged.	National Building Code of Canada 2020 published by National Research Council Canada, 2022

Category	BAP Modelling Assumption	Source
Existing Residential Building Energy Performance	Approximately 20 single-family detached homes are retrofitted annually for energy efficiency by 2026. Annually, 12 homes will be achieving an average reduction of 44% of total energy demand and eight will be achieving an average reduction of 16%. Energy-consuming equipment shares remain unchanged.	Clean Energy Improvement Program, January 2024 Home Upgrades Program for Affordable Services Program Participants
Existing Non-Residentia l Building Energy Performance	Municipal buildings are retrofitted to become 50% more efficient by 2030.	Town of Canmore Climate Action Plan, 2018
Grid Electricity	Same as the BAU.	Table 3: BAU Assumptions
On-Road Transportation	Starting in 2035, all new light- and medium-duty vehicles are zero emissions. By 2050 this will mean that 98% of all light and medium-duty vehicles on the road are zero-emissions.	Canadian Federal Government Electric Vehicle Availability Standard

Category	BAP Modelling Assumption	Source
Sustainable Transportation	2030 Internal Trips Mode Share Targets Transit: 5% Walk: 10% Bike: 15% 2030 targets held constant to 2050. 2050 External Trips Mode Share Target Unchanged	Town of Canmore Integrated Transportation Plan Update, 2018
Transit Fleet	Purchase of one electric bus in 2024.	ROAM Transit
Rooftop Solar	2022: 2.87 MW 2050: 13.6 MW 100 kW/year of solar energy added to residential buildings by 2030.	Town of Canmore Community Solar Program Assessment, 2023—Scenario 2
Waste, Wastewater, and Water	Waste generation and water consumption will match population and employment growth in the town.	
Temperature Change	Unchanged from BAU.	See Table 3

Low-Carbon Scenario

The model projects how energy flow and emissions profiles will change in the long term by modelling potential changes in the context (e.g., population, development patterns), projecting energy services demand intensities, and projecting the composition of energy system infrastructure.

Policies, Actions, and Strategies

Alternative behaviours of various energy system actors (e.g., households, various levels of government, industry, etc.) can be mimicked in the model by changing the values of the model's user input variables. Varying their values creates "what if"-type scenarios, enabling a flexible mix-and-match approach to behavioural models that connect to the physical model. The model can explore a wide variety of policies, actions and strategies via these variables. The resolution of the model enables the user to apply scenarios to specific neighbourhoods, technologies, building or vehicle types or eras, and configurations of the built environment.

Methodology

1. Develop a list of potential actions and strategies;
2. Identify the technological potential of each action or group of actions to reduce energy and emissions by quantifying the actions:
    a. If the action or strategy specifically incorporates a projection or target; or
    b. If there is a stated intention or goal, review best practices and literature to quantify that goal; and
    c. Identify any actions that are overlapping and/or include dependencies on other actions.
3. Translate the actions into quantified assumptions over time.
4. Apply the assumptions to relevant sectors in the model to develop a Low-Carbon Scenario (i.e., apply the technological potential of the actions to the model).
5. Analyze the results of the Low-Carbon Scenario against the overall target.
6. If the target is not achieved, identify variables to scale up and provide a rationale for doing so.
7. Iteratively adjust variables to identify a pathway to the target.
8. Develop a marginal abatement cost curve for the Low-Carbon Scenario.

Assumptions

The Low-Carbon Scenario is built upon the BAU and BAP scenarios described in the previous sections. Unless otherwise stated, assumptions from the BAU and BAP were carried forward into the BAP. Key assumptions in the Low-Carbon Scenario are described in Table 5.

Table 5: Low-Carbon Scenario assumptions.

