Town of CANMORE

Climate Emergency Action Plan

Carbon Budget Report

May 2024

Key Terms and Definitions

Annual carbon budget: An annual accounting of projected greenhouse gas (GHG) emissions for the next fiscal year.

Annual carbon budget report: An annual report that compares the annual carbon budget against the carbon budget target and describes the GHG impact of projects.

Annual GHG inventory: An assessment of the historical GHG emissions that were released from a particular organization for any given calendar year. This could be for the Town of Canmore, for the entire community of Canmore, or any other subset.

Carbon accounting framework: A method for quantifying the number of GHG produced directly or indirectly by an organization's activities within a set of boundaries, providing the organization with a better understanding of their climate impacts. Usually reported in the form of a GHG inventory.

Carbon budget: The maximum allowable greenhouse gas emissions to keep global warming below a specific temperature threshold.

Carbon budget framework: The policy, governance and management system which enables the implementation of the carbon budget.

Climate Emergency Action Plan (CEAP): Town of Canmore's strategic guidance for proactively addressing the multifaceted impacts of climate change.

Community: The jurisdictional municipal boundary of the Town of Canmore.

Corporate: The municipality's operated assets and services as determined by the corporate GHG inventory.

Cumulative emissions: The sum of annual GHG emissions over a defined number of years.

Equity or Fair-share carbon budget: An organization's share of the remaining global carbon budget that is grounded in the principles of equity and common but differentiated responsibilities. A fair share carbon budget ensures equitable greenhouse gas reductions by considering each country's historical emissions, economic capacity, and development needs. It aims for fairness by distributing the global carbon budget proportionally, expecting developed nations to shoulder more responsibility while supporting developing countries in sustainable growth.

GHG: Greenhouse gas emissions.

GHG Calculator for Municipal Projects: A tool for calculating the GHG impact of projects and policies. Available for free as a Microsoft Excel add-in .

Purpose of This Document

This document provides guidance on establishing a carbon budget framework for the Town of Canmore to operate within a carbon budget that aligns with the low-carbon pathway set out in the Climate Emergency Action Plan (CEAP).

Based on the logic of financial budgets, a carbon budget framework is a management system to align the Town's plans and expenditures (operating and capital) with its GHG reduction targets. Given the urgent need to reduce emissions, the Town of Canmore requires a systematic way to reduce emissions, ensure that policies and programs do not lock in further emissions, and maximize opportunities resulting from the energy transition.

Key Messages

1. Staying within Canmore's carbon budget will require an adjustment to the financial planning process to integrate GHG emissions reductions into Town decision-making processes.
2. The carbon budget framework is a planning tool that aligns expenditures and investments with GHG targets and builds capacity and expertise across the organization.
3. Successful deployment of the new decision making process will require champion(s).
4. Canmore will achieve transparent accountability for its carbon budget framework by publishing annual or biennial reports.

What is a Carbon Budget?

Carbon budgets started out as a communication tool to represent how much carbon the world has left to emit before exceeding our desired global temperature increases. When nations came together to sign the Paris Agreement in 2015, they agreed that the desired level should be "well below 2°C above pre-industrial levels'' and to "pursue efforts to limit the temperature increase even further to 1.5°C".

Even fractional increments of warming intensify extreme weather events and threaten ecosystems, economies, and human health. This means that every action or decision that results in greenhouse gas (GHG) emissions "spends" more of the carbon budget, inching the world closer to the 1.5°C threshold.

The global carbon budget is rapidly depleting

The Intergovernmental Panel on Climate Change (IPCC), in its Sixth Assessment Report, estimates that, for at least a 66% chance of staying below the 1.5°C target, the atmosphere can absorb no more than 400 gigatonnes of carbon dioxide from the beginning of 2020. Limiting warming to below 1.5°C is essential to mitigate risks and prevent irreversible tipping points with catastrophic consequences.

Types of Carbon Budgets

1. **Cumulative Carbon Budget:** Sets the total allowable GHG emissions over a specific period to limit global warming to a certain level.
2. **Annual Carbon Budget:** Sets specific GHG emissions targets for a given year, often integrated with financial budgets to align with the broader cumulative carbon goals.

Figure 1 portrays the difference between a cumulative and annual carbon budget. GHG emissions over a 30-year period for two different pathways are depicted here (one pathway in blue, the other in black), operating with a 30-year cumulative carbon budget of 2,000 kt CO_2e (represented by the red line).

Both pathways achieve the same cumulative emissions over the 30-year period, but one reflects delayed mitigation efforts with emissions continuing to grow until they peak around year 11, by which time very steep reductions are required to stay within the carbon budget. In the other pathway, strong and immediate mitigation efforts result in a more gradual and manageable transition. By year 15, annual emissions have declined in both pathways to 78 per cent of the starting year level, but the delayed action pathway has spent 90 per cent of the carbon budget compared to only 70 per cent for the more gradual pathway.

This underscores the importance of defining viable pathways in which annual emissions are continually brought down over time to assure compliance with the cumulative limits. Trajectory matters as much as the target.

