Calgary Climate Mitigation Action Plan White Paper

BEST PRACTICE REVIEW FOR THE 2022 CALGARY CLIMATE MITIGATION ACTION PLAN UPDATE

CLIMATE CHANGE PROGRAM, CITY OF CALGARY

Contents

Introduction

This white paper is intended to inform and initiate discussions regarding best practices relevant to updating the 2022 Calgary Climate Mitigation Plan (the Plan), which will be presented to Council in Q2 2022. The policy direction provided through the white paper process is considered to be preliminary and will be used when updating the Plan, which will be aligned with the objectives of the Paris Agreement. This white paper outlines five strategic pathways to help overcome the challenges to reduce Calgary's greenhouse gas (GHG) emissions, in responding to the climate emergency via net zero homes and buildings, renewable energy supply, zero carbon mobility and land use, zero waste, carbon capture storage and utilization, and carbon budgeting and funding.

Along with more than 130 countries in committing to be net zero emissions by 2050, including all other G7 nations, Canada has committed to reach net zero emissions by 2050. Achievement of this ambitious emission reduction target will require rapid decarbonization initiatives at the federal, provincial/territory, and municipal levels. According to the federal government, "achieving net zero emissions means our economy either emits no GHG emissions or offsets its emissions.[1]"

In 2018, Calgary City Council unanimously approved its Climate Action Plan titled the Climate Resilience Strategy and within that strategy was a Climate Mitigation Action Plan. "Calgary City Charter requires that the Action Plans be reviewed and updated every five years."[2]

On November 15, 2021, Calgary City Council voted to declare a climate emergency, which increased the ambition of climate action in Calgary and committed to achieving net zero emissions by 2050.

Low Carbon Economy

A low carbon economy is an economy that operates on clean energy sources, and therefore produces little to no GHG emissions. Currently in Calgary, increasing economic output is tied very closely to increasing greenhouse gas emissions. The transition to a low carbon economy will mean that economic growth is decoupled from GHG emissions. In other words, the economy may grow while at the same time, GHG emissions decrease.

Many of the opportunities to reduce GHG emissions in Calgary are also economic development opportunities. By investing in the low carbon energy transition, Calgary will stimulate its economy, improve its energy security, create employment and generate a wider range of social benefits such as improved public health and reduced energy poverty through investments in energy efficiency and low carbon development.[3]

[1] See: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html
[2] See: https://www.calgary.ca/uep/esm/energy-savings/climate-change.html?redirect=/climateprogram
[3] https://www.calgary.ca/content/dam/www/uep/esm/documents/esm-documents/economics-of-low-carbon-development-calgary.pdf

As part of tracking our progress to a low carbon economy, most common metrics for low carbon economies across municipalities include job creation, gross domestic product (GDP) and energy cost savings.

Since 2005, Calgary's economy has grown, and overall GHG emissions have remained relatively flat. Total jobs per GHG emissions increased by 25 per cent and GDP per community wide GHG emissions increases by 28 per cent since 2005. The total community wide GHG emissions still fluctuate based on Calgary's economic performance. As part of the Calgary Climate Mitigation Action Plan updates in 2022, *The Economics of Low Carbon Development* report from 2018 will be updated, and performance indicators and measures will be addressed.

Climate Mitigation Action Plan Best Practices

Cities can have a significant influence on GHG emissions. Local governments have some control more than half of the country's GHGs and are key to meeting Canada's climate goals as stated by The Federation of Canadian Municipalities (FCM). Choices made in cities today about long-lived urban infrastructure will determine the extent and impact of climate change, our ability to achieve emission reductions and our capacity to adapt to changing circumstances. Local government is also closest to citizens, which is central to understanding the social realities of climate protective actions. Integrated climate planning and policy needs to focus on how to mitigate and prepare for climate change. It connects land use, ecosystem, watershed and spatial planning with energy systems and infrastructure. It brings public awareness and engagement to the fore, it reaches across sectors and agencies, and it connects local activity with higher levels of government.

A comprehensive climate action plan will be important to address some main technical elements of climate change mitigation, "including an assessment of existing conditions, a summary of climate risks, a GHG emissions inventory and a detailed overview of the strategies and actions cities will pursue for achieving reductions in GHG emissions and improvements in climate resilience over time, according to the United Nations Human Settlements Programme."[4]

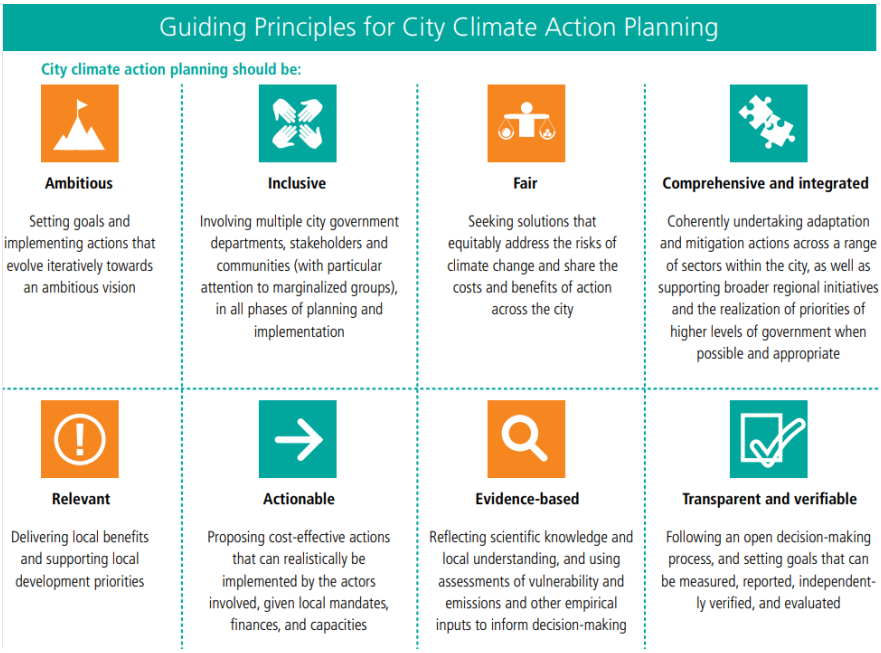
C40 also recommends that a climate action plan aligned with the Paris Agreement will:

1. Develop a pathway to deliver and emissions neutral city by 2050 at the latest, and set an ambitious interim target and/or carbon budget;
2. Demonstrate how the city will adapt and improve its resilience to the climate hazards that may impact the city now and in future climate change scenarios;
3. Engage with the community to inform the plan, outline the social, environmental and economic benefits expected from implementing the plan, and establish ways to ensure equitable distribution of these benefits to the city's population;

[4] C40 Climate Action Planning Resource Centre

4. Detail the city's governance, powers, and capacity, as well as identify the partners who need to be engaged in order to accelerate the delivery of the city's mitigation targets and resilience goals.[5]

A robust climate action planning (CAP) should consider interdependencies between adaptation and mitigation initiatives to maximize their benefits using municipal resources and partnerships. "It is important for an effective plan to be transparent, equitable and developed with stakeholders' input and support." [6]The City of Calgary follows very similar approaches and is developing adaptation and mitigation action plans in conjunction; however, best practices associated with Climate Adaptation Action Plans are outlined in the Climate Adaption White Paper.