Category	LC Modelling Assumption	Source
Population, Employment, and Building Growth	Same as the BAU.	See Table 3: BAU Assumptions
New Building Energy Performance	Starting in 2035, all new commercial and residential buildings will be net-zero ready. This equates to a 75% energy demand reduction for residential buildings and a 85% energy demand reduction for commercial buildings.	Current model National Building Code and National Energy Building Code 2020 proposes buildings be net-zero ready by 2030. (Net Zero Energy Ready (NZER) is a highly energy-efficient building that minimizes energy use such that on-site or community renewables or energy from a clean grid can be used to reach NZE.) NZER is achieved using a mandatory step code, starting in 2022. For our modelling purposes, we opted to be net-zero ready starting in 2035, defining net-zero ready to have an Energy use intensity (EUI)of 80 kWh/sqm for residential and 100 kWh/sqm for non-residential.

Category	LC Modelling Assumption	Source
Existing Building Energy Performance —Residential and Non-Residential	By 2050, retrofit 100% of existing residential and commercial building stock. These retrofits include replacing water and space heating systems with electric heat pumps equipped with natural gas back-up, reducing energy consumption by 50% and reducing plug load by 30%.	Studies undertaken by the US National Renewable Energy Laboratory and the Rocky Mountain Institute indicate that retrofits achieving far more than 50% in energy savings are possible and that the deeper and more systemic the retrofits, the more affordable they become. The Integrated Ontario Electricity and Natural Gas Achievable Potential Study shows that 30% of plug load savings are achievable.
Building End Uses	By 2050, space conditioning systems and water heaters shift to electricity as the fuel source with heat pumps being equipped with natural gas back-up furnaces (natural gas would contribute 5% of the total heating fuel consumed). All appliances and auxiliary equipment will be electrified by 2050.	To ensure net zero by 2050, limited fossil-fuelled heating systems can be in use by 2050. In addition, air-source heat pumps offer the most efficient use of energy for cooling and heating.
Grid Electricity	Same as the BAU	See Table 3: BAU Assumptions
On-Road Transportation	Heavy-duty vehicles are 50% electric/50% hydrogen by 2050. Light- and medium-duty vehicles are the same as in the BAP.	
Sustainable Transportation	2050 Internal Trips Mode Share Targets Transit: 15% Walk: 15% Bike: 20% 2050 External Trips Mode Share Target Transit: 15%	Discussion with Canmore staff

Category	LC Modelling Assumption	Source
Car-Share Program/E-bike Incentives	Reduce the average number of vehicles per household by 2% by 2050 and develop an EV car-share program to replace trips that would have been taken in privately owned vehicles.	Canmore E-bike Incentive Pilot Program, 2024
Transit Fleet	Electrify the entire transit fleet by 2040.	Discussion with Canmore staff
Rooftop Solar	Maximize rooftop solar capacity to 37 MW by 2035.	Rooftop Solar in Canmore Report suggests that there is the potential for 42181.07 MWh/year with an average capacity factor of .13 which equates to a total 37 MW generating capacity added.
Municipal Solar Canopies	2.2 MW added to Canmore Recreational Parking Lot, Public Works Yard and Pumphouse 4 by 2035.	Town of Canmore Solar Project Feasibility Assessment
Municipal Operations	Municipal operations have a purchase agreement to procure renewable electricity for their operations.	Alberta Virtual Power Purchase Agreement Evaluation for Canmore and Banff
Low- or Zero-Carbon Energy Generation (Community-Scale)	Between 2025 and 2045, 9.8 MW/year of solar production and 4.9 MW/year of wind production are added annually either through purchasing agreements or installations beyond the Canmore boundary.	To align with international best practices on removal of carbon-intensive fuels and replacement with renewable sources of energy, this project models the wide-spread adoption of renewable electricity generation combined with energy storage for supply management.