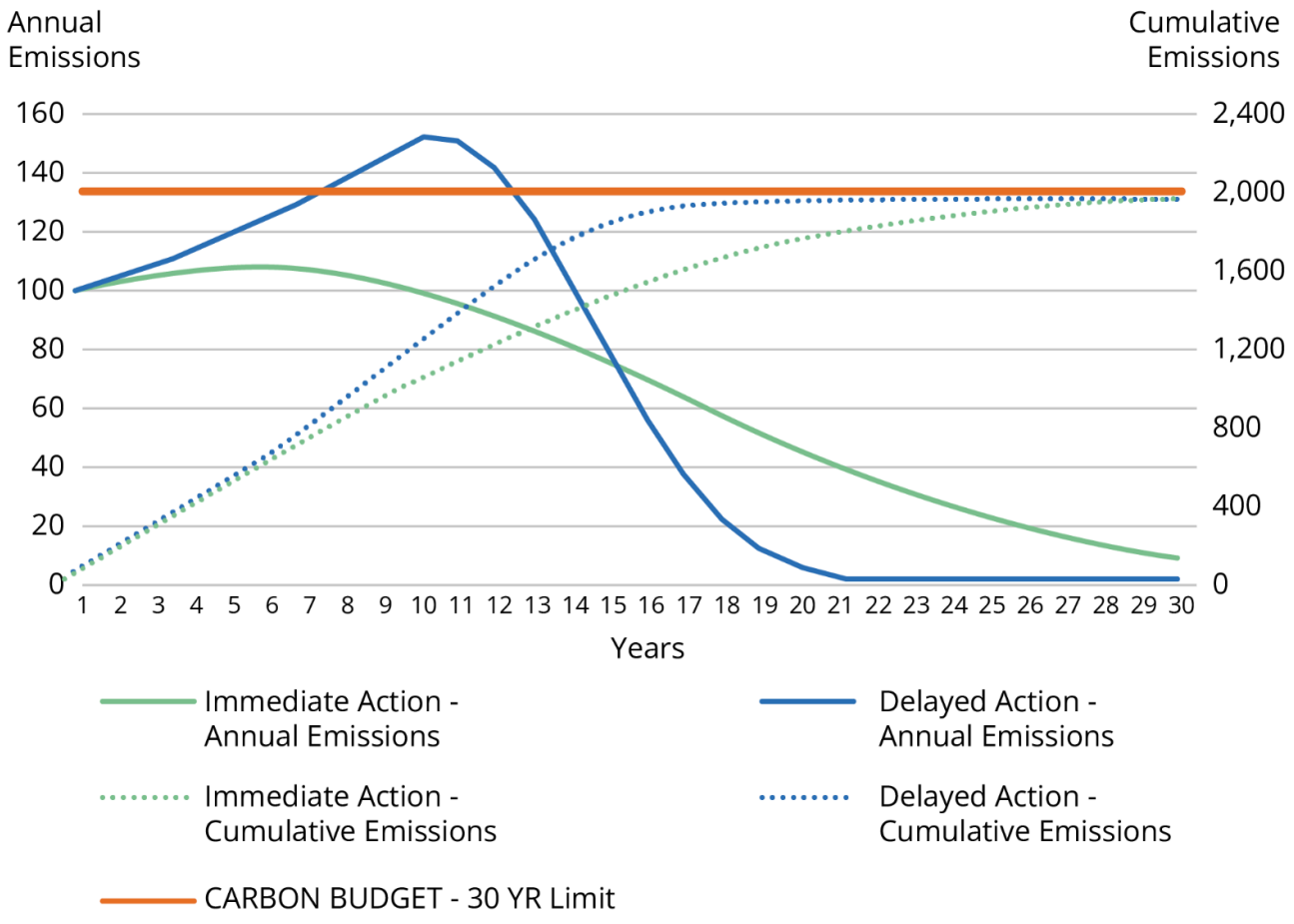

Figure 1. Delayed versus immediate action in meeting a cumulative carbon budget.

What is a carbon budget framework?

The carbon budget framework is a GHG emissions management system that scales down the global carbon budget into a municipal carbon budget, thereby establishing a ceiling on the amount of emissions that can be released by that community. This carbon budget is then operationalized alongside more conventional and familiar fiscal budgets. Carbon budgeting specifically addresses emissions management, influencing financial decisions and outcomes through set emission targets or limits.

At the beginning of the budget cycle, project proposals requesting capital and operational budgets will include estimated GHG emissions that would result from the project. Then, municipal staff and leadership strategize on how to stay within the budget. Once projects are underway or completed, consistent monitoring and reporting using carbon accounting methods track the city's carbon budget status.

Climate lens as a decision-making tool in the carbon budget framework

A carbon budget can be used as an effective "climate lens" to ensure a local government remains on track to achieve their emission reduction goals. By integrating a climate perspective into financial decisions, especially significant capital investments, local governments can ensure that their fiscal policies align with their climate objectives.

For example, a capital budget may include expenditures for a new building. Applying a climate lens to this expenditure would involve quantifying the emissions that will result from the construction and operation of the building. Based on the quantification, total carbon budget, and GHG emissions expenditures for other projects in the budgeting cycle, a local government may choose to explore alternative building options to lower the expected GHG emissions associated with construction and operation.

Such strategic investment decisions are supported by carbon accounting frameworks, which help quantify the emissions impacts of various budgeting choices. This quantification not only allows for the comparison of different spending options based on their environmental impact but also aids in aligning the town's financial strategies with its commitments to reducing carbon emissions and meeting its carbon budget targets.

Carbon accounting as a verification tool in the carbon budget framework

Carbon accounting is the process of quantifying the number of GHGs produced directly or indirectly by an organization's activities within a set of boundaries, providing the organization with a better understanding of their climate impacts. These GHGs are typically reported in the form of a GHG inventory that provides a snapshot of energy use and associated emissions over a given period of time. Most Canadian municipalities, including the Town of Canmore, comply with the Greenhouse Gas Protocol, a globally recognised standard for measuring and managing GHG emissions.

In the context of the carbon budget framework, GHG inventories can be evaluated against the total carbon budget at the end of each budget cycle to determine if the Town has stayed within or exceeded its allocated budget.

Carbon Budget Framework for Town of Canmore

The Town of Canmore's path towards a sustainable future adheres to a low-carbon pathway with a clear commitment to achieving net-zero emissions by 2050. This is in line with the global Race to Zero campaign, which has the ambitious aim of capping the rise in global average temperature to 1.5°C. Canmore's target is to reduce annual emissions to 350 kilotonnes CO_2e by 2030, starting from a higher 2022 level of 460 kilotonnes CO_2e. The trajectory then progresses towards a net-zero emission goal by 2050.

Canmore's trajectory markedly diverges from a business-as-usual scenario, which would see emissions gradually decline only to rise back to higher levels in the future. Under the business-as-planned scenario, which projects Canmore's expected emissions with current policies and practices but no additional policy or climate interventions, Canmore's emissions decline gradually by 26% to reach 340 kilotonnes CO_2e.by 2050.

To successfully deviate from these two trajectories, Canmore is exploring new and effective ways to embed GHG reduction strategies within its budgeting and policy frameworks. Although the Town will control some levers of change, it acknowledges that broader influences on GHG emissions may lie beyond its direct control. As the community moves forward, it will increasingly integrate such external actions into its carbon budgeting process, enriching the town's experience with carbon budgeting in municipal decision-making.

Cumulative Carbon Budget

Carbon budgeting in Canmore has been informed by the C40 methodology, which underscores the significant role that affluent nations and their communities play in aggressively reducing emissions due to historical contributions to the climate crisis.

Canmore has set a target to reduce annual emissions from 460 kilotonnes CO_2e in 2022 to 350 kilotonnes CO_2e by 2030, and net-zero emissions by 2050. This target translates to a cumulative carbon budget of 6,833 kilotonnes CO_2e from 2022 to 2050. If the Town continues on its business-as-planned trajectory, this carbon budget will be depleted in less than 15 years.