Source: Guiding Principles for Climate Action Plan Planning, UN-Habitat, 2015[7]

- C40's CAP Framework outlines essential criteria, organized into three separate pillars, that a leading CAP should include with examples of more ambitious actions that cities can take. This criterion is summarized in the table below:

[5]https://cdn.locomotive.works/sites/5ab410c8a2f42204838f797e/pages/5ae2f92374c4837e195d0e00/files/20200324_C40_Climate_Action_Planning_Framework.pdf?1620380307
[6]C40 Climate Action Planning Resource Centre
[7] The Guiding Principles | UN-Habitat (unhabitat.org)

Pillar	Category	Sub-Category	Essential	Ambitious Examples
Commitment and Collaboration	Vision, commitment and engagement	Long-term vision and political commitment	A signed commitment from the mayor or city leader, to begin implementing transformational and inclusive action to deliver an emissions neutral and climate resilient city by 2050, consistent with the objectives of the Paris Agreement.	- A signed legislative commitment with cross-political and/or multi-sector support for delivering the plan and the objectives of the Paris Agreement; - Signed legislation; - Commitments published in other documents outside of the plan, clearly referencing the plan and the signatory.

		Targeted engagement and consultation with stakeholders	The plan is informed by consultation with key government, business and civil society stakeholders (including the communities directly impacted by climate change).	- The plan is informed by a stakeholder engagement strategy (which identifies a vision for engagement with hard-to-reach groups and communities), stakeholder mapping and analysis, techniques and tools and monitoring efforts and feedback during the plan's implementation; - Reports of community or stakeholder engagement (e.g. townhall meetings, focus groups, surveys), including government, business and civil society stakeholders. This could include stakeholder engagement at neighbourhood level, such as a survey demonstrating that a wide range of groups (on the basis of gender, age, ethnicity, income) are informed and aware of the development of the plan; - A tracker or log, documenting stakeholder feedback received and how it has been addressed in the plan; - A pledge and/or letter of support from business and/or civil society to support the city's climate change goals; - Letters of support from other levels of government.

	Coordination with related initiatives and institutions	Evaluation of related city legislation and plans	A review of the opportunities for integration with existing laws, regulations, policies, plans, and of the local government institutions that are key for accelerating delivery and are involved in the development of the plan.	- Update existing city laws, regulations, policies and plans in order to integrate and accelerate the delivery of climate action; - Integrate or align other plans with the CAP (e.g., social, economic, transport, buildings, energy plans or strategies); - Provide written confirmation from local government institutions that city laws, regulations, policies or plans will be updated to reflect the goals of the CAP.
		Identification of related national and regional commitments	Identification of relevant commitments (governmental and non-governmental) and acknowledgement of where targets and actions are shared with or owned by other tiers of government or stakeholders.	- Commitments to or letters already submitted to other tiers of government that advocate for amendments to existing relevant legislation, policies and plans in line with the objectives of the Paris Agreement; - Collaboration with relevant authorities to update, reform or introduce the national or sub-national commitments, laws, regulations, policies or plans needed to accelerate transformational climate action. City advocacy for updates to national or sub-national laws, regulations, policies or plans, where they might pose a challenge to the plan's delivery; - Commitments to or evidence of meetings held to discuss collaboration to deliver climate actions.

	Goals and targets for mitigation and wider benefits	Emissions neutrality target and interim target	Ambitious targets in the climate action plan align with emissions declining rapidly or peaking in the shorter term (e.g., 2030) and achieving emissions neutrality in the longer term (by 2050). Targets are informed by, and aligned with, the principles of C40's Deadline 2020 research.	- City wide emissions budgets are adopted, in addition to targets; - Targets and carbon budgets exceed the indicative emissions reductions identified in the Deadline 2020 research; - Targets and carbon budgets are identified for specific sectors, strategies and actions as well as for city-wide action; - The targets and carbon budget are established based on detailed emissions modelling.
		Goals and targets for wider benefits	The plan identifies goals and/or targets for the additional benefits of climate actions.	- Goals and targets are identified for specific benefits at the city, sector, community and/or action level; - Benefits are highlighted at the sector/ community level, either within the plan or as an accompanying socioeconomic or environmental impact study (or similar); - Ambitions are derived from the robust measurement of benefits and from projections based on reasonable assumptions (detailed where possible).
	Human resources	Human resources identified within government	The human resources that are needed to ensure delivery of the plan in the short term have been identified, and, where possible, appropriate budgets have been allocated.	- There is a long-term plan or commitment to secure skills and capacity, through recruitment and/or training; - A summary of the city's budget planning cycle aligned with detailed programming of longer term actions in the plan of year one climate actions (e.g. as part of internal project management documentation); - Departmental business plans showing/ specifying the allocation of human and capital resources to the CAP.

	Communications, outreach and advocacy	Comprehensive communications, outreach and advocacy program	There is a communications plan for the CAP launch and implementation, which informs stakeholders in the city. The communication plan incorporates information on how stakeholders will be able to contribute towards the implementation of the plan.	- The city's communication efforts are specifically designed to inform hard-to-reach groups and communities, as well as those who will be particularly impacted by the city's climate actions; - The city involves partners and stakeholders in co-designing and delivering communications and education regarding the plan; - Scheduled meetings with stakeholder groups or a schedule of communications to be published through media channels; - Examples of marketing/communications materials (e.g. flyers, websites, social media content) and evidence of planned or completed outreach events (e.g. programs with schools, businesses, communities) where city staff have communicated/will communicate the plan; - Education and capacity-building materials prepared for specific audiences; - Communications materials translated into commonly spoken languages and different languages for international audiences.