Category	LC Modelling Assumption	Source
Waste	By 2030, reduce commercial waste generation by 15% and both residential and commercial food waste by 15%. Increase waste diversion to 50% by 2030 and 75% by 2050 across both residential and commercial sector waste streams. Divert 95% of all food waste to composting by 2050. Shift to a landfill with methane capture in 2035 (assume 60% methane capture).	Discussions with Canmore staff
Wastewater	Shift to anaerobic digestion for wastewater treatment with methane capture to be used on site.	Discussions with Canmore staff
Water	Energy efficiency improvement in municipal water and wastewater facilities, reducing both electricity and natural gas by 2% per year starting in 2025, to a 10% reduction by 2030. Decrease water volume use by 10% by 2030 starting in 2025.	Discussions with Canmore staff
Temperature Change	Same as the BAU.	See Table 3: BAU Assumptions

Financial Accounting

The model also has a financial dimension expressed for most of its stocks and flows. Costs and savings modelling considers:

- Upfront capital expenditures—This is related to new stocks, such as new vehicles or new building equipment;
- Operating and maintenance costs—Annualized costs associated with stocks, such as vehicle maintenance;
- Energy costs—This is related to energy flows in the model and accounts for fuel and electricity costs; and
- Carbon pricing—Calculated by emissions generation.

Table 6 summarizes the expenditure types evaluated in the model. Detailed financial assumptions are provided in Appendix 5.

Table 6. Expenditure categories.

Category	Description
Residential buildings	Cost of dwelling construction and retrofitting; operating and maintenance costs (non-fuel).
Residential equipment	Cost of appliances and lighting, heating, and cooling equipment.
Residential fuel	Energy costs for dwellings and residential transportation.
Residential emissions	Costs resulting from a carbon price on GHG emissions from dwellings and transportation.
Commercial buildings	Cost of building construction and retrofitting; operating and maintenance costs (non-fuel).
Commercial equipment	Cost of lighting, heating, and cooling equipment.

Category	Description
Commercial vehicles	Cost of vehicle purchase; operating and maintenance costs (non-fuel).
Non-residential fuel	Energy costs for commercial buildings, industry, and transport.
Non-residential emissions	Costs resulting from a carbon price on GHG emissions from commercial buildings, production, and transportation.
Energy production emissions	Costs resulting from a carbon price on GHG emissions for fuel used in the generation of electricity and heating.
Energy production fuel	Cost of purchasing fuel for generating local electricity, heating, or cooling.
Energy production equipment	Cost of the equipment for generating local electricity, heating, or cooling.
Municipal capital	Cost of the transit system additions (no other forms of municipal capital assessed).
Municipal fuel	Cost of fuel associated with the transit system.
Municipal emissions	Costs resulting from a carbon price on GHG emissions from the transit system.
Energy production revenue	Revenue derived from the sale of locally generated electricity or heat.
Personal-use vehicles	Cost of vehicle purchase; operating and maintenance costs (non-fuel).
Transit fleet	Costs of transit vehicle purchase.
Active transportation infrastructure	Costs of bike lane and sidewalk construction.

Financial Reporting Principles

The financial analysis is guided by the following reporting principles:

1. Sign convention: Costs are negative, revenue and savings are positive.
2. The financial viability of investments will be measured by their net present value.
3. All cash flows are assumed to occur on the last day of the year, and for purposes of estimating their present value in Year 1, they will be discounted back to time zero (the beginning of Year 1). This means that even the initial capital outlay in Year 1 will be discounted by a full year for purposes of present value calculations.
4. We will use a discount rate of 3% in evaluating the present value of future government costs and revenues.
5. Each stock category will have a different investment horizon.
6. Any price increases included in our analysis for fuel, electricity, carbon, or capital costs will be real price increases, net of inflation.
7. Where a case can be made that a measure will continue to deliver savings after its economic life (e.g., after 25 years in the case of the longest-lived measures), we will capitalize the revenue forecast for the post-horizon years and add that amount to the final year of the investment horizon cash flow.
8. In presenting results of the financial analysis, results will be rounded to the nearest thousand dollars unless additional precision is meaningful.
9. Only actual cash flows will be included in the financial analysis.

Addressing Uncertainty

There is extensive discussion about the uncertainty in models and modelling results. The assumptions underlying a model can be from other locations or large datasets that do not reflect local conditions or behaviours, and even if they did accurately reflect local conditions, it is exceptionally difficult to predict how those conditions and behaviours will respond to broader societal changes and what those broader societal changes will be.