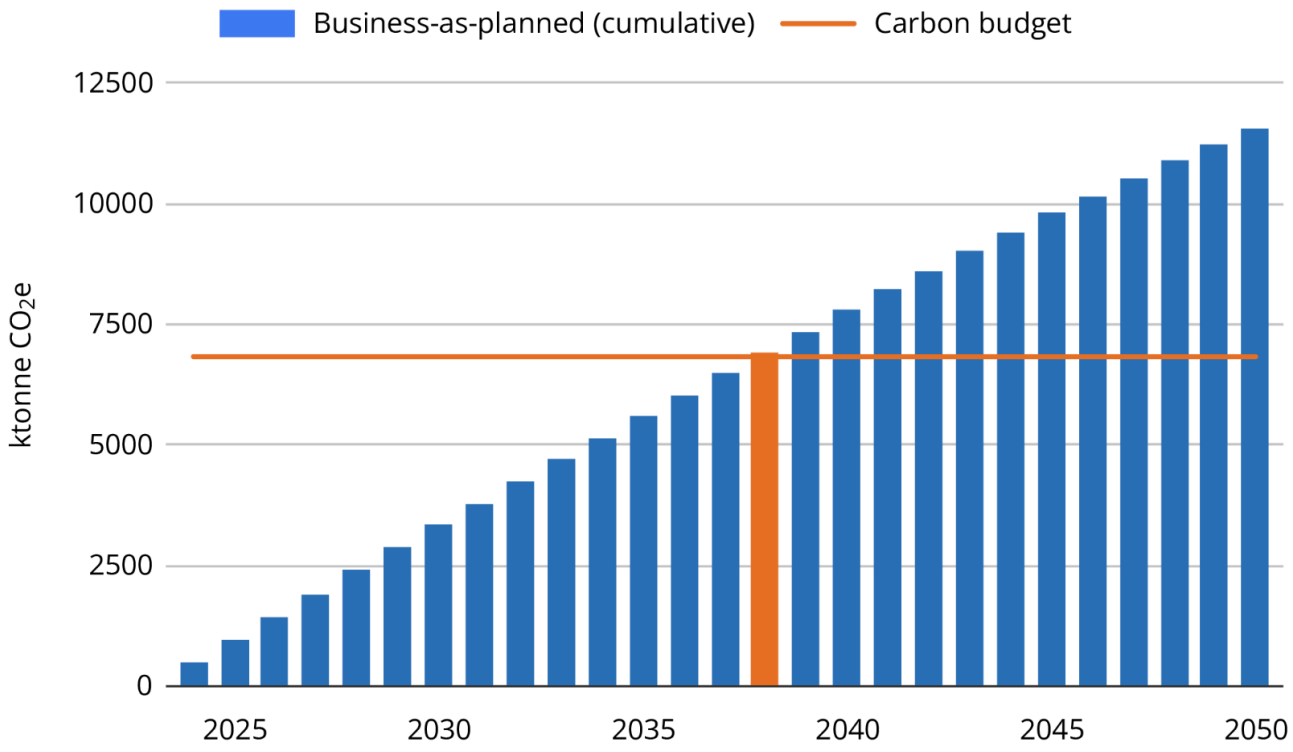

Figure 2: Cumulative GHG emissions for Town of Canmore under the business-as-planned scenario, compared to the cumulative carbon budget of 6,833 from 2022 to 2050.

Annual Carbon Budget

The annual carbon budget is derived from the Town's cumulative low-carbon pathway out until 2050. Included also are carbon budgets for the C40 method, and equity model. The low-carbon pathway developed for Canmore identifies the annual community-wide carbon budget (Table 1).

1. C40 Carbon Budget

The C40 carbon budget is part of an initiative led by the C40 Cities Climate Leadership Group, which is a network of the world's megacities committed to addressing climate change. C40 helps cities to collaborate effectively, share knowledge, and drive meaningful, measurable, and sustainable action on climate change. This method was used to develop carbon budgets for these large cities, and then has been downscaled for other locations based on the per-capita GHG emissions for nearby locations. The C40 carbon budget model often includes:

- Straight Line Reduction: This approach involves setting a linear path of emissions reductions from a baseline year to a target year, aiming to meet certain climate goals, like the Paris Agreement's target to limit global warming to 1.5°C above pre-industrial levels. This pathway is included in this report.
- Exponential Reduction: This method sets a more aggressive reduction path that starts slower but accelerates over time, reflecting technological advancements and increasing socio-economic capacity to reduce emissions. This pathway is not modelled in this report.

2. Equity Carbon Budget

The Equity carbon budget takes into account the principles of fairness and differential responsibilities. It is designed based on factors such as historical emissions, per capita emissions, and the economic capabilities of different regions or entities. This method develops a carbon budget for Canada, which is then downscaled based on the proportion of the national GHG emissions the municipality in question produces. In this framework:

- Each entity's carbon budget is adjusted according to its capacity to cut emissions and its historical responsibility for them.
- This often means that wealthier, more developed areas have stricter and more immediate reduction targets compared to developing regions, which might be allowed more time to grow their economies before making steep cuts.

3. Low-Carbon Scenario: Canmore

The Low-Carbon Scenario outlines a pathway for drastically reducing greenhouse gas emissions to achieve near-zero or net-zero emissions by a mid-century target. This scenario:

- Is often tailored to the specific capabilities and goals of a city or region, incorporating sustainable development strategies.
- Includes transitions to renewable energy sources, enhancements in energy efficiency, and broader systemic changes across transportation, industry, and residential sectors.

Each of these scenarios serves a specific strategic purpose:

- The C40 carbon budget aligns with global city-led initiatives emphasizing aggressive, measurable climate actions.
- The Equity carbon budget ensures that climate action is fair and just, considering global socio-economic disparities.
- The Low-Carbon Scenario carbon budget aligns with the modelled pathway for Canmore's CEAP; it provides a comprehensive roadmap towards a sustainable, low-carbon future.

Figure 3 shows the three different pathways that the Town of Canmore could take towards achieving net-zero emissions by 2050, compared to the business-as-usual (BAU) trajectory. The business-as-usual projects the Town's GHG emissions if no additional action was taken from 2022 to 2050, it is a useful reference showing the size of challenge the Town faces in meeting its climate action goals. The C40 and equity-based carbon budgets follow similar trajectories, but the differing methodologies and priorities account for the small differences between the two pathways.

