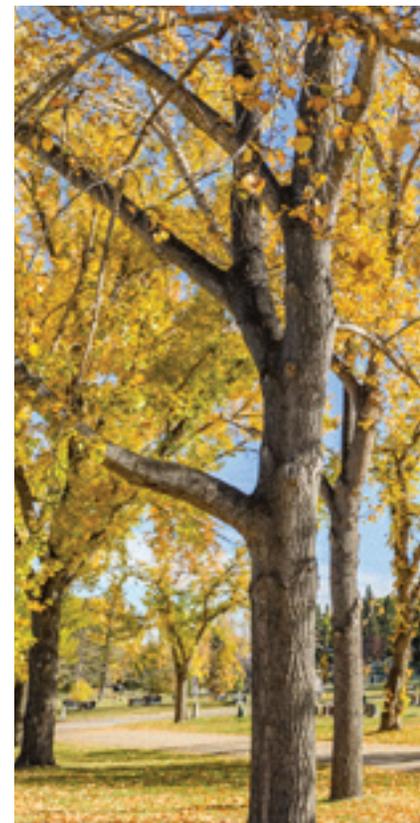


Calgary



Calgary Climate Strategy

Pathways to 2050

June 2022



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land acknowledgement

We acknowledge that we reside on the traditional territories of the people of the Treaty 7 region in southern Alberta. This includes the Blackfoot First Nation tribes of Siksika, the Piikani, the Kainai; the Stoney Nakoda First Nation tribes of Chiniki, Bearspaw and Wesley; and the Tsuut'ina First Nation. The City of Calgary is also homeland to the historic Northwest Metis and to Metis Nation of Alberta, Region 3.

We acknowledge all Indigenous urban Calgarians who have made Calgary their home and we are all Treaty beneficiaries with shared roles and responsibilities in protecting our lands and communities from the impacts of climate change.



climate emergency declaration

On November 15, 2021, Calgary City Council declared a climate emergency (Appendix 1) in support of accelerated action to respond to climate change and to recognize the pace and scale of the action needed to reduce emissions and adapt to climate change. More than 2,000 jurisdictions and local governments around the world have declared a climate emergency, including most major cities in Canada.

Addressing climate change is a strategic priority for The City of Calgary, and City Council has committed to accelerating the timelines necessary to reduce greenhouse gas emissions, updating City-wide and corporate greenhouse gas reduction targets to be net zero emissions by 2050, to help limit global warming to 1.5 °C. The City of Calgary is also committed to helping prepare our city and citizens for the impacts associated with climate change through adaptation.

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Our commitment to equity, inclusion and climate action for all

The impacts of climate change affect all Calgarians; however, adverse impacts of climate change are felt disproportionately by equity-deserving people. As a city, Calgary must ensure we adapt to a changing climate so that no one is left behind in our efforts to address the climate crisis and that all Calgarians are empowered to take climate action.

introduction



Global **climate change** is causing a significant shift in regional climates, including rising temperatures, changing precipitation patterns and an increase in extreme **weather** events. Calgary is joining leading municipalities to achieve our greatest potential greenhouse gas emissions reduction and build a climate-resilient city.

In alignment with other major Canadian cities and global leaders, The City of Calgary (The City) will accelerate the pace and scale of climate action needed to achieve our goal of **net zero emissions** by 2050. **Net zero** refers to a state in which **greenhouse gas** (GHG) emissions emitted into the atmosphere are balanced by the removal of GHG out of the atmosphere.

The City's mandate for climate action comes from the *Municipal Government Act*, Calgary City Charter, and the 2021 Climate Emergency Declaration by City Council. The Calgary City Charter requires the Mitigation and Adaptation plans be reviewed every five years to keep current with the most recent scientific findings and best practices. Calgary City Council has directed these updates to occur one year prior to each business cycle to allow planning of budgets and workplans. This 2022 update is intended to support The City's 2023 to 2026 business planning and budget cycle.

The impacts of climate change are being felt around the globe and Calgary has already experienced significant impacts. The City must integrate climate action across the corporation and throughout our communities, by taking urgent action to reduce our GHG emissions and helping Calgarians to prepare for a changing **climate**.

As Calgary emerges from the uncertainties of the COVID-19 pandemic and an economic recession, it is important that The City's future climate action is equitable, effective, efficient, and implemented with consideration for all Calgarians. Now, more than ever, an unparalleled effort will be needed to implement climate actions across communities and to help residents, city-builders, businesses, industries, decision-makers and investors understand the opportunities of our transition to a **low carbon economy** and the importance of creating a **climate-resilient** city.

We have seen the successes of climate action in other places around the world. Other Canadian cities, including Vancouver and Toronto, have set admirable goals and are well on their way to implementing climate programs. European cities are even further ahead, having seized the opportunities of climate change action two decades ago. It is not too late for Calgary, as we learn from and adapt from the successes of other cities.

A prosperous and economical future

Climate action is not a cost, but an investment in the sustainability of our economic future and the health and resilience of future generations of Calgarians. Calgary has always been a leader in the development and provision of energy to the world and our expertise in traditional oil and gas sectors makes us uniquely positioned to provide leadership in the **energy transition**. In Alberta, it is estimated that a transition to a low carbon economy will create over 160,000 jobs in **clean technology** and generate over \$60 billion dollars in Gross Domestic Product (GDP) by 2050 (1). New industries and sectors in clean technology include electrification, hydrogen, agricultural technology, energy efficiency, renewables, and carbon capture, and digitization (1). With the right investment in upskilling and retraining for the workforce, Calgarians can expect diverse new opportunities and be confident in taking part in the transition.

In addition to potential gains, modelling demonstrates a net zero future could lead to cumulative energy savings of \$60-80 billion for Calgarians by 2050 (2). By transitioning our economy and achieving net zero by 2050, Calgary could save as much as \$4 billion each year in avoided energy costs; savings that can be realized by investing in climate action now (2).

Why we need to act now

Left unchecked, the impacts of climate change will stretch government and municipal resources, exacerbate inequality, disrupt businesses, pressure supply chains, displace population, and damage our natural ecosystems beyond repair. The socioeconomic impacts from severe climate events, including subsequent impacts on **infrastructure**, the natural environment, economy and health care in Calgary are estimated to cost a staggering \$2.6 billion annually by the 2050s and \$7.8 billion annually by the 2080s. (3)

Recent estimates show the total cumulative investment from all orders of government and stakeholders needed to transition Calgary to a net zero economy is an estimated \$88 billion by 2050 (or just over \$3 billion each year) with returns and savings of \$72 billion over that time. The investment required is significant and we'll likely not break even from energy cost savings alone; however, the longer we wait, the higher the expense will become while the savings diminish. **The true value of a climate-resilient Calgary goes beyond breaking even.** A more climate-resilient Calgary is also one that is more resilient to economic, environmental, and social shocks and stressors, with positive effects on the quality of life of Calgarians and future generations.

In addition to the costs needed to transition to a net zero economy, investment in **climate adaptation** is just as critical. Across a sample of 60 national adaptation actions, the average benefit to cost ratio was 6:1, with 75 per cent of actions having a ratio greater than one. An Insurance Bureau of Canada (IBC) and Federation of Canadian Municipalities (FCM) study, based on Alberta's accrued costs due to severe weather events, estimates that the Alberta-only climate adaptation cost would equate to an average investment cost of \$300 million annually per Alberta community (4). This high-level cost estimate is for both community and corporate municipal measures.

All the actions identified are priority actions necessary for Calgary to achieve net zero by 2050 and become a climate-resilient city. All the actions are either underway or, with adequate funding, can be implemented immediately. Implementation of new actions and progress on existing actions will continue as The City integrates climate action across the corporation.

The City is committed to reducing city-wide emissions and increasing climate resilience through outreach and education, advocacy building, capacity, enhance partnerships and relationships, research, incentives, funding and financing, regulation, and within City-operations. **The City of Calgary cannot do it alone.** Climate action requires a collaborative and coordinated effort from all Calgarians, including all businesses, industries, city-builders, organizations, educators, and institutions. When it comes to climate change action, we all have a role to play.



The vision, guiding principles, goals and targets guide the overall objectives of climate action for Calgary and provide strategic direction to climate-related activities, programs, initiatives and plans. Our vision is consistent with Calgary City Council’s strategic direction for 2023 to 2026.

Vision

Calgary is a city that recognizes the climate emergency and does its part to limit global warming to 1.5 °C (Figure 1). Our vision is to become a more sustainable community that can manage the impacts of severe weather events, reduce emissions, build a green economy and play an active role in climate innovation.

Calgary is a resilient city and our decisions are guided by economic, social and climate resilience.

Guiding principles

To support the development, design and implementation of the Calgary Climate Strategy, seven Guiding Principles were developed. These have been updated since

2018 to reflect the changing landscape of climate action and best practices across Canada. The Guiding Principles will inform decision-making, ensuring future decisions at The City are made to align with these overarching principles.

Innovation: Calgary will become a global centre of excellence in climate mitigation and energy transition. The City will play an active role in the implementation and enabling of climate innovation.

Equity and inclusiveness: Calgary will be an inclusive, equitable, and prosperous City with support and respect for **equity-deserving** people who are vulnerable to the impacts of climate change. The City is committed to working collaboratively with equity-deserving groups so that climate actions deliver benefits to, and strengthen climate resilience in, all communities.

Integration: The City will integrate climate mitigation and adaptation considerations in all investments to improve energy use, reduce GHG emissions, reduce disaster risks, and strengthen resilience for future climate conditions.

Relevance: The City will develop locally relevant solutions to address **climate risks** and vulnerabilities and take advantage of low carbon energy opportunities. The City will encourage Calgary to leverage its expertise in traditional energy to provide leadership in the energy transition.

Collective responsibility: Climate action is a shared responsibility and collective action is foundational to developing and implementing effective climate solutions.

Commitment: The City will provide strong governance that sustains progress to align policies, adequately fund programs, and ensure ongoing and meaningful partnerships.

Indigenous knowledge and reconciliation: The strength, guidance and holistic knowledge provided by Indigenous Peoples will build and enhance new and planned climate actions. The City is committed to adherence to the constitutionally-protected rights and treaties of Indigenous Peoples, and the goals of reconciliation.

Goals

The City is committed to addressing Calgary's **fair share** of global emissions by improving energy use and reducing GHG emissions through the actions identified in the Mitigation Plan.

The changing climate poses risks to our economy, environment and collective health. The City will work to reduce risk from climate change through the actions identified in the Adaptation Plan.

Targets

Our target is 60 per cent reduction of GHG emissions below 2005 levels by 2030 and net zero GHG emissions by 2050.



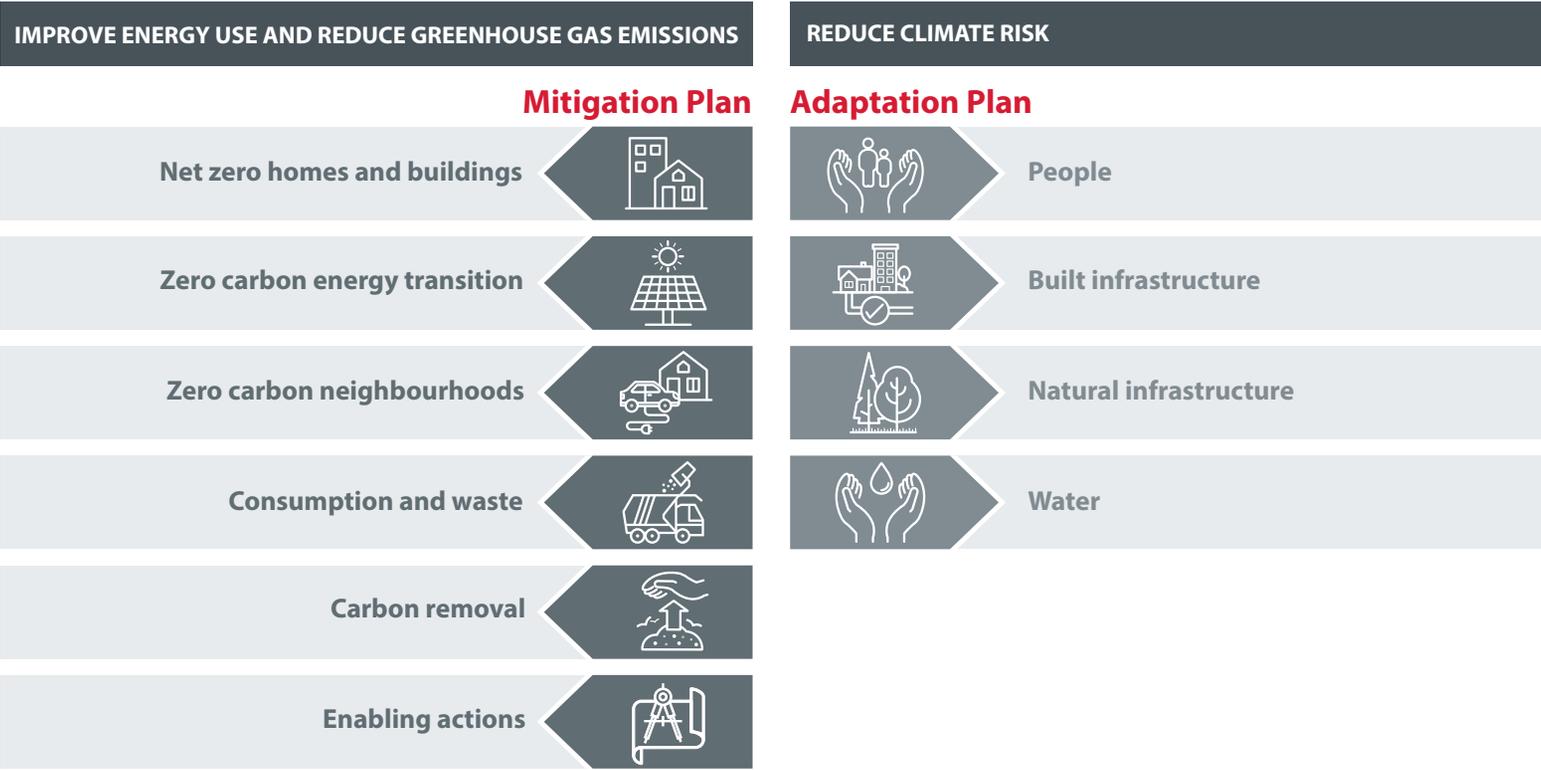
Vision

Calgary is a resilient city and our decisions are guided by economic, social and climate resilience

Principles

- Innovation
- Equity and inclusiveness
- Integration
- Relevance
- Collective responsibility
- Commitment
- Indigenous knowledge and reconciliations

Goals



Implementation

- Integrated decision-making
- Community engagement
- Capacity building
- Readiness and timing
- Partnerships
- Funding
- Accountability and transparency

Figure 1: Calgary Climate Strategy Pathway to 2050 framework

implementation

of the plans



The implementation of the Calgary Climate Strategy will require considerable effort in the years to come. Successful implementation will lead Calgary to a low carbon economy and climate-resilient communities.

A low carbon economy will provide opportunities to advance equity through more job opportunities, easier and more abundant transportation options, increased affordability, and increased physical and mental health. As we implement the Calgary Climate Strategy it's critical to acknowledge that Indigenous perspectives and land stewardship are integral to climate action.

Equitable city for all

The challenges of climate change are intertwined with those of social and economic inequality. **Structural inequities** (arising from our existing social conditions) will continue to make equity-deserving communities more susceptible to the impacts of climate change. Not all people have had the opportunity to have their voice represented in the development of climate actions, and they need to be

engaged to help shape climate solutions. The City is committed to identifying and collaborating with equity-deserving groups, to more effectively engage and support them in climate resilience and action. Differences in age, race, gender, ability, sexual orientation, income, immigration status, culture, health status, and language intersect with social and institutional systems to influence a person's lived experience, their ability to personally make changes to reduce emissions, and especially their resilience to shocks such as climate change events.

Engagement efforts during development of the Strategy have shown that equity-deserving Calgarians overwhelmingly desire greater choice and autonomy as they face climate change-related issues. Improved transit, lowered energy costs, improved access to green space, and access to spaces to share their experience will enhance their resilience and provide opportunities to focus on contributing to climate solutions.

Indigenous approaches

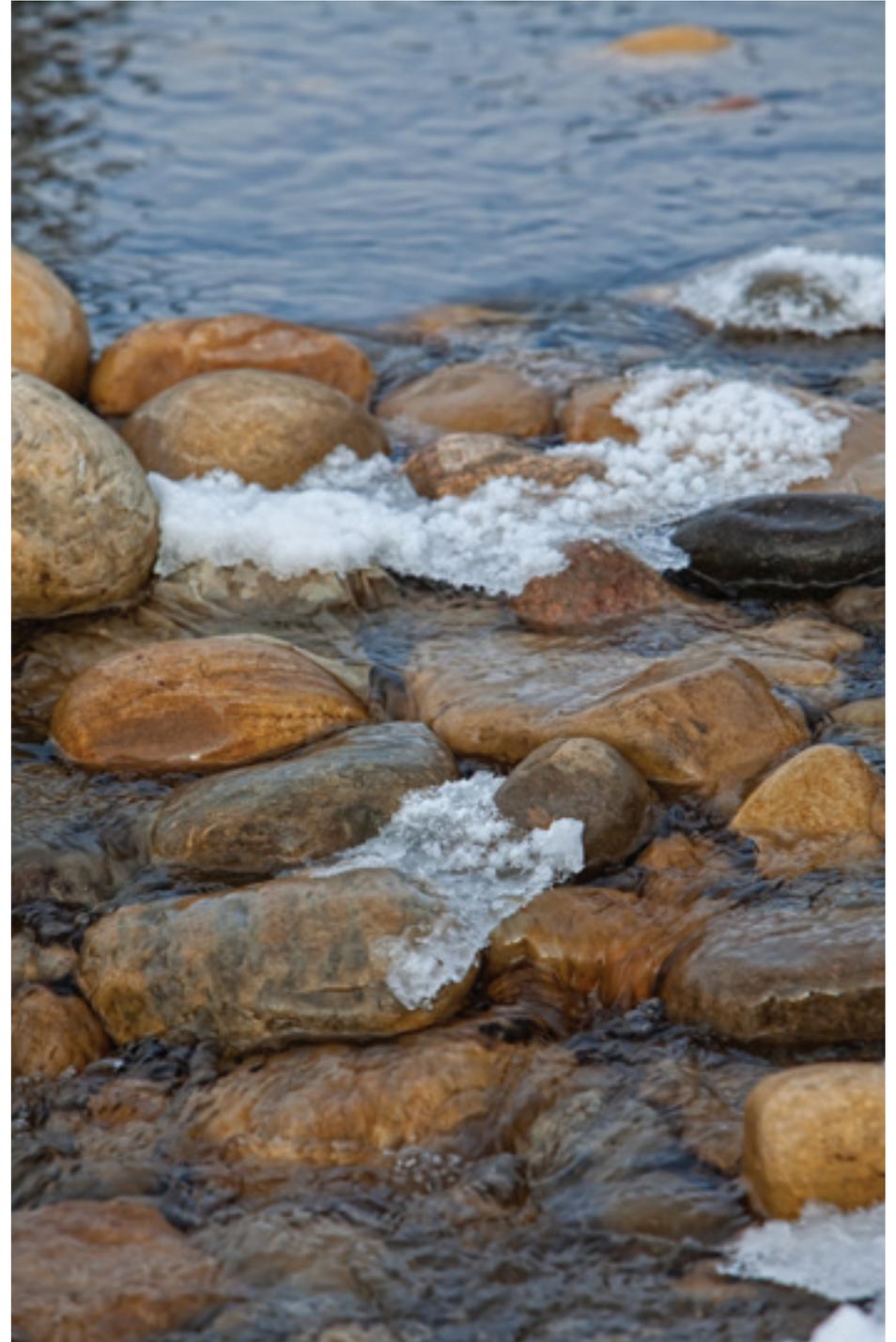
An Indigenous approach is one of relationality: relationships with the land, culture, community, people, ancestors and spirituality. The ongoing practice of Indigenous culture results in intact ecosystems (5), and the innate multi-generational approach of Indigenous Peoples is demonstrated in their long-term historical management of resources and knowledge for the protection of future generations. Climate-related events have the potential to exacerbate further loss of these relationships for Indigenous Peoples living in and around Calgary. Supporting Indigenous knowledge-based adaptation is critical to reducing climate change risks and effective climate adaptation, as noted in the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (6). Educating all Calgarians on the importance of place-based approaches to reconciliation and climate action is critical.

To align with the Truth and Reconciliation Commission's Calls to Action (7) and to respect the tenets of Ethical Space collaboration, Calgary's climate action must embody protection of Indigenous languages, and a commitment to achieving a diverse array of social and economic outcomes for Indigenous Peoples. To align with the City of Calgary's Indigenous Policy, Calgary's climate actions must reflect:

- Consideration of Indigenous matters of historical and contemporary significance, and respect for the oral transmission of language.
- Inclusion of Indigenous science, ethical space, philosophies and governance processes when engaging with Indigenous Peoples.
- Inclusion of Indigenous Ways of Knowing, engaging and building relationships that lead to the development of equitable partnerships.

Low carbon economy

A low carbon economy is based on the use of energy sources that produce low levels of GHG emissions. This means using low carbon energy for all activities within Calgary while fostering and growing businesses in the clean technology and low carbon energy sector. Calgary has always been a leader in the development and provision of energy to the world and the energy transition provides an opportunity to further build on our existing knowledge and play a leadership role in the global transition to a low carbon economy. The transition to a low carbon economy, while not easy, brings many opportunities for growth and is critical to Calgary's future economic prosperity. Bringing new clean technology positions to Alberta can



provide stable, well-paying and attractive employment to Albertans impacted by the boom-and-bust economic cycle and automation of the oil and gas sector (28).

Building climate resilience into The City's infrastructure and operations, and investing in climate adaptation at the community scale, puts Calgary in a good position to reduce potential future costs and damages. Adaptation measures also have the potential to create new opportunities for job growth and prosperity, such as novel agriculture practices, **natural infrastructure** solutions and innovative engineering projects.

Implementation elements

One of the biggest challenges with climate action is implementation and putting actions into practice. The successful implementation of the Calgary Climate Strategy requires key elements that are common to both climate mitigation and adaptation. Future projects, programs and initiatives will require thoughtful implementation and will consider the following elements:

Integrated decision-making

Integrating policy, implementation tools, and processes is key to enabling effective climate action and ensuring efficient use of resources. Integration ensures that climate change is a part of land use planning and infrastructure policies, guides and bylaws, and is reflected in all decisions that are made across The City. An integrated approach to decision-making ensures that groups across the corporation are involved and are empowered to take climate action.

- **Policy alignment**

Policy across the corporation must be aligned to integrate climate targets and objectives. For example, The City will develop a future climate policy to direct Administration on topics such as low carbon climate resilient procurement practices, implementation of operating and capital investment in decision-making for GHG emissions, fuel management and carbon offsets.

- **Strategically prioritizing climate action**

All climate actions are prioritized and reflect the pace and scale of action required to reduce GHG emissions and support climate-resilient communities. Climate actions presented in the mitigation and adaptation plans have been reviewed and confirmed with internal and external stakeholders as the Strategy has been developed.

- **Service plans and budgets**

The City will develop business plans and budgets across all departments that invest in and accelerate high priority emissions and climate risk reduction opportunities.

Community engagement

Climate change action will require community-wide engagement and may involve large, systemic changes to the way Calgarians live and work. It is important for The City to support Calgarians through this transition. Engagement work with equity-deserving Calgarians has shown that there is a desire for greater choice and autonomy as they face climate change-related issues.

Through community engagement, The City can enhance Calgarians' resilience and provide opportunities for Calgarians to contribute to climate solutions.

Capacity building

Improving awareness and understanding of climate change while facilitating access to information and resources is key to gaining public support for climate-related policies. The City will work to improve Administration's knowledge and appreciation of Indigenous Ways of Knowing so they can better apply both western and Indigenous scientific approaches to climate action.

- **Education and training**

The City recognizes the important role of outreach, education and engagement in the success of climate action. Climate education initiatives are critical to ensure future generations and the broader community within Calgary are educated and engaged in climate action.

Opportunities for training and upskilling will play a significant role in the transition of employment in Alberta. The City will aid in the transition of Calgary's future workforce and businesses by supporting partners such as Calgary Economic Development, post-secondary institutions and training centres.



- **Communications**

Communications plans are required to meet climate change goals and objectives, increase awareness of City initiatives, influence behavioural change, and respond to issues as they arise.

Capacity-building requires significant and long-term engagement with the communities of Calgary, and comprehensive communications campaigns and supporting materials help to inform and connect with Calgarians about climate action projects, programs and services.

Readiness and timing

Developing timely responses to external funding programs is critical and requires building relationships with all orders of government, anticipating changes to federal and provincial policy and regulation, and responding to market transformations and new funding instruments as they are developed. The City is developing programs that are aligned with available opportunities and anticipated future opportunities.