The SSG modelling approach uses four strategies for managing uncertainty applicable to community energy and emissions modelling:

1. Sensitivity analysis: One of the most basic ways of studying complex models is performing a sensitivity analysis, which helps quantify uncertainty in a model's output. To perform this assessment, each of the model's input parameters is drawn from a statistical distribution in order to capture the uncertainty in the parameter's true value (Keirstead, Jennings, & Sivakumar, 2012).

Approach: Selected variables can be modified by ±10–20% to illustrate the impact that an error of that magnitude has on the overall total.

2. Calibration: One way to challenge untested assumptions is to use "back-casting" to ensure the model can "forecast the past" accurately. The model can then be calibrated to generate historical outcomes, allowing the model to better replicate observed data.

Approach: Variables are calibrated in the model using two independent data sources. For example, the model calibrates building energy use (derived from buildings data) against actual electricity data from the electricity distributor.

3. Scenario analysis: Scenarios are used to demonstrate that a range of future outcomes are possible given the current conditions and that no one scenario is more likely than another.

Approach: The model will develop a reference scenario.

4. Transparency: The provision of detailed sources for all assumptions is critical to enabling policy-makers to understand the uncertainty intrinsic in a model.

Approach: Modelling assumptions and inputs are presented in this document.

Appendix 1: GPC Emissions Scope Table for Detailed Model

Green rows = Sources required for GPC BASIC inventory

Blue rows = Sources required GPC BASIC+ inventory

Red rows = Sources required for territorial total but not for BASIC/BASIC+ reporting

Exclusion Rationale Legend

N/A	Not Applicable, or not included in scope
ID	Insufficient Data
NR	No Relevance, or limited activities identified
Other	Reason provided in other comments

Table 7: GPC Emissions Scope.

GPC ref No.	Scope	GHG Emissions Source	Inclusion	Reason for exclusion (if applicable)
I		STATIONARY ENERGY SOURCES		
I.1		Residential buildings		
I.1.1	1	Emissions from fuel combustion within the town boundary	Yes	
I.1.2	2	Emissions from grid-supplied energy consumed within the town boundary	Yes	
I.1.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	Yes	
I.2		Commercial and institutional buildings/facilities		
I.2.1	1	Emissions from fuel combustion within the town boundary	Yes	
I.2.2	2	Emissions from grid-supplied energy consumed within the town boundary	Yes	

GPC ref No.	Scope	GHG Emissions Source	Inclusion	Reason for exclusion (if applicable)
I.2.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	Yes	
I.3		Manufacturing industry and construction		
I.3.1	1	Emissions from fuel combustion within the town boundary	No	NR
I.3.2	2	Emissions from grid-supplied energy consumed within the town boundary	No	NR
I.3.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	No	NR
I.4		Energy industries		
I.4.1	1	Emissions from energy used in power plant auxiliary operations within the town boundary	No	NR
I.4.2	2	Emissions from grid-supplied energy consumed in power plant auxiliary operations within the town boundary	No	NR
I.4.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption in power plant auxiliary operations	No	NR
I.4.4	1	Emissions from energy generation supplied to the grid	No	NR
I.5		Agriculture, forestry, and fishing activities		
I.5.1	1	Emissions from fuel combustion within the town boundary	No	NR
I.5.2	2	Emissions from grid-supplied energy consumed within the town boundary	No	NR
I.5.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	No	NR
I.6		Non-specified sources		
I.6.1	1	Emissions from fuel combustion within the town boundary	No	NR
I.6.2	2	Emissions from grid-supplied energy consumed within the town boundary	No	NR
I.6.3	3	Emissions from transmission and distribution losses from grid-supplied energy consumption	No	NR
I.7		Fugitive emissions from mining, processing, storage, and transportation of coal		
I.7.1	1	Emissions from fugitive emissions within the town boundary	No	NR
I.8		Fugitive emissions from oil and natural gas systems		