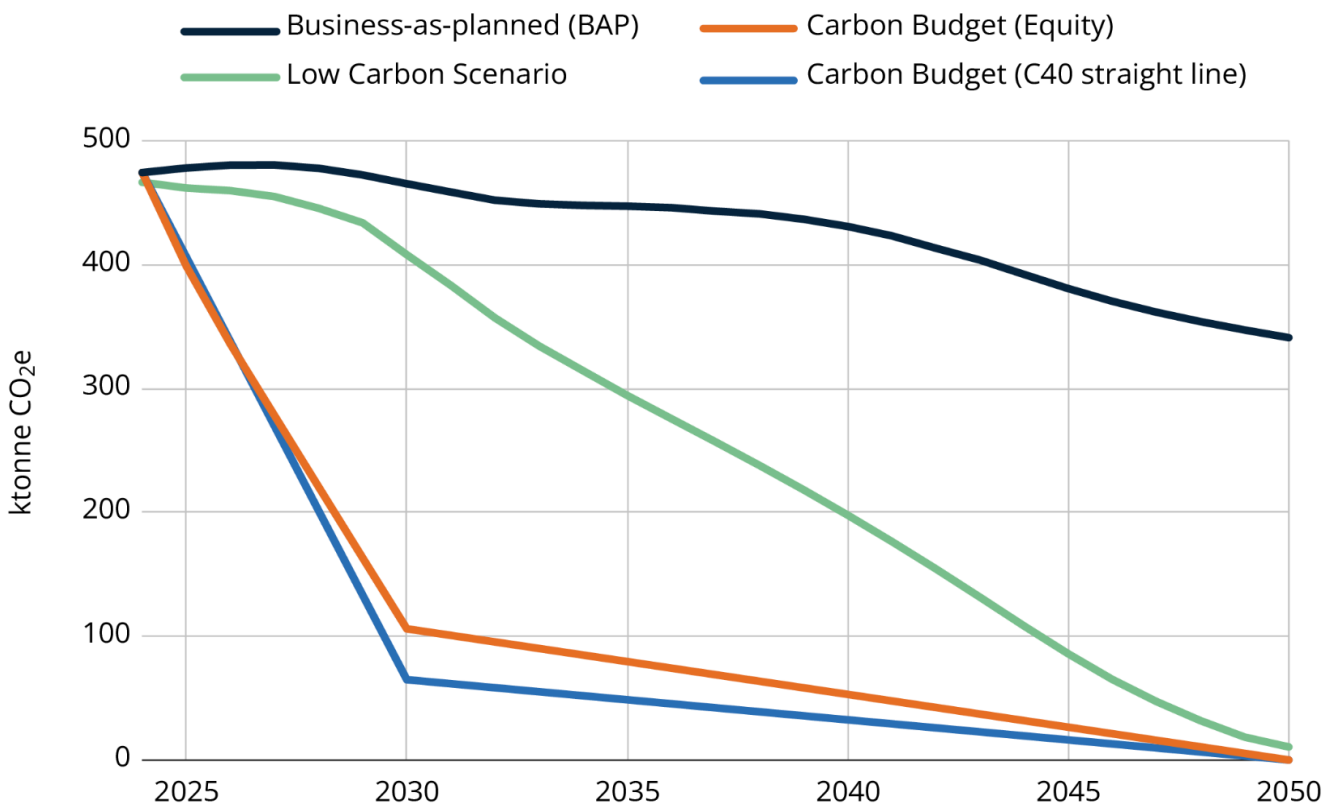

Figure 3: Carbon Budget possibilities for Canmore: Low-carbon scenario, C40, and Equity, with visitor travel incorporated.

The Low-Carbon Scenario pathway was chosen for the Town of Canmore for the carbon budget framework implementation. While less ambitious compared to the C40 and equity pathways, the Low-Carbon Scenario pathway best aligns with the CEAP methodology, which is rooted in local context, wide-spread engagement, and robust modelling, making it the most realistic and achievable pathway for Canmore at this time.

Table 1 provides the annual carbon budgets in kilotonnes (ktCO2e) for each scenario, rounded to no decimal places for clarity. This accurately reflects the reduction paths under each scenario, helping Canmore to align its emissions reduction strategies.

The municipal carbon budget is calculated based on the relative proportion of municipal emissions compared to the total Canmore emissions (1.8% of total emissions in 2022).

Table 1. Annual Carbon Budgets for the Entire Community (2024-2050 in ktCO2e)

Year	C40 Straight Line ($ktCO_2e$)	Equity ($ktCO_2e$)	Low Carbon Scenario ($ktCO_2e$)	Municipal Proportion ($ktCO_2e$)
2024	475	475	475	8.3
2025	406	399	446	7.9
2026	338	336	429	7.6
2027	270	278	416	7.4
2028	201	221	395	7.0
2029	133	163	371	6.6
2030	65	106	347	6.2
2031	62	101	324	5.8
2032	58	95	299	5.3
2033	55	90	278	4.9
2034	52	85	259	4.6
2035	49	79	241	4.3
2036	45	74	224	4.0
2037	42	69	206	3.7
2038	40	64	189	3.3

Year	C40 Straight Line ($ktCO_2e$)	Equity ($ktCO_2e$)	Low Carbon Scenario ($ktCO_2e$)	Municipal Proportion ($ktCO_2e$)
2039	36	58	171	3.0
2040	32	53	154	2.7
2041	29	48	136	2.4
2042	26	42	116	2.1
2043	23	37	95	1.7
2044	19	32	74	1.3
2045	16	26	54	1.0
2046	13	21	37	0.7
2047	10	16	25	0.4
2048	6	11	18	0.3
2049	3	5	13	0.2
2050	0	0	11	0.2

Carbon Budget Framework for the Town of Canmore

Framework Objectives

The development and implementation of Canmore's carbon budget framework are driven by seven objectives:

1. Manage carbon emissions from municipal operations and assets.
2. Align operating and capital budgets with the carbon budget.
3. Highlight financial trade-offs and synergies related to GHG decisions.
4. Track municipal initiatives, actions, and policies and their impact on the community's carbon budget.
5. Provide a framework for accountability.
6. Facilitate transparent reporting.
7. Enhance carbon literacy within the municipal government.

This framework is an integral part of Canmore's ongoing operational and capital budgeting processes under the Climate Emergency Action Plan.

GHG Quantification Activities

Effective carbon budgeting requires three critical GHG quantification activities:

1. Establishing a base-year inventory.
2. Quantifying actions, investments, and policies for planning purposes.
3. Monitoring, auditing, and verifying measurable impacts and adjusting budget allocations annually.

This plan focuses on community-wide emissions, but can be adapted to report specifically on municipal operations, expanding its scope over time based on municipal experience.

Carbon Budget Reporting

The carbon budget report is presented along with financial capital and operating budgets. It describes the Town's progress in staying within the carbon budget (i.e. surplus, deficit, and balance). Similar to municipal financial budgets, the carbon budget report also lays out the projects, plans and initiatives for the upcoming budget cycle, the expected GHG emissions impact, and evaluates the total estimated emissions to the allocated carbon budget for that budget cycle.

Implementation Steps

1. **Project Identification**: Municipal staff will compile a list of actions designed to meet or exceed GHG reduction targets within the carbon budget period (same as the financial budgeting process), applying insights from the Climate Emergency Action Plan.

2. **Analysis of GHG Impacts**: The GHG impacts of proposed actions are quantified and entered into the GHG Calculator for Municipal Projects to ensure alignment with the carbon budget. Engineering analysis may be employed when direct measurement isn't feasible, utilizing identified key performance indicators for monitoring.

3. **Prioritization**: Actions are evaluated through a priority-based budgeting process, where GHG reductions are a significant criterion.

4. **Identification of Carbon Surplus/Deficit**: Based on the priority-based budgeting process and analysis in the GHG Calculator for Municipal Projects , the Town will present overall results of the proposed actions, determining if they result in a surplus or deficit of GHG emissions. These results then feed into the formal budgeting process, including presentations to the Finance Committee, and ultimately, decisions by the Council.

5. **Evaluation**: As actions are implemented, their impacts on GHG emissions are evaluated and tracked annually, either through direct measurement of energy or emissions or via key performance indicators. Annual GHG inventories help assess whether emissions are within the carbon budget, the magnitude of any carbon deficit, and the effectiveness of implemented actions. Like the financial budgeting process, supplemental adjustments are made annually based on continuous reporting and evaluation.