Challenges and Opportunities	City context	Current climate and environmental quality	There is a description of the administrative boundaries and physical geography as relevant to climate change (e.g., coastal, inland, fluvial, topography, elevation).	- Information is provided on the city's environmental quality (e.g. air quality, water quality, soil quality, noise pollution) and/or resource management (e.g. solid waste volume and management, water, energy, food sources and consumption); - Third-party research (e.g. academic or research institution) about the city's environment and climate is used as evidence for (and referenced in) the plan; - Published environmental indicators and monitoring databases are referenced in the plan.

		Socioeconomic context and key future trends	Contextual information (including trends where available) is presented. This includes indicators or information on social and economic priorities for the city (e.g., demographic information, as well as information on key themes such as health and wellbeing; education and skills; economic prosperity; essential public services; civil society; institutions and governance). Where available, information is included on the availability/ access, affordability/ prosperity, and spatial inclusion aspects of these themes.	- Additional socio-economic data on population demographics and disaggregated data (e.g., travel patterns, age profiles, immigration, skills in relation to climate action); - Contextual data on city infrastructure and systems (e.g. waste management systems, quality/age of critical assets such as buildings and infrastructure); - Data on economic growth (e.g. housing affordability, energy demand/access/poverty, employment rates) within the city; - Contextual city data regarding future trends within the city (e.g. emerging technologies, innovations and disruptors enabling transformational action); - The plan provides data or information in relation to the Sustainable Development Goals, and maps interdependencies between indicators; - The plan includes assessments of critical assets or functions (e.g. water supply and distribution) in relation to future climate projections, undertaken by a skilled professional.

	City management and powers	City administrative structure and scope of the plan	The plan describes the city's governance and administrative structure and the scope of the plan (e.g., the inclusion of non-governmental bodies).	- There is a detailed mapping of decision making and operational roles and responsibilities across local government institutions and their relevance to delivering the plan; - A diagram showing connections between local government institutions and other tiers of government, highlighting roles and responsibilities related to the plan; - A stakeholder map showing other organizations within the city that have a role in delivering the plan, and the relationship between them and the lead local government institutions.
		City powers and capacity	There is an assessment of the powers held by city government over relevant sectors, assets, and functions or actions, noting where additional collaboration is needed to accelerate the delivery of transformational actions over the short term.	- There is an assessment of which other stakeholders have powers over sectors, assets, and functions or actions where city government power is weaker; - Detailed sector-, asset-, function-, or action-based assessment of powers.

	GHG emissions inventory	GHG emissions inventory	The sector-level inventory includes details of, or references to, the methodology used, and covers the following emissions sources: scope 1 emissions from fuel use in buildings, transport and industry; scope 2 emissions from use of grid-supplied energy; and scope 1 and 3 emissions from waste generated within the city's boundary. The inventory covers a full year of data and was compiled no more than 4 years prior to publication of the plan. The inventory also includes emissions from the 'industrial processes and product use' (IPPU) sector and the 'agriculture, forestry and other land use' (AFOLU) sector where the city's economy contains strong contributions from the industrial and agricultural sectors.	- The inventory is available for multiple years, including an assessment of consumption-based emissions. There is a commitment to tracking consumption-based emissions; - A consumption-based emissions inventory for the city.
	GHG emissions trajectories	Business-as-usual emissions trajectory	The BAU emissions trajectory is presented in the plan, which takes into account the projected population and economic changes for the city and provides a scenario to 2050. The methodology is documented, with transparency on the inputs and assumptions used.	- The BAU emissions trajectory incorporates sector-specific trends and considerations appropriate to the local context, including anticipated sectoral energy intensity changes; - The BAU emissions trajectory is provided in 10-yearly (or higher frequency) breakdowns; - Multiple BAU scenarios are described, based on various plausible future factors.

		Emissions trajectory or carbon budget	Evidence is presented to show that the strategies and actions (conditional or unconditional) identified in the CAP could deliver on the emissions trajectories and targets (or budgets) that have been established. Any residual emissions are identified in this emissions trajectory.	- The carbon budget specifies actions in a detailed emissions trajectory (based on a contraction and convergence methodology); - The budget and actions are distributed across 3-year or 5-year cycles and there are regular reviews and annual public reporting; - Documentation of the rationale and calculations for any adopted carbon budgets (e.g. based on emissions trajectories, or other carbon budgeting methodologies); - The expected aggregate impact of specific major climate actions is projected against milestone through to 2050; - Actions are allocated to individual institutions, who are responsible for implementing actions and meeting key performance indicators.
Acceleration and implementation	Mitigation actions designed to be equitable and inclusive	Evidence-based mitigation actions	The list of mitigation actions is informed by the evidence base. It focuses on the highest emissions sectors, and the actions that deliver the greatest emissions. Mitigation actions are considered in an integrated way, maximizing efficiencies and minimizing investment risk.	- There is a detailed summary of actions across sectors that identifies synergies between mitigation to actively leverage interdependencies. The summary includes major actions implemented/planned by the city government and other tiers of government, quantified in terms of their contribution to the city's mitigation targets; - An interdependencies study of mitigation actions or a mapping exercise for action synergies.

		Funding and financing	Potential financing / funding sources for priority actions have been identified.	- Actions have been assessed to determine anticipated costs (i.e. operational and capital costs) as well as potential financing / funding sources; - A budget plan covering the first city short term budget cycle, clearly outlining the anticipated costs of climate mitigation actions; - A spreadsheet highlighting the whole lifecycle costs attributed to actions in the plan; - There is a detailed summary of financial resources that are allocated to mitigation actions; - A cost-benefit analysis of action implementation is included in the plan.
		Transparent methodology for prioritization of actions	Actions are selected and prioritized based on their impact on reducing GHG emissions, or on their wider benefits. The prioritization methodology is documented.	- The wider impacts or benefits relevant to the city (e.g., health, air quality, employment, equity) are also considered when prioritizing actions; - Stakeholders from beyond city government (e.g. business and civil society) are engaged in the prioritization process
		Identification of the wider benefits	Wider social, environmental and economic benefits of climate actions are identified in the plan and aligned with local priorities.	- Relevant social, environmental and economic benefits of climate actions are quantified in the plan wherever possible and are used to prioritize actions and to articulate the business and social case for delivery; - Method papers and/or calculation spreadsheets showing how benefits have been measured for specific climate actions, using robust and transparent methodologies.