Partnerships

To advance innovation and increase capacity, The City will broker, facilitate and encourage partnerships with businesses, institutions, industries and organizations to develop and implement programs and projects.

Funding

Significant investments into climate mitigation and adaptation initiatives will be required for The City to work towards our goals and targets and The City has developed a report exploring internal and external funding options (8). The level of investment and support for climate programs and initiatives should reflect that addressing climate change is a strategic priority for The City. Increasing investments is equally as important as prioritization of investments and resources, and there should be a critical review of projects, actions and developments to eliminate those that inhibit the path towards The City's climate goals.

- **External funding**

The City recognizes that coordinated efforts from the provincial and federal governments, as well as the private sector, will be necessary to fund climate action. The City will pursue multiple streams of funding and financing mechanisms to support programs and actions and continue to leverage available funding opportunities.

- **Internal funding**

The City is committed to dedicating adequate resources and investment to kickstart the transition, align with our emissions target and to work towards building a climate-resilient city. Public sector investment, along with policy and regulation direction, can be used to spur private investment by increasing investor confidence in climate projects and emerging technologies, catalyzing a low carbon economy in Calgary.

Accountability and transparency

As global citizens, we have a responsibility to decarbonize in alignment with the global carbon budget and remove our fair share of global emissions. To be internally and publicly accountable and transparent on climate action, it is necessary for the corporation to evaluate, measure and report on progress.

- **Reporting**

The City will continue to develop and refine mechanisms to evaluate, measure and report on climate action progress. Examples of reporting mechanisms currently used are:

Carbon Disclosure Project (CDP): A global disclosure system to report climate change mitigation and adaptation progress. The City has been reporting into the CDP since 2014.

Task Force on Climate-related Financial Disclosure (TCFD): Disclosure of governance, strategy, risk management and metrics, and targets related to climate risks and opportunities in annual financial reporting.

Carbon Budget Framework: A GHG management system that helps The City to understand the GHG emissions implications of a wide range of investment and policy decisions, and publicly report against corporate and community GHG reduction targets.

- **Monitoring and adjustment**

The City will report annually on climate action to provide Council and Calgarians an update on the status of targets and performance measures. Monitoring indicators have been selected specific to each climate program and are intended to be relevant, objective and understandable. The intent is to be transparent on The City's progress towards the ambitious goals of reducing GHG emissions and improving climate resilience between now and 2050.

Unplanned or disruptive changes and unforeseen circumstances such as energy price changes, international events, technological developments, and funding availability will be considered in future recommendations and updates.

The City's role

Sustainable community building in Calgary is an effective way of reducing GHG emissions, increasing resilience, and achieving the long-term goal of net zero communities. The City has a role in influencing the future of Calgary in how we build and renovate, how we move, and how we capture carbon. The manner in which Calgary grows and develops has a significant impact on GHG emissions and our capacity to adapt to changing climate conditions. The way we design our city and neighborhoods impacts the need for energy, and influences where people live, work, and the choices they make to get around the city.

To be successful, climate leadership must occur at all orders of government as well as within the community (Figure 2). Innovation in emissions reduction and community-level programs will be more successful if there is understanding and support through the leadership of elected officials, Administration, and the community. When it comes to climate action, all Calgarians have a role to play.

Elected officials

It is the role of Calgary's elected officials to provide Administration with strategic direction, lead by example and to advocate for climate action with international organizations, governments, regional partners, educational institutions and citizens. Council can also play a role in encouraging investment opportunities for businesses and fostering Calgary's international reputation as an energy leader.

Administration

The City has direct ownership over the source of emissions from capital and service delivery. The City of Calgary can make decisions that directly impact emissions from these activities, including through procurement, investment decisions, service delivery and partnership with civic partners. It's Administration's role to implement climate action by integrating approved climate targets and actions into their business service lines, plans, budgets and operations.

The City's Administration can lead by example by collaborating with internal and external groups and advisory committees. Strategic programs providing information, education or training can be developed to target specific groups and industries as well as Administration.

The City can support innovation and piloting of new technologies or approaches to reduce emissions and build climate resiliency into communities. The City can identify incentives, financing and the funding needed to implement climate action and provide non-monetary process incentives to reduce red tape and costs for projects. Lastly, The City can use its jurisdictional powers to require emissions reductions and climate adaptation measures. The City has the jurisdiction to set and enforce regulations throughout the land use planning approvals continuum and through authority granted by provincial legislation.

Community

Calgary is a prosperous and capable city, and home to educated, technically-skilled, and entrepreneurial people. Calgary has significant capacity to help address the climate crisis. The role of the community in climate change cannot be understated. Alongside The City, communities, businesses, organizations, and industry will be empowered to develop and implement programs and initiatives to support climate action.

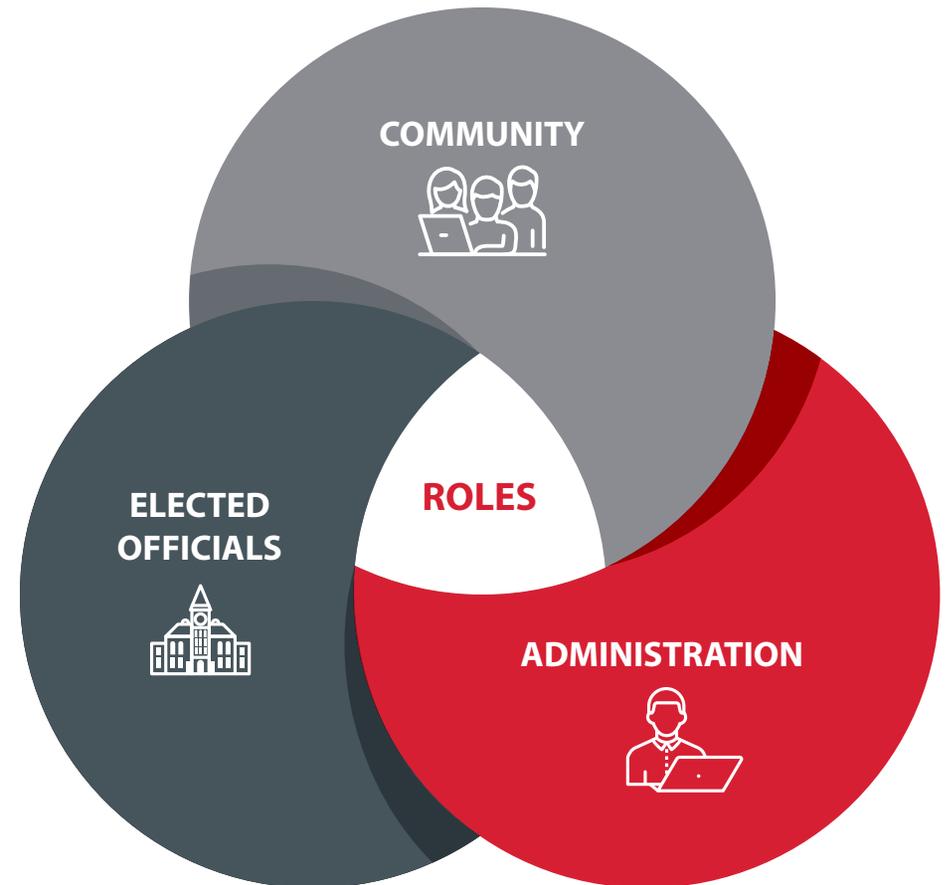


Figure 2: The role of community, Administration and elected officials in climate action



mitigation plan





introduction

Climate mitigation is taking action to reduce and prevent GHG emissions from going into the atmosphere or removing GHG emissions from the atmosphere through natural or technological means.

The Mitigation Plan is an update to the action plan created in 2018 and charts the pathway to city-wide net zero emissions in Calgary by 2050. This involves taking action to do our part to reduce Calgary's fair share of global GHG emissions in five key theme areas aligned to the sources of GHG emissions in Calgary and the areas that require rapid decarbonization. The sixth theme supports emissions reductions across the first five with cross-sectoral enabling actions (Figure 3). Within each of the theme areas are Program Pathways that identify the programs and actions that need to be implemented to reduce Calgary's emissions towards net zero emissions by 2050 and contribute to Calgary's resilience and economic prosperity.

Updating the Mitigation Plan

The purpose of the update is to align Calgary's GHG emissions reduction actions to achieve net zero emissions in Calgary by 2050, to recognize the pace and scale of transition necessary to get on track, and to evolve Calgary's approach to climate change mitigation to align with best practices.

Figure 3: Mitigation Plan themes and Program Pathways



Integrating equity considerations

The previous Climate Mitigation Plan approved in 2018 did not explicitly integrate equity considerations in identifying, planning, or executing climate mitigation programs and actions. This Plan was developed with the intention to remedy this exclusion, informed by *An Equity Review of the City of Calgary's Climate Resilience Strategy* (29). This Plan addresses some of the gaps identified in previous plans, and we recognize that this work still requires significant and long-term engagement with the communities of Calgary to better understand community **vulnerability**, and to develop and strengthen relationships between City Administration and Calgarians. The City will work to ensure climate action will benefit local communities and equity-deserving people and will not place a financial burden or penalize residents with low and moderate incomes or small businesses. The City will continue to grow this work over the next four-year budget cycle and beyond.

Integrating Indigenous perspectives

Integrating Indigenous perspectives is a foundational principle of this Mitigation Plan. The *Reconciliation and the Intersections of Indigenous Peoples and Climate Literature Review* (10) has provided some guidance for identifying and planning climate mitigation programs and actions to respectfully integrate engagement and advice from Indigenous Peoples. We recognize that relationship-building with Indigenous Peoples on climate mitigation are in the beginning stages and it is premature to have identified explicit programs or projects for implementation in this plan. However, The City of Calgary commits to ethical space dialogue and to continuing to grow this work over the next four-year budget cycle and beyond.

Transition to a low carbon economy

The economic development opportunities of implementing climate change mitigation actions and supporting the transition to a low carbon economy is a critical outcome of the Mitigation Plan. Implementation of climate mitigation actions often have the co-benefits of creating jobs and attracting local investment. Calgary Economic Development estimates that the net zero transition would result in more than 160,000 jobs and \$60 billion in GDP as compared to business-as-usual (Figure 4) (1).

The actions for this plan were informed by an update to *The Economics of Low Carbon Development: Calgary, Canada* report (11), originally developed in 2018 and updated in 2021 (2), as well as through collaboration with Calgary Economic Development and other key stakeholders. The City commits to continuing to design and implement the actions in the Mitigation Plan to support and accelerate the transition to a low carbon economy.

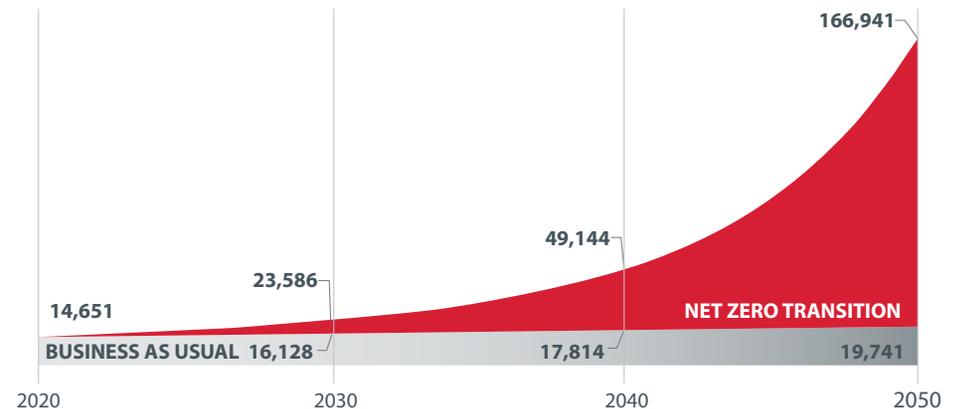


Figure 4: Job creation potential of the net zero transition (1)

The City of Calgary's role in reducing city-wide emissions

While climate change is a global issue, cities play a crucial role in tackling climate change. Each order of government has its own level of jurisdiction and different tools to reduce emissions. As a municipal government, The City is responsible for reducing emissions from within Calgary's geographic boundary, even those emissions it does not directly control. The City can directly and indirectly influence city-wide emissions in five key ways:

- **City operations:** Where The City has direct ownership over the source of emissions, from capital and service delivery. This includes municipal buildings, infrastructure and fleet, services, and partnerships and funding agreements with Civic Partners. The plan to reduce emissions in The City's operations is detailed separately in *Calgary's Corporate GHG and Energy Plan (12)*.
- **Education, advocacy and capacity building:** Strategic programs that provide information, education or training to help people or stakeholders take action to reduce emissions that they directly control. These programs can be intended for a broad public audience or can target specific stakeholders such as commercial building owners or private fleet managers. This role also includes advocating to other orders of government to support GHG emissions reduction objectives.
- **Research and innovation:** The City will support innovation and pilot new technologies or approaches to reduce emissions through funding and partnerships.
- **Incentives and financing:** The City can right-size taxes and fees to make them climate-equitable and provide funding (through mechanisms such as grants or loans) to help reduce the cost to stakeholders to reduce GHG emissions. These programs can also include non-monetary process incentives, such as expedited permitting, to reduce red tape and the associated costs for low carbon projects.
- **Regulation:** The City can use its jurisdictional powers to require emissions reductions. The City has the jurisdiction to set and enforce regulations throughout the land use planning approvals continuum and through authority granted by provincial legislation.

The Program Pathways and the key actions detailed in this Mitigation Plan follow a market transformation approach that aligns to the different roles that The City can play to reduce emissions. Where a technology falls on the market transformation curve helps inform what role The City should play to further acceleration implementation. Typically, regulations are the most direct way to reduce emissions, but can be politically sensitive to implement quickly. Therefore, The City can use the other approaches to help build support, capacity, buy-in, and increased adoption before introducing regulation. For example, incentives can be used to accelerate early adoption, and once it achieves mainstream adoption, regulations can be introduced, and incentives phased out (Figure 5).

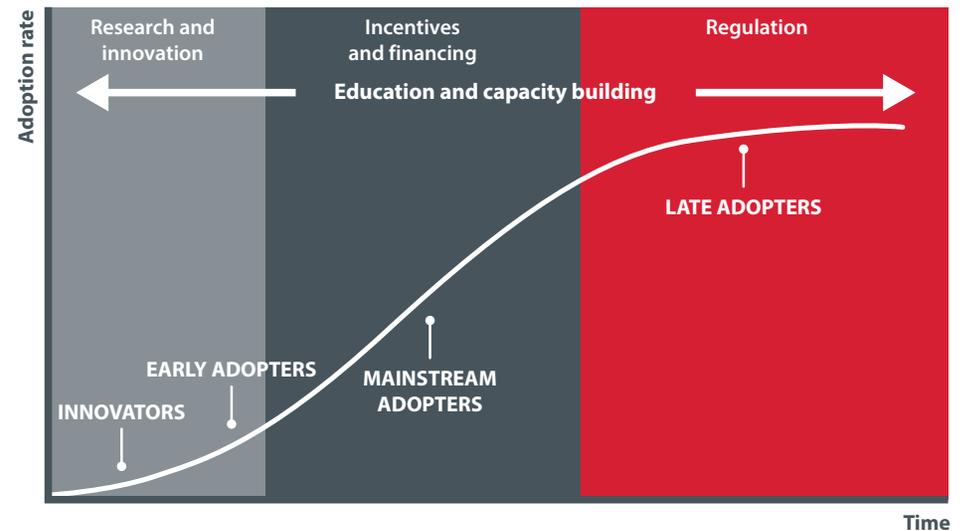


Figure 5: Market transformation curve illustrating the design of the Mitigation Plan Program Pathways

Getting to net zero emissions by 2050

In April 2022, the Intergovernmental Panel on Climate Change published the sixth assessment report on climate change stating that not only do global emissions need to decline to net zero emissions by 2050, but that global emissions must peak in the next three years and decline to 45 per cent below 2010 level by 2030 to keep global temperature rise below 1.5 °C (13). In other words, minimizing the total amount of emissions released between now and 2050 is just as important as achieving net zero emissions in 2050. Every tonne of GHG emissions emitted from now on gets us further from the goal of limiting global temperature rise to 1.5 °C.

Municipal GHG reduction targets should consider three basic equity or “fair-share” concerns: securing basic human needs, attributing responsibility for historical emissions, and accounting for benefits from past emissions. Cities like Calgary, that have benefitted from carbon-intensive economic development and have the resources and capacity to take on more of the responsibility to reduce emissions quickly, should do so. Calgary must act now to decarbonize quickly.

The City of Calgary commits to city-wide emissions targets of:

- 60 per cent reduction in GHG emissions below 2005 levels by 2030
- Net zero emissions by 2050

To ensure that Calgary is on track to achieve net zero emissions by 2050 and that emissions are declining quickly enough to do our part to help keep global temperature rise to 1.5 °C, Calgary has set an interim emissions target to reduce emissions to 60 per cent below 2005 levels by 2030.

Figure 6 describes the emissions sectors and the associated energy source (fuel) of GHG emissions in Calgary. Emissions in 2021 were still greatly affected by the ongoing COVID-19 pandemic. Calgary’s city-wide emissions were 15.93 megatonnes of **carbon dioxide equivalent (CO₂e)**, which is one per cent higher than in 2020. It remains to be seen if emissions will continue to rebound to pre-pandemic levels.

Energy used for building heating, cooling, lighting and power in the residential, commercial and institutional sectors contribute 57 per cent of Calgary’s overall emissions. Energy used in industrial buildings contribute eight per cent. Diesel and gasoline used in personal and fleet vehicles accounts for 34 per cent, and methane emissions from our landfills and wastewater treatment facilities represent one per cent. We are not yet on track to meet our 2030 or 2050 emissions reduction targets.

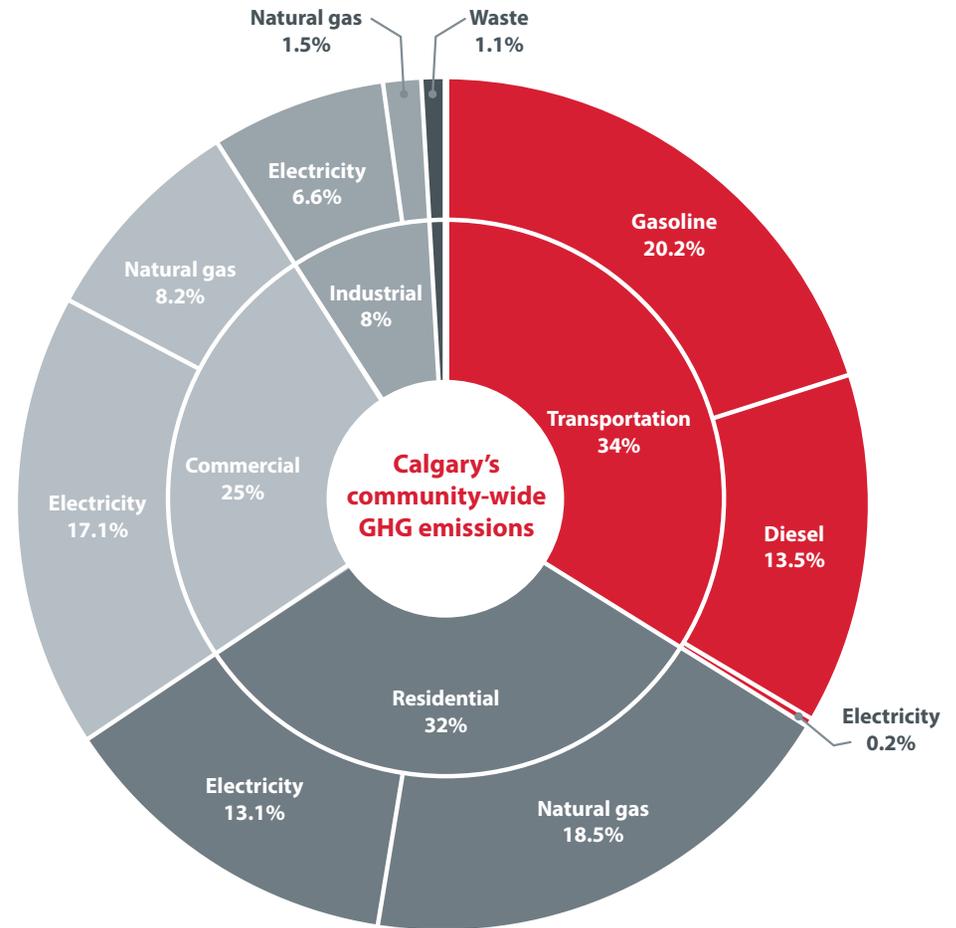


Figure 6: Breakdown of Calgary community-wide GHG emissions by percentage

Calgary's modelled pathway to net zero

The City used a GHG modelling approach to project future emissions if business-as-usual is continued. The model included demographic data, energy price data, financial metrics, addition of stretch measures and the addition of sensitivity analysis for energy and carbon prices and emission factors. The model assessed a long list of the measures that range from changing light bulbs to rebuilding offices, and it assessed the investment cost, net cost and carbon implications of single actions as well as specific scenarios – such as the net zero scenario presented here.

By 2050, Calgary could achieve a 66 per cent reduction in modelled emissions compared to our expected baseline emissions (Figure 7.1). If the electricity grid gets cleaner faster than is currently predicted by the Alberta Energy Systems Operator (AESO) and is net zero emissions by 2045, the reduction could increase to 92 per cent by 2050 (Figure 7.2). If we assume that the natural gas system includes 20 per cent hydrogen blending, the reduction potential of the net zero scenario could increase from 66 per cent to 68 per cent reduction by 2050.

Of the 66 per cent total reduction, nearly half of those reductions are seen in the residential sector (49 per cent), a third come from the transportation sector (33 per cent) and smallest proportion of the savings come from the commercial and industrial sectors (18 per cent).

The cost of the modelled pathway represents the capital investment needed across all governments, industry, businesses, organizations and individuals to get to net zero, and is modelled in 2022 dollars. The investment required is significant due to the high cost to retrofit homes to net zero emissions and the pace and scale of retrofits that are required over a short period of time.

Total cumulative investment for the net zero scenario is estimated at \$87.89 billion by 2050. Depending on the price of energy, the net costs for implementation ranges from \$5.58 to \$27.4 billion.

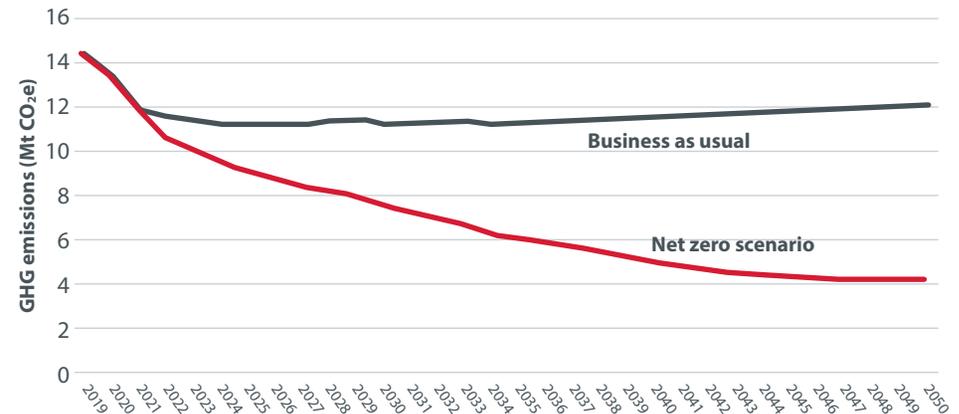


Figure 7.1: Calgary's net zero emissions scenario to 2050

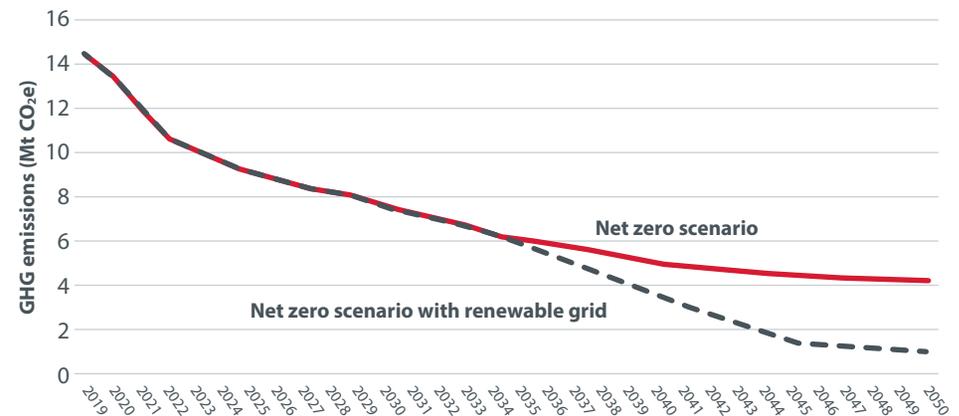


Figure 7.2: Calgary's net zero emissions scenario to 2050 (with a renewable electricity grid)

The gap to net zero

Even given the significant investment and ambitious pace and scale of implementation required to achieve the net zero scenario, the modelling shows there is a gap between the estimated reductions and achieving net zero. The net zero scenario is the most aggressive scenario that could be designed using available data and maximized GHG emissions savings with current technology. It is important to note that this modelling exercise does not lock Calgary into implementing any specific technology pathway. It will be important to revisit this modelling and trajectory to net zero as new information becomes available.

