CLIMATE CHANGE ACTION PLAN

OUR CLIMATE FUTURE
climate change action plan

The City of SPRUCE GROVE

Draft for City Council Review: February 9, 2022

Message from the mayor (suggested)

Suggested message for final published report describing the support of Mayor and Council for this plan

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1. Purpose and Direction

Our Climate Change Action Plan (CCAP) describes how the City of Spruce Grove (the "City") will contribute to the collective goal of limiting future climate change, while also preparing the City for the impacts of a changing local climate.

Direction to complete this plan was set out in the 2021 Corporate Plan for the City.

2. Vision and Principles

a. Why is Spruce Grove taking action on climate change?

In terms of climate impact, cities globally are **responsible for more than 70% of carbon dioxide emissions**. Cities are also at high risk from many of the negative impacts of climate change. Weather and climate extremes can be very disruptive to the systems of a city, and is also where most of us live, work and raise our families.

Integral to the climate change problem, cities like Spruce Grove and all people who live there are also a key part of the solution.

Climate change does not affect all of us equally, however. Disadvantaged groups are more negatively by its effects. As well, disadvantaged groups are both less able to adapt to these effects or to take advantage of opportunities. An inclusive and equitable plan must reflect the needs of our most vulnerable.

b. Our Vision

Our city wants to do our part to help Spruce Grove to be a resilient, safe and attractive City to live, work and play.

The City recognizes the threat and opportunity climate change poses to our economy, public health and safety, natural environment, and quality of life.

This plan provides a roadmap to carbon-neutral and climate resilient communities, by identifying actions that will make our communities safer, current and future generations of residents healthier and more secure, our economy more vibrant and stable, our environment more sustainable, and our society more inclusive and equitable.

What is Climate Change?

- Persistent, long-term changes to the normal patterns of weather in a region, typically over 30 years or more.
- Caused mostly by greenhouse gases (GHGs) produced through human activity (e.g., burning of fossil fuels)
- Unabated, changes in climate will continue to negatively many aspect of our lives, including our health, economy and the natural environment.

c. Important Principles

The plan is guided by the following core principles:

- Comprehensive: Consider the role that both the City and wider community can play in reducing greenhouse gas (GHG) emissions and enhancing resilience to climate change
- Science-based: Ensure the plan leverages the latest climate research and data
- Co-benefits: Promote actions that have multiple economic, social and environmental benefits for the community
- Equity: Ensure a just and equitable transition to a climate resilient and low carbon future.
- Public engagement: Meaningfully engage the public in plan development.

3. Scope

a. Timeline

This plan was designed with a vision for the future. While the actions described here are designed to be taken between 2022 and 2033, the climate change projections are for the period of 2051-2080 (the 2060's), and the GHG mitigation plan describes a time trajectory from 2022 until 2050.

b. The Whole Community

This plan identifies actions to be taken by both the City of Spruce Grove (the "corporation") as well as by residents and local businesses.

c. Local Focus

Climate change is and will continue to affect every aspect of how we live our lives. It affects everything from our health and quality of life to our economy, infrastructure and the natural environment around us. This plan focuses on how to adapt to and reduce the effects of climate change within the boundaries of Spruce Grove. It does not examine broader social, economic, or political changes that may happen in the future.

d. Climate Change Assumptions

In order to help prepare the City for the biggest possible change to our climate, the projections in this report are based on a "business as usual" climate change scenario and assumes that GHG emissions continue to increase at current rates through the end of the century. This scenario results in more severe global warming. If strong global action is taken to

reduce GHG levels in the coming decades, we can expect to see smaller changes to the local climate.

Ways to measure GHGs

$tC0_2eq$	Tonnes of carbon dioxide equivalent – a metric to measure the total amount of all GHGs released or removed to the atmosphere[1]
$tC0_2eq/p$	Tonnes of carbon dioxide equivalent 'per person'.

e. Which Greenhouse Gases?

The CCAP focuses on greenhouse gases that come from activities that take place directly in the City. So, for example, this report does include GHGs from the car you drive inside the city. However, it does not look at GHGs from the plane flight that someone living in the city takes to another part of the world, because the airport is located outside the city. Similarly, it does not look at GHGs caused by the manufacturing in another country of a cellphone purchased by someone living in Spruce Grove.