		Fair and equitable distribution of benefits	There is an explanation of how inclusivity has been taken into account across the suite of actions and how specific vulnerabilities or inequalities in the city are addressed within the plan.	- There is a social and/or economic impact assessment of the plan (or an equivalent process); - Vulnerable groups are actively engaged in the development of the plan to ensure that impacts are well understood and addressed; - Specific actions of the plan target vulnerable groups to reduce inequality and maximize benefits; - Actions are prioritized based, in part, on their ability to improve accessibility and distribution of benefits.
		Action ownership and powers	Each action has, at a minimum, a lead institution. The means of implementation (conditional or unconditional of the support of, or funding by other actors) are identified in the plan. Where other actors have been identified as lead organizations, the role of the city in tracking progress, as well as partnership or collaboration arrangements, should be described.	- Partner organizations are engaged and committed to contributing to the delivery of actions; - Letters/emails to/from partner organizations inviting or agreeing to collaborate on delivering specific climate actions.
		Delivery timescales	Action delivery timescales (start and end) are linked to the 2050 emissions trajectory, demonstrating how actions will contribute to meeting stated goals.	Action delivery timelines are broken down into phases (e.g. planning, design, construction) with milestones on the way to the end date.
	Identifying barriers	Identifying barriers	Significant barriers to implementation of actions have been identified, along with actions to overcome them.	- The impacts of the implementation of actions are assessed using 'systems thinking' (e.g. linkages between actions on energy and buildings and unintended consequences);

	Residual emissions	Residual emissions	Once all action is exhausted, the quantity of residual emissions is estimated through to 2050 and identified in the 2050 trajectory. There is a written commitment to update emissions trajectories and to maintain an up-to-date estimate of residual emissions.	- A strategy that commits the city to monitoring residual emissions, the sources of these emissions and the policies, technologies and/or mechanisms to reduce the residual amount; - Offsets are pursued only where necessary and according to environmental integrity and transparency principles. Where possible, offsets are used only to reduce scope 3 and/or consumption-based emissions (e.g. transboundary aviation). Where cities choose to offset, there is a strategy for managing offsets (e.g. identifying accredited offsetting measures).
	Monitoring, evaluation, reporting and revision	Monitoring implementation	There is a process for monitoring and reporting progress on implementation of the climate action plan with key performance indicators identified for priority actions. This includes regular monitoring and public reporting, in line with existing governance and reporting systems.	- There is a public access data and reporting platform; - Evidence of Mayoral / senior official briefings on action implementation; - A data and reporting platform led by the city (in development or operational).

		Evaluation of impact	There is a process for evaluating impact of the climate action plan, which includes city wide emissions reductions and the equitable distribution of benefits. There is a commitment to regular evaluation of impact of the climate action plan in line with city context/capacity.	- The plan includes a commitment to evaluate the impact of priority/all actions on a regular basis; - The emissions inventory is updated annually; - Information is updated on a public city specific reporting platform, with information on emissions reductions and associated inclusive benefits; - Evidence of review meetings in which impact has been discussed; - Evidence of annual emissions reductions projects previously undertaken; - A data and reporting platform led by the city (in development or operational).
		Review and revision of the plan	There is a commitment to publishing updates, supplements or addenda on a five-yearly basis, and/or at the start of each new mayoral term (particularly where a change of administration has occurred), informed by evidence from monitoring and evaluation.	There is a commitment to a 3-yearly process of review and revision, informed by evidence from monitoring and evaluation of major transformational actions.

Source: Climate Action Planning Framework, C40 Cities, 2021[5]

As of the United Nations COP26 summit in early November 2021, the world was on track for disastrous levels of global warming far in excess of the limits in the Paris climate agreement. According to published research, temperature rises will top 2.4 degree Celsius by the end of this century, based on the short-term goals countries have set out.[8] The world would need to halve emissions over the next decade and reach net zero carbon emissions by 2050 if we are to limit global temperature increase to 1.5°C. Canadian cities have been working on near-term and long-term GHG mitigation targets to align with the initiatives:

- Near-term and long-term GHG mitigation targets from some other Canadian municipalities:
  - Edmonton targets:[9]
    - 2025 – Reducing community-based net GHG emissions by 35 per cent (compared to 2005 levels)
    - 2030 – Reducing community-based net GHG emissions by 50 per cent (compared to 2005 levels); Reduce energy consumption by 35 per cent per person by 2030 (compared to 2005 levels); Generate 10 per cent of Edmonton's electricity locally
    - 2050 – Achieving net zero GHG emissions per person
  - Toronto mitigation targets[10] based on 1990 levels:
    - 30 per cent by 2020
    - 65 per cent by 2030
    - Net zero by 2050, or sooner
  - Vancouver target[11]
    - Reduce carbon pollution by 50 per cent by 2030

[8] See: https://www.forbes.com/sites/teakvetenadze/2021/11/09/researchers-predict-dire-24-degree-temperature-rise-even-with-climate-pledges/?sh=7afb8e087afb

[9] Edmonton's Community Energy Transition Strategy and Action Plan

[10] TransformTO, Net Zero Strategy, and GHG Inventories – City of Toronto // TransformTO Reports & Resources – City of Toronto

[11] Climate Emergency Action Plan | City of Vancouver

Themes The City's 2018 Climate Resilience Strategy identified the most relevant areas for mitigating GHG emissions in the community at that time. The themes will be updated to better enable action and to further focus the City's efforts at reducing emissions to achieve its interim and long-term GHG emission reduction targets.

Proposed themes for the updated Mitigation Action Plan are below with best practices associated with each theme. These themes and best practices will be discussed during internal and external stakeholder engagement currently taking place.

Five focus areas/big moves have been identified in the previous version of the 2018 Climate Resilience Strategy to achieve the most reduction and effective pathway to achieve our net zero GHG target by 2050:

- Net Zero Homes and Buildings
- Renewable Energy Supply
- Zero Carbon Mobility and Land Use
- Zero Waste
- Carbon Capture Utilization and Storage

Net Zero Homes and Buildings

Homes and buildings are the largest source of GHG emissions in Calgary today, accounting for two-third of total community emissions. Approximately half of building emissions are attributed to residential buildings, including single-family homes, and half to commercial and institutional buildings. Emissions stem from the use of natural gas to warm buildings and to heat water. Some other North American cities has implemented voluntary performance measures and targets that will transition to mandatory requirements in a few years. Other jurisdictions, including Vancouver, New York City, St. Louis, Washington D.C. and Washington State have successfully transitioned performance targets from voluntary to mandatory compliance, to drive the required retrofits.