Calgary's ability to achieve net zero emissions by 2050 is dependent on our ability to encourage and require the implementation of zero and low carbon technologies within Calgary city boundaries. It is also dependent on several factors that are less within our control. For example, how quickly and to what extent the Alberta electricity grid decarbonizes, the pace and scale of federal carbon price increases and the implementation of other provincial and federal net zero policies, regulations, programs and funding (30).

Additional ways to reduce emissions will need to be identified to achieve our emissions targets. By indicating the gaps in our reduction efforts, The City invites other partners to help create, invest in, and support the energy transition. The City will continue to work with our industry and research partners to understand new and innovative ways to reach our emissions goals.

Pace and scale of implementation

The Mitigation Plan identifies sector-specific milestones for each Program Pathway to illustrate the pace and scale of transformative action necessary in each sector to get on track to reduce emissions to net zero by 2050 (Table 1). These milestones are ambitious and will serve to benchmark Calgary's actual implementation. It also provides context as to the level of collective investment that needs to be leveraged from all stakeholders.

Scaling up implementation to match these milestones in the short-term will be impacted by factors such as technological innovation, market demand, investment and capacity.

Program-level key performance indicators will still need to be developed as part of each program's development and implementation.



Table 1: Pace and scale of implementation needed to get on track to net zero emissions by 2050

Theme	Program Pathway	By 2030	By 2050
Net zero homes and buildings	New buildings	<ul style="list-style-type: none"> All new buildings are built to a net zero standard. New buildings contain 40% less embodied emissions from construction. 	<ul style="list-style-type: none"> All new buildings in Calgary are built to a net zero standard, including embodied carbon.
	Existing buildings	<ul style="list-style-type: none"> Achieve an annual conversion rate to net zero emission homes of 3% or 19,000 dwellings. Achieve an annual deep retrofit rate in the commercial and industrial sector of 5% or 317 structures. 	<ul style="list-style-type: none"> All buildings in Calgary achieve a net zero emissions standard by 2050.
	Energy poverty	<ul style="list-style-type: none"> The number of Calgary households experiencing energy poverty is reduced by half (to 32,000 households). 	<ul style="list-style-type: none"> Energy poverty is eliminated in Calgary.
Zero carbon energy transition	Zero carbon energy	<ul style="list-style-type: none"> 10% of total electricity used in Calgary is generated within city boundaries from renewable sources. 15% of residential electricity demand is offset by rooftop solar installations. 	<ul style="list-style-type: none"> 40% of total electricity used in Calgary is generated within city boundaries from renewable sources. 60% of residential electricity demand is offset by rooftop solar installations.
	Provincial energy supply	<ul style="list-style-type: none"> 100% of coal-generated electricity is retired by 2024. The Alberta grid emissions factor is less than 0.3 tCO₂/Megawatt hour (MWh). 	<ul style="list-style-type: none"> Provincial electricity supply is generated from 100% zero carbon energy sources.
Zero carbon neighbourhoods	Zero emissions vehicles	<ul style="list-style-type: none"> 100% of all new livery transport passenger vehicles licensed to operate in Calgary are zero-emissions vehicles. 100% of new residential construction is built to an EV-ready standard; 10% EV-ready requirement for new commercial construction, with 90% conduit/partial readiness. 	<ul style="list-style-type: none"> 100% of all vehicles registered in Calgary are zero emissions vehicles.
	Zero emissions transportation modes	<ul style="list-style-type: none"> 40% of all trips are taken by walking, wheeling or transit. 45% of people live within 400 metres (m) of the primary transit network. 	<ul style="list-style-type: none"> 60% of all trips are taken by walking or wheeling or transit. 95% of Calgarians live within 2000 m of a dedicated transit facility (e.g. LRT, MAX bus service). Completion of 5A Network implementation. 25% reduction in daily vehicle kilometers traveled (VKT) per capita
	Zero emissions city design	<ul style="list-style-type: none"> All new communities are built to a net zero community standard. 	<ul style="list-style-type: none"> To be determined (TBD).

Theme	Program Pathway	By 2030	By 2050
Consumption and waste	Waste reduction	<ul style="list-style-type: none"> Reduce 50% of food and other organic waste in the garbage, compared to 2019. 	<ul style="list-style-type: none"> TBD – to align with update to the United Nations Sustainable Development Goals and the development of a Calgary consumption-based GHG inventory.
	Waste diversion	<ul style="list-style-type: none"> 70% of waste diverted from landfills by 2025. 	<ul style="list-style-type: none"> TBD
Carbon removal	Natural infrastructure	<ul style="list-style-type: none"> Restore 20% of Calgary’s open space (in 2015) to increase biodiversity by 2025. Achieve 10% urban tree canopy coverage by 2030. Increase the habitat condition rating category for 20% of priority 1 and 2 natural environment parks to performing to their full ecological potential by 2035. 	<ul style="list-style-type: none"> Achieve 16% urban tree canopy coverage by 2050.
	Carbon negative technologies		<ul style="list-style-type: none"> 100% of remaining community-wide emissions are offset by carbon negative technologies.



mitigation themes and program pathways



The Mitigation Plan is organized into six themes and 12 program pathways. There are five themes aligned to the major sources of GHG emissions in Calgary and represent the critical areas of opportunity to reduce GHG emissions: net zero homes and buildings; zero carbon energy transition; zero carbon neighbourhoods; consumption and waste; and carbon removal. The sixth theme contains enabling actions that are foundational to achieve emissions reductions across the other five themes.

Within each theme, there are two to three Program Pathways that Calgary will focus on to reduce emissions. The Program Pathways are made up of interdependent programs that must all be implemented in a coordinated way to achieve real greenhouse gas reductions.

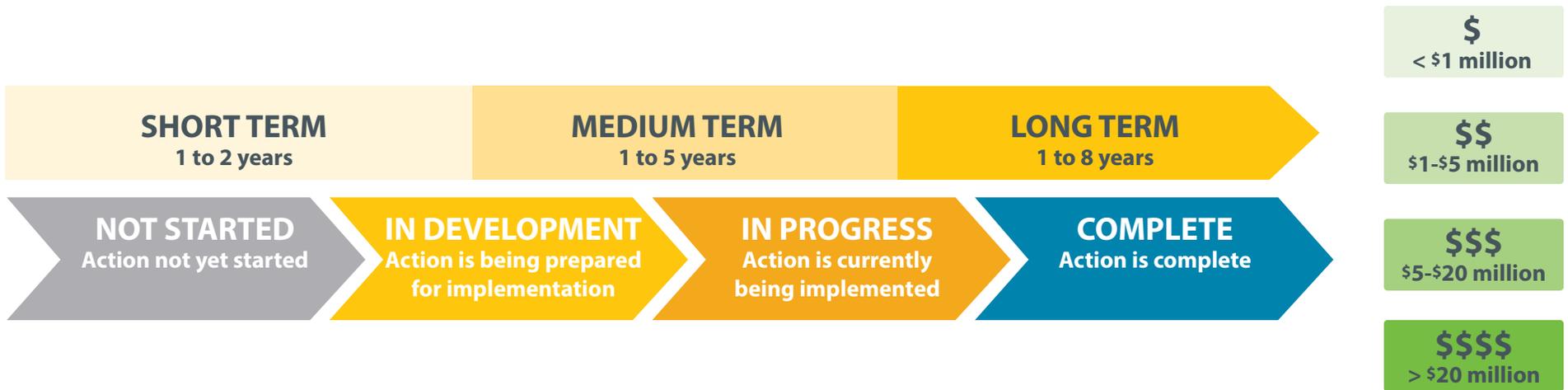
If only some of the programs in each Program Pathway are implemented, then the measurable GHG reductions in that pathway may not be achieved. There is a diagram at the beginning of each Program Pathway below that illustrates the interdependencies and timing of how the programs in each Program Pathway should be rolled out to achieve net zero emissions by 2050.

Two key principles informed the development of the Program Pathways, and should inform the program development and implementation:

1. Program design and implementation should always keep the end goal of net zero emissions in mind. There are some technologies that can deliver cost effective emissions reductions in the short-term but will lock us into a higher emissions future by 2050. For example, retrofitting buildings with cost effective technologies today, but not to a net zero emissions standard, will lock in higher emissions and higher energy costs in the future.
2. Actions to reduce emissions should always be considered before using offsets to achieve net zero emissions.

For each key action in the plan, the current status is identified as not started, in development or in progress. Work on each action should at least begin in the next four-year budget cycle, but not all actions in the plan will be completed in that time frame. The timeline to complete the action is identified as short term (1 to 2 years), medium term (1 to 5 years) or long term (1 to 8 years). Each action also has an estimate of the budget required for full implementation. These estimates have been provided as a guide to understand the approximate scale of investment required

from The City of Calgary. For actions that involve financing or lending initiatives (e.g., the Clean Energy Improvement Program), the financing amount is considered flow through and has not been included in the estimates for those actions. All the actions can be scaled up or down depending on the final budget approved by Council; however this will have a direct effect on the pace and scale of emissions reductions Calgary can achieve.



Theme: Net zero homes and buildings

Energy use in buildings for heating, cooling, lighting and power is the largest opportunity for GHG emissions reductions in Calgary. Natural gas and electricity used in Calgary's residential, commercial, institutional and industrial buildings make up about two-thirds of total emissions generated in Calgary.

Net zero emissions homes and buildings are highly energy-efficient buildings that produce or procure emissions-free renewable energy or high-quality carbon offsets to counterbalance the annual carbon emissions from building materials and operations. In effect, the buildings can be operated with no net new emissions being added to the atmosphere.

Investments in building energy efficiency and clean energy present an unparalleled opportunity. By reinvesting in improved energy performance of buildings, Calgarians will save money on utility bills, benefit from more comfortable and higher quality buildings, and support local job growth in the energy efficiency and clean energy sectors. This theme also seeks to ensure that all Calgarians, regardless of income, race, age and background, have equitable access to the programs to improve building energy performance in Calgary.

The actions in this theme are organized into three Program Pathways:

- **New buildings – Build new buildings to a net zero emissions standard**
- **Existing buildings – Retrofit to a net zero emissions standard**
- **Energy poverty – Support Calgarians impacted by energy poverty**



Program Pathway A: New buildings – Build new buildings to a net zero emissions standard

Accelerating the implementation of new **net zero emissions buildings** is an efficient way to reduce emissions in the building stock. Once built to a higher energy performance standard, buildings will use much less energy and produce less GHG emissions over the lifetime of the buildings. It also removes the need to retrofit the buildings to a net zero standard in the future. Given that most buildings have a lifecycle of greater than 30 years, any building built today to less than a net zero emissions standard will need to be retrofitted before 2050 for Calgary to meet the 2050 target. This could mean retrofitting buildings ahead of when the regular maintenance and lifecycle would require upgrades or replacement. It is typically easier and most cost effective to build new buildings to a high energy performance standard than retrofitting the same building once it's already been constructed. This is also a key opportunity for growth in local low carbon jobs.

The key actions in this Program Pathway are designed to eventually move to a Net Zero Emissions Building Standard for Calgary. The provincial energy code and the development of a federal net zero energy-ready code (for potential adoption by the provinces) ensures that new buildings' energy performance will continue to improve. However, to meet our 2030 and 2050 emissions targets, building performance must improve more quickly than the energy codes currently dictate.

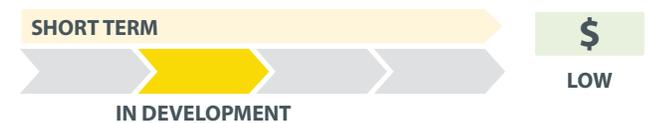
Program Pathway



A1.1 Develop a mechanism to require that all new residential buildings establish and disclose a building energy label.



A1.2 Develop a mechanism to require that all new commercial buildings participate in measuring and disclosing their energy performance through the City of Calgary's Commercial and Institutional Building Energy Benchmarking program.



A2.1 Facilitate and support an information sharing, capacity-building and skills training centre to accelerate zero emissions new buildings and retrofits for commercial and residential buildings, in collaboration with stakeholders (e.g. industry, industry associations, businesses, skills training and employment organizations and other labour and non-profit organizations).



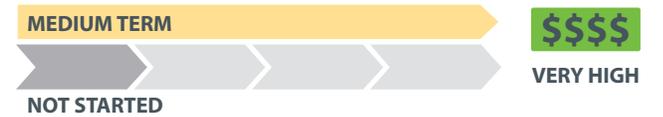
A3.1 Investigate and develop financing programs, in collaboration with public and private-sector stakeholders, to leverage public and private financing sources to support new zero emissions buildings in both the residential and commercial sectors.



A4.1 Develop process incentives to encourage net zero emissions residential and commercial buildings.



A4.2 Develop financial incentives to encourage achieving higher energy performance standards for new residential and commercial buildings, in alignment with the development of a Net Zero Emissions Building Standard.



A5.1 Establish Net Zero Emissions Building Standard that requires that new buildings achieve a better energy performance standard than required in the code. This should align with and accelerate implementation of federal net zero building code changes and be developed in collaboration with key stakeholders, other Alberta municipalities and other levels of government.



A5.2 Establish a strategy to increase the use of low carbon building materials in new construction and renovations in buildings and infrastructure.



The City leading by example

The Haskayne Pavilion is The City of Calgary's first net zero energy building pilot and was designed to generate its heat and power needs onsite using solar photovoltaics and a ground source heat exchange.

Program Pathway B: Existing buildings – Retrofit existing buildings to a net zero standard

Existing buildings represent one of the largest and most complex opportunities for GHG emissions reductions in Calgary. Approximately 50 per cent of the buildings standing in Calgary today will still be in use in 2050. This means that ambitious and widespread building retrofits need to occur. This can be challenging because retrofits can be more expensive and complicated than simply building new buildings to a net zero emissions standard at construction. **Deep energy retrofits**, which focus on reducing as much energy consumption as possible, achieve at least a 40 per cent improvement in the building’s overall energy performance. This can be achieved through improvements to the efficiency of the building envelope, heating and cooling equipment upgrades, and the installation of on-site renewable energy systems, like **solar photovoltaic (PV)**. Even with a strong economic case for energy efficiency and improved energy performance, many residential, commercial and institutional building owners are not investing in better energy performance. There are other barriers to upgrading buildings to improve energy performance, and this Program Pathway attempts to reduce those challenges through education, capacity building, incentives, financing, and eventually through regulation.

Program Pathway



B1.1 Establish a mandatory building labelling program for existing residential buildings.



B1.2 Expand the Commercial and Institutional Building Energy Benchmarking program by requiring participation from all existing commercial and institutional buildings.



B1.3 Develop mechanisms to establish energy performance standards as part of the Commercial and Institutional Building Energy Benchmarking program.



B2.1 Facilitate and support information sharing, training and accreditation for contractors, energy auditors, homeowners, landlords and realtors in collaboration with stakeholders.



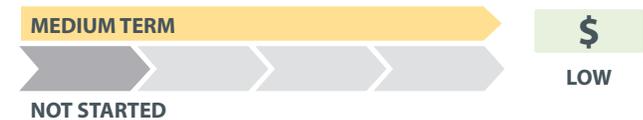
B3.1 Develop and launch the Calgary Clean Energy Improvement Program to provide financing for residential energy efficiency and renewable energy retrofits.



B3.2 Develop and launch a CEIP financing program for commercial buildings to encourage deep energy retrofits.



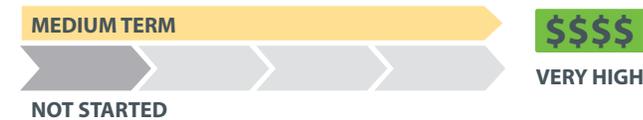
B3.3 Investigate non-CEIP financing models and repayment mechanisms, in collaboration with public and private-sector stakeholders, to leverage public and private financing sources to accelerate GHG reductions in residential and commercial buildings.



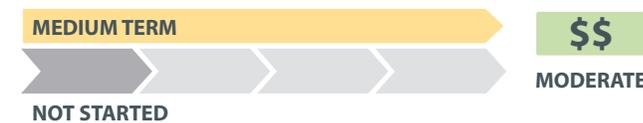
B4.1 Develop process incentives to encourage deep energy retrofits in residential and commercial buildings.



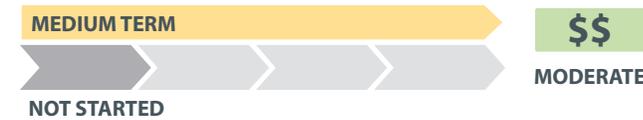
B4.2 Develop a net zero emissions retrofit incentive program to support the greater downtown.



B4.3 Develop a retrofit incentive program to encourage the adaptive reuse of buildings.



B4.4 Develop a retrofit incentive program for tenants that allows non-owners to benefit from improved energy performance and cost savings.



B4.5 Develop financial incentives to retrofit residential and commercial buildings, in alignment with the development of a Net Zero Emissions Retrofit Standard.



B5.1 Design and implement a mandatory emissions performance standard for building retrofits in alignment with federal government direction and in collaboration with stakeholders.



B5.2 Establish a strategy to increase the use of low carbon building materials in renovation in buildings and infrastructure.



B5.3 Integrate climate mitigation considerations into strategies related to irregular building types (i.e., industrial, historic and institutional buildings) to support energy and GHG emissions reductions.



The City leading by example

The City of Calgary is working toward low carbon emissions in its buildings. We're starting by retrofitting to reduce energy demand, combined with renewable electricity supply for all corporate operations. Most of our downtown offices are now connected to the district energy heating network, which aims to deliver zero emissions energy in the long term.



Program Pathway C: Energy poverty – Support Calgarians impacted by energy poverty

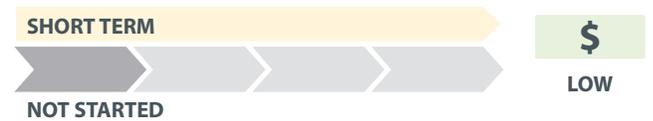
Energy poverty means that a household is struggling to pay its energy bills. In Canada, this is specifically defined as needing to spend twice the average percentage of after-tax household income on home heating and power. The average Canadian household spends less than three per cent of after-tax income on energy bills. Therefore, households that spend six per cent, or more, of after-tax income are experiencing energy poverty. These families struggle when energy prices rise and are often unable to upgrade their homes to reduce their energy usage and reduce their bills, either because they are tenants, or because they cannot afford the up-front cost of the renovations. In Calgary, about 64,000 households are currently living in energy poverty (14).

There are direct linkages between experiencing energy poverty and other impacts to health and wellness. In some cases, people are choosing between paying bills or buying other necessities like groceries or medicine. Homes that are poorly insulated may also be drafty and uncomfortable and have problems with mold or mildew. Living in energy poverty is also stressful and can take a toll on mental health. The key actions in this Program Pathway are intended to specifically identify and implement programs to support those Calgarians living in energy poverty who may not be able to participate in typical programs. We also intend to ensure that our programs do not inadvertently exacerbate the problems of energy poverty for Calgarians with low income or other equity-deserving Calgarians. The first step in achieving these objectives is deep engagement with those experiencing energy poverty to better understand their perspective and needs. It is important that the program design and implementation is based on this feedback and not just on assumptions about who is experiencing energy poverty, and what types of interventions could help.

Program Pathway



C1.1 Engage with Calgarians impacted by energy poverty to understand their perspective and determine programming needs.

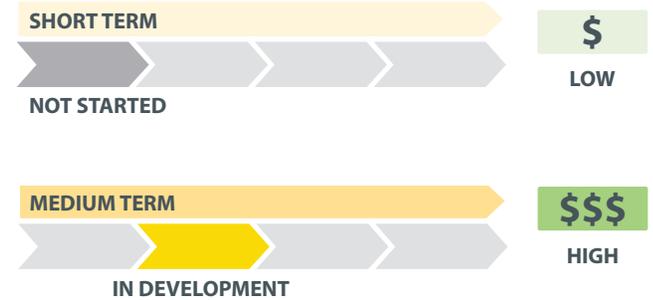


C1.2 Develop a comprehensive strategy to alleviate energy poverty in Calgary and ensure integration with other City of Calgary poverty alleviation strategies and programs.



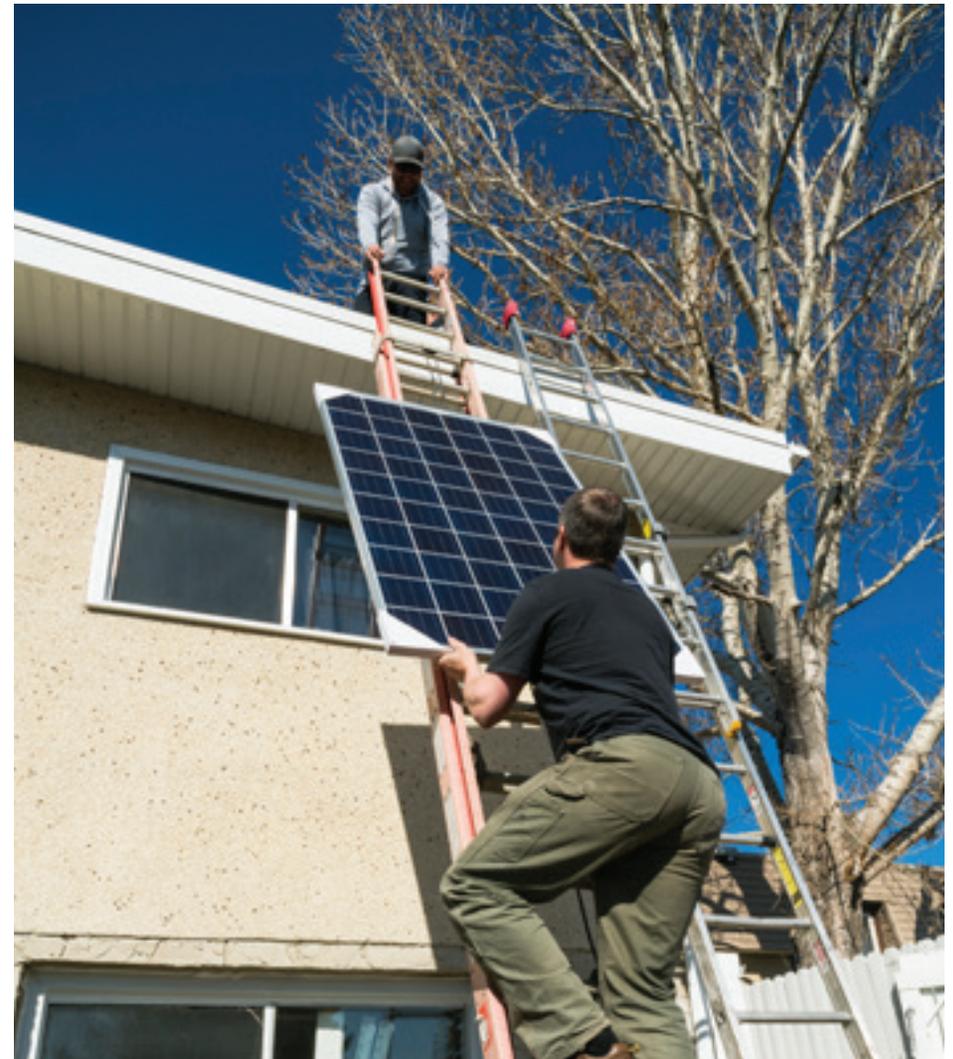
C2.1 Develop a process to integrate energy poverty and equity considerations into the design and implementation of actions across all Program Pathways in the Climate Mitigation Plan to maximize co-benefits and to ensure that the program design and implementation mitigates any negative impact on low income and other vulnerable Calgarians, particularly with respect to housing and energy affordability.

C3.1 Establish a retrofit program for Calgarians experiencing energy poverty in partnership with community partners.



The City leading by example

The City of Calgary, in partnership with Empower Me, delivers energy conservation and education to diverse, multilingual, and hard to reach communities. Empower Me is currently available in 16 languages reaching more than 320,000 multilingual and multicultural community members.



Theme: Zero carbon energy transition

Regardless of how efficient new buildings become, some energy will be needed to heat and power these structures, and electricity will be needed to power electric vehicles and transit systems. Therefore, increasing the availability of zero carbon electricity and heating fuels is necessary for achieving net zero emissions in Calgary by 2050. The Program Pathways in this theme focus on cleaning the electricity and heating supply through large or neighbourhood-scale energy projects.