GPC ref No.	Scope	GHG Emissions Source	Inclusion	Reason for exclusion (if applicable)
I.8.1	1	Emissions from fugitive emissions within the town boundary	Yes	
II		TRANSPORTATION		
II.1		On-road transportation		
II.1.1	1	Emissions from fuel combustion for on-road transportation occurring within the town boundary	Yes	
II.1.2	2	Emissions from grid-supplied energy consumed within the town boundary for on-road transportation	Yes	
II.1.3	3	Emissions from portion of transboundary journeys occurring outside the town boundary and transmission and distribution losses from grid-supplied energy consumption	Yes	
II.2		Railways		
II.2.1	1	Emissions from fuel combustion for railway transportation occurring within the town boundary	Yes	
II.2.2	2	Emissions from grid-supplied energy consumed within the town boundary for railways	No	NR
II.2.3	3	Emissions from portion of transboundary journeys occurring outside the town boundary and transmission and distribution losses from grid-supplied energy consumption	No	NR
II.3		Water-borne navigation		
II.3.1	1	Emissions from fuel combustion for water-borne navigation occurring within the town boundary	No	N/A
II.3.2	2	Emissions from grid-supplied energy consumed within the town boundary for water-borne navigation	No	N/A
II.3.3	3	Emissions from portion of transboundary journeys occurring outside the town boundary and transmission and distribution losses from grid-supplied energy consumption	No	N/A
II.4		Aviation		
II.4.1	1	Emissions from fuel combustion for aviation occurring within the town boundary	No	N/A
II.4.2	2	Emissions from grid-supplied energy consumed within the town boundary for aviation	No	N/A
II.4.3	3	Emissions from portion of transboundary journeys occurring outside the town boundary and transmission and distribution losses from grid-supplied energy consumption	Yes	

GPC ref No.	Scope	GHG Emissions Source	Inclusion	Reason for exclusion (if applicable)
II.5		Off-road		
II.5.1	1	Emissions from fuel combustion for off-road transportation occurring within the town boundary	No	NR
II.5.2	2	Emissions from grid-supplied energy consumed within the town boundary for off-road transportation	No	NR
III		WASTE		
III.1		Solid waste disposal		
III.1.1	1	Emissions from solid waste generated within the town boundary and disposed in landfills or open dumps within the town boundary	No	N/A
III.1.2	3	Emissions from solid waste generated within the town boundary but disposed in landfills or open dumps outside the town boundary	Yes	
III.1.3	1	Emissions from waste generated outside the town boundary and disposed in landfills or open dumps within the town boundary	No	N/A
III.2		Biological treatment of waste		
III.2.1	1	Emissions from solid waste generated within the town boundary that is treated biologically within the town boundary	No	N/A
III.2.2	3	Emissions from solid waste generated within the town boundary but treated biologically outside of the town boundary	Yes	
III.2.3	1	Emissions from waste generated outside the town boundary but treated biologically within the town boundary	No	N/A
III.3		Incineration and open burning		
III.3.1	1	Emissions from solid waste generated and treated within the town boundary	No	N/A
III.3.2	3	Emissions from solid waste generated within the town boundary but treated outside of the town boundary	No	
III.3.3	1	Emissions from waste generated outside the town boundary but treated within the town boundary	No	N/A
III.4		Wastewater treatment and discharge		
III.4.1	1	Emissions from wastewater generated and treated within the town boundary	Yes	

GPC ref No.	Scope	GHG Emissions Source	Inclusion	Reason for exclusion (if applicable)
III.4.2	3	Emissions from wastewater generated within the town boundary but treated outside of the town boundary	No	N/A
III.4.3	1	Emissions from wastewater generated outside the town boundary	No	N/A
IV		INDUSTRIAL PROCESSES AND PRODUCT USE (IPPU)		
IV.1	1	Emissions from industrial processes occurring within the town boundary	No	NR
IV.2	1	Emissions from product use occurring within the town boundary	No	ID
V		AGRICULTURE, FORESTRY, AND LAND USE (AFOLU)		
V.1	1	Emissions from livestock within the town boundary	No	NR
V.2	1	Emissions from land within the town boundary	No	NR
V.3	1	Emissions from aggregate sources and non-CO2 emission sources on land within the town boundary	No	NR
VI		OTHER SCOPE 3		
VI.1	3	Other Scope 3	No	N/A

Appendix 2: Building Types in the Model Specific to Canmore

Table 8: Building Types Specific to Canmore.