Comparison to other cities:

Theme	**Net Zero Homes and Buildings:** Reduce emissions in all new and existing buildings to net zero emissions by 2050		
Canadian Cities	Edmonton[12]	Toronto[13]	Vancouver[14] [15]
2030 Targets	50 per cent growth from infill development by 2030.	By 2030, all new buildings will be built to produce near-zero GHG emissions.	- To cut our carbon pollution from buildings in half, compared to what we had in 2007 - For 40 per cent less embodied emissions from new buildings and construction projects compared to 2018 - All buildings constructed from 2020 onward to be carbon neutral in operations.
2050 Targets	By 2050, over 350,000 residential buildings and over 11 million square feet of commercial space retrofitted for deep energy savings.	By 2050, all existing buildings will have been retrofitted to achieve net zero emissions.	Not specified other than 100 per cent renewable energy used in Vancouver by 2050.
Performance Measures	ConnectEdmonton Indicators (specifically: Community Greenhouse Gases, Energy Use) indicator reporting.	Not specified yet as this is part of the nine key policy actions.	There are three metrics: - Greenhouse Gas Intensity (GHGI - kg CO2e/m2 annually) - Thermal Energy Demand Intensity (TEDI kWh/m2 annually) - Energy Use Intensity (EUI)
Key Actions/Strategic Approaches	Key actions include accelerated and expanded build-in retrofit program, home renovation program and emissions neutral building standard for	The Net Zero Existing Buildings Strategy includes the following nine key policy action recommendations the City can implement:	There are two reduction pathways to be focused on: - High Performance Building Envelope and Ventilation Systems

[12] https://www.edmonton.ca/public-files/assets/document?path=PDF/EnergyTransitionStrategy2021-04-20.pdf
[13] https://www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-168402.pdf
[14] https://vancouver.ca/files/cov/zero-emissions-building-plan.pdf
[15] Greenest City 2020 Action Plan Part Two: 2015-2020 (vancouver.ca)

Theme	**Net Zero Homes and Buildings:** Reduce emissions in all new and existing buildings to net zero emissions by 2050		
Canadian Cities	Edmonton[12]	Toronto[13]	Vancouver[14] [15]
	new City of Edmonton buildings. Strategy Goal #1: The buildings that Edmontonians live, work and play in are emission neutral and improve personal wellness Strategy Goal #2: Eliminate energy poverty Strategy Goal #3: Catalyze the local green building and energy efficiency industry Milestones: Increasingly stringent energy codes in alignment with federal and provincial governments Urgently increase home renovation rate Over 350,000 residential buildings and 11 million square feet of commercial space retrofitted for deep energy savings.	- Require annual reporting and public disclosure for emissions performance from all building owners - Establish emissions performance targets - Audits and tune-ups for energy and emissions - Provide support to aid in the reduction of cost, complexity, and time related to retrofits - Improve retrofit financing - Simplify permitting and approval for deep retrofits - Awareness and capacity building for homeowners to undertake emissions reduction measures - Support for workforce training and development - Collaboration with other orders of government.	- Neighbourhood Renewable Energy Systems

Opportunities and Challenges:

- Improved building comfort, air quality and environmental control
- Embedded climate resilience in design and building materials
- Create a building-level understanding of energy performance and GHG emissions through energy benchmarking and labelling

- Develop local knowledge, skills, principles and practices to design, construct, operate, and maintain net zero emissions buildings
- Expand local supply chain to support the transition of the building stock to net zero emissions
- Expand local energy assessor availability
- Revisit general understanding of net zero building definitions, costs, and benefits with businesses
- Advocate to increase local industry capacity to perform net zero construction and renovations at the scale required
- Develop financial mechanisms to fund projects at the scale required
- Alignment between governments, utilities and the public on the pathway forward

Renewable Energy Supply

Approximately 91 per cent of electricity in Alberta is produced from fossil fuel, including about 43 per cent from coal and 49 per cent from natural gas. The remaining 8 per cent is produced from renewables such as wind, hydro and biomass.[16]

Solar Photovoltaic energy is generated by panels on rooftops or ground-mounted systems. The cost for this technology has been decreasing rapidly, and more residential and commercial users are installing panels. Since 2009, when the technology was practically new, annual growth rates have been strong with new capacity in 2020 increased by 66 per cent from the previous year. The current installed capacity is measured in kilowatts and is about 2.8 million MW-hour AC per year of solar potential. This applies mostly to residential buildings, which helps to reduce one-third of our community emissions. Other benefits include improved local air quality, reduced reliance on grid electricity, and lower GHG emissions in Alberta.

Comparison to other cities:

Theme	**Renewable Energy Transition:** Support the transition to a low carbon energy supply		
Canadian Cities	Edmonton[17]	Toronto	Vancouver[18]
2030 Targets	10 per cent of the electricity used in Edmonton generated locally by 2030	Not specified	Not specified

[16] CER – Provincial and Territorial Energy Profiles - Alberta (cer-rec.gc.ca)
[17] Edmonton's Community Energy Transition Strategy and Action Plan
[18] Renewable City Strategy (vancouver.ca)

Theme	**Renewable Energy Transition:** Support the transition to a low carbon energy supply		
Canadian Cities	Edmonton[17]	Toronto	Vancouver[18]
2050 Targets	Supplied with 100 per cent emission neutral electricity and heating by 2050 and a complete build out of a city-wide decarbonized district energy network by 2050	By 2050, 100 per cent of energy will come from renewable or low-carbon sources.	Derive 100 per cent of the energy used in Vancouver from renewable sources before 2050
Performance Measures	Renewable Energy Generation via ConnectEdmonton indicators reporting	• Percentage of communitywide energy derived from renewable or low-carbon • Percentage of communitywide floor space energy derived from renewable or low-carbon • Total square metres of floor space connected to low-carbon thermal energy	Not specified

Theme	**Renewable Energy Transition:** Support the transition to a low carbon energy supply		
Canadian Cities	Edmonton[17]	Toronto	Vancouver[18]
Key Actions/Strategic Approaches	Strategy Goal #1: Edmonton is a thriving city powered by low carbon energy Strategy Goal #2: Edmonton is a hub for low carbon energy innovation and investment Strategy Goal #3: Edmonton uses waste as a resource Milestones: Attract and incubate next generation energy companies Plan and establish district energy network Increasing local renewable installations and decarbonizing of the grid	1. Advance Community Energy Planning 2. Advance low-carbon/renewable thermal energy networks (district energy) 3. Create Renewable Energy Strategy	1. Develop new neighbourhood renewable energy systems 2. Support on-site renewable energy generation 3. Increase renewable grid electricity supply 4. Support ownership and financing

Opportunities and Challenges:

- Collaboration with energy sectors
- Calgary's innovation ecosystem is supporting tech startups across diverse sectors – this helps to attract innovators and increase employment rate
- Alberta is phasing out coal by 2030 and our economy is still relying on oil and gas industries – will continue to advocate with provincial governments on clean energy policies

Zero Carbon Mobility and Land Use

Urban transport energy efficiency and environmental sustainability continue to present big challenges for city leaders and policy think tanks. As the share of the world's population living in cities grows to nearly 70 per cent between now and 2050, urban transport energy consumption is forecast to double to meet the travel demand in the world's future cities.