The actions within this theme are organized into two Program Pathways:

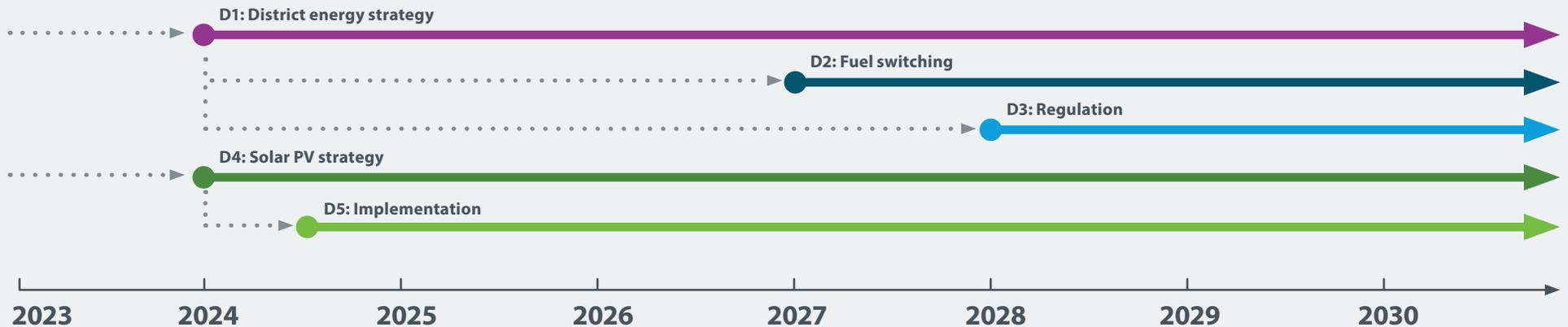
- **Renewable energy: Implement neighbourhood-scale renewable energy projects**
- **Support a clean provincial energy supply**



Program Pathway D: Renewable energy – Implement neighbourhood-scale renewable energy projects

Solar PV and district energy systems are important technologies to help Calgary transition away from fossil fuels. District energy systems can use waste heat or low carbon fuel sources to supply heating and cooling to multiple buildings and improve overall system performance. Renewable energy can provide a localized source of low carbon energy. On-site systems will be part of the strategy to achieve net zero emissions buildings, but industrial or neighbourhood-scale projects will also help provide an important source of zero carbon energy. Alternative ownership models for renewable energy projects can also be an innovative way for Calgarians to participate in the low carbon economy. The actions in this Program Pathway are intended to support the implementation of renewable energy within Calgary city boundaries.

Program Pathway



D1.1 Develop and implement a long-term District Energy Strategy for downtown, high-density developments, health and education campuses and industrial areas.



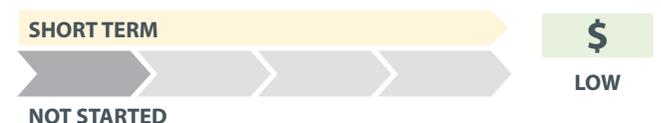
D2.1 Investigate and pursue opportunities to support the transition of existing district energy systems to low carbon fuel sources in partnership with system owners and operators.



D3.1 Where district energy systems already exist, develop mechanisms to ensure that new developments in proximity connect, unless a lower emissions option for the project can be demonstrated.



D4.1 Develop and implement a city-wide strategy to accelerate the installation of solar PV in residential, commercial and industrial applications.



D5.1 Support the implementation of solar PV on community buildings such as community associations and schools.



D5.2 Explore and support community and co-operative ownership models for local renewable energy projects.



The City leading by example

The City of Calgary is currently building about 1880 kW of solar parks at Mount Pleasant Fire Station No.7, Bearspaw Water Treatment Plant, Manchester Building M, TELUS Spark PV ground-mount and Shepard Solar Park.



Program Pathway E: Support a clean provincial energy supply

Reducing the GHG intensity of provincial electricity and heating fuels is mostly outside the City of Calgary’s jurisdiction. Beyond implementing renewable energy and zero carbon energy projects within city boundaries, the GHG intensity of these electricity and natural gas systems are managed by other provincial stakeholders. However, meeting our net zero emissions targets significantly depends on these fuels becoming zero carbon by 2050. The pace and scale of greening the provincial electricity and natural gas supply is incredibly impactful on Calgary’s overall emissions. This Program Pathway recognizes action must happen at the provincial scale and identifies important collaboration, partnerships and advocacy that The City can do to support the clean transition of the provincial electricity and natural gas supply.

Program Pathway



E1.1 Work with Enmax and other electric utilities to support the transition to zero carbon electricity, particularly to implement grid and service upgrades to enable electrification.



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LOW

E2.1 Work with ATCO and other natural gas suppliers to explore low carbon fuels for heating, particularly to align with provincial and federal hydrogen strategies.



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LOW

E2.2 Integrate ATCO Hydrogen Strategy data into The City of Calgary GHG model to quantify the hydrogen pathway for decarbonizing home heating, and identify a 2030 and 2050 milestone for decarbonization of building heating fuels.



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E3.1 Advocate to the provincial and federal governments to support low carbon electricity, low carbon heating fuels, demand side management, energy storage and expanded energy data access.



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LOW

E3.2 Advocate to the Alberta Utilities Commission to support low carbon electricity, low carbon heating fuels, demand side management, energy storage and expanded energy data access.



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LOW

The City leading by example: The City of Calgary currently purchases renewable electricity certificates to cover 100 per cent of the electricity used in City operations.

Theme: Zero carbon neighbourhoods

Where people live, work, and access amenities impacts how they choose to get around Calgary. Currently, transporting people and goods account for one-third of Calgary's emissions. How we design our neighbourhoods and city have a significant impact on the amount of fuel needed to travel around the city.

A net zero emissions neighbourhood is a community that has greatly reduced energy needs through energy efficiency and relies on zero emissions electricity, heating and transportation fuels. If there are emissions remaining, high-quality offsets can be purchased to reduce community emissions to zero. The buildings and renewable energy aspects have been addressed in this plan in previous themes. The zero carbon neighbourhoods theme focuses on the land use planning and transportation aspects of net zero emissions neighbourhoods.

Emissions from the transportation sector come from the use of two main transportation fuels: diesel and gasoline. To reduce these emissions there are three broad approaches: use land more efficiently to transition to a denser, more compact city to minimize travel distances, switch vehicle fuels to a cleaner, low carbon fuel, and switch to transportation modes that use less energy. Residents who can meet many of their daily needs by walking, bicycling, or riding transit also benefit from improved health, thriving local business districts, and increased opportunities for diverse housing and jobs. Providing diverse and high-quality transportation options for all residents is an important way that climate action and equity considerations intersect.

This theme is organized into three Program Pathways:

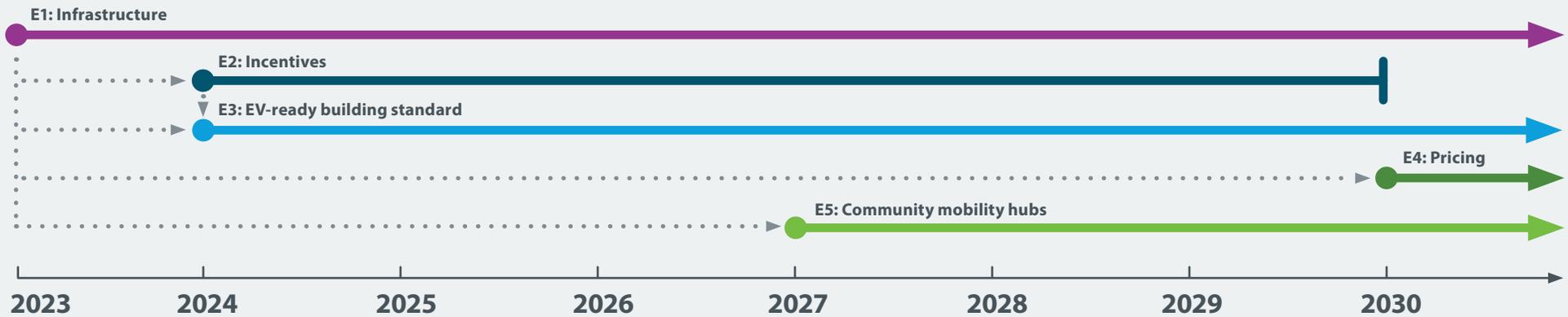
- **Zero emissions vehicles: accelerate the transition to zero emissions vehicles**
- **Mode shift: shift mode-share to low or zero emissions modes**
- **Zero emissions city design: transform land use planning to prioritize zero emissions city design**



Program Pathway F: Zero emissions vehicles – Accelerate the transition to zero emissions vehicles

Calgary's spread-out urban form will necessitate the use of vehicles to transport people and goods around Calgary for the foreseeable future. As a result, for transportation emissions to decline quickly enough to meet net zero emissions by 2050, fuel switching in both privately-owned vehicles and commercial fleets is the most significant opportunity to reduce emissions in the transportation sector. Electric vehicles are the leading technology for emissions reductions and cost savings, however there are other technology options that may become a greater opportunity in the future, such as hydrogen vehicles. Strategies that focus on incentivizing private electric vehicles are likely to disproportionately benefit middle-and-high-income individuals, so it is critical that the program design and implementation of this Program Pathway keeps equity considerations front of mind.

Program Pathway



F1.1 Implement local and regional public electric vehicle Level 2 and Level 3 fast charging infrastructure.



F2.1 Develop process and financial incentives to support: at-home charging infrastructure, retrofit EV charging infrastructure in multi-unit residential buildings, private e-bikes and electric vehicles, low carbon or zero emissions fleet vehicles.



F3.1 Require that all new residential buildings be built to an EV-ready standard, and require commercial buildings to be 10 per cent EV-ready with 90 per cent conduit/partial readiness.



F4.1 Establish Zero Emissions Transportation Zones.



F4.2 Work with the province to implement road pricing tools that address the “direct user pay” costs of travel, responding to time, location, type of vehicle and even the level of congestion present along the route.

F5.1 Create community mobility hubs to facilitate EV charging and travel by modes other than private automobiles.



The City leading by example

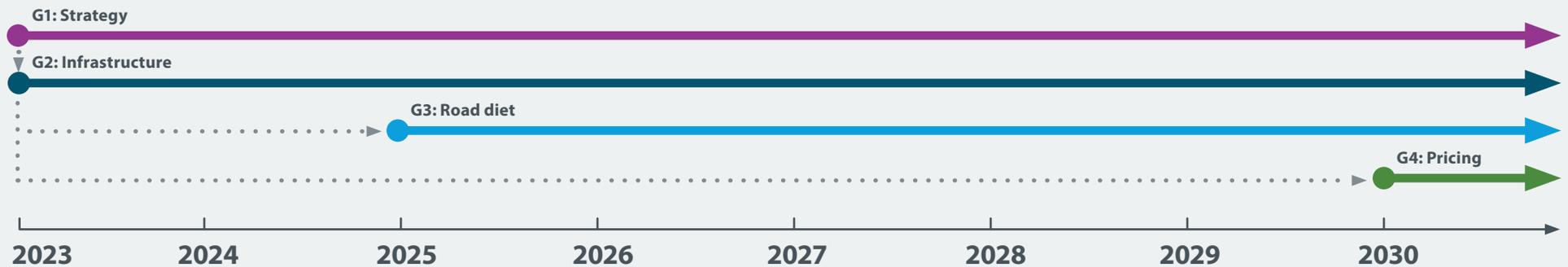
The City of Calgary invested \$120,000 to leverage \$2 million in federal, provincial and regional partner funding to design the network for, procure and install 20 EV fast-charging stations in the southern Alberta Peaks-to-Prairies EV network. This unique regional collaboration has significant benefits for Calgary drivers and has economic development benefits in Calgary and in partner communities.



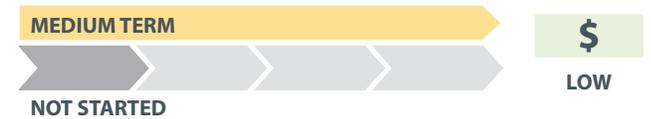
Program Pathway G: Mode shift – Increase the mode share of zero or low emissions transportation modes

High quality transit, walking and wheeling infrastructure and carpooling networks provide the backbone of a low carbon transportation system. The COVID-19 pandemic has had a significant impact on transportation patterns in the city. Both transit demand and transit funding significantly declined and have not yet recovered to pre-pandemic levels. It's not yet clear what the long-term effect of the pandemic will be on transportation patterns in Calgary. However, high-quality, convenient and safe transit, walking and wheeling transportation options were consistently identified as a priority in the initial engagement with equity-deserving people and groups. The City of Calgary should reinvest in infrastructure, frequent and convenient transit service, consistent and prioritized maintenance and snow clearing, and improved comfort and safety to achieve both climate action and equity objectives.

Program Pathway



G1.1 Integrate GHG emissions reduction considerations into Calgary Transit route planning and service decisions.



G1.2 Integrate explicit evaluation of, and accounting for, the GHG emission impacts associated with transportation infrastructure investment alternatives as part of The City's corporate infrastructure investment planning process.



G1.3 Develop a travel-demand management strategy to support increased use of ride-sharing, car-pooling and working from home.



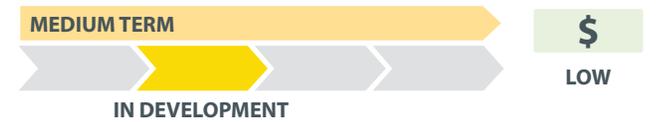
G2.1 Increase investment in walking and wheeling infrastructure to support full implementation of the 5A network by 2050, and revise community design and development standards to support implementation.



G2.2 Expand investment in primary transit network service provision.



G3.1 Identify opportunities to repurpose existing vehicle travel lanes and update policies and complete streets design guidelines to prioritize active mobility, transit, green infrastructure, and traffic safety.



G4.1 Investigate additional pricing structures (i.e., road tolls, parking fees) to shift demand to low carbon modes.



The City leading by example

The Always Available for All Ages and Abilities (5A) network was approved by Council as part of the 2020 Calgary Transportation Plan. The 5A network is a city-wide plan for a network of pathways and bikeways protected from motor vehicle traffic, designed to meet the needs of people of all ages and abilities as it will provide a consistent, reliable experience through lighting and year-round maintenance. Calgary's wheeling network has expanded from 1,065 km in 2009 to 1,807 km in 2021.



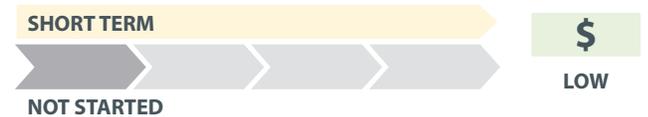
Program Pathway H: Focus land use planning to prioritize zero emissions city design

Calgary is expected to grow to a population of two million people over the next 50-60 years. It is crucial that a variety of low carbon climate-resilient housing types and transportation options in a variety of communities are available to Calgarians to support net zero goals. Rapid suburban growth and the removal of natural and agricultural landscapes for development can have significant impacts on Calgary's carbon emissions and can result in the loss of key ecosystem services that buffer communities from the impacts of climate change. Building a net zero and climate-resilient city will require balancing many considerations, some of them competing. Holistic approaches to city-building must include new frameworks for urban planning, changes to building and infrastructure design, and measures to enhance overall resilience. Our communities will transition to compact, mixed-use neighbourhoods with abundant natural infrastructure and where transit and active modes of transportation (e.g., walking, cycling) are the preferred mobility choice. Calgary's future communities must link sustainability to social equity. Reducing emissions and adapting to the impacts of climate change requires a shift in the way our communities are built and function. These changes can also bring benefits to Calgarians' social wellbeing, physical health, economic vitality, and sense of community. Land use planning is a key function of municipal governments, and The City of Calgary has significant authority to influence the type and quality of the urban form in Calgary. This Program Pathway identifies how The City can tailor plans and policies to develop existing and future neighbourhoods in such a way to prioritize net zero emissions communities. As Calgary moves towards a denser urban form, maintaining the availability and quality of parks, green spaces, and natural areas is also critical.

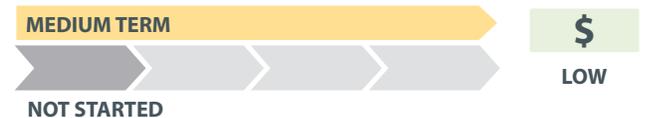
Program Pathway



H1.1 Update the Municipal Development Plan and the Calgary Transportation Plan to incorporate the net zero emissions targets and support the relevant actions of the Mitigation Plan.



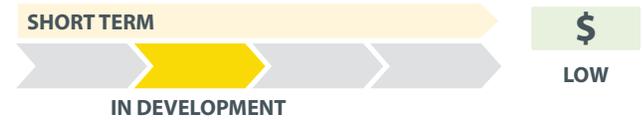
H1.2 Incorporate climate mitigation and adaptation into new local area plans. When existing local area plans are proposed for amendment to support development ensure alignment with the Climate Strategy.



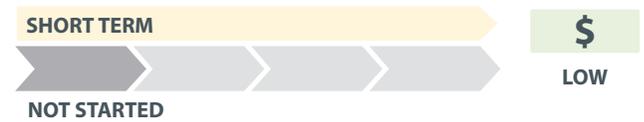
H1.3 Review and update existing planning policies, guidelines, regulations and processes for alignment with the Climate Strategy and to incentivize innovation.



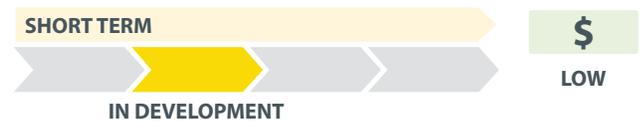
H1.4 Update the Industrial Strategy to support industrial operators in reducing GHG emissions and reducing vulnerability to climate related hazards in industrial areas.



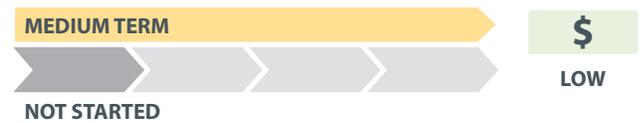
H2.1 Use modelling to determine the necessary growth split to achieve 2030 and 2050 net zero targets and implement through the appropriate City of Calgary policies.



H2.2 Ensure climate and energy planning are strategic priorities in decisions that initiate new community growth.



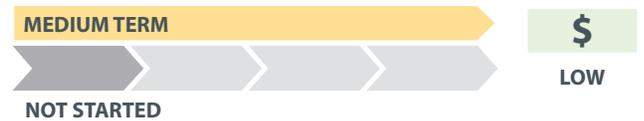
H3.1 Develop and implement Net Zero Emissions and Climate Resilient Design Guidelines for both new and established communities.



H3.2 Align the build-out of new communities with the provision of active mobility infrastructure and transit service in each build-out phase and prioritize transit-oriented development in all phases.



H3.3 Prioritize climate mitigation and adaptation in the review of outline plan applications and where significant benefits can be realized, consider all available options to enable innovation including additional flexibility in applying City subdivision design standards.



H4.1 Incentivize and prioritize energy efficient development in all areas through land use bylaw rules and policy direction.

H4.2 Through the land use bylaw update, enable increased housing types and support uses in residential areas to facilitate complete communities and reduce dependency on private vehicles.

H4.3 Consider viable options for removing and/or reducing motor vehicle parking minimums in residential areas, to allow for more compact development, more efficient use of land and encourage alternate modes of transportation.

H4.4 Update parking stall standards to include EV-ready infrastructure.



The City leading by example

The City is developing a new generation of multi-community plans to replace the existing patchwork of planning documents (Area Redevelopment Plans). The Climate Program staff are collaborating with Planning & Development to pilot new climate-lens tools to support the development of the plans. Pilot results will inform decisions to incorporate these tools into additional local area plans.



Theme: Consumption and waste

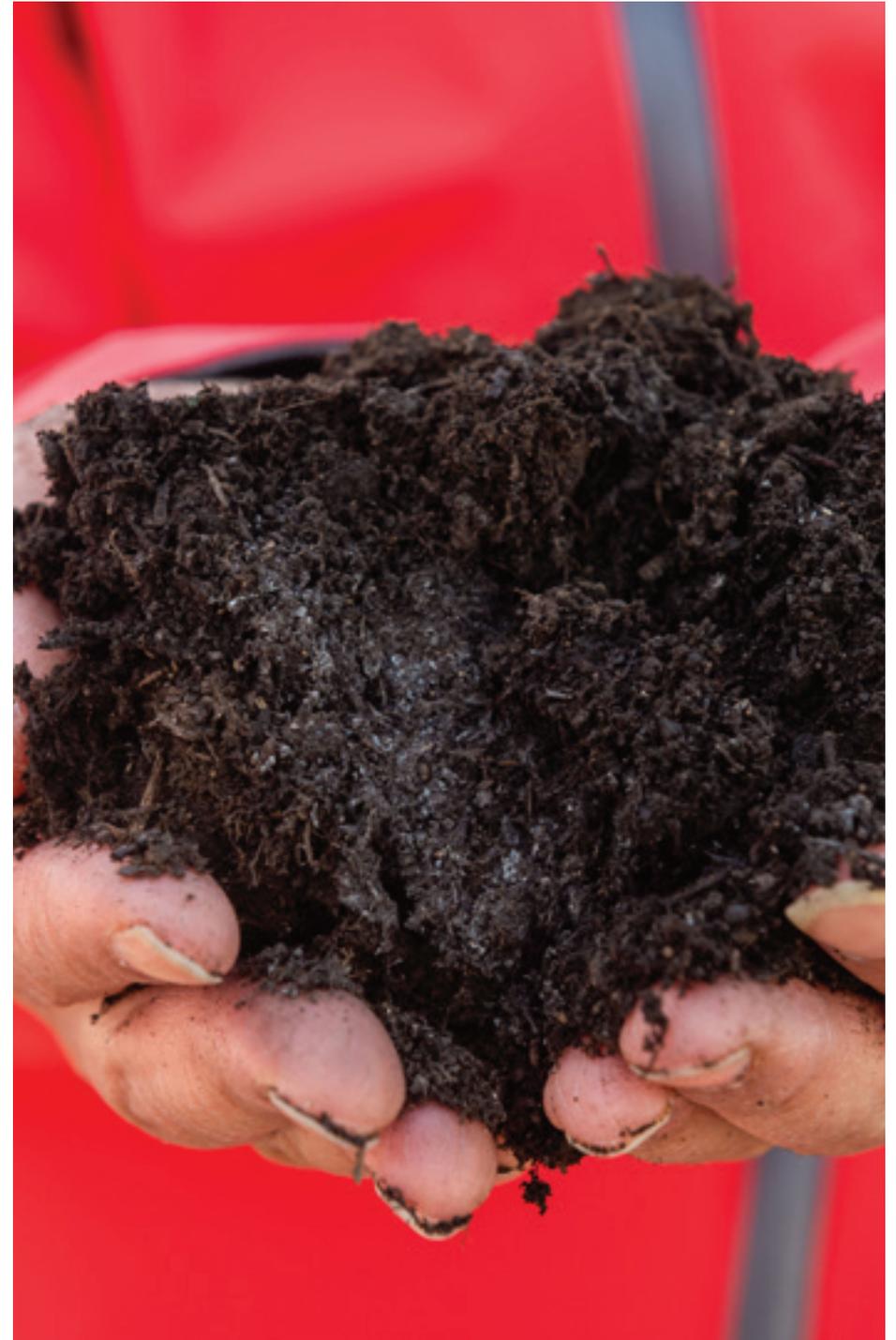
The waste we create and how we dispose of it can have a measurable impact on GHG emissions. Currently, our GHG inventory only accounts for methane emissions from City of Calgary waste and wastewater facilities, which accounts for about one per cent of the GHG emissions in Calgary. However, there are GHG emissions that are embodied in the products that we use and dispose of in Calgary. We don't currently measure these emissions, but based on analysis from other cities, embodied emissions could double the emissions that we account for in our inventory. The Program Pathways in this theme focus on reducing the creation of waste in the first place, and then, once waste creation has been minimized as much as possible, we aim to divert as much waste from our landfills as possible, particularly organic waste.

Taking action to create a more circular economy in Calgary has the opportunity to create jobs, as more things require repair, refurbishment and redesign. There is also an opportunity to design food waste strategies to enhance food security and access to healthy food for low-income residents.

In recent years, The City has taken significant action in reducing GHG emissions from the waste sector by implementing a series of programs and actions surrounding waste reduction, recycling, GHG capture, and composting. This plan aims to strengthen its commitment to reduce GHG emissions associated from waste emissions while starting to consider the embodied GHGs from the goods and services we consume. Actions that are focused on methane gas capture, management and use at City facilities are addressed in the *Corporate Energy and GHG Plan* (12).