Residential Building Types	Non-Residential Building Types	
- Single-Detached, small - Single-Detached, medium - Single-Detached, large - Double-Detached, small - Double-Detached, large - Row House, small - Row House, large - Apartment 1 to 3 Storey - Apartment 4 to Storey	- School - Retirement or nursing home - Hospital - Transit terminal or station - Airport - Parking - Hotel/motel/inn - Golf course - Retail - Vehicle and heavy equipment service - Warehouse retail - Restaurant - Commercial retail - Commercial	- Warehouse - Religious institution - Municipal office - Municipal fire station - Municipal police stations - Municipal culture - Municipal community centre - Municipal arena and pools - Municipal yard and maintenance - Municipal other - Municipal retirement home - Surface infrastructure - Water pumping and treatment

Appendix 3: Emissions Factors Used

Table 9: Emissions Factors

Emissions Factors		
Natural gas	49 kg CO2e/GJ	Environment and Climate Change Canada. National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada. Part 2. Tables A6-1 and A6-2.
Electricity	2022: CO2: 498 g/kWh CH4: 0.043 g/kWh N2O: 0.011 g/kWh 2022 Grid GHG Intensity 502 gCO2e/kWh 2050: CO2: 225 g/kWh CH4: 0.061 g/kWh N2O: 0.0086 g/kWh 2050 Grid GHG Intensity 229 gCO2e/kWh	CER Energy Futures: Current Measures
Gasoline	g/L CO2: 2316 CH4: 0.32 N2O: 0.66	NIR Part 2 Table A6–12 Emission Factors for Energy Mobile Combustion Sources
Diesel	g/L CO2: 2690.00 CH4: 0.07 N2O: 0.21	NIR Part 2 Table A6–12 Emission Factors for Energy Mobile Combustion Sources

Emissions Factors

Fuel oil	Commercial g/L CO_2: 2753 CH_4: 0.026 N_2O: 0.031	Environment and Climate Change Canada. National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada. Part 2. Table A6–4 Emission Factors for Refined Petroleum Products
Propane	g/L Transport CO_2: 1515.00 CH_4: 0.64 N_2O: 0.03 Residential CO_2: 1515.000 CH_4 : 0.027 N_2O: 0.108 All Other Sectors CO_2: 1515.000 CH_4: 0.024 N_2O: 0.108	NIR Part 2 Table A6–3 Emission Factors for Natural Gas Liquids Table A6–12 Emission Factors for Energy Mobile Combustion Sources
Aviation	Jet Fuel, g/gal CO_2: 9,750 CH_4: 0.41 N_2O: 0.08	US Energy Information Agency (EIA) for 2022
Waste/WW	Wastewater Emissions Factors CH_4: 0.06 kg CH_4/kg BOD N_2O: 3.2 g/(person * year) from advanced treatment 0.005 g/gN from wastewater discharge Landfill emissions calculated from first-order decay of degradable organic carbon deposited in landfill derived emission factor in 2022 = 6.03 kg CH_4/tonne solid waste	CH_4 wastewater: IPCC Guidelines Vol 5 Ch 6, Tables 6.2 and 6.3, MCF value for centralized aerobic treatment plant N_2O from advanced treatment: IPCC Guidelines Vol 5 Ch 6 Box 6.1 N_2O from wastewater discharge: IPCC Guidelines Vol 5 Ch 6 Section 6.3.1.2 Landfill emissions: IPCC Guidelines Vol 5 Ch 3, Equation 3.1

Emissions Factors

Natural Gas Fugitive Emissions	0.0067 kg CO_2e/GJ	Assuming 1% of throughput is unaccounted for gas (internal source) Fraction of methane in NG: 0.965 Natural gas density in AB: 0.743 kg/m3
Greenhouse Gases	Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N20) are included. Global Warming Potential CO_2 = 1 CH_4 = 34 N_2O = 298	Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3) are not included.