Currently, electric vehicle registrations are increasing in Calgary, based on availability of new models from manufacturers and increasing availability of charging infrastructure. Electric vehicles account for a small number of the one million vehicles in Calgary, but rapid growth is happening. New registrations in 2020 increased by 80 per cent from the previous year. Benefits of this conversion will include improved local air quality, lower energy use, and decreased greenhouse gas emissions.

In addition to supporting low carbon vehicles and infrastructure, land use development patterns, and the corresponding building types and transportation systems can influence our climate mitigation targets. Considering climate change in land use planning practices can assist in reducing emissions, increasing resilience, and achieving the long-term goal of a low carbon city[19].

Comparison to other cities:

Theme	**Zero Carbon Mobility and Land Use**		
Canadian Cities	Edmonton[20]	Toronto[21]	Vancouver[22] [23]
2030 Targets	The complete build out of the active transportation network with a completed zero emission vehicle charging network by 2030 - 50per cent trips by active transportation by 2040 - 15-minute communities with nodes and corridor approach	Not specified	- 90 per cent of people living within an easy walk or roll of their daily needs - 2/3 trips in Vancouver to be by active transportation and transit - Reduce average distance driven per resident by 20 per cent from 2007 - 50 per cent of the km driven on Vancouver's roads to be by zero emissions vehicles
2050 Targets	Edmonton with city districts that are carbon neutral by 2050	By 2050, 100 per cent of vehicles in Toronto will use low-carbon energy; 75 per cent of trips under 5 km will be walked or cycled.	Not specified

[19] Climate-Brief_Land-Use-Planning-bm.pdf.aspx (cip-icu.ca)
[20] https://www.edmonton.ca/public-files/assets/document?path=PDF/EnergyTransitionStrategy2021-04-20.pdf
[21] TransformTO: Climate Action for a Healthy, Equitable & Prosperous Toronto
[22] Climate Emergency Annual Report presentation - 2021 (vancouver.ca)
[23] Greenest City 2020 Action Plan Part Two: 2015-2020 (vancouver.ca)

Theme	Zero Carbon Mobility and Land Use		
Canadian Cities	Edmonton[20]	Toronto[21]	Vancouver[22] [23]
Performance Measures	ConnectEdmonton Indicators (specifically: Community Greenhouse Gases, Energy Use, and Renewable Electricity Generation)	Decreased tonnes of CO2e from transportation sector Increased number of low or zero carbon personal vehicles Increased number of low or zero carbon public transit vehicles Increased percentage of active transportation used for trips under 5km	Not specified
Key Actions/Strategic Approaches	Key actions include completing building out of a zero emission charging network, complete build out of active transportation network, work on development and redevelopment that creates 15 minute communities with a nodes and corridor approach. Strategy Goal #1: Edmonton is planned, designed and built to be a vibrant Strategy Goal #2: Safe and accessible zero emission mobility Strategy Goal #3: Edmontonians reduce consumption based emissions by supporting local businesses Milestones: Completing building out of a zero emission charging network, complete build out of active transportation network,	- Invest in infrastructure and programs to support safe cycling and walking - Enhance transit network infrastructure and service levels - Develop a community-wide low carbon freight strategy, and related interdivisional policies, regarding urban goods movement/urban freight in alignment with Metrolinx's Regional Transportation Plan - Catalyze EV infrastructure and support electric vehicle sales.	Walkable, complete neighbourhoods: - Exceed our walkable neighbourhoods target in current planning initiatives, such as the Broadway Plan, and achieve a sustainable transportation target of at least 80 per cent of trips be made on foot, bike, or transit by 2030 in current and emerging planning areas around rapid transit stations. - Bring walkable, complete neighbourhoods city-wide with The Vancouver Plan, currently under development Active transportation and transit: - Plan for transportation pricing in the metro core that would start in 2025 - Expand and improving our walking, rolling, and biking network - Improve bus speed and

Theme	Zero Carbon Mobility and Land Use		
Canadian Cities	Edmonton[20]	Toronto[21]	Vancouver[22] [23]
	work on development and redevelopment that creates 15 minute communities with a nodes and corridor approach.		reliability - Encourage more walking, biking, and transit use - Promote remote and flexible work options - Eliminate parking minimums and introduce parking maximums for new developments - Implement residential parking permits city-wide Zero emissions vehicles: - Implement carbon pollution surcharge on residential parking permits - Increase EV charging on private property - Expand public charging network - Support EV charging for passenger fleets
Land Use	Actions include: - Implement regulatory and policy changes to enable renewable energy access to support wide-spread adoption on appropriate land uses. (City Plan Policy Intention 1.4.1 Support Edmontonians' transition to a low carbon future in their daily lives; Direction 1.4.1.3 Facilitate the use of local renewable energy.)	GHG emissions and removals from land use and land cover change are not included[24].	Complete communities are key: - Land use planning is the best transportation planning as transit choices are inextricably connected to housing affordability, work, proximity to daily needs, available services, safety, and income. - Emphasis on the importance of developing complete communities through land use

[24] https://www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-173759.pdf

Theme	Zero Carbon Mobility and Land Use		
Canadian Cities	Edmonton[20]	Toronto[21]	Vancouver[22] [23]
	- City Plan Policy Intention 1.4.1 Support Edmontonians' transition to a low carbon future in their daily lives; Direction 1.4.1.3 Facilitate the use of local renewable energy (City Plan Policy Intention 2.4.1 Support ecological function and energy efficiency of Edmonton's built environment) - In partnership with the region, protect agricultural lands from further fragmentation and conversion to other land uses (City Plan Policy Intention 5.3.1 Support the conservation of agricultural land to reduce its loss and fragmentation and contribute to economic development and resilience of the food system) - Promote urban agricultural activities and local farmers markets on appropriate land uses (City Plan Policy Intention 2.2.2 Ensure affordable housing and local food options to support social equity and meet the		planning to reduce reliance on vehicles, which requires establishing partnerships with regional and provincial organizations to ensure there are adequate, reliable and safe transit options, as well as services, such as childcare and schools. - Important to remember the needs of shift workers, and individuals working in the informal economy[25].