Actions in this theme are organized into two Program Pathways:

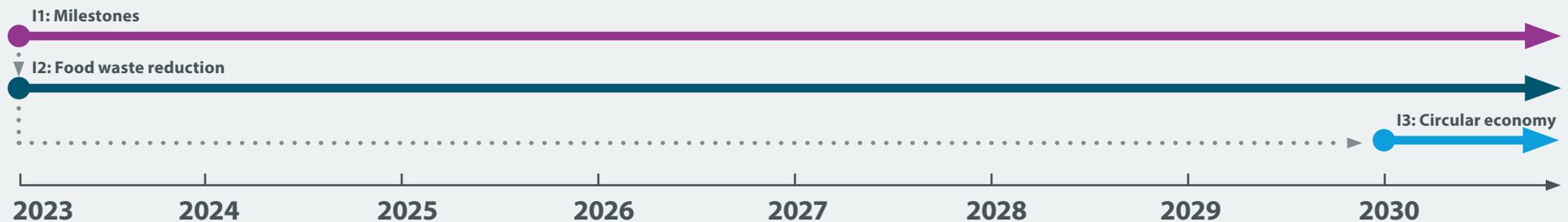
- **Waste reduction: Reduce total waste generation in all sectors**
- **Waste diversion: Increase waste diversion from landfills**



Program Pathway I: Waste reduction – Reduce total waste generation in all sectors

Traditionally, climate change mitigation plans address waste emissions (i.e., methane) by capturing or managing the emissions once they are created. This Program Pathway attempts to take a more proactive approach by reducing the amount of waste that is created in the first place. One concept that includes a more proactive approach to reducing the amount of waste created is a circular economy. In a circular economy, nothing is wasted. The circular economy retains and recovers as much value as possible from resources by reusing, repairing, refurbishing, remanufacturing, repurposing, or recycling products and materials, including those used in the construction of infrastructure and our built environment. While recycling and composting are helpful steps in reducing emissions associated with the things we buy, these actions only address emissions at the end of the product’s life. The majority of GHG emissions from the products we buy and build are generated during manufacturing and transportation, meaning that reducing the amount of new products used and then discarded can have an impact on GHG emissions. This Program Pathway identifies the first steps in moving towards a circular economy in Calgary.

Program Pathway



I1.1 Develop 2030 and 2050 milestones for waste reduction aligned to the United Nations Sustainable Development Goals and the development of a Calgary consumption-based GHG inventory.



I2.1 Enable and promote food waste reduction.



I3.1 Enable reuse, sharing and a more circular economy.



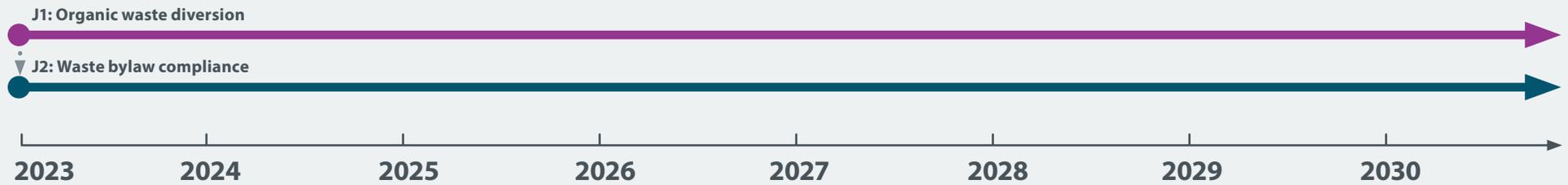
The City leading by example

Calgary was selected along with 14 other Canadian municipalities to participate in the Circular Cities and Regions Initiative. The goal is to identify potential focus areas (e.g., built environment, food systems, manufacturing, plastics, retail) and potential opportunities for municipal intervention (e.g., partnerships, fiscal measures, public procurement, capacity-building, awareness raising, asset management, regulation, etc.) to implement a circular economy in Calgary.

Program Pathway J: Waste diversion – Increase waste diversion from Calgary landfills

Methane is twenty-five times more potent than carbon dioxide in causing climate change and is produced when organic waste decomposes in **anaerobic conditions** (15). In a municipal context, methane is generated from solid waste in landfills, from biosolids in wastewater treatment processes, and to a lesser extent in composting facilities. How much methane generated is a factor of how much organic waste is in those facilities. Therefore, diverting organic waste, particularly from landfills, is a significant opportunity to decrease the amount of methane released into the atmosphere. The Program Pathway below addresses opportunities to expand, and improve on, Calgary’s organic diversion.

Program Pathway



J1.1 Deliver waste diversion programs and services that target food and organic waste.



J2.1 Improve participation in existing diversion programs and compliance with the Waste Bylaw.



The City leading by example

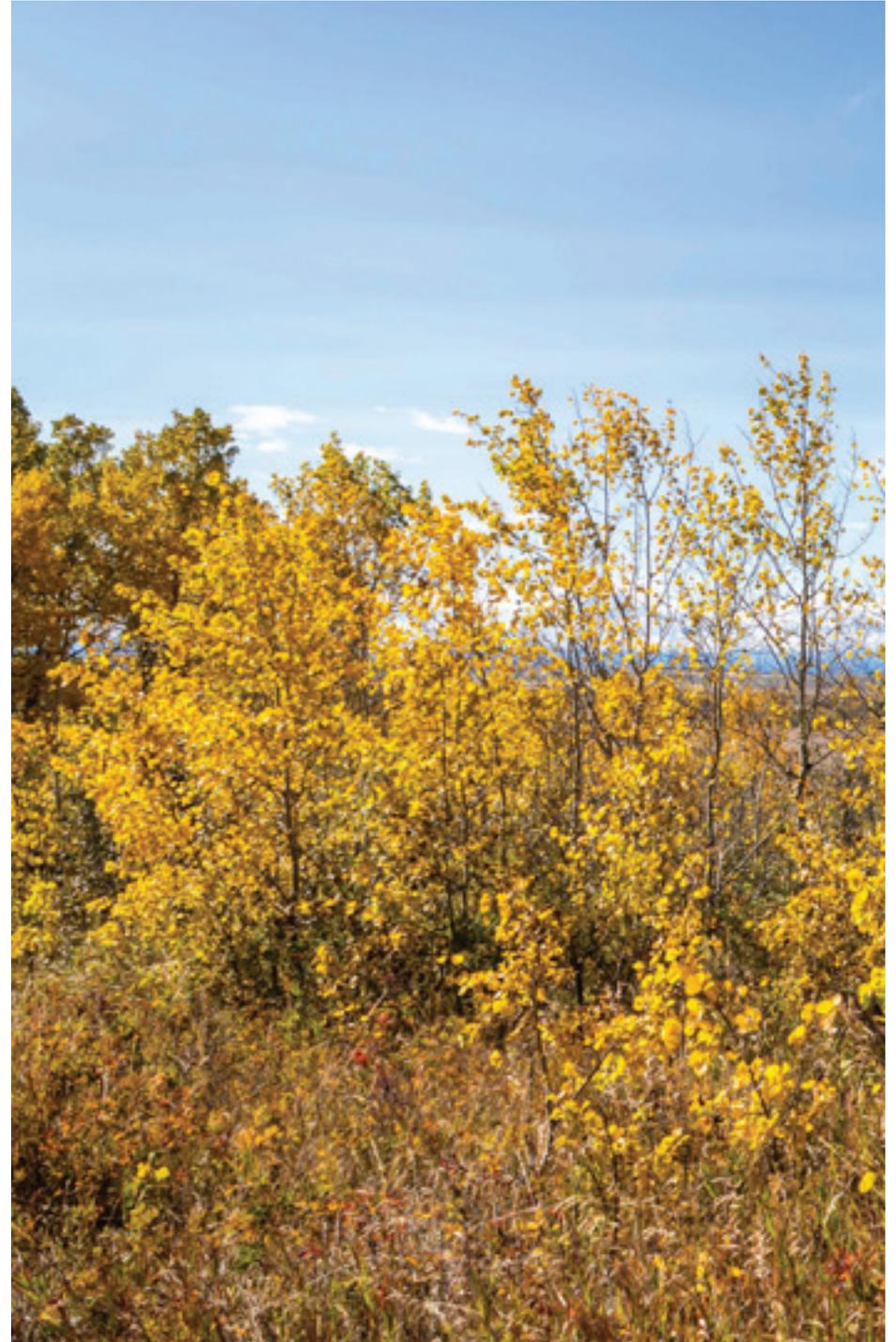
The Calgary Composting Facility is the largest of its kind in Canada. The facility opened in 2017 and processes materials from the Green Cart Program and some biosolids, a nutrient-rich by-product of wastewater treatment. Plans are already underway to expand the facility due to the success of the Green Cart Program. The residential Green Cart Program diverted more than 110,000 tonnes of food and yard waste from landfill in 2021, which reduced methane emissions and produced valuable compost.

Theme: Carbon removal

Calgary's GHG emissions modelling shows that even with aggressive and ambitious action, there is still a gap between what can be achieved by 2050 and net zero. Therefore, it will be necessary to find ways to remove carbon from the atmosphere, either through natural or artificial means, to balance the remaining emissions in 2050.

This theme organizes The City's approach in two Program Pathways:

- **Natural infrastructure: Manage natural infrastructure to maximize carbon sequestration**
- **Carbon negative technologies: Explore the implementation of carbon negative technologies**

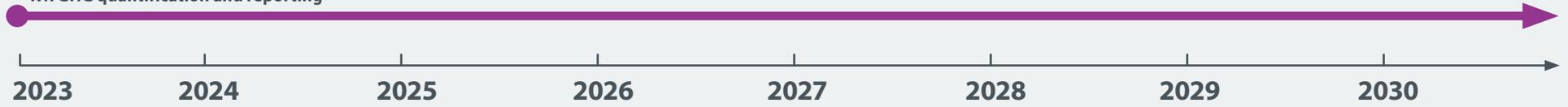


Program Pathway K: Natural infrastructure – Manage natural infrastructure to maximize carbon sequestration

Natural assets include wetlands, riverbanks, trees and parks. In addition to providing a critical role in adapting to climate change, trees, and other natural infrastructure, help by sequestering carbon dioxide and reducing building energy use through cooling and shading in summer and lessening heat loss in winter. The GHG impact of the disruption of our natural systems is becoming increasingly important, as the conservation of natural areas, the restoration of disrupted systems, and the types of developments we permit in our city will directly impact the potential of these systems to act as a carbon sink, and to provide other environmental benefits. Most of the actions that relate to the management of Calgary’s natural infrastructure are detailed in the Adaptation Plan. The action included here is meant to improve Calgary’s ability to quantify and report on the GHG emissions impact of natural infrastructure to further support and justify conservation and restoration activities in Calgary.

Program Pathway

K1: GHG quantification and reporting



K1.1 Integrate GHG quantification into how conservation, natural areas and natural infrastructure are managed and prioritized (including in the approval of new communities), and include in annual GHG reporting.



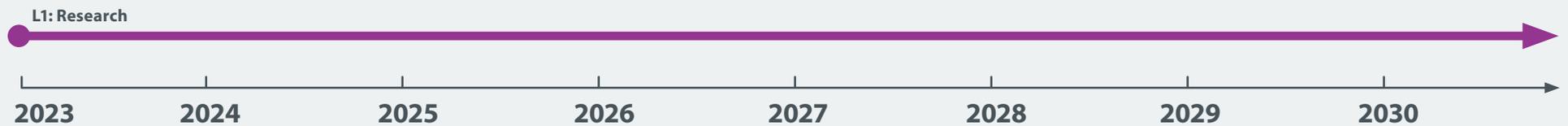
The City leading by example

The City of Calgary’s willow tree plantation uses biosolids as fertilizer and creates a carbon storage sink that leads to fewer GHG emissions. The harvested willows are also used in Calgary’s composting facility. Over the lifetime of this project, Calgary will see a cumulative reduction of about 200,000 tonnes of GHG emissions—equivalent to removing approximately 61,000 cars from the road for one year.

Program Pathway L: Carbon negative technologies – Explore the implementation of carbon negative technologies

Carbon negative technologies are technologies that remove more carbon from the atmosphere than they emit. In the most recent IPCC report, almost all the pathways analyzed relied to some extent on carbon negative approaches to achieve net negative emissions by 2050 (16). Carbon negative technologies can also play a role in supporting the low carbon energy transition: they can neutralize or offset emissions that are currently technically challenging or prohibitively expensive to address. This could include some industrial processes, such as steelmaking and cement production, and long-distance transport. It is important to not rely on a yet-to-be-discovered technological solution to achieving net zero. However, it is important to monitor technology options such as carbon capture, storage and utilization as they evolve. This Program Pathway recognizes Calgary’s pathway to net zero will likely require implementation of some carbon negative technologies, and that it will be important to monitor and pilot promising innovations.

Program Pathway



L1.1 Monitor research and development of carbon negative technologies, and pilot promising options.



The City leading by example

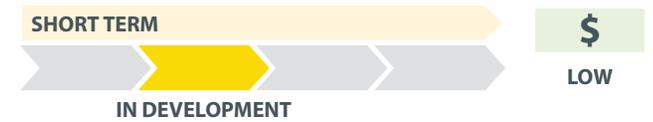
Calgary Roads is piloting concrete with carbon capture (i.e., CO₂ mineralization), which is a product from a technology for the concrete industry that introduces recycled CO₂ into fresh concrete to reduce its carbon footprint without compromising performance.

Theme: Enabling actions

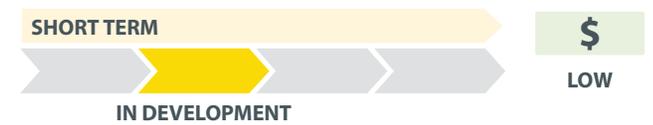
The key actions identified in this theme are foundational cross-sectoral actions necessary to ensure successful implementation of all the other actions in this action plan. The actions include enhancing our GHG emissions data measurement and reporting, integrating important perspective throughout the successful implementation of all the other actions in this Mitigation Plan through deep engagement with Indigenous Peoples and other equity-deserving groups, and demonstrating that The City is leading by example in our own operations.



M1.1 Implement a city-wide carbon budget and accounting framework.



M1.2 Improve the detail and scope of annual GHG emissions tracking and reporting by establishing a consumption-based inventory and expanding current GHG inventory to include Scope 3 emissions, based on data availability.



M1.3 Refine GHG modelling and tools to better inform City decision-making.



M1.4 Establish GHG emissions as a priority for capital priorities and investment planning and develop a tool to support decision-making.



M2.1 Deep engagement and relationship-building to integrate the perspectives of a broad cross-section of equity-deserving groups into the implementation and future revisions of the Mitigation Plan. This should be coordinated with Climate Adaptation.



M2.2 Pursue partnership opportunities with academic institutions, non-profit organizations and private businesses to support innovation, research, pilots and implementation of actions in the Mitigation Plan.



M3.1 Implement the *Calgary Corporate GHG and Energy Plan*.



The City leading by example

In 2020, The City of Calgary was one of 95 cities worldwide to achieve the Carbon Disclosure Project's Cities 'A' list. To achieve this score, Calgary had to demonstrate best practice standards across adaptation and mitigation reporting, including setting ambitious, but realistic goals and making progress towards achieving those goals. Calgary has strategic, holistic plans in place to reduce climate impacts and vulnerabilities of individuals, businesses and organizations in Calgary.



adaptation plan



introduction

The goal of climate adaptation is to reduce climate risk, explore the potential benefits that come from a changing climate, and increase the resilience of our community. This will require solutions that touch on economic, environmental, and social aspects of resilience beyond just the immediate response to climate emergencies. It will require continuous learning and collaboration with community members and City departments and the provision of clear information, programs, policies and strategies to enable adaptation action.

The costs of **climate impacts** will continue to grow across Canada. Over the most recent decade, insured losses have averaged about \$1.9 billion per year (4). Uninsured losses are typically estimated to be three to four times higher than insured losses in Canada. Projected annual costs due to climate change in Canada by the 2050s, assuming no adaptation, range from \$30 to \$62 billion (2019 dollars). Climate adaptation can significantly reduce the projected costs of climate change. The City commissioned a study of the costs of climate change impacts, including infrastructure damage and replacement, impacts to ecosystem services, loss of productivity, and human health impacts. The study estimates the market and non-market costs of climate change will reach \$2.6 billion annually by 2050s and

\$7.8 billion annually by 2080s (3). The study provides an in-depth analysis of which systems will be damaged by various **climate hazards**, allowing The City to target climate adaptation measures and make economically sound decisions. The staggering cost of these impacts highlights the critical need to act on climate change now.

Climate adaptation refers to the laws, policies, programs, tools and strategies that will reduce the negative impacts and prepare for the benefits of climate change on our city's infrastructure, natural assets, economy and people.



With a changing climate, most local climate hazards, such as floods, droughts, storms, and heatwaves, are expected to increase in frequency, intensity, and variability. Adaptation requires developing a proactive plan to protect these systems from current and future climate impacts. It also involves building the capacity of Calgarians, organizations, and communities to adapt to and withstand the effects imposed by a changing climate. Mobilizing and equipping communities towards a proactive perspective on climate change will help Calgarians assess, plan, and implement preparations to reduce the severity of future climate impacts. Conducting risk assessments on vital systems, critical infrastructure and valuable assets prepares Calgary to be ready for the long-term consequences of climate change.

Calgary's Adaptation Plan

The Adaptation Plan builds on the work done since the approval of the 2018 Climate Resilience Strategy (29), and acknowledges current and future climate hazards, describes the impacts the changing climate will have on our city, the risks these impacts pose, and the actions The City, communities and businesses must take to prepare and adapt now to reduce risk and foster climate resilience.

This Adaptation Plan update represents the progression of a journey that will continue to evolve with new ideas and changing conditions. The City will continue to support community-led and place-based initiatives to prepare for and recover from acute climate events and chronic climate trends. The Adaptation Plan takes a people-centred approach to build capacity, strategically invest in infrastructure, and proactively embed climate resilience into plans and processes.

The Adaptation Plan builds on foundational knowledge gained through:

- A best practice review of adaptation planning in jurisdictions across Canada, the United States, and Europe.
- The **community climate risk index** (CCRI) for Calgary, which details the unique community level risk landscape across the city.
- Calgary's natural asset valuation.
- Extensive stakeholder engagement.

Supporting Indigenous climate adaptation

The depth and breadth of knowledge nurtured by Indigenous communities in and around the region has been created over thousands of years and reflects their respect for the interconnectedness of all things on earth. Working in Ethical Space, the understanding that two disparate worldviews, Indigenous and Western, can work in parallel towards shared understandings and meaningful dialogue takes time and requires trust.

The City of Calgary is committed to engaging with, learning from, and supporting the efforts of Indigenous communities in adapting to climate change. Ethical Space recognizes the need to elevate Indigenous knowledge systems that are deeply rooted in the oral histories and traditions of Indigenous Peoples. The powerful ways of combining Indigenous and non-Indigenous information in the principles of “two-eyed seeing” and “two-legged walking” will strengthen the resilience of Calgary and all its people to future climate change events. Indigenous knowledge is foundational to all climate adaptation efforts.

Integrating equity into climate adaptation planning

The Adaptation Plan has been developed to address equity actions and gaps (informed by *An Equity Review of The City of Calgary's Climate Resilience Strategy* (9) by the Toronto Environmental Alliance, and by engagement with equity-deserving Calgarians), and seeks to create opportunities or benefits for equity-deserving people and communities in Calgary. For climate adaptation strategies to be successful, the full participation of all people is needed. In order to integrate equity considerations, climate adaptation plans, policies, and tools must acknowledge differences in how people will experience and respond to climate impacts and plan to address these gaps. Further engagement and community partnership efforts will target equity-deserving groups, leverage existing community networks, provide tools to support community participants and establish a community climate vulnerability and resilience working group to guide climate adaptation efforts.

Transition to a low carbon economy

The economic development opportunities of implementing climate change adaptation actions and supporting the transition to a low carbon economy is a critical outcome of the Adaptation Plan. The transition to a low carbon economy, while not easy, brings many opportunities for growth and is critical to Calgary's future economic prosperity.

Building climate resilience into The City's infrastructure and operations and investing in climate adaptation at the community scale puts Calgary in a good position to reduce potential future costs and damages. Adaptation measures also have the potential to create new opportunities for job growth and prosperity, such as novel agriculture practices, natural infrastructure solutions and innovative engineering projects. The City commits to implementing the actions in the Adaptation Plan to support and accelerate the transition to a low carbon economy.

Understanding the impacts of climate change

The world is on track for unprecedented rising global temperatures due to cumulative GHG emissions and aerosols within the earth's atmosphere (13). Climate change is already affecting every area on Earth, with changes to precipitation patterns, shifting seasons, glacial retreat, sea level rise and extreme heat events. While reducing GHGs is critical, even with substantial efforts to curtail GHG production, global surface temperatures will continue to rise until at least the mid-century (13).

The climate is changing more substantially and rapidly in higher latitudes such as Canada. Calgary has already experienced significant climate events (e.g., flooding, severe storms, extreme heat and poor air quality from wildfire smoke). Not only does climate change threaten the health and wellbeing of communities and ecosystems, but climate risks also pose a substantial economic risk.

Adaptation efforts are critical to reduce both the long- and short-term damages of climate impacts. According to the Global Commission on Adaptation, every dollar invested in climate adaptation will have an averaged six dollar **return on investment** (ROI) (17). The implications of not adapting are far more costly than taking action to prepare today. The City has been dedicated to understanding climate risk to prioritize actions that will develop climate resilience. Prioritization of The Plan's program areas align with the systems and sectors that will experience the greatest socioeconomic impacts due to climate change.

Climate change and Calgary

The global annual average temperature has increased by about 1°C since 1880, with the greatest warming occurring since the 1970s (13). On average, both Calgary (18) and Canada have warmed by about 2°C since 1880 (19). Changes in longer-range regional climatic trends and more severe and frequent extreme weather events are happening now and will increase due to climate change. A detailed analysis of future climate scenarios in the 2050s and 2080s is outlined in the *Climate Projections for Calgary Report* (18). The City utilizes the **Representative Concentration Pathway (RCP) 8.5** scenario as a risk-informed approach to climate adaptation planning so that the full breadth of risks can be considered (20).

Using advanced **climate projections** to predict changes in temperature, precipitation, and extreme weather events provides decision-makers, asset owners and the public with information to understand potential future impacts on the people in our community, built infrastructure, the natural environment and the economy.

Calgary's climate hazards

There are eight main climate hazards The City identifies as being of the greatest concern to Calgary. These hazards have been assessed and projected into the future, as described in the *Climate Projections for Calgary Report* (18), to better understand the future of these hazards in a changing climate. The main climate hazards (Figure 8) include:

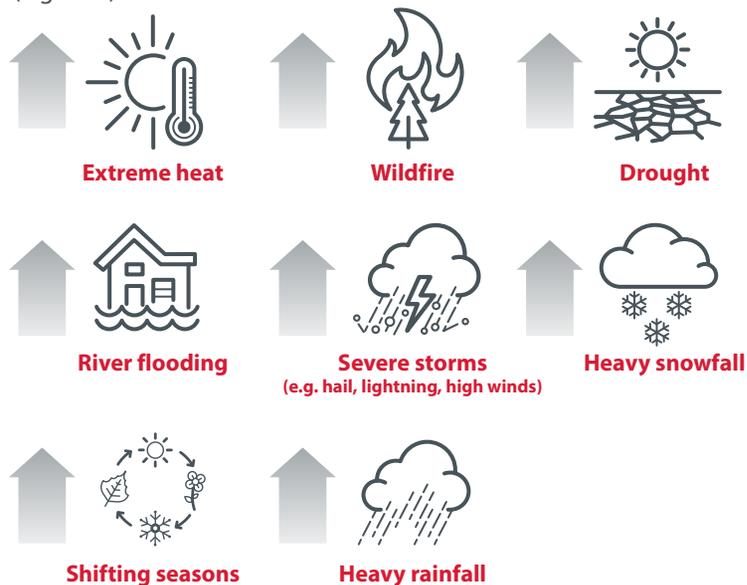


Figure 8: Calgary's climate hazards

Projections indicate that regional warming is expected to continue at an accelerated rate. As a result, the seasons in Calgary are shifting; shorter winters, earlier spring, and longer summers. As the amount of water vapour in the air increases with higher temperatures, precipitation is likely to increase. Precipitation types and timing will shift, as fall and spring will receive less snow and more rain, resulting in a smaller mountain snowpack, earlier snowmelt and increasing glacial melt leading to decreased summer runoff. These conditions will result in lower flows and decreased water quality for the Bow and Elbow rivers amidst drier, longer and hotter summers, increasing the risk of drought conditions. However, increasing rain, high spring temperatures and rain-on-snow events can all trigger flooding in Calgary.

As temperature and moisture increases, the amount of energy in the atmosphere available to fuel severe storms also increases (Figure 9). Severe storms cause more hail and lightning, higher winds, more intense rainfall and a greater risk of tornadoes. During dry conditions, wildfires can be started by lightning strikes and spread by high winds associated with severe storms. Resultant wildfire smoke suppresses cloud formation by creating a hot, dry environment, further fueling the loop of precipitation suppression and fire growth.