This structured approach ensures that Canmore's strategies for reducing greenhouse gas emissions are integrated seamlessly with financial planning, enhancing the effectiveness and accountability of the Town's climate actions.

Recommended Governance Framework

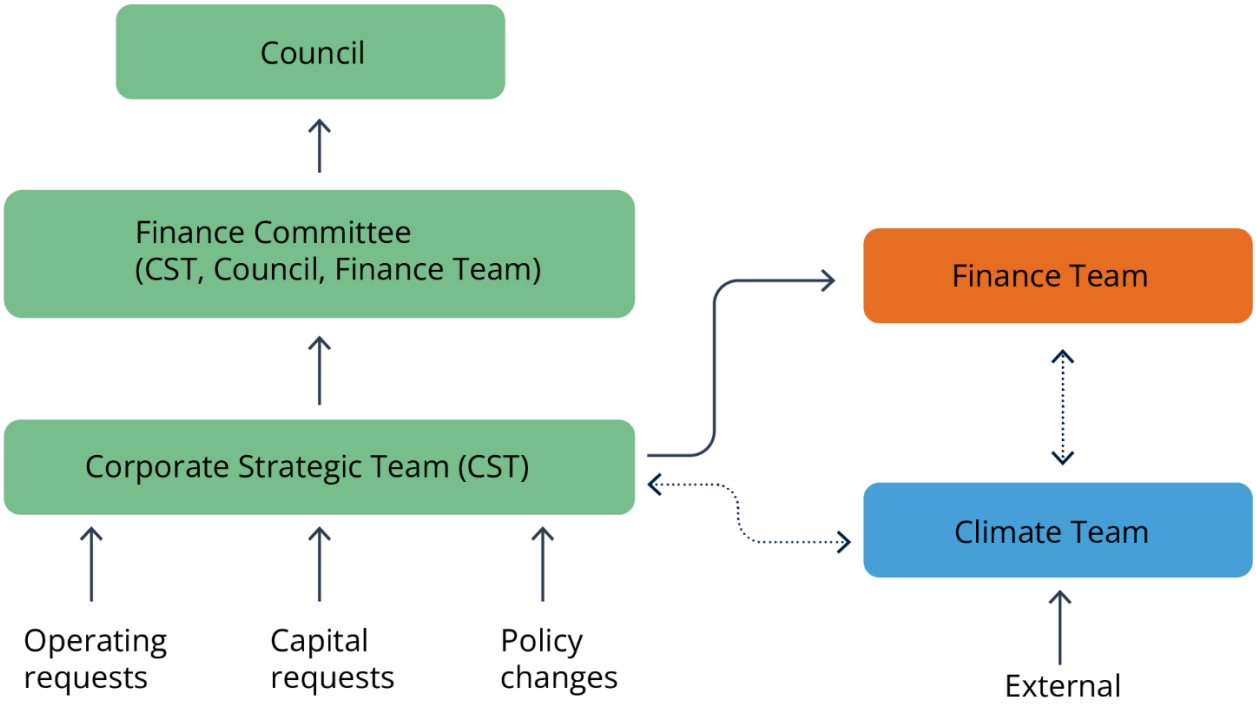

Figure 4. Key carbon budget framework roles.

Table 5. Key responsibilities in administering the carbon budget framework.

Group	Description	Responsibilities
Town of Canmore Council	Decision-makers	Council will: • Review and approve the annual/biennial carbon budget.

Group	Description	Responsibilities
Corporate Strategic Team (CST)	Champion	The champion is the central hub of climate action, providing leadership, convening, coordinating, reporting, and analyzing. The CST will: ● Coordinate the Climate Team; ● Act as an administrative resource for programs/departments; ● Provide transparency on progress to the organization and the community; and ● Jointly prepare and/or present the Annual Carbon Budget Report with the Finance Department.
Finance Department	Carbon budgeting	The Finance Department will: ● Ensure processes under the Framework remain aligned with the business planning and budgeting processes and the municipality's financial framework, long-term financial outlook, policies, procedures, and requirements; ● Evaluate the financial implications at the corporate level; ● Evaluate the impact of GHG reduction decisions on other municipal priorities (e.g. job growth, economic growth and stability, etc.); ● Lead business case development, carbon budgeting for the organization as a whole (new role recommended), support staff on individual carbon accounting; and ● Jointly prepare the Annual Carbon Budget Report with the CST.

Group	Description	Responsibilities
Climate Team	Cross-organization and coordination	As climate change is a cross-program issue, a venue to support senior organizational decision-making is required. The Climate Team will: ● Review proposed GHG reduction actions and implications within current year business plans, budgets, and forecasts; ● If necessary, propose additional actions to achieve the carbon budget based on available funding, longer-term asset/financial strategies, and current year and proposed forecasts; ● Evaluate the impact of GHG reduction decisions on other municipal priorities (e.g. job growth, economic growth and stability, etc.); and ● Coordinate/facilitate the assessment of cross-program or multi-program initiatives. ● Training, resources, and support to all staff involved in the carbon-budgeting process.
Managers	Project/initiative identification, recommendation, studies and implementation	Each manager or program lead will: ● Integrate consideration of climate into business plans and budget submissions; and ● Implement Council-approved actions/directions.
Departmental Staff/ Program Leads	Distributed responsibility	Responsibility for GHG reductions options development, analysis, and incorporation in program business plans and budgets. Responsibilities for implementing approved program changes will be embedded within job descriptions. Responsibilities will include: ● Evaluating the GHG impacts of program initiatives and projects; ● Developing performance measures for GHG reduction actions; ● Conducting strategic assessments and a business case analysis, including the implementation of an approved climate lens and life-cycle analysis of GHG implications; and ● Measuring and verifying implemented actions and actual GHG reductions.

Implementing the carbon budget will require the continuation of existing roles, as well as the creation of new or revised roles and responsibilities, as outlined in Table 5. For technical expertise, in particular, hiring additional staff to address the scope of climate re-prioritization across the municipal government will be required. Staff leading the climate budgeting process should work closely with Finance staff, if not within the Finance Department, and should have in-depth knowledge of the Town's budgeting process, asset management planning process, and long-term financial planning process and outlook.

Revised responsibilities and new roles inevitably mean a need for increased capacity building for relevant staff across the organization. For those with expanded job responsibilities, capacity building is likely to include:

- Dedicated training for specific responsibilities;
- Hiring new staff or shifting responsibilities amongst existing staff;
- Providing clear guidance and tools for applying the carbon budget framework to existing processes;
- Establishing liaisons at the Finance Department for resourcing, problem-solving, and resolution of any cross-program issues; and
- Accessing online resources and corporate-wide tools.

Quantification of Actions

Protocols

There are several different protocols and GHG emissions quantification guides available, and it is recommended that the Climate Team evaluates each one and tests different documents in the early implementation stages to identify which approaches are most appropriate for Canmore. Relevant resources are listed in Appendix C. The following principles are generally applied for project-level GHG quantification:

Relevance

The data and GHG quantification procedures most appropriate to the project should be selected. The levels of accuracy and uncertainty associated with the quantification process should reflect the intended use of the data and the objectives of the project.