Appendix 4: Baseline Data Sources

Table 10: Baseline Data Sources

Category	Baseline Assumptions	Source
Demographics		
Population	# persons	Statistics Canada, 2021 census profile, adjusted to the base year of 2022 assuming the same annual growth trend from 2016–2021
Employment	# jobs (place of work)	Statistics Canada, 2021 census profile
Dwellings	# dwelling units	Town of Canmore Statistics Canada, 2021 census profile Building and Parcel Layer Shapefiles and Assessment Tables
Buildings		
Parcel fabric	Zoning codes	Parcel Fabric Shapefile Town of Canmore Open Data
Building footprints	Spatially allocate buildings to neighbourhoods Building footprint sqm	Building Footprint Shapefile Town of Canmore Open Data

Category	Baseline Assumptions	Source
Property assessment roll	Building construction year Building storeys Building types Building total square footage Building structure type Building number of dwellings Building year built Building parcel number	Town of Canmore Assessment Data
Municipal	Buildings under the jurisdiction the municipality: - Operation Name - Operation Type - Address - Floor Area - Electricity Consumed - Natural Gas Consumed	Town of Canmore Open
Land Use		
Municipal boundaries	Regional and municipal boundaries	Town of Canmore Open Data
Policy boundaries	GIS maps showing built boundary, designated greenfields, green belt, protected areas	Town of Canmore Open Data

Category	Baseline Assumptions	Source
Fuel Consumption		
Natural gas	2022 community consumption by sector	ATCO Gas
Electricity	2022 community consumption by sector	Fortis Electricity
Fuel oil	Fuel oil consumption will be estimated based on the Alberta average value for commercial building types and end uses scaled down to Canmore	Natural Resources Canada, Report on Energy Supply and Demand
Gas and diesel sales	2022 annual sales by fuel	Kalibrate Fuel Sales
Decentralized electricity generation (excluding district energy); behind the meter and grid-connected generation	Capacity of electricity generated	Fortis Electricity
Residential energy-consuming stocks	Fuel and stock type of heating, cooling, and water-heating systems, fuel and stock type of appliances	CanESS initial estimates
Transportation		
Zones (traffic)	Canmore Neighbourhood Zones	Town of Canmore Open Data

Category	Baseline Assumptions	Source
Vehicle fleet	2022 Vehicle registration counts for passenger and commercial vehicles in the region	Province of Alberta Vehicle Registration data
Corporate vehicle fleet	2022 by body type (car, light truck); fuel type; technology type (internal combustion, hybrid, electric); weight class. VKT and/or fuel consumption	Town of Canmore
Local and regional (in-boundary) transit system	2022 route/network GIS files; fleet by type; VKT; energy/fuel use; vehicle fuel consumption per km	ROAM Transit
Visitor Transportation	2022 Canmore Vehicle Traffic Analysis; hotel occupancy and length of stay	Town of Canmore
Aviation fuel use	Fuel use for passenger and freight aviation trips that start in or end in region	Aviation industry data
Waste		
Solid waste produced	2022 tonnage of waste by type and sector	Town of Canmore
Waste disposal routing	2022 fraction of waste generated within town handled within town boundary and handled outside of city, by type	Town of Canmore

Category	Baseline Assumptions	Source
Solid waste facilities	Waste handling facilities capacity (within and outside of city boundary), by facility type Quantities of waste taken in by handling facilities within boundary, by facility type Percentage of waste taken in by handling facilities is imported	Town of Canmore
Diversion rates	2022 recycling and compost diversion rates for residential and ICI waste	Town of Canmore

Town of
CANMORE