[25] https://council.vancouver.ca/20201103/documents/p1.pdf

Theme	Zero Carbon Mobility and Land Use		
Canadian Cities	Edmonton[20]	Toronto[21]	Vancouver[22] [23]
	needs of all Edmontonians) - Development and launch of Edmonton's Urban Primary Vegetation and Land Inventory that can be used to track how municipal greenhouse gas emission levels are being impacted by land use change, among other applications.		

Opportunities and Challenges:

- Collaboration with utility sectors.
- The combination of an improvement in air quality from reduced reliance on personal vehicles for travel within Calgary, potential reductions in environmental noise, an increased number of people walking and biking, investments in the public transportation network, and a switch to low carbon vehicles offers many health benefits.
- Physical activity from active transportation has a demonstrated positive effect on a range of mental illnesses and health and wellness. Increasing the use of active transportation can also generate significant social, environmental, economic and transportation system benefits.

Zero Waste

Zero waste means that all discarded materials are treated as resources that can be repaired, reused, recycled or composted, and no garbage is sent to landfill. Although Calgarians have made efforts to divert and recycle their waste, we still send 550 million kilograms of garbage to City of Calgary landfills each year, or nearly 420 kilograms per person in 2020. Our waste hierarchy states that from an environmental and economic perspective, disposal in landfill is the least preferable way of dealing with materials. Currently, The City of Calgary established a waste diversion target of 70 per cent of waste from landfill by 2025 and this is critical to aim for zero waste and circular economy through waste reduction and diversion. The circular economy finds ways to retain the value of resources in the economy via reuse and recycle spent materials. Currently, there are no specific targets set but circular economy is a critical way to address key environmental challenges like climate change.

Comparison to other cities:

Theme	Zero Waste		
Canadian Cities	Edmonton[26]	Toronto[27]	Vancouver[28]
2030 Targets	20 per cent reduction in residential waste generation per person by 2044	Net zero waste achieved at all City-owned facilities by 2030	Zero waste community by 2040
2050 Targets	Not specified	By 2050, we will have advanced towards a zero-waste circular economy.	Not specified

[26] https://www.edmonton.ca/sites/default/files/public-files/documents/WRRoadmap.pdf
[27] https://www.toronto.ca/wp-content/uploads/2017/10/9803-Final-Long-Term-Waste-Management-Strategy.pdf
[28] https://cwma.ca/wp-content/uploads/2020/03/Chris-Underwood-ENG-SWM-Zero-Waste-2040-Presentation-V3-Coast-Waste-Management-Association-8May2020-Virtual-Conference.pdf

Theme	Zero Waste		
Canadian Cities	Edmonton[26]	Toronto[27]	Vancouver[28]
Performance Measures	- per cent of residential waste (by weight) that is single-use items - number of community bin events with reuse opportunities - quantity of durable goods recovered through bin events - number of embedded waste reduction approaches documented and showcased through regular reporting	- Change in waste generation Rates in Single Family Residential, multi residential, non-residential in kg/capita or kg/customer - Change in waste diversion rate in single family residential, multi residential and non-residential in kg/capita or kg/customer - Reduction in food waste in circular economy in change in organics in green bins or garbage in in single family residential and multi-residential in kg/unit or kg/capita for units served - Textile Reuse or Recycling in change in quantities of textiles in garbage bins - Total tonnage managed	Annual solid waste disposed to landfill in tonnes
Key Actions/Strategic Approaches	- Edmonton residents and the non-residential sector make the behavioural and operational shifts necessary to reduce waste - Barriers to zero waste innovation and circular economy initiatives are reduced - Awareness of and participation in waste reduction programs increases	A Zero Waste goal places emphasis on preventing waste (e.g. reducing packaging), rather than managing it at the end of life. A circular economy shifts the way we view waste, looking at how products and packaging are designed, and how waste is managed to maximize resource recovery.	- Focus on waste avoidance, reduction, reuse - Pursue new opportunities to recover and divert residuals - Support investments in innovation - Support a move to a Circular Economy - Lead by example - Solutions require an engaged community and collaboration

Opportunities and Challenges:

- Collaboration with construction sectors
- Engagement with public about waste reduction and diversion
- Advance towards net zero circular economy
- Technology advancement to improve operational efficiency

Carbon Capture, Utilization and Storage

Limiting global warming to 1.5°C would require rapid and far-reaching transitions in land, energy, industry, buildings, transport, land use, coastal zone management and agriculture, as well as the immediate scale-up of technological carbon removal and climate finance. According to IPCC, global net human-caused emissions of carbon dioxide (CO2) would need to fall by about 45 per cent from 2010 levels by 2030, reaching net zero around 2050. This means that any remaining emissions would need to be balanced by removing CO2 from the air.[29] Natural assets provide valuable carbon storage (the total stock of carbon stored in a given unit of nature) and sequestration (the net addition of carbon stored in a given unit of nature over a specified period of time, typically one year). Without detailed carbon modelling for the City of Calgary it is not possible to get a spatially explicit estimate of the amount of carbon stored each year. However, drawing on empirical estimates of average rates of carbon storage for different general natural asset types allows for the approximation of this value. Overtime, these lands may transition from agriculture lands to developed lands thereby losing their ability to sequester carbon. It is currently estimated more than 45,000 tonnes of carbon dioxide equivalent (CO2e) of GHG emissions can be sequestrated annually.

Comparison to other cities:

Theme	**Carbon Capture Utilization and Storage**		
Canadian Cities	Edmonton[30]	Toronto	Vancouver[31]
2030 Targets	- Protecting and restoring significant ecosystems by 2030 and planting an additional two million trees by 2040.	Not available	Tree planting targets for 2020 (150,000 new trees)
2050 Targets	City of Edmonton emission neutral corporation by 2050 Achieving net zero per person GHG emissions by 2050	Not available	Targets yet to be set

[29] Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments — IPCC
[30] https://www.edmonton.ca/sites/default/files/public-files/assets/PDF/EnergyTransitionStrategy2021-04-20.pdf
[31] https://vancouver.ca/green-vancouver/how-we-capture-carbon-pollution.aspx

Performance Measures	City Plan's low carbon city targets (specifically: Achieve total community-wide carbon budget of 135 megatonnes Two million new urban trees planted Net per person GHG emissions are zero	Not available	Targets yet to be set
Key Actions/Strategic Approaches	Key actions include accelerated tree planting campaign; expanded and accelerated conservation and restoration of urban ecosystems, conservation offset program and expanded CO2 infrastructure. Strategy Goal #1: Edmonton is full of nature, to support healthy people, emissions reductions, communities and carbon sequestration Strategy Goal #2: Expand carbon technology investment/opportunities and business in the Edmonton Metropolitan region Strategy Goal #3: Edmonton cares for future generations by offsetting remaining emissions Milestones: Protecting and restoring significant ecosystems by 2030 An additional two million trees planted by 2040 City of Edmonton emission neutral corporation by 2050	Not available	Potential pathways for the City's sequestration efforts are identified five distinct categories, each with a range of potential activities: - Forests - Freshwater wetlands - Agriculture and grasslands - Coastal wetlands Cross-sectoral approaches.