Completeness

All relevant GHG emissions and removals should be included, along with information to support criteria and procedures.

Consistency

All data, methods, criteria, and assumptions should be applied consistently to ensure meaningful comparisons between the baseline and the project scenario.

Accuracy

Estimates and calculations should be unbiased, and uncertainties should be reduced as far as practical. Calculations should be conducted in a manner that minimizes uncertainty.

Transparency

All assumptions, methods, calculations, and associated uncertainties should be explained to allow the intended users to make decisions with reasonable confidence.

Conservativeness

Where there are uncertainties, the values used to quantify GHG emissions should err on the side of underestimating potential reductions.

Quality Control

As the Town gains experience with quantification, it is expected that the decision-making process regarding GHG impacts will evolve. A review by a carbon budget manager (potential new position) is a quality control step that takes place prior to submitting the results to the Corporate Strategic Team for organization-wide budget evaluation. For major projects, third-party verification could also be beneficial.

Boundary

The boundary defines the scope of the GHG analysis and is generally the geographic boundary of the Town of Canmore, unless otherwise specified. GHG emissions will be reported according to the carbon accounting framework for cities, which includes:

Direct Emissions: Emissions or removals from GHG sources or sinks that are owned or controlled by the Town. At the GHG inventory level, direct emissions are also commonly referenced as Scope 1 emissions, such as natural gas combustion in boilers for water heating in municipal facilities, or diesel combustion for operating the municipal fleet.

Indirect Emissions: Emissions or removals that are of consequence to the project, but occur at GHG sources or sinks not owned or controlled by the Town. For example, reduced electricity consumption might be considered a secondary effect in some infrastructure projects. Indirect emissions can include Scope 2 emissions as well as some Scope 3 emissions as defined under the GHG Protocol. Examples of Scope 2 emissions are electricity used to operate municipal facilities, while Scope 3 emissions could be emissions from employee commuting or emissions from producing goods used by the municipality.

Table 6. Definition of scope.

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

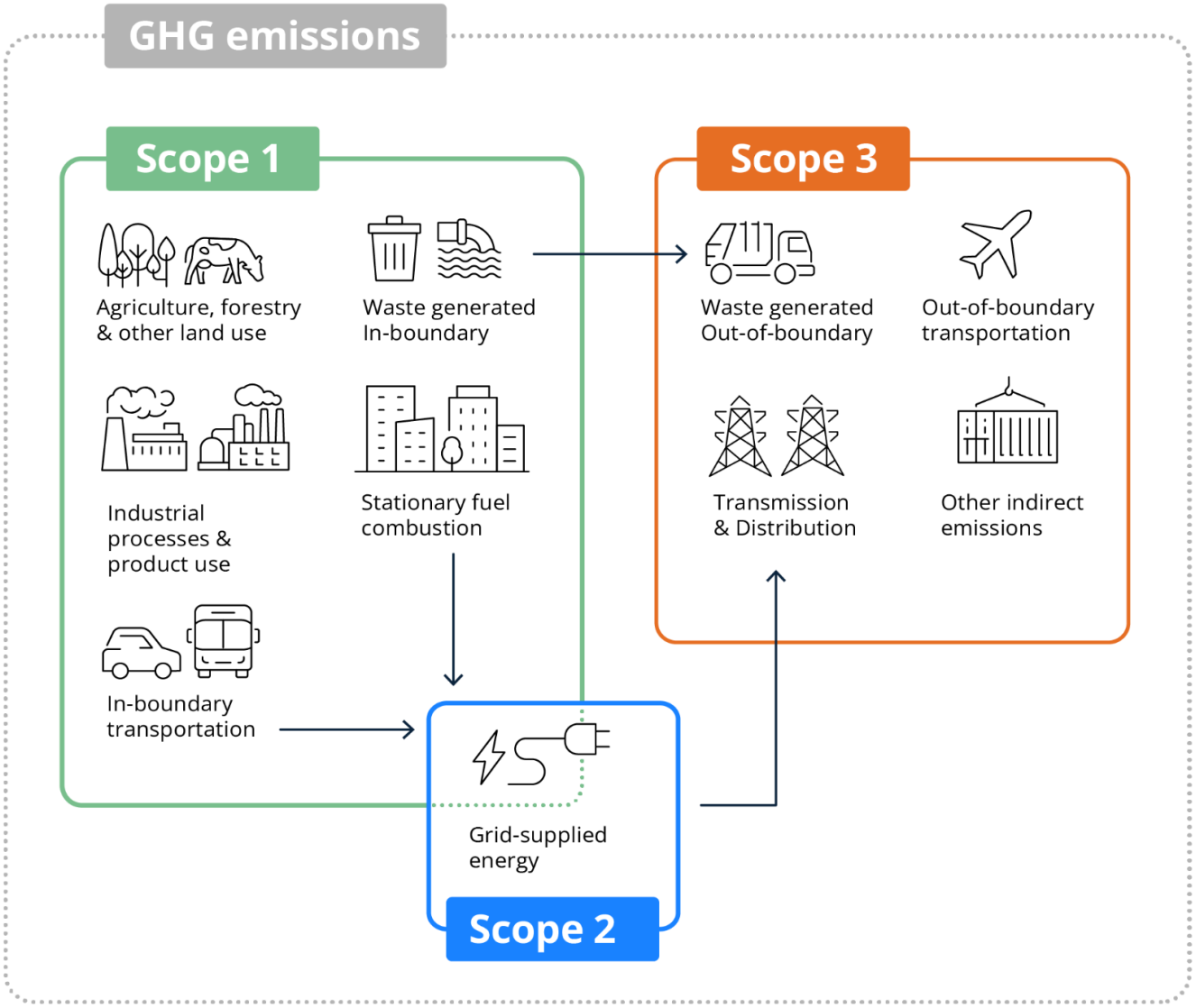

Figure 5. Illustration of scopes for a Town calculation.

Greenhouse Gases

Mitigation assessments, like GHG inventories, consider the same greenhouse gases tracked through Canada's National Inventory Report. Each greenhouse gas has a different global warming potential and persists for a different length of time in the atmosphere. For ease of comparison, each greenhouse gas must be converted into CO_2 equivalent (CO_2e) using the Global Warming Potentials identified in the most up-to-date version of Canada's National Inventory Report and reported in tonnes (t), kilotonnes (kt), or megatonnes (Mt).

Table 8. Global Warming Potential (GWP) values.