All of Calgary's climate hazards are influenced directly or indirectly by increasing air temperatures associated with a warming climate.

Increased annual temperatures impact air conditioning needs and costs for buildings to maintain thermal comfort. Extreme heat can lead to heat-related illnesses in vulnerable individuals, such as outdoor workers, the elderly and those with pre-existing health conditions. When drought conditions arise, water quality can decrease while water demand increases, affecting water supply. With hotter, drier summers expected in the future, an increase in wildfire smoke and poor air quality will impact Calgarians' health, wellbeing and enjoyment of outdoor activities. Severe storms and intense rainfall can overwhelm drainage systems, damage infrastructure and lead to localized flooding. Physical health and safety concerns, as well as property damage, can result from hail, lightning, heavy rain and flooding.

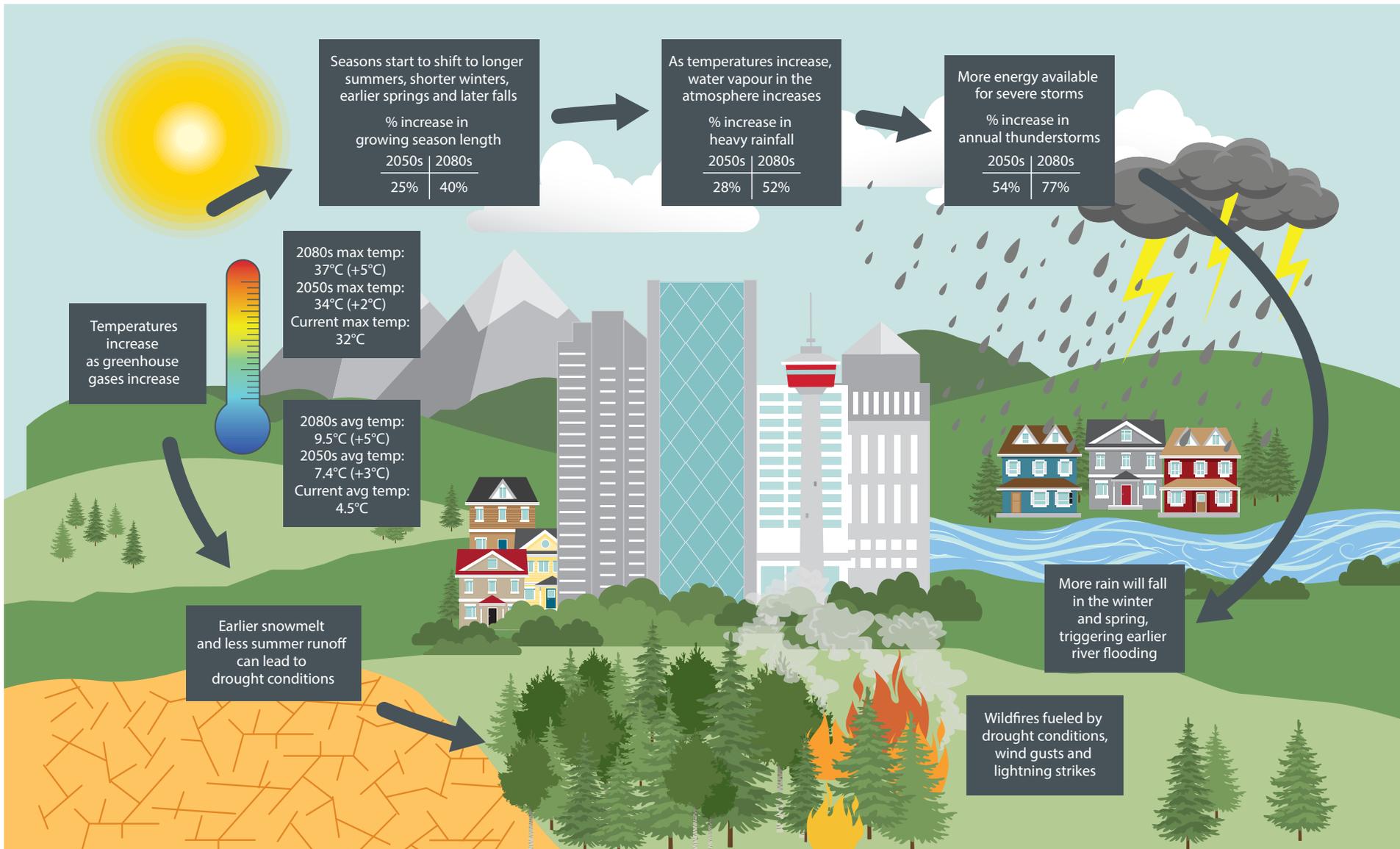


Figure 9: Climate projections for Calgary

climate adaptation

plan overview



The Adaptation Plan is organized into four themes and 10 Focus Areas. Each theme represents an important and interconnected part of our city being impacted by climate change, while the Focus Areas describe categories of work needed to progress climate resilience in each theme. Programs have been prioritized to guide long-term outcomes, and each program is supported by key actions that are needed to move towards a more climate-resilient Calgary. These actions will be implemented over the next four to eight years.

The themes of the Adaptation Plan (Figure 10) are:

People: Reduce Calgarians' vulnerability to the impacts of climate change.

Built infrastructure: Build climate resilient infrastructure to reduce damage and service disruption from climate impacts.

Natural infrastructure: Preserve, restore and build natural infrastructure as a multi-benefit solution for climate resilience.

Water: Prepare for flooding, drought and declining water quality in a changing climate.



Figure 10: Adaptation Plan themes and Focus Areas

The City will start priority actions as quickly as feasible to achieve the goals of each Focus Area. The implementation of the Adaptation Plan can be scaled up or down depending on the final budget approved by Council, which will impact the speed and completion time of each key action.

To indicate the relative duration (timeline) and cost of each key action for each program of work, symbols have been assigned as shown in the table below. Key actions that are expected to have a total duration beyond this four-year business cycle are noted as “Long” in timeline. This would include actions that have an exploratory phase in the next four years and continue action in the next business cycle (2027 to 2030).

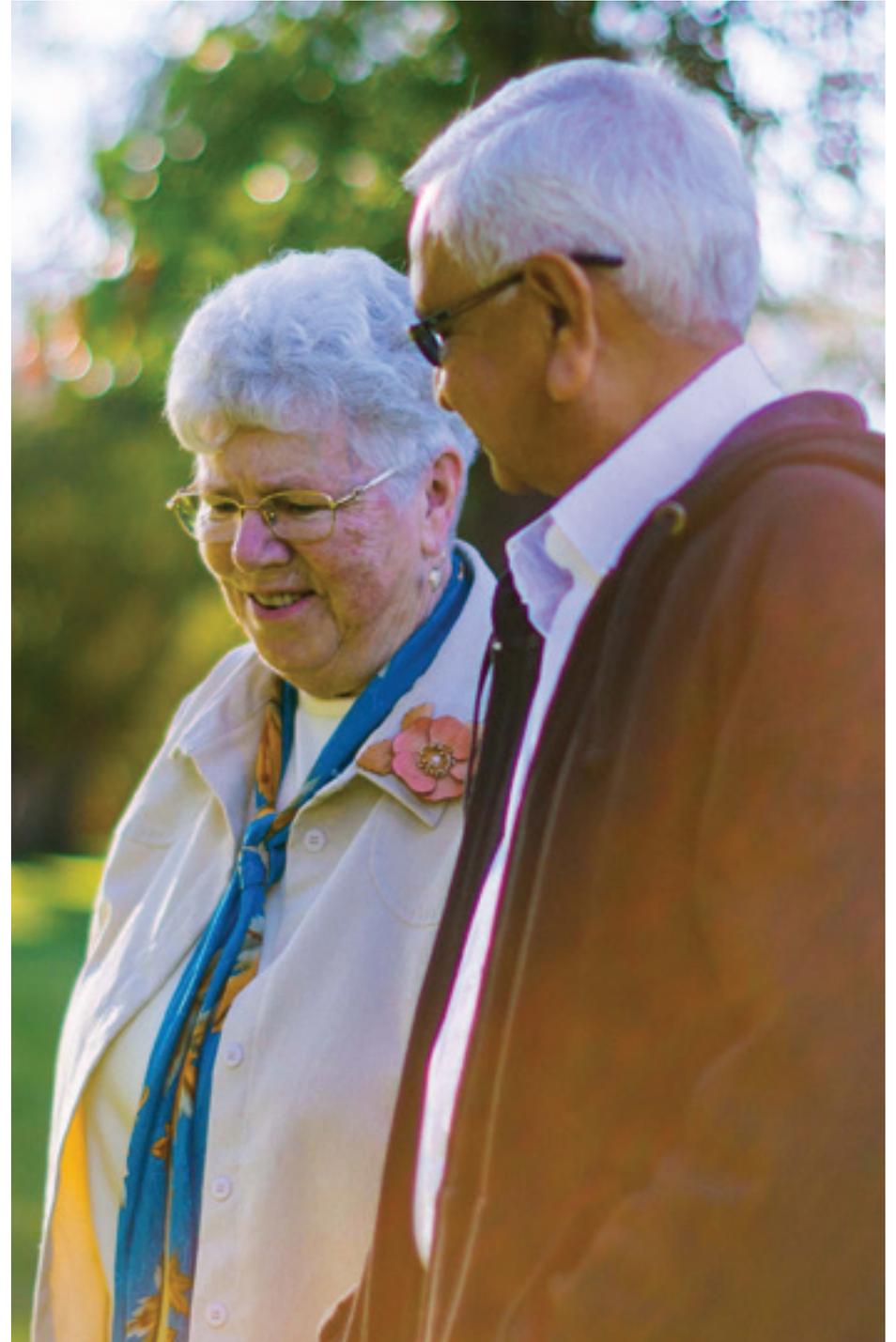


Theme: People

Goal: Reduce Calgarians' vulnerability to the harmful impacts of climate change.

As a municipal entity, it is the role of The City to support and enhance the ability of Calgarians, organizations, businesses and City employees to prepare for, cope with, recover from and respond to the impact of climate hazards. Hazards such as extreme weather events can cause serious harm to people's health, sense of safety and security, emotional well-being and financial stability. While every person in Calgary will be impacted by climate change, some groups are more vulnerable than others and will feel the impacts sooner and more drastically. Vulnerability to climate-related events is influenced by intersecting factors such as access to healthcare, community resources, information, and social supports; systemic social inequities; neighbourhood/geographical location; and access to social and financial capital. People that are more likely to disproportionately face climate impacts can include seniors, youth, individuals with existing health challenges, Indigenous Peoples, racialized communities, women, single-person households, and those who lack the financial resources to prepare for and respond to climate change. Each community in Calgary will face unique climate risks based on population density and the amount and state of built and natural infrastructure in each community.

The purpose of the people-related actions is to better understand which communities will face disproportionate climate risks, and to develop plans and policies that target and address the unique sources of risk in each community. This work requires significant and long-term engagement with the communities of Calgary to better understand community vulnerability, and to develop and strengthen relationships between City Administration and Calgarians. Actions related to education, engagement and outreach are therefore both within the People theme, and other Focus Areas of the Adaptation Plan. The actions within the People theme will foster climate resilience in Calgary's people and communities and reduce the impacts of climate change.



Focus Area A: Climate-resilient communities

Objective: The people and places of Calgary experience enhanced climate resilience

Climate risk is unique to different communities in Calgary, differentiated by distinct sources of vulnerability and **exposure** to climate hazards. The City is using detailed climate data to understand sources of vulnerability and risk for communities, and actions in this focus area are concentrated on building social capital and capacity for climate resilience. Climate adaptation measures that support community and food resilience are critical parts of preparing for future climate change.

Program 1: Supporting climate-resilient people	Purpose: Understand how climate change will affect economic, social and cultural communities in Calgary, and implement climate adaptation measures that support climate resilience in these communities.
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|---|--|--|
| <p>1.1 Establish a community climate vulnerability and resilience working group that can provide a diversity of worldviews and perspectives to guide and inform climate adaptation efforts. The proposed membership and scope of this working group are in the process of being refined and will be implemented in 2022 through 2023.</p> | | <div style="background-color: #c6e0b4; padding: 5px; display: inline-block;">\$</div>
LOW |
| <p>1.2 Leverage The City’s community outreach programs to establish or support community climate-change ambassadors to help disseminate information, encourage community members to attend engagement events, and help The City target climate adaptation and disaster risk reduction efforts in communities and people that need them the most.</p> | | <div style="background-color: #c6e0b4; padding: 5px; display: inline-block;">\$\$</div>
MODERATE |
| <p>1.3 Develop a climate equity toolkit, addressing equity through a variety of lenses, that will be used by City staff and community-based organizations to assess climate change adaptation programs, policies, tools and financial mechanisms, and determine how they reflect and advance equity goals.</p> | | <div style="background-color: #c6e0b4; padding: 5px; display: inline-block;">\$\$</div>
MODERATE |
| <p>1.4 Strengthen relationships with community-based organizations to support their efforts to develop, promote and utilize climate adaptation practices and strategies, and to help The City engage with equity-deserving community members and groups.</p> | | <div style="background-color: #c6e0b4; padding: 5px; display: inline-block;">\$\$</div>
MODERATE |
| <p>1.5 Map and develop equitable access to community spaces (indoor and outdoor) during climate hazard events by working with communities to understand their needs during periods of heat, cold and drought, and planning for long-term access solutions.</p> | | <div style="background-color: #c6e0b4; padding: 5px; display: inline-block;">\$\$</div>
MODERATE |

Program 2: Creating climate-resilient communities

Purpose: Understand the vulnerabilities of Calgary’s geographic communities to climate change to inform climate adaptation measures.

- 2.1 Complete community climate risk profiles** for all existing Calgary communities that detail community specific drivers of climate risk, characteristics that may cause vulnerability, urban heat island analysis and equity considerations. The community climate risk profiles will inform strategies and plans to reduce the unique sources of climate risk and guide risk-reducing investments within each community.
- 2.2 Understand the impacts of climate change on communities experiencing vulnerability** through community engagement and integrate this improved understanding of community vulnerability into the CCRI tool and climate risk profiles.
- 2.3 Develop a toolkit of climate adaptation and disaster risk reduction measures** based on the latest advancements in best practices that can inform City planners and partners as they implement measures to reduce risk and increase resilience.



Program 3: Developing food resilience

Purpose: Assess the Calgary and regional area food system and provide recommended actions for a food resilience plan, identifying ways to support a food system that is consistently available, accessible, affordable, appropriate and healthy for all Calgarians.

- 3.1 Develop an implementation plan for food preparedness strategies** to encourage food system organizations and businesses in Calgary to prepare and plan for current and future climate risks.
- 3.2 Develop and implement strategies to reduce the climate change vulnerabilities of Calgary’s food systems**, including crafting and enacting policies and legislation that acknowledge and address climate risks to food security.
- 3.3 Strengthen connections between food system stakeholders** to allow collaborative climate adaptation work between local and regional agriculture, and to support and strengthen local and community-scale food production.
- 3.4 Support the regionalization and diversification of food supply chains** by working with provincial and federal governments, private sector, and other partners on a multi-level approach to food system security.



Focus Area B: Managing extreme weather and climate-related events

Objective: Integrate climate adaptation into existing disaster risk reduction and emergency management strategies

Calgary is located in an area of high risk for extreme weather events and we have invested significantly in preparedness measures. Our experience managing some of the largest disasters in Canadian history has informed our strategies with an overall focus on reducing the risk of hazardous events and increasing resilience. While The City of Calgary has effective and industry-leading disaster risk reduction practices in place, climate change poses additional risk management challenges as it acts as a risk multiplier by increasing the frequency, variability and intensity of hazards. An expected overall increase in the number of severe weather events and climate extremes, such as heat events, will require the integration of climate adaptation into existing emergency management strategies and broader disaster risk reduction objectives.

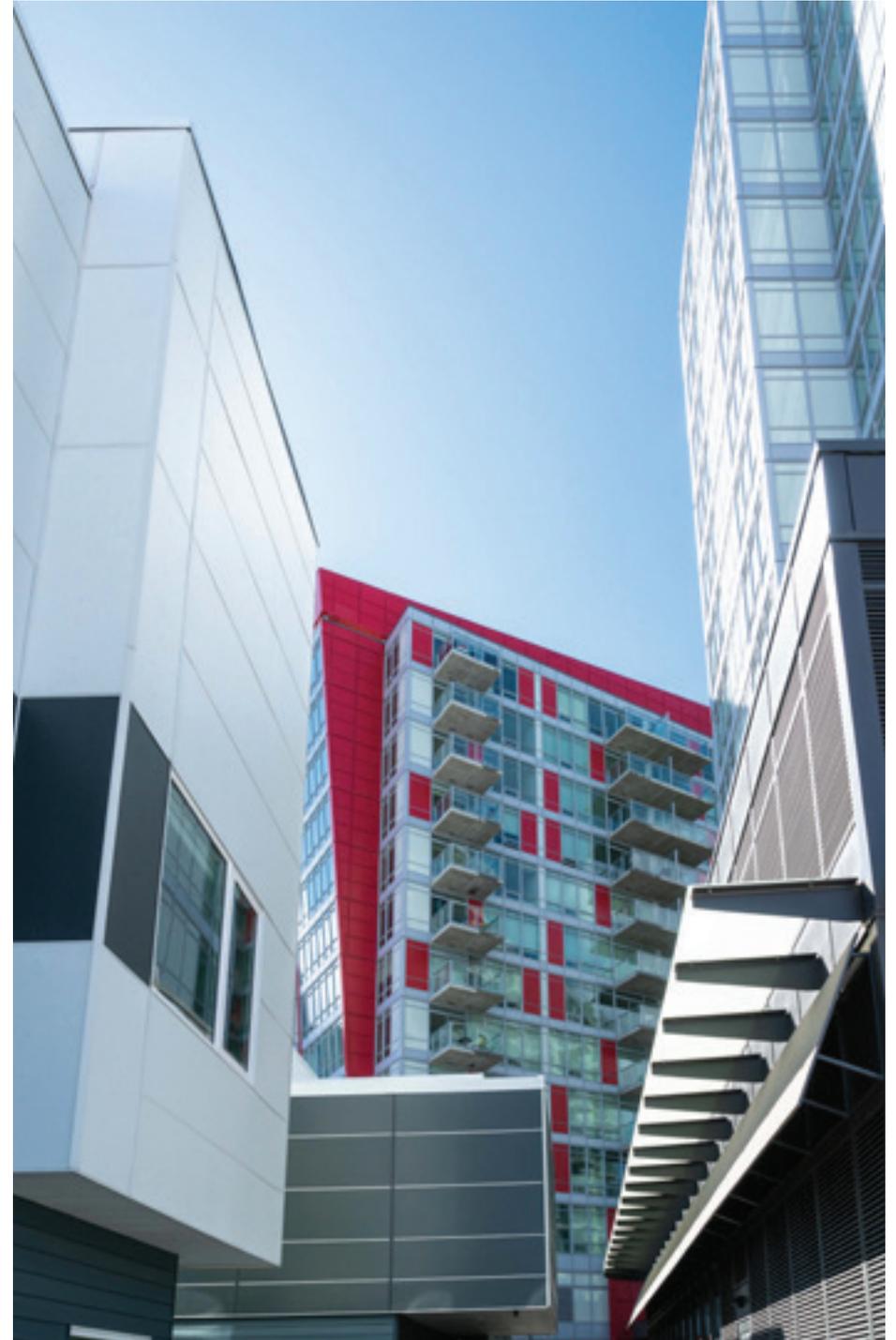
Program 4: Advancing emergency preparedness	Purpose: Continue to augment existing emergency management and disaster risk reduction strategies with adaptation and climate risk management principles.
<p>4.1 Integrate disaster risk reduction principles into City strategies, policies and plans by enhancing communication and increasing collaboration amongst key City decision-makers.</p>	
<p>4.2 Evolve emergency management strategies, policies, operational plans and budgets to incorporate climate risk management and adaptation principles. This work will focus on climate hazards that will become more frequent and/or severe due to climate change, e.g., severe storms and extreme heat.</p>	
Program 5: Ensuring business and service continuity	Purpose: Support the delivery of City services by integrating projected climate risks into existing continuity strategies and reducing the impact of these events on Calgary people, City personnel, facilities, operations and supply chains.
<p>5.1 Integrate projected climate risks into existing service continuity strategies and plans.</p>	
<p>5.2 Integrate projected climate risks into existing health and safety protocols for City personnel.</p>	
<p>5.3 Identify and reduce climate vulnerability in The City's supply chain to ensure continuous operations during severe weather events and climate-related emergencies and develop guidance and strategies for The City and businesses to integrate sustainable procurement practices that reduce climate risk.</p>	

Theme: Built infrastructure

Goal: Build climate-resilient infrastructure to reduce damage and service disruption from climate impacts.

Infrastructure is the backbone of a city; it supports where we live and work and how we get around. When infrastructure is damaged, critical services that we rely on can be disrupted, causing harm to Calgarians. We must integrate appropriate climate resilience measures into all aspects of the built environment to ensure our city's infrastructure can withstand the impacts of climate change. Compounding risks that are amplified due to climate change must be considered and addressed through planning, design, construction and operation stages of infrastructure and facility life cycles. For example, climate induced changes to temperatures will result in dramatic changes to building cooling and heating needs, with a resultant impact on electrical and other energy systems, further driving the need for low carbon, climate-resilient measures.

The City owns more than \$90 billion of total assets, supporting more than 28 services (e.g., sports and recreation facilities, water and wastewater infrastructure buildings, roads, bridges, pathways and transit) (21).



Focus Area C: Climate-resilient City-owned infrastructure

Objective: Public infrastructure is built, operated and maintained to be climate-resilient

Most new public infrastructure will have a service life until the end of this century, when the full force of climate change will be apparent. For this reason, it is important that City practices, guidelines and policies include appropriate climate resilience strategies. Over the next 10 years, reviewing and updating these practices, guidelines and policies in conjunction with regulatory partners, operators and stakeholders to incorporate shifting climatic conditions will be important so public assets continue to deliver services regardless of climate impacts. The City can directly influence the design standards, guidelines and practices for wholly-owned and third-party partnership facilities and infrastructure, and has the ability to advocate, support and drive change in provincially and federally mandated regulations, standards and guidelines.

Program 6: Building new City-owned infrastructure to be climate-resilient

Purpose: Incorporate climate resilience into new City-owned infrastructure to reduce the impacts of climate change.

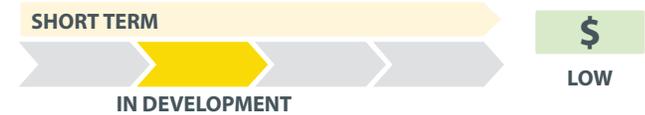
- 6.1 **Build capacity through education and training opportunities** both internally and externally to increase understanding of climate risk and resilience. Training opportunities should be focused on planners, engineers, project managers, project coordinators and others involved in the delivery of built infrastructure projects.
- 6.2 **Complete climate risk and resilience assessments** for facilities and infrastructure that meet defined criteria. Project specific mechanisms for integrating appropriate resilience measures to reduce climate risk will be implemented.
- 6.3 **Undertake financial analysis** to investigate the financial implications (e.g., cost-benefit analysis and market cost implications) of integrating climate resilience measures into The City's public infrastructure portfolio.
- 6.4 **Develop central funding for climate-resilient infrastructure** to support the incorporation of prioritized climate resilience measures in new facility/infrastructure development and existing facility/infrastructure retrofits.
- 6.5 **Integrate climate-resilient design requirements** into corporate design guidelines (e.g., updated Sustainable Building Policy, Design Guidelines for City Funded Buildings) informed by climate risk and resilience assessments, best practices and stakeholder engagement. Support federal and provincial initiatives to update standards and guidelines for climate resilience.



Program 7: Reducing climate risk to existing City-owned infrastructure

Purpose: Assess and retrofit City-owned infrastructure to be more resilient to climate change.

7.1 Develop a simplified climate risk assessment process to support The City in recognizing risk and prioritizing investments that reduce climate risk to City assets, and to facilitate a funding gap analysis for key infrastructure. Results of these assessments will be integrated into facility management processes and asset management plans, and will help The City make decisions on how to improve the climate resilience of City-owned infrastructure.



7.2 Update The City’s asset management tool for City-owned facilities to include climate risk and adaptation considerations and thereby enable asset managers and decision makers to consider climate related risks, cost and impacts in asset planning and approvals, including future investments and divestments.



7.3 Develop guidance for climate-resilient retrofits to support the timely, cost-effective and equitable retrofit of existing city facilities and public infrastructure to be climate-resilient. This will be intended to align with other corporate guidelines, requirements and protocols.



7.4 Incorporate climate resilience throughout the downtown planning and revitalization process.



Program 8: Developing climate resilience with our civic partners and subsidiaries

Purpose: Support best practices for climate resilience in civic partnership projects.