	Achieving net zero per person GHG emissions by 2050		

Opportunities and Challenges:

- Valuations of natural infrastructure
- Technology advancement to improve focusing on carbon capture
- Potential areas to help us offset our landfill emissions via methane destruction
- Generation carbon offsets

Implementing a Climate Action Plan

- The City plays a key role in bringing community stakeholders together to facilitate discussions and foster collaboration in planning and strategizing integrated approaches to achieve long-term energy sustainability goals and build local resilience. Through education and civic engagement, the City can explain the benefits and promote action towards a long-term sustainable future.

Carbon Budgeting

- Municipalities require a systematic way to reduce emissions, to ensure that policies and programs do not lock in further emissions, and to maximize opportunities resulting from the energy transition.
- C40 recommends that climate action plans aligning with the Paris Agreement set ambitious interim GHG emissions reduction target(s) and/or a carbon budget.
- A carbon budget framework borrows similar management system practices that are used for financial budgets, to ensure that the GHG emissions resulting from City plans and expenditures align with its GHG emissions reduction targets
- A carbon budget framework can be instrumental in achieving transformative emission reductions because it:
    - Enables long-term planning
    - Can be used to prioritize initiatives that reduce GHG emissions over initiatives that result in high GHG emissions
    - Incentivizes climate considerations in decision making
- A carbon budget consists of two components:

- Carbon Budget Quantity: The total amount of GHG emissions that can be released from the community and/or the corporation from now, ad infinitum, to limit global temperature increase to 1.5 degree Celsius from pre-industrial levels.
- Carbon Budget Framework: A management system for integrating GHG emissions impacts throughout the administration, to inform decision-making related to Capital, Operating, Policy/Planning, and Community initiatives.

Calgary Current Context

- Governance:
  - In Calgary, there are legal requirements for climate change to be integrated into development planning through the City Charter and Council Approval of the Climate Resilience Strategy in 2018. The Charter requires an update of Climate Action Plans every five years, and Council requires updates to occur one year before each business cycle. Currently, we are developing methodologies to integrate GHG emissions reduction potential into growth management decisions and transportation assessments and it is critical to keep ourselves on track to our GHG emissions reduction targets.
  - The City of Calgary has a Climate Program and dedicated climate team (Adaptation, Mitigation and Governance and Strategic Planning) with limited long-term committed funding, aligned with the five-year OneCalgary business plan (2019-2022) process. Planning and action decisions made by this team are supported by a network of external (Calgary Climate Panel and the Panel's Climate Adaptation Working Group) and internal (working groups and subject matter expert cohorts) reviews and input.
  - On 15 November 2021, Calgary has declared a Climate Emergency stating that The City of Calgary develops strategic business plans and budgets across all departments that identify, invest in and accelerate ideas such as high priority emissions reduction, climate risk reduction opportunities, and implementation of a carbon budget. This will also reinforce the authority and importance of the Climate Program and provide support for the resources needed to strengthen coordination with federal and provincial ministries and agencies. Budget adjustments for 2022, and the 2023-2026 budget process are currently underway with significant focuses on climate mitigation in response to the declaration of a Climate Emergency approved by City Council.
- Updates from 2021:
  - Calgary's 2020 community wide GHG emissions were 15.7 megatonnes of carbon dioxide equivalent (CO_2e). This is a decrease of 14 per cent compared to 2019, which is an unprecedented change. The decrease in emissions happened for several reasons, including COVID-19 restrictions impacting energy use across all sectors, the provincial electricity supply becoming cleaner, and warmer-than-usual weather reducing the demand for heating. Despite the significant reduction in the last year, the long-term trend has not decreased. Calgary's 2020 emissions were still only 0.4 percent below 2005 levels, meaning we are not on track to meeting our net zero GHG emissions by 2050 target.
  - The City of Calgary has been reporting to Carbon Disclosure Project (CDP) since 2014 and achieve an "A" standing since 2018 in the CDP Cities Scoring Methodology,

acknowledging the strength of climate adaptation and mitigation plans, and climate mitigation actions carried out as part of City project and planning work.[32]

- The development of a carbon budget framework is in progress as part of the Climate Strategy Update.
- The City of Calgary has committed to making climate change a strategic priority by accelerating the timelines to reduce GHG emissions, updating the citywide and corporate GHG reduction target to be net zero emissions by 2050.
- Key actions, required to get the city-wide emissions on track, is identified in the current Mitigation Action Plan, which is organized into five themes, and ten key program areas. The 2020 Annual Report is published on the Calgary Climate Program website[33].
- The Climate Mitigation Action Plan is going to be updated in 2022 with stakeholder engagement.
- Over the past few years, The City of Calgary has been working on the development of citizen-based climate action information and online webinars to reach community members. The Climate Panel contain a multi-sector spectrum of engaged community members. A portion of Climate Program education and outreach funding is focused on climate mitigation and GHG emissions reductions, and further development is planned over the next year. The City has also partnered with the Alberta Council on Environmental Education and EcoSchools Canada to deliver in school programming including miitigation actions schools can take, shared GHG emissions impact and mitigation examples with students through presentation at Mayor's Environment Expo, and finally, partnered with CPAWS to deliver experiential environmental education through a climate lens.

As we move forward building a more sustainable and resilient city while supporting our low carbon economy transition, there is a continuous role for all to play in the success of our next priority to achieve net zero by 2050. Based on the research completed in this white paper, five focus areas and approaches are found in the climate mitigation practices and plans we studied. A successful climate mitigation plan promotes partnership and collaboration – the outcomes of these partnerships can be new markets for clean technologies and sustainable products, opportunities for public and private financing, and investments that help support our low carbon economy transition. We are seeking best practices addressed in this white paper to help us achieve effective long-term climate mitigation planning.

[32] https://data.cdp.net/

[33] https://www.calgary.ca/content/dam/www/uep/esm/documents/esm-documents/climate-resilience-strategy-and-action-plans-annual-report-2020.pdf