Greenhouse Gas	Formula	Global warming potential
Carbon Dioxide	CO_2	1
Methane	CH_4	28
Nitrous Oxide	N_2O	325

The Basic Formula

The quantification strategies are designed to provide GHG estimates for a source or activity as a result of an expenditure or action taken by the Town of Canmore. The general equation for emissions quantification is as follows:

GHG emissions = [source metric] X [emissions factor] X [GWP]

This calculation is used when:

- The source metric is the unit of measure of the source of emissions. For example, in the case of transportation, the source metric is vehicles kilometres travelled. For building energy use, it is the energy intensity or energy consumption per square metre of building space;
- The emissions factor is the rate at which emissions are generated per unit of source metric. In the case of a vehicle, it is kgCO_2 per kilometre travelled; and/or
- The GWP is the factor that converts different greenhouse gases to their carbon dioxide equivalent.

GHG Emissions Reductions

Table 9. Types of GHG emissions reductions.

Reduction categories	Description
Avoided GHG emissions	The activity that generates the emissions is avoided. For example, a vehicular trip is replaced by a transit trip or a walking trip, avoiding the GHG emissions resulting from that vehicle.
Fewer created GHG emissions	The same activity is undertaken but with a strategy that generates fewer GHG emissions. For example, a more efficient vehicle is used or a more efficient boiler is installed.
Sequestration of emissions	Carbon emissions are embedded in a structure that can hold the emissions, preventing them from being released into the atmosphere. Planting trees is an example of biological sequestration. Carbon capture and storage injects emissions underground, an example of physical sequestration.

Reductions are calculated by subtracting GHG emissions resulting from a low-carbon action from GHG emissions in a reference or BAU case. For example, in order to identify the impact of the purchase of an electric car, GHG emissions resulting from the electric carbon are subtracted from GHG emissions created with a gasoline car, with the gasoline car representing the reference case.

GHG reduction = [Reference case]−[Low carbon case]

This calculation is used when:

- GHG reduction is the GHG emissions avoided as a result of the action taken or policy implemented;
- Reference case is the calculation of GHG emissions if current practice continues; and
- Low-carbon case is the calculation of GHG emissions when the action or policy is implemented.

GHG Calculator for Municipal Projects

The GHG Calculator for Municipal Projects is a free tool for municipal staff across all departments who want to understand the climate impact of their decisions. The tool is an add-in for Microsoft Excel, and was designed by SSG together with the City of Calgary, Region of Durham, and City of Ottawa. The tool has been customised for use by the Town of Canmore, and the climate team has attended training on how to use this tool on April 29, 2024.

By inputting their project parameters, users would be able to quickly understand the greenhouse gas implications of policies and decisions, such as instituting a composting program or adopting a policy to reduce greenfield development. The calculator is able to do GHG calculations at project-level to see project specific impacts annually, and to aggregate the impacts of all projects at the municipal-level, to evaluate the overall expected emissions on a year-by-year basis. Comparing this total with the allocated carbon budget will show if the municipality is in deficit or surplus, and if steps should be taken to stay within the budget.

The GHG Calculator is suitable for typical municipal projects. For major projects that require investments above a certain threshold, or are externally funded, a higher level of scrutiny is applied using third-party standardized approaches or standards such as the ISO 14064 or GHG Protocol methodologies, while other projects apply a simpler approach with the GHG Calculator for Municipal Projects.

Implementation

In practice, capital and operating expenditures by the Town of Canmore determine the level of corporate greenhouse gas emissions and have direct and indirect impacts on the level and pattern of greenhouse gas emissions in the community.

The connections include decisions made about solid waste services, transportation infrastructure investment, land-use planning and zoning, development bylaws, and many other areas of municipal operating and capital expenditures. Therefore, even in the first phase of the carbon budget framework's implementation, a key design issue will be anticipating community emission impacts and incorporating them into budgetary proposals. This will require ongoing evaluation and tracking of the GHG impacts of the Town's expenditures, adaptive management regarding tracking, and adjustments of programs and policies as needed. The overall Climate Emergency Action Plan (CEAP) outlines all of these recommended actions.

Many different approaches can be taken to phasing the implementation of the carbon budget framework so it can be fully applied to the next Town of Canmore budget. These approaches include demonstrating the framework with a subset of departments, focusing on capital budgets first, starting with the decisions that have the largest emission impacts, or starting with the decisions with emission consequences that are most sensitive to delay.

Another question is how best to situate managing the carbon budget process within the organization. There is a certain amount of technical expertise required in the quantified analysis of emissions impacts, suggesting the option of a carbon budget office that could support town departments in complying with the requirements of the carbon budgeting and accountability processes. On the other hand, a more distributed approach to compliance could result in higher levels of "carbon literacy" throughout the organization, which, in turn, would generate more innovative proposals for meeting mission-critical objectives with low-carbon solutions.

The initial recommendation is that the responsibility for the Carbon Budget Framework should be assigned to the Finance Department. As implementation ramps up, additional staff will likely be required. Project managers should be responsible for project-level GHG quantification.

While the objective is to align the carbon, operating, and capital budgets, there will also be trade-offs, and the process will ensure that decision-makers are able to evaluate the options with more complete information. In particular, every proposed expenditure will indicate whether it increases or decreases GHG emissions or has no impact and whether it saves money or costs money.

The carbon budget framework will ensure consideration of GHG emissions during project development, and will therefore help Canmore avoid stranded investments—projects that are implemented and need to be adjusted or undone because they lock in GHG emissions that the town cannot afford.

By distributing responsibility for GHG quantification to project managers, the carbon budget framework will increase climate literacy across the organization so GHG emissions become a currency similar to money.

Conclusion

The Carbon Budget Framework is a carbon management system that allows the Town of Canmore to integrate corporate and community GHG emissions into key decision-making processes.

When fully developed and implemented, the carbon budget framework will provide transparency about how decisions by the Town Council and Administration impact Canmore's ability to achieve its GHG reduction targets.

This ensures the GHG implications of policy or financial investment decisions are clearly understood, allowing decision-makers to make informed choices and understand trade-offs about if the project or investment will get Canmore closer or further from its GHG targets, before the project is implemented.

The Town will face a range of challenges when establishing a carbon budget framework, such as different risk appetites and fluctuating political and executive leadership, as well as operational, financial, contractual policy, and legal constraints. Creating awareness, training staff, and building support amongst Town Staff and Council will be key towards successful deployment of the carbon budget framework.

Appendix A: Case Study: Oslo's Carbon Budget

The City of Oslo pioneered the climate budget approach to local government climate mitigation planning and is now implementing its fourth annual climate budget. The following observations are based on a review of the 2019 and 2020 Oslo climate budgets and the related 2020 Oslo capital and operating budgets.

Oslo has a population of just under 700,000 and is one of the world's most energy-efficient cities. It also has the advantage of a virtually carbon-free, hydroelectricity-based electric grid, and per-capita greenhouse gas emissions in Oslo are currently about 1.6 tonnes per capita, among the lowest in the developed world. Over half the city's emissions are from road transport, and another 25 per cent come from the city's waste incineration and energy supply facilities. Although Oslo anticipates population growth throughout the 2020s, it is pursuing a carbon budget that would reduce its emissions by more than 90 per cent by 2030 (95 per cent relative to their 2009 base year).