8.1 Support climate resilience with The City’s civic partners by implementing contractual agreements and supporting the latest best practices for climate resilience in Civic partnership facilities, including new construction and retrofit projects.



Focus Area D: Climate-resilient homes and buildings (privately-owned)

Objective: Our private homes and industrial, commercial and institutional (ICI) buildings are resilient to the effects of climate change

Many levels of regulation support the construction and renovation of private homes and buildings, and there is an increasing understanding of the urgency needed to address limitations in National Building Code. The City will work within its legislative authority to improve climate resilience in private homes and ICI buildings through education, engagement, advocacy, and incentive programs. Although often considered as a privately managed cost, the true impacts of climate related damages and insurance claims have a broad societal impact and implications for City costs and services. A holistic approach to climate resilience, low carbon energy alternatives and buildings that promote wellness is necessary to manage the many facets of climate change and avoid maladaptive measures.

Program 9: Developing new climate-resilient buildings	Purpose: Improve the climate resilience of newly built private sector residential, commercial, industrial and institutional buildings.
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<p>9.1 Require climate risk and resilience assessments be completed in the development permit process for private builds that meet a defined assessment threshold and/or criteria (multi-family, commercial, industrial, institutional).</p>		<div style="background-color: #c6e0b4; padding: 5px; display: inline-block;">\$</div> LOW
<p>9.2 Conduct a financial analysis for homes and commercial buildings to investigate the Return on Investment (ROI) and market cost implications of climate-resilient measures for homeowners and businesses. This will be used to inform incentive or regulatory approaches to support climate resilience.</p>		<div style="background-color: #c6e0b4; padding: 5px; display: inline-block;">\$\$</div> MODERATE
<p>9.3 Investigate incentives for climate resilience in new residential developments which will include a review of incentive programs, pilot programs and opportunities.</p>		<div style="background-color: #c6e0b4; padding: 5px; display: inline-block;">\$\$\$</div> HIGH
<p>9.4 Engage with industry and regulators on climate-resilient incentives, building standards and guidelines for new residential, commercial, industrial and institutional buildings. Explore opportunities to learn from leading resilience practices demonstrated by private industry and commercial building owners.</p>		<div style="background-color: #c6e0b4; padding: 5px; display: inline-block;">\$</div> LOW

Program 10: Retrofitting homes to be climate-resilient

Purpose: Improve the climate resilience of existing private homes through a community-based comprehensive audit process, education, and financial and incentive-based support.

10.1 Communicate the Climate Ready Home Guide and other adaptation resources broadly so Calgarians have information on climate-resilient measures that can be implemented in and around their homes. This guide could be used to model the future development of similar guides for other building sectors.



10.2 Explore the development of a climate-resilient retrofit program for homes across the city to improve community resilience through individual, lot-level actions. Exploration to include a ROI analysis on various climate resilience options and approaches.



10.3 Develop a low-interest financing program for climate-resilient retrofit measures (e.g., similar to the Clean Energy Improvement Program) to support homeowners in making their homes more climate-resilient.



Program 11: Improving access to climate-resilient housing

Purpose: Improve access to climate resilient housing for communities or groups where there are significant barriers.

11.1 Implement pilot projects in affordable housing projects to demonstrate the return on investment for energy-efficiency and climate-resilient measures in non-market housing, with the understanding that the cost of these measures must not compromise our ability to meet the demand for housing in Calgary.



11.2 Improve funding for climate-resilient housing for low-income earners through collaboration with funders and community groups who support affordable and non-market housing. The need to improve climate resilience in equity-deserving populations can be met in part through adequate, safe, and accessible housing.



11.3 Assess the climate resilience and energy efficiency of Calgary Housing Corporation's existing housing stock and develop strategies to improve its resilience on a priority basis.



Focus Area E: Climate-resilient utility services

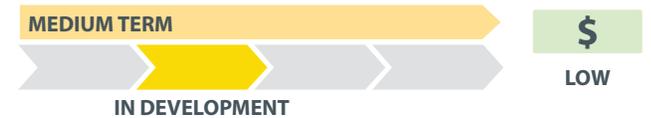
Objective: Utility infrastructure and services are built, operated and maintained to be climate resilient

Utilities operated by third parties, including communications, electrical and natural gas are critical services that can be disrupted by climate impacts. When these impacts occur, Calgarians can experience damage, disruption, and the potential for loss of life. Supporting and collaborating with utility providers in enhancing their climate resilience is important for City services, businesses and residents. The City can be a supportive stakeholder for utility providers as we work towards greater community climate resilience.

Program 12: Supporting the climate resilience of Calgary's and The City's third-party utilities

Purpose: Improve the climate resilience of utilities provided by third parties.

12.1 Support, engage and share resources to improve critical utility service providers understanding of climate risk and support implementation of resilience measures.



12.2 Examine climate risk to third-party utilities and assess the related impacts to Calgarians (e.g., power outages, communications failures, natural gas supply disruption).



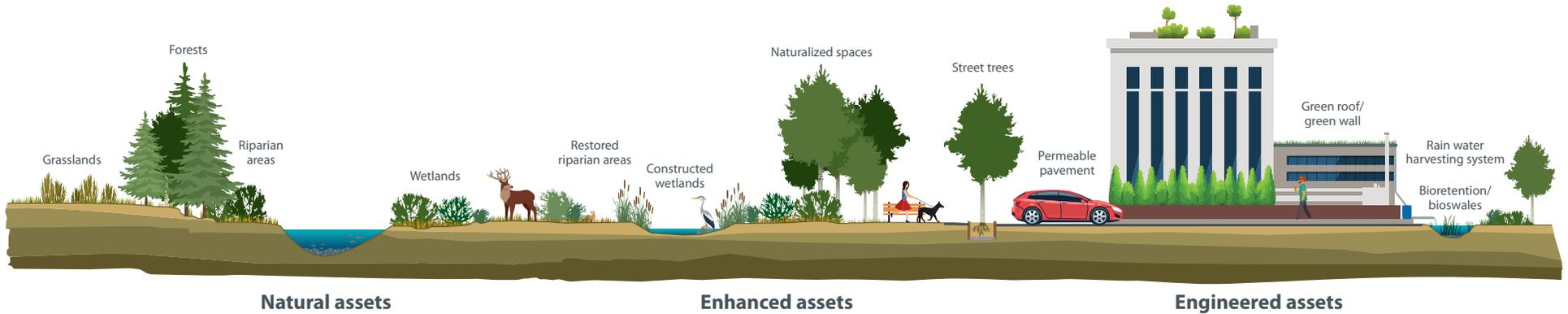


Figure 11: Natural infrastructure within Calgary

Theme: Natural infrastructure

Goal: Preserve, restore and build natural infrastructure as a multi-benefit solution for climate resilience.

Natural infrastructure includes the preserved and restored natural areas in our city, such as grasslands, forests and waterbodies, as well as the green stormwater assets built to use natural processes to manage water and provide ecosystem functions in an urban environment, such as green streets, constructed wetlands, rain gardens and green roofs (Figure 11).

Natural infrastructure provides significant environmental, economic, recreational, and societal benefits. It builds our city's resilience to the impacts of climate change, by providing stormwater retention, urban heat reduction and carbon sequestration. However, natural infrastructure is also vulnerable to climate change, as seasons shift, extreme heat, drought, and severe storms impact plants and their ability to thrive. Natural infrastructure is noted as a key pillar of a resilient city (22), and as the COVID-19 pandemic has demonstrated, it provides high value to residents for recreation and improved health and wellbeing.

All Calgarians benefit from natural infrastructure, however due to factors such as geography, residents' income and housing and land use planning decisions, access to natural infrastructure is not experienced equitably across the city. The City of Calgary recognizes a cross-corporate responsibility to manage natural infrastructure, however natural assets continue to be at risk from conventional land development decisions and historic underinvestment in maintaining natural infrastructure.

A previous zero-based review found that Calgary funds natural areas at about 10% of the rate of other comparable cities. To better understand, protect and manage the services provided by natural assets, a financial valuation was completed in 2021, the results of which are shown in Figure 12:

Natural assets within The City of Calgary have a replacement cost of **\$6.9 billion** which generate a flow of **ANNUAL service value** of approximately **\$2.5 billion**

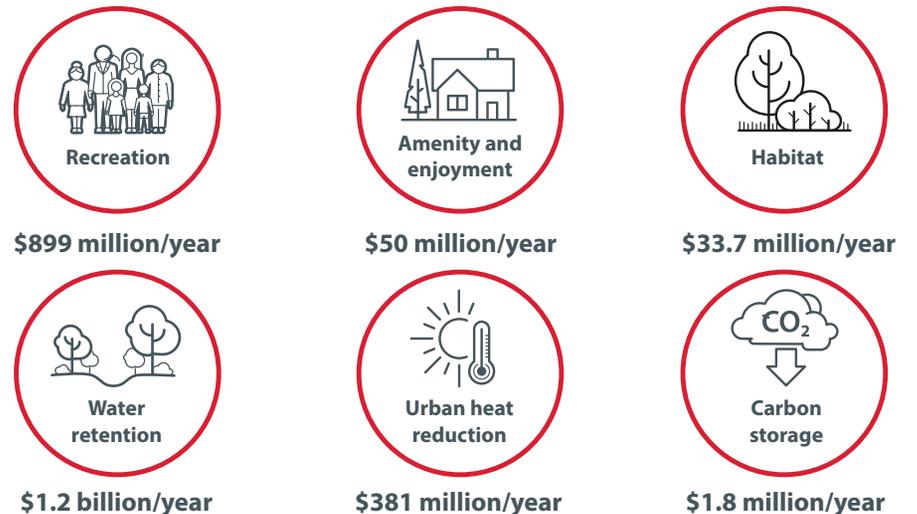


Figure 12: Natural assets within Calgary

Focus Area F: Integrated natural infrastructure value

Objective: The value of natural infrastructure is communicated and integrated into decision making processes to sustain ecosystem services into the future and reduce climate risk

Natural infrastructure is critical to supporting biodiversity, sequestering carbon, reducing climate risk and providing ecosystem services that enhance the wellbeing of Calgarians. While the intrinsic value of nature for environmental and human wellbeing is appreciated, the conventional metrics of economics and development can often lead to its undervaluation in municipal finances. We must integrate the value of natural assets into decision making, including through asset management, accounting and financial reporting, to ensure they are preserved and well managed into the future.

Program 13: Integrating and communicating the benefits of natural infrastructure **Purpose: The value of natural infrastructure will be integrated into decision making through regulatory, management, educational and operational practices.**

13.1 Improve awareness through holistic messaging, education, outreach and an online presence for the natural infrastructure program to support aligned initiatives, build public understanding and access resources to grow our portfolio of natural infrastructure.



13.2 Expand the scope of the natural asset valuation analysis by assessing additional assets, other services provided and site-specific case studies.



13.3 Integrate natural infrastructure into asset management, accounting and financial reporting and examine the importance of full cost accounting to avoid missed opportunities and counterproductive decision making. Collaborate with provincial, federal and international experts in the development of standards for asset management, accounting and reporting to share Calgary's expertise.



13.4 Improve the natural asset inventory dashboard through data and functionality updates so this tool can be used as an ongoing monitoring and reporting database and informational resource both internally and externally.



Focus Area G: Investing in natural infrastructure

Objective: Natural infrastructure is preserved, restored, built and maintained as a climate adaptable multi-benefit solution to reduce impacts of a changing climate

Natural infrastructure must be preserved and restored, so that the ecosystem services and multiple benefits provided can continue to reduce climate risk into the future. Natural infrastructure itself is vulnerable to the impacts of climate change, so implementing practices to reduce climate risk to natural infrastructure and partnering with the private sector to find solutions are also necessary. Through the use of roadside naturalization, green roofs, restoration and native landscaping practices, some benefits of natural assets can be built directly into the urban fabric of our city. Further, we must understand the limits and capacity of natural infrastructure to buffer the challenges of urbanization and climate change, and support practices such as invasive species management and the use of native and climate-adapted species that improve this capacity to thrive.

Program 14: Preserving, restoring and building natural infrastructure

Purpose: Investment in natural infrastructure increases, through the development of policy, plans and implementation practices that reflect the value of ecosystem services and the holistic benefits provided by natural infrastructure

14.1 Develop policies and plans that protect natural infrastructure and incorporate its' climate adaptive services and value (e.g., Municipal Development Plan, Land Use Bylaw, Open Space Plan, Asset Management Plans) into city-building processes. Aligning initiatives such as Our Biodiversity, the Ecological Network and integrating the contributions of **Environmentally Significant Areas** can help to improve biodiversity and environmental performance in the changing urban environment. Improve cooperation between City service lines to implement multi-functional landscapes and land uses.



14.2 Develop and implement an integrated funding strategy to fund the preservation, operation, restoration and creation of natural infrastructure, with shared climate adaptation, biodiversity, community and watershed health outcomes. Investigate and implement the use of levies, fees, grants, and sponsorships, where appropriate, to leverage funds whenever possible. Investigate the opportunity for creating a Conservation Reserve fund.



14.3 Develop guidance to support on the ground implementation such as **green stormwater infrastructure** guidelines, green roof recommendations, landscape specifications, restoration guidelines and private tree protection to build more climate-resilient natural infrastructure across the city. Resources including education, incentives and opportunities to guide private landowners in lot-level tree planting and site naturalization can increase climate resilience, biodiversity and ecosystem services provided by non-City owned land including multi-residential settings.



14.4 Implement operational practices that improve the climate resilience of natural infrastructure in Calgary to provide a thriving landscape into the future (e.g., restoring underutilized spaces, selecting native species and drought tolerant vegetation, managing invasive species and pests, protecting riparian areas and maintaining green stormwater infrastructure).

14.5 Integrate natural infrastructure into Calgary’s greater downtown through multifunctional stormwater infrastructure, green network and support for innovative solutions in a highly urbanized environment.

14.6 Improve equitable access to natural infrastructure. Engage with communities with inequitable access to enhance opportunities through land use decisions, strategic planning for park space and tree planting programs, and opportunistic additions of natural infrastructure on public and private property redevelopment.



Theme: Water

Goal: Adapt to and manage increased risks of flooding, drought, changing water supply and declining water quality in a changing climate.

We recognize that climate change and water related impacts, including floods, droughts and declining water quality are critically and intrinsically linked and will impact people, infrastructure and the environment. Integrated water management is essential to ensure a reliable, secure and high-quality water supply for Calgary and downstream users; to manage stormwater; and to reduce the risks from flooding.

Water infrastructure, including infrastructure that stores, treats and distributes water, collects and treats wastewater, and manages stormwater, constitutes the largest combined value of infrastructure at The City. Several of the key actions in Focus Area C (Climate-resilient City-owned Infrastructure) are highly relevant and applicable to water, stormwater and wastewater infrastructure. This theme area includes additional programs and actions that are specific to the effects of climate change on water.



Focus Area H: River flood management

Objective: Calgary's resilience to river flooding is improved

River flood hazards are increasing in the Bow and Elbow River watersheds as climate change is shifting precipitation patterns, increasing rainfall intensity and causing an earlier melting of the mountain snowpack. The City aims to reduce risk from river flooding through upstream and community flood mitigation infrastructure and operations measures, strengthening flood policy, property level resilience, and improving flood response and forecasting capabilities.

Program 15: Reducing risk from river flooding	Purpose: Reduce the exposure and vulnerability of Calgarians to river flooding from more frequent and/or extreme river flood events.
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15.1 Improve upstream water storage solutions through collaboration with upstream water managers, license holders and the provincial government to manage risks exacerbated by climate change, including flooding and drought. Dam operational practices and building new upstream reservoirs can significantly reduce flood risk and improve water security during drought to Calgary.



15.2 Improve understanding of climate impacts on flood frequency and severity, and to groundwater through research and modelling, to better integrate these risks into flood maps, planning and policy for improved flood resilience.



15.3 Update and align land use planning policy and regulations including flood maps, flood zone classifications, and land use bylaw, guided by the principles of economic resilience, equity and sustaining the ecological value of river valleys to support overall flood risk reduction.



15.4 Integrate watershed management concepts and practices to support long-term water security and resilience to floods, droughts, and other changes in climate that influence our water resources.



Focus Area I: Stormwater management

Objective: Calgary is more resilient to stormwater flooding and declining stormwater quality due to climate change

Climate change is causing a shift in temperature and precipitation regimes, with projected increases in rainfall volumes, heavy rainfall events, hail and freeze-thaw cycles. The City is working to reduce risk from stormwater flooding and decreased stormwater quality due to climate-amplified rain events through community and local drainage improvement programs, improvements in stormwater system design, integration of green stormwater infrastructure, and efficiency in operations and maintenance practices. Climate change will be integrated into the Stormwater Management Strategy that is under development to guide stormwater management over the next 20 years.

Program 16: Integrating climate change into stormwater management

Purpose: Reduce localized flood risk through the integration of climate change projections in stormwater management strategies, plans, policies and guidelines to improve resilience in system design, construction, and operations.

16.1 Integrate climate projections in developing and updating stormwater management strategies, plans, policies and guidelines to provide systems that are resilient in the future climate.



16.2 Improve our understanding of stormwater flood risk in different areas of the city, including current guidelines, processes and practices with the projected climate impacts to precipitation (e.g., intensity frequency and variability) and integrate this into stormwater infrastructure design and implementation to improve neighbourhood resilience.



16.3 Develop and implement a Green Stormwater Infrastructure (GSI) Plan including ecosystem services and their efficacy at managing impacts of densification and climate change city-wide. GSI can be beneficial in reducing flooding as well as significantly improving stormwater quality.



16.4 Implement stormwater management improvements to reduce risk from localized flooding and improve stormwater quality in established areas as climate change exacerbates risk. Review opportunities to retrofit existing infrastructure or underutilized space to improve stormwater management outcomes and protect communities.



16.5 Provide guidance and explore support to property owners to reduce their site-specific risk of flooding; protecting homes, businesses and belongings from more severe rainfall events. Stormwater education and engagement with the general public, property owners, the ICI sector and key stakeholders will require focused resources to improve understanding of stormwater management and reduce risk from flooding.



Focus Area J: Water supply and wastewater management

Objective: Providing a safe, secure and reliable water supply in a changing climate

Climate related changes in the Bow River Watershed are expected to impact Calgary's surface water and groundwater quantity and quality. Snowpack melt and spring runoff are predicted to occur earlier in the year while summer and fall river flows will likely decrease. Long-term glacial melting will influence source water, and Calgary will increasingly see changes in when and how water is received from the watershed. Large, widespread wildfires may become more frequent and can pose challenges to water treatment as run-off from burned landscapes can affect the water quality in rivers. Population growth and a longer and hotter outdoor water use season will increase the demand on these climate-impacted water resources. Seasonal and long-term drought and increasing incidences of water shortages are likely to become climate change realities, as they already have in many western locations across North America. The influence of compounding climate change impacts on Calgary's water resources in addition to population growth and a larger urban footprint in the watershed will have acute and lasting effects.

The One Calgary One Water Security Framework (2020) addresses climate impacts to both water quality and quantity and supports action to address these challenges. The following programs align with the priority actions in the Framework:

Program 17: Integrating climate change into long-term water supply plans, policies, strategies and operations	Purpose: Reduce risk to our water supply, manage demand and conserve water, considering the compounding impacts of declining long-term river flow volume, flow timing shifts, population change and water quality changes from shifting seasonality, drought, and higher temperatures due to climate change.
17.1 Improve The City's understanding of climate impacts on long-term river flow, water quality and demand to inform plans and policies and adjust planning, engineering, and operational processes as needed.	 <div style="display: flex; align-items: center; justify-content: flex-end;"> <div style="background-color: #76b82a; color: white; padding: 5px; margin-right: 5px;">\$\$</div> <div style="text-align: right;">MODERATE</div> </div>
17.2 Assess water treatment and distribution infrastructure and operational practices for climate change risks so customers continue to receive high quality water in a changing climate.	 <div style="display: flex; align-items: center; justify-content: flex-end;"> <div style="background-color: #76b82a; color: white; padding: 5px; margin-right: 5px;">\$\$</div> <div style="text-align: right;">MODERATE</div> </div>
17.3 Improve water usage and water loss data to inform water efficiency and water loss management initiatives, so that current and future water supply is managed efficiently.	 <div style="display: flex; align-items: center; justify-content: flex-end;"> <div style="background-color: #76b82a; color: white; padding: 5px; margin-right: 5px;">\$\$</div> <div style="text-align: right;">MODERATE</div> </div>
17.4 Conserve and preserve our water under drought and other changing climate conditions by implementing plans and policies such as the Source Water Protection Plan and Policy and the Drought Management Plan. Strategic management of water licenses, restrictions, and operations with regulators, stakeholders and customers will be explored to improve water management.	 <div style="display: flex; align-items: center; justify-content: flex-end;"> <div style="background-color: #76b82a; color: white; padding: 5px; margin-right: 5px;">\$\$</div> <div style="text-align: right;">MODERATE</div> </div>
17.5 Investigate, evaluate and implement innovative alternative water supply sources including water reuse and stormwater use to provide fit-for-purpose water.	 <div style="display: flex; align-items: center; justify-content: flex-end;"> <div style="background-color: #76b82a; color: white; padding: 5px; margin-right: 5px;">\$\$</div> <div style="text-align: right;">MODERATE</div> </div>

Program 18: Integrating climate change into wastewater treatment

Purpose: Reduce risk to Calgarians and the environment from changes in wastewater composition, treatment and regulatory limits from shifting seasonality, more extreme events and higher temperatures.

18.1 Improve understanding of climate risk to wastewater collection, treatment processes and Approval to Operate conditions for effluent release to protect human health and aquatic life in a changing climate.



Monitoring and reporting on climate adaptation actions

Climate change is a dynamic challenge and climate adaptation is an on-going process that needs to respond to changing conditions. As The City implements climate adaptation actions, a framework for continual improvement ensures that The City is aware of evolving risk, program successes, and opportunities for improvement.

Overall progress on the integration of climate adaptation across the organization will be measured through the internationally-recognized (TAMD) framework. This framework tracks the ability of The City of Calgary to prepare and implement climate adaptation measures in eight indicator categories, consisting of:

- Integration of climate change into planning (including development of strategy and plan documents, and their integration into development planning).
- Institutional coordination for integration (including identifying authoritative bodies, and their coordination with ministries and agencies).
- Budgeting and finance.
- Institutional knowledge and capacity (including whether there are dedicated and trained climate change teams).
- Adaptation planning under uncertainty (including use of envelopes of uncertainty in decision making).
- Participation (including the quality of stakeholder engagement in decision making).
- Awareness of climate change issues, risks and responses among stakeholders.

Additionally, the Climate Adaptation team distributes climate adaptation

information publicly, through workshops, academic lectures, white papers, presentations and contributions to wider City processes, federal and provincial initiatives. These knowledge-sharing events and opportunities are tracked as a measure of the Climate Team's public outreach program.

Indicators have been selected specific to each Program Area to demonstrate advancements within each of the Climate Adaptation themes. Selected indicators are intended to be relevant, objective, available, realistic, specific, and understandable, and are closely linked to program implementation. They are selected to be gathered simply during the implementation of projects and processes, to minimize the need for complex and costly monitoring programs. Data will be collected so that there are baselines from which to measure progress and so data collection processes and analysis are able to shift with program development. Indicators will be reviewed and adjusted as program areas mature through the next four years (2023 to 2026).

People

Supporting climate-resilient people	As the community climate resilience working group evolves, The City will initially track the <i>number of members and number of meetings</i> that occur.
	As the community climate ambassadors’ program develops, The City will track the <i>number of ambassadors and the number of communities</i> that are represented in the program.
	Track the <i>number of community-based organizations</i> supported by the City (e.g. in kind, training, financial support) for climate adaptation work.
Climate-resilient communities	Track the <i>number of community climate profiles</i> that are created using the community climate risk index. Track the <i>number of community climate profiles</i> that are integrated into community planning and through climate risk and resilience assessments (e.g., Area Redevelopment Plans, multi-community plans, facility planning)
Developing food resilience	Report on the <i>per cent completion of the Food Resilience Implementation Plan</i> .
Advancing emergency preparedness	Monitor how climate change is integrated into the Disaster Risk Explorer and other disaster risk reduction plans, processes and tools.
	Track the <i>number of public awareness messages</i> released describing what to do during high heat and smoke days.
Ultimately, this theme area is intended to reduce community risk, through education, engagement, and access to resources. Through the citizen survey The City will continue to track <i>what percentage of Calgarians know what to do to prepare for climate change or following a climate event</i> and <i>what percentage of Calgarians agree they have the ability to adapt to climate change</i> in their personal lives.	



Built infrastructure

Climate-resilient City-owned infrastructure	Track the <i>number of climate risk and resilience assessments</i> that are completed for City owned and funded infrastructure projects.
	Track the <i>number of climate-resilient infrastructure projects</i> supported by the centralized Climate Infrastructure Fund. Report on the <i>amount of funding available, through this City fund</i> , in comparison to the amount of funding leveraged through provincial, federal and other sources to support climate-resilient infrastructure.
	Track the number of <i>standards and guidelines</i> that are updated or adjusted to consider future climate parameters.
Reduce climate risk to existing City-owned facilities	Track the <i>number of existing City-owned or managed assets that are screened for climate risk</i> . Monitor the <i>average projected cost of climate risk to existing City-owned assets</i> . Monitor the <i>number of facility retrofit projects that implement best practices</i> from the climate adaptation guide to reduce risk.
Building new homes and buildings to be climate-resilient	Track the <i>number of climate risk and resilience assessments</i> that are completed for major private sector development permits for new projects. Monitor the <i>number of new builds that integrate climate resilience measures</i> (program TBD).
Retrofitting homes to be climate-resilient	Once it is in place, The City will track the <i>number of people accessing the climate-resilient retrofit financing program</i> .
Climate-resilient affordable housing	Track the <i>number of units of climate-resilient affordable housing built/retrofit/supported</i> annually.

Natural infrastructure

Integrating natural infrastructure value	The <i>value of natural assets in The City</i> will be updated and reported every five years, or as new data becomes available. Monitor the <i>number of City processes or policies</i> that integrate natural asset value (e.g., The MDP).
Investing in natural infrastructure	With our implementation partners, The City will <i>track the hectares of active restoration/hectares of completed restoration</i> , and the Riparian Health Score across the city. <i>Track the number of climate-resilient natural infrastructure projects</i> supported by the centralized Climate Infrastructure Fund. <i>Monitor the hectares of natural assets</i> that these projects have improved annually.

Water

River flood management	Monitor the number of changes and the substance of changes, to flood policy and regulations. With our implementation partners, The City will monitor <i>annualized average damages (flood damages)</i> as new flood mitigation measures are constructed.
Stormwater management	Track the number and substance of stormwater management guidelines that functionally incorporate climate change to reduce risk. Track City and developer investment in stormwater quality projects (planned, underway, completed) to track commitment of resources to provide enhanced stormwater quality.
	With our implementation partners, track the number of properties at risk for localized stormwater flooding from a range of future storm severities. With our implementation partners, The City will estimate <i>annualized average damages (stormwater flood damages)</i> across a range of future storm severities (TBD).
Water supply and wastewater management	Continue to track <i>average day demand</i> of potable water demand. Continue to track <i>peak day demand and instantaneous demand</i> demonstrating how much water is used in Calgary on the highest demand day each year.

Climate impact indicators monitoring

While not all impacts of climate change can be managed, The City endeavours to better understand the current reality of our changing climate. To work towards this, a climate impact indicators monitoring program has been initiated, to encourage collaboration, information sharing and knowledge building across various internal and external stakeholder groups. This work will be reported annually and tracks both the physical and impact indicators of the previously identified climate hazards. For example, extreme heat is being measured by tracking the number of hot days and warm nights per year (physical indicators), and the associated number of heat-related visits and hospitalizations (impact indicators). By examining both types of indicators, The City can better understand the changing climate and what that means for Calgarians.

The Climate Adaptation Plan will be updated every four years to reflect the latest climate change science, best practices in climate adaptation, the latest evaluation of the vulnerability and exposure of people and places in Calgary to climate impacts, and the lessons learned from the implementation indicators.





appendix **1** climate
emergency declaration





Report Number: EC2021-1525

Meeting: Executive Committee

Meeting Date: 2021 November 09

REVISED NOTICE OF MOTION

RE: Declaration of Climate Emergency and Call to Action

Sponsoring Councillor(s): Mayor Gondek, Councillor Carra, Councillor Dhaliwal, Councillor Mian, Councillor Penner, Councillor Spencer, and Councillor Walcott

WHEREAS...

- Climate change is contributing to billions of dollars annually in property and infrastructure damage worldwide, causing stress on local and international economies through food and water insecurity, as well as social instability;
- Half the world's population currently live in urban areas, producing more than 70 per cent of energy-related global greenhouse gas emissions, with projections that by 2050 about 2/3 of the planet's people will live in urban centers creating additional pressures on our urban environments; therefore, expert consensus indicates cities, towns and regions must play a central role in adapting to a changing climate and mitigating the causes of climate change;
- Calgary and Alberta were home to six out of the top ten costliest natural disasters in Canada on record and five out of the top five in the past 5 years, clearly signaling the need to mitigate climate impacts;
- Amongst large and mid-sized Canadian cities, Calgary is one of the few without a climate emergency declaration, compromising our city's ability to compete for global capital and talent;
- In the 2020 Citizen Satisfaction and Quality of Life Survey, 80 per cent of Calgarians stated they are "concerned about climate change" and 79 per cent agreed with the statement "I think we need to act now to address climate change";
- As corporations like Shell, Cenovus, Repsol and Teck have publicly committed to net-zero emissions targets by 2050, and campaigns like Race to Zero have spurred the Net Zero Asset Managers Initiative that represents 220 signatories managing \$57 trillion in assets, investment in climate tech has grown to around \$60 billion US; and
- Immense opportunity exists to create a climate resilient city that transitions towards a low carbon economy to provide an inclusive, equitable and prosperous Calgary which includes support and respect for Indigenous Peoples, as well as people in positions of vulnerability.

NOW THEREFORE BE IT RESOLVED ...

- That The City of Calgary declares a climate emergency;
- That The City of Calgary will become part of the global community (not-for-profit, public and private sectors) taking action on climate change through international initiatives such as the Global Covenant of Mayors, Resilient Cities Network, and Race to Zero, **by adopting best practice and leveraging**

REVISED NOTICE OF MOTION

capital investment with the goal of becoming a global center of excellence in climate adaptation and mitigation, and energy transformation;

- **That The City of Calgary engage with First Nations, through the Indigenous Relations Office, to foster relations, ensure collaboration, integration of traditional knowledge and ensure intersectional Climate Change strategies;**
- That The City of Calgary makes climate change a strategic priority by accelerating the timelines to reduce greenhouse gas emissions, updating the city-wide and corporate greenhouse gas reduction target to be net zero emissions by 2050;
- That The City of Calgary develop 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;**
- That Council direct that The City of Calgary **to update agreements** with civic partners and subsidiaries **to support and ensure alignment with Calgary's emissions reductions targets;** and
- That The City of Calgary will advocate for funding from all orders of government for the purposes of accelerating immediate and near-term actions to rapidly reduce greenhouse gas emissions, reduce climate risk to public built and natural infrastructure, deliver upstream flood and drought mitigation on the Bow River, **build community resilience**, seek disaster risk reduction from climate change **and support strategic opportunities for Calgary's economy.**

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Report Number: EC2021-1698

Meeting: Executive Committee

Meeting Date: 2021 December 14

NOTICE OF MOTION

RE: Building Accountability into the Declaration of a Climate Emergency and Call to Action

Sponsoring Councillor(s): Cllr Walcott, Cllr Wyness, Cllr Dhaliwal

WHEREAS:

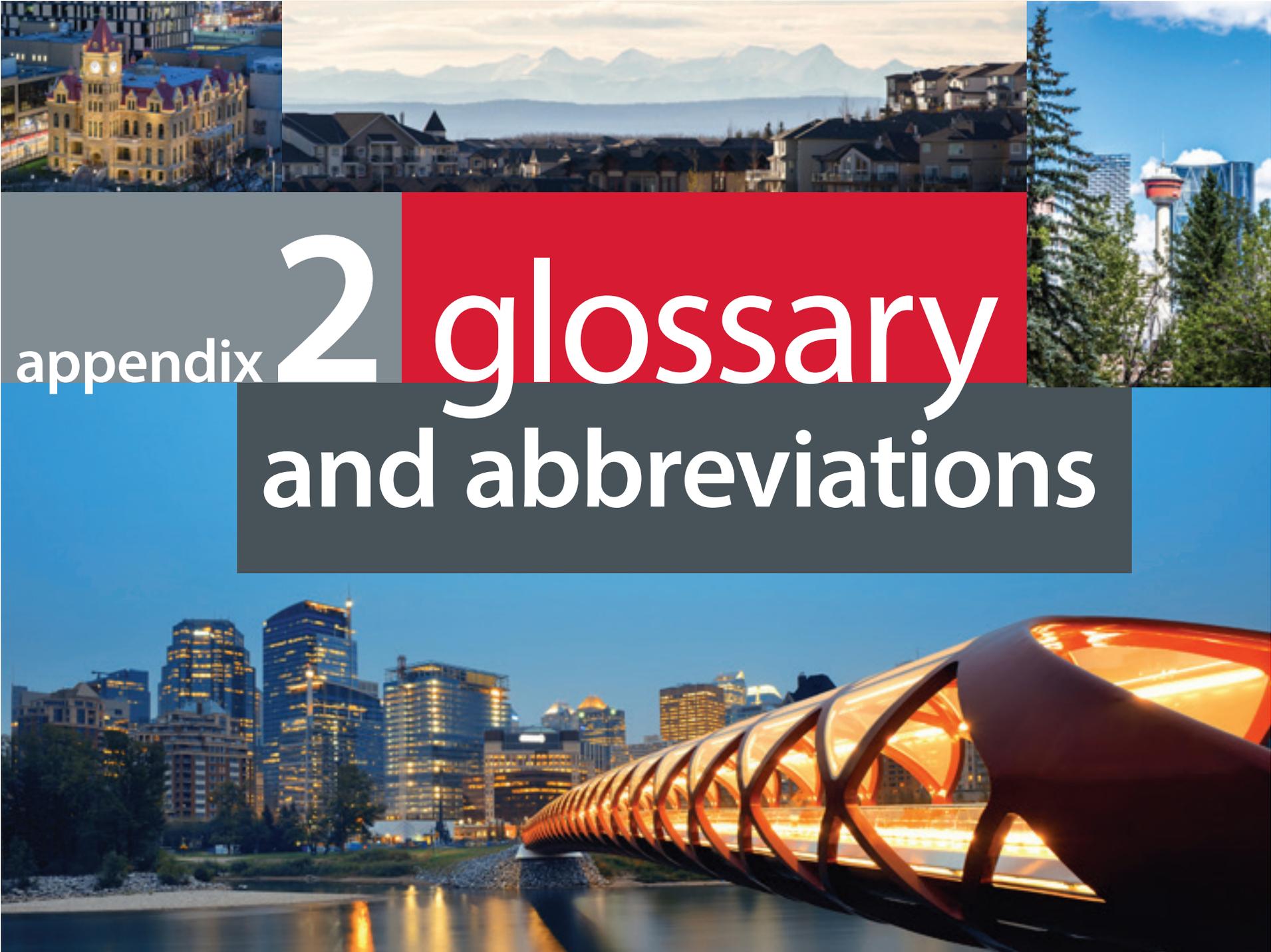
- On November 16, 2021, Council approved EC2021-1525 Declaration of Climate Emergency and Call to Action where Calgary City Council made clear our commitment to taking local action on a global crisis;
- Within the Declaration of Climate Emergency and Call to Action, the target of Net Zero by 2050 became a part of our public mandate;
- The Declaration of a Climate Emergency and Call to Action adds to a list of commitments made by the City of Calgary including, but not limited to, the 2018 Climate Resilience Strategy, the 2009 Calgary Climate Change Accord, and the 2006 Climate Change Action Plan.
- The 2020 Calgary Climate Panel, in their review of our current efforts to achieve the goals set out by council commitments, stated that “that there is a need to accelerate development of a more comprehensive strategy, policy, and implementation framework;”
- In consultation with community partners, such as the Calgary Climate Hub, it has become clear the City of Calgary is falling behind its own commitments, falling behind other major municipalities, and leaving major opportunities on the table;
- That given the City of Calgary’s renewed commitment to transforming our response to the Climate Crisis, we must create and build the structures necessary to hold ourselves to account, while allowing for us to be fluid and adaptable to the changing nature of the Climate Crisis.

NOW THEREFORE BE IT RESOLVED:

1. That Council direct Administration to develop a **framework to measure and report** on the Climate Strategy actions, budget and annual spend.
2. That Council direct Administration to provide **ongoing expenditure reports** to be submitted to Audit Committee;
 - a. **Future reports will explore financials** including cost of action/inaction, avoided costs and cost savings as it relates to climate mitigation and adaptation.
 - b. **Qualitative reporting** to include indigenous world view, equity, and environment
3. That Council direct Administration to update the city-wide and corporate greenhouse gas reduction target to be net-zero emissions by 2050 and set **sector specific interim targets** to ensure accountability and benchmarking;
4. That Council direct Administration to present a plan to retrofit and update all **City owned assets** with clean energy infrastructure and improvements that exceeds current energy standards;

- a. The Plan should include anticipated timelines, a costs/savings analysis, and an action prioritization of City-owned facilities and operations
 - b. Each Business Unit to build carbon targets and actions into their 2023 – 2026 business plans and budgets
5. That Council direct Administration to work with ***civic partners and subsidiaries*** to ensure alignment with Calgary’s climate risk reduction goals and emissions reductions target, including the interim targets;
 6. That Council direct Administration to connect with community partners in an ***outreach and educational campaign*** that will empower all Calgarians to play their part in meeting the City’s net-zero target and reduce climate risk in our communities;

Due to the urgent nature of the Global Climate Emergency, Council directs Administration to pursue and report on the progress on the above actions, to be reported on by the end of Q3 2022, in order to be considered during the 2023-2026 Budget Cycle.



appendix **2** **glossary**
and abbreviations

Glossary

5A Network: The “Always Available for All Ages and Abilities” Network is a city-wide mobility network plan in Calgary consisting of off-street pathways and on-street bikeways. The 5A Network was approved by Council on February 8, 2021 as part of the Calgary Transportation Plan bylaw.

Adaptive capacity: Organization and public capacity to change in response to, and in expectation of, the impact of climate hazards.

Anaerobic conditions: The absence of oxygen.

Carbon budget: Is the total amount of CO₂ emissions the world can emit while remaining within a certain temperature threshold.

Carbon budget framework: A GHG management system that helps The City achieve and publicly report against its corporate and community GHG reduction targets.

Carbon capture and sequestration (CCS): the process of capturing greenhouse gases before they enter the atmosphere and storing it.

Carbon dioxide (CO₂): Carbon dioxide is the most common heat-trapping (greenhouse) gas, released through human activities such as deforestation and burning fossil fuels, as well as natural processes such as respiration and volcanic eruptions.

Carbon dioxide equivalent (CO₂e): Carbon dioxide equivalent is a standard unit for measuring the contribution of different greenhouse gases such as methane and nitrous oxide, which have different warming effects on the atmosphere. The impact of each different greenhouse gas is expressed in terms of the amount of CO₂ that would create the same amount of warming.

Carbon Disclosure Project: A global disclosure system to report climate change mitigation and adaptation progress.

Carbon negative technologies: Technologies that remove more carbon from the atmosphere than they emit.

Carbon utilization: Ways in which captured carbon can be used or recycled.

Civic partners: Independent organizations that have either been created by The City, or with whom The City partners to deliver a Council approved strategy or mandate through an operating grant or other form of investment over \$500,000. This category includes wholly-owned subsidiaries.

Abbreviations

AESO	Alberta Energy Systems Operator
BILD	Building Industry and Land Development
BOMA	Building Owners & Managers Association
CCRI	Community climate risk index
CDP	Carbon disclosure project
CEIP	Clean Energy Improvement Program
CO₂	Carbon dioxide
CRFD	Climate-related financial disclosure
ECO	Environmental Careers Organization
FCM	Federation of Canadian Municipalities
IBC	Insurance Bureau of Canada
GBA+	Gender Based Analysis Plus
GDCF	Growth and Development Climate Framework
GHG	Greenhouse gas
GPC	Global Protocol for Cities
GSI	Green Stormwater Infrastructure
IPCC	Intergovernmental Panel on Climate Change
RCP	Representative Concentration Pathway
ROI	Return on Investment
TAMD	Tracking adaptation and measuring development
TCFD	Task force on climate-related financial disclosure
VKT	Vehicle kilometers traveled

Clean technology: As defined in the *Calgary Economic Development Energy Transition Report*, clean technology refers to ag-tech and agriculture, carbon capture, utilization and storage, digitalization, electrification, energy efficiency, energy storage, hydrogen production, methane monitoring and abatement, non-thermal use of fossil-based feedstock, renewable energy production, small modular reactor development, sustainable fuels, waste management and advanced recycling and water efficiency and wastewater treatment (1).

Climate: The average weather conditions of a region over a long period of time. Or more rigorously, the statistical description in terms of the mean and variability of relevant quantities over a period of time. The standard period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant attributes are most often surface climate variables such as temperature, precipitation and wind (23).

Climate adaptation: Refers to the actions, policies, programs, tools and strategies intended to reduce the negative impacts of climate change on our city's infrastructure, natural assets, economy, and people.

Climate change: A long-term change in the average weather patterns that have come to define earth's local, regional and global climates due to the increase in atmospheric greenhouse gases caused by human activities.

Climate hazard: The potential occurrence of a climate change driven event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources (24). Climate change amplifies the intensity, frequency and variability of climate hazards.

Climate impacts: The adverse effects of climate-related acute events (climate hazards) or long-term trends on the human-valued attributes of built, natural and human systems. The magnitude of impact(s) is dictated by the event and/or trend itself, the vulnerability of the systems impacted based on their sensitivity and response capacity and the exposure of the system affected (24).

Climate mitigation: The actions intended to reduce and prevent greenhouse gas emissions from going into the atmosphere, or those activities that remove these greenhouse gases from the atmosphere through natural or technological means.

Climate projections: Simulations of a future climate using computer models and emissions scenarios.

Climate resilience: The ability of social, economic and environmental systems to cope with a climate-driven hazardous event, trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation and transformation.

Climate risk: A metric used to understand climate impacts, determined by the interactions between climate hazards, the exposure to each hazard and the community vulnerability of the affected system or human to the hazards.

Climate Risk and Resilience Assessment: A process used to assess climate risk and recommend resilience measures for a specific site or infrastructure project.

Community climate risk index (CCRI): A dashboard that details the unique drivers of climate risk to each community in Calgary by intersecting climate change hazard information, exposure to climate hazards, and conditions that create vulnerability to climate change impacts.

Consumption based GHG emissions: Focuses on the consumption of all goods and services by residents of a city, and GHG emissions are reported by consumption category rather than emission source categories. Captures direct and lifecycle GHG emissions of goods and services (including those from raw materials, manufacturing, distribution, retail and disposal) and allocates GHG emissions to the final consumers of those goods and services.

Deep energy retrofit: A whole building analysis and construction process that aims at achieving on-site energy use minimization in a building by achieving at least a 40 per cent improvement in the building's overall energy performance.

Energy poverty: Needing to spend twice the average percentage of after-tax household income on home heating and power. Households that spend 6 per cent or more of their after-tax income are experiencing energy poverty.

Energy transition: The shift from carbon-emitting fuels towards non-carbon-emitting fuels.

Environmentally significant areas (ESAs): Areas that contain rare or unique elements or that include elements that may require special management consideration due to their conservation needs. ESAs are important to the long-term maintenance of biological diversity, soil, water or other natural processes at multiple spatial scales (25).

Equity: Means conditions are adjusted to meet people's diverse needs, strengths and social realities. It requires recognition that different barriers (often systemic) exist for diverse individuals or groups. The result of equity is all people have the opportunity to benefit equally from City services.

Equity-deserving people and groups: Are communities that identify barriers to equal access, opportunities, and resources due to disadvantage and discrimination, and actively seek social justice and reparation. This marginalization could be created by attitudinal, historic, social, and environmental barriers based on characteristics that are not limited to sex, age, ethnicity, disability, low economic status, gender, gender expression, nationality, race, sexual orientation and creed.

EV-ready: Requires a percentage of parking spaces in a building to include electrical infrastructure at the time of construction to allow for future EV charging infrastructure.

Exposure: Exposure reflects the presence of something of human value (within a built, natural or human system) in a place and/or setting that could be impacted by a hazard. (i.e., people, livelihoods, ecosystems, environmental functions, services, resources, infrastructure, or economic, social or cultural assets) (24).

Fair-share emissions target: An emissions reduction target that is considered a government's "fair share" contribution to the global effort in reducing greenhouse gas emissions. Many consider it fair that those who have made a bigger contribution to the problem, or who have a higher capability to act, should do more.

Greenhouse gas: Gases that absorb and emit radiant energy within the atmosphere, including carbon dioxide and methane.

Green streets: Roads or streets that incorporate green infrastructure, including natural and human-made elements such as trees and green walls to help manage stormwater, improve biodiversity and add more greenspace.

Green Stormwater Infrastructure (GSI): Incorporates natural features and processes into stormwater management. Measures such as infiltration, evapotranspiration, harvesting, filtration and retention are used to reduce stormwater rates and volumes and remove contaminants at or close to the source of runoff. GSI aims to mimic the natural water cycle and provides multiple ecosystem and community benefits.

Infrastructure: The processes, systems, facilities, technologies, networks, assets and services essential to the effective functioning of society. Examples include roads, bridges, municipal facilities, transit, communication networks, etc.

Intergovernmental Panel on Climate Change (IPCC): The Intergovernmental Panel on Climate Change is the United Nations body for assessing the science related to climate change. The IPCC provides regular assessments of the scientific basis of climate change, its impacts and futures risks, and options for adaptation and mitigation.

Low carbon economy: Is an economy that is based on the use of energy sources that produce low levels of GHG emissions.

Natural infrastructure: Includes the preserved and restored natural areas in our city, such as grasslands, forests and waterbodies, as well as the green stormwater assets built to use natural processes to manage water and provide ecosystem functions in an urban environment, like constructed wetlands, rain gardens and green roofs.

Net zero: A state in which greenhouse gas (GHG) emissions emitted into the atmosphere are balanced by the removal of GHG out of the atmosphere

Net zero emissions: Refers to a state in which GHG emissions emitted into the atmosphere is balanced by the removal of GHG out of the atmosphere.

Net zero emissions building: A building that is a highly energy-efficient that produces on-site, or procures, emissions-free renewable energy or high-quality carbon offsets to counterbalance the annual carbon emissions from building materials and operations.

Net zero emissions community: A community or neighbourhood that has greatly reduced energy needs through efficiency gains and the balance of energy for vehicles, thermal, and electrical energy within the community is met by zero emissions energy sources located either on-site or through connection to a zero emissions electricity grid or zero emissions thermal network. High-quality carbon offsets may be used to counterbalance any remaining annual carbon emissions.

Representative Concentration Pathways (RCP): Scenarios that include time series of emissions and concentrations of the full suite of GHGs and aerosols and chemically active gases, as well as land use/land cover. The word representative signifies that each RCP provides only one of many possible scenarios. The term pathway emphasizes that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome (23).

Return on investment (ROI): Loss avoided in relation to the project cost for adaptation, resilience or disaster mitigation projections.

Response capacity: Incorporates both coping and adaptive capacity to manage and reduce the impact of climate hazards.

Scope 1 emissions: GHG emissions are produced by sources from owned or controlled by the City. For example, the greenhouse gases emitted from the combustion of fuels in vehicles or buildings.

Scope 2 emissions: GHG emissions generated indirectly from the consumption of purchased energy (electricity, heating and cooling).

Scope 3 emissions: Indirect GHG emissions such as emissions produced in the supply chain of the goods and services we buy.

Sensitivity: The degree of adverse impacts, influenced by system assets' condition, asset interdependencies, and human-infrastructure coupling. The degree to which a social, built or natural system is affected by climate change, and is determined by the predisposition of systems to suffer harm because of intrinsic and/or contextual conditions.

Social infrastructure: The set of organizational arrangements and investments in society's systems, relationships, and structures that enable us to create a more resilient, just, equitable, and sustainable world. It includes social, economic, environmental and cultural assets (26).

Solar PV: Solar photovoltaic cells which convert sunlight directly into electricity.

Structural inequity: The personal, interpersonal, institutional, and systemic drivers—such as, racism, sexism, classism, able-ism, xenophobia and homophobia—that make those identities critical to the fair distribution of opportunities and outcomes.

Task force on climate-related financial disclosure (TCFD): Refers to an international accountability and reporting framework, developed by the Financial Stability Board, to create more effective climate-related disclosures that promote more informed investment, credit, and insurance underwriting decisions related to carbon-related assets and exposure to climate-related risk.

Tracking Adaptation and Measuring Development (TAMD) framework: Evaluates climate adaptation success as a combination of how widely and how well The City manages climate risks, and how successful adaptation interventions are in reducing climate vulnerability and keeping development on course.

Vulnerability: The degree to which a system may be adversely affected; vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and system response capacity.

Weather: The short-term changes in the condition of the atmosphere, over days to months (27).

Zero emissions zones: Is an area where only zero-emission vehicles (ZEVs), pedestrians, and cyclists are granted unrestricted access. Other vehicles are either prohibited from entering or permitted to enter upon payment of a fee.



appendix **3** **sources**
and references



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