The City of Oslo maintains a special climate agency, which is a branch of the Department of Environment and Transport, but the responsibility for reporting and managing the climate budget resides with the financial department.The Carbon Budget constitutes the first chapter after the introduction in Oslo's Financial Budget. For the four-year budget planning cycle (2020–2023), new operating expenditures (not including previously approved funding) to implement climate measures total CAD 110 million but increase steadily from CAD 17 million in 2020 to CAD 41 million in 2023. In addition, the 2020 capital budget includes CAD 3 million for EV charging infrastructure and dedicated parking for shared vehicles. These allocations for carbon budget implementation represent less than half of 1 per cent of the City's operating budget, and an even smaller portion of the capital budget, but that does not reflect the extent to which carbon budgeting influences both capital and operating budget decisions and priorities. Placing the responsibility for the carbon budget with the City's financial planners and comptrollers and giving the carbon budget priority placement within the City's budget documents, has the effect of bringing a carbon lens to all financial decisions and priorities.

>> A successful aspect of Oslo's carbon budget is its management by the City's financial planners and controllers.

In Norway, the federal and state governments share Oslo's commitment to making the transition to a low-carbon future, and they back that commitment with strong policies and programs, including a federal ban on the use of heating oil for space heating (already in effect), a pending ban on the use of any fossil fuel for building heating, and generous tax incentives for purchasing electric vehicles. These and other senior government policies constitute major contributions to Oslo's plans for meeting its ambitious carbon budget.

The most recent statistics for Oslo's greenhouse gas emissions show a 16 per cent decline between 2015 and 2017. National emissions decreased by just 0.9 per cent in 2018 and the city is expecting that when the 2018 statistics for Oslo are published they will confirm a slowing of progress toward the emissions target.

Oslo's carbon budget for 2020 targets 560,800 tonnes CO2e reduction compared to the 2009 reference year, but only 452,000 tonnes CO2e of this total are the result of quantified measures in the budget (Appendix 1). Not all emission reduction measures can be quantified. This is especially true of enabling measures, such as the provision of training for building retrofits, or the building of infrastructure for electric vehicles. In other cases, the experience or data does not exist to quantify a measure or it is impossible to isolate its impact from other causes. Some "soft" measures, such as public education on the importance of climate change, build the necessary support for government investments and policies but are impossible to quantify with the precision required for a budgeting exercise. Performance indicators can still be identified and measured for these actions, but the impact on emissions can only be assumed.

The baseline of projected emissions under a BAP scenario is a critical tool in the Oslo carbon budgeting process because it provides the basis for quantifying the expected impacts of measures adopted to close the gap between the budget and the baseline.

Three categories of measures are identified in the Oslo carbon budgeting process: (1) measures with quantified emissions reductions (e.g. the ban on fuel oil for heating), (2) non-quantified measures that are expected to provide emission reductions (e.g. increased investment in public transport), and (3) foundation measures (e.g. communications and marketing, research and development, and demonstration). In the Oslo lexicon, a "measure" is the physical change that results in reduced GHG emissions, and the term "instrument" is used to describe the tools authorities use to trigger the measures, such as duties, regulations, subsidies and incentives, and information campaigns.

The Oslo climate budget process includes frequent reporting, and this is regarded as key to successfully integrating carbon considerations into Oslo's broader planning and budgeting processes. Progress is reported on the same schedule as financial reporting—three times a year. The "climate barometer" is also an important component of Oslo's engagement strategy.

>> The accountability mechanism of Oslo's carbon budget is transparency through annual reporting.

A major source of funding for climate initiatives in Oslo is the "toll ring", a charge on vehicles entering central Oslo that is in the range of CAD 6–8 for cars, depending on time and fuel type, with electric and hydrogen cars being fully exempt. While raising funds for other measures in Oslo's climate strategy, the toll ring also reduces the number of gas and diesel vehicles entering the core, provides an incentive for electric vehicle purchases, and helps promote transit use.

Oslo's Climate Agency leads the measure quantification work in collaboration with the responsible City departments, utilizing external consultants as required. A pragmatic, flexible, bottom-up, factor-based approach is preferred because this provides more measurable inputs for quantification and verification and allows the specific quantification method to be tailored to the measure and available data.

Appendix B: Case Study: Edmonton's Carbon Budget[1]

The City of Edmonton incorporates carbon considerations directly into the City's standard financial budgeting process. During the budget cycle, all approved requests within the capital, operating and utility budgets are brought into one carbon budget document. The City then calculates the amount of carbon eliminated or added from each request using various carbon accounting methods. The City's emissions forecast, and remaining carbon budget are then updated based on the total emissions for each budget request. This only includes requests that were approved by Council and could be quantified.

In December 2022, Edmonton released Canada's first municipal carbon budget report for the period of 2023-2026. The report indicated that Edmonton was on track to deplete its carbon budget of 176 Mt CO2e by 2037 and would fall short of its 2050 net-zero target.

Despite these findings, Edmonton's commitment to the carbon budgeting process is still encouraging. It provides residents with access to up-to-date information on the climate impacts of all municipal capital and operating decisions.

This transparency empowers residents and Council to hold the City accountable for its actions and serves as a catalyst for municipal decision-makers to reassess their strategies and make necessary corrections.

[1] Clean Air Partnership, 2024. Climate Accountability Toolkit: A Roadmap for Municipalities.

Appendix C: GHG Quantification Resources

Document	Use case	Guidance
WBCSD (2005) The GHG Protocol for Project Accounting	Expert-level guidance on key concepts and methods for quantifying GHG emissions from projects.	Comprehensive guidance on GHG accounting for projects.
ISO 14064- Part 2	Industry standard approach. Applies to large projects where third party quantification is required.	Standard method for quantifying GHG emissions from projects.
CAPCOA (2010) Quantifying Greenhouse Gas Mitigation Measures	Guidance for typical community-scale projects. First stop for quantification completed internally in the City. Accessible to most project managers.	Method and formula for calculating GHG emissions for community projects.
CPA (2016). The Time Value of Carbon.	Applies to projects which release CH4 and HCFCs.	Accounting method to capture the impacts of CH4 and HCFC.
Government of Canada (2018). Climate Lens- General Guidance	Applies to projects with federal funding. Refers to the GHG Protocol and ISO 14064.	Incorporates both mitigation and resilience.
FCM (2020). Guidebook on quantifying greenhouse gas emissions reductions at the project level.	Appropriate for small budgets, simple projects, or preliminary quantifications.	Simple, entry-level introduction. Guidance for municipal projects.

Document	Use case	Guidance
ChemInfo (2017). Ontario Public Service Guidance Document for Quantifying Projected and Actual Greenhouse Gas Emission Reductions	Designed for public-sector projects. Useful for large projects.	Comprehensive guidance for projects of all scales and impacts.
SSG (2023). GHG Calculator for Municipal Projects	Designed for typical municipal projects and policies. Useful for quick, preliminary GHG quantifications.	Microsoft Office Add-in for Excel. Estimates project GHG emissions with formulas and emission factors embedded within the tool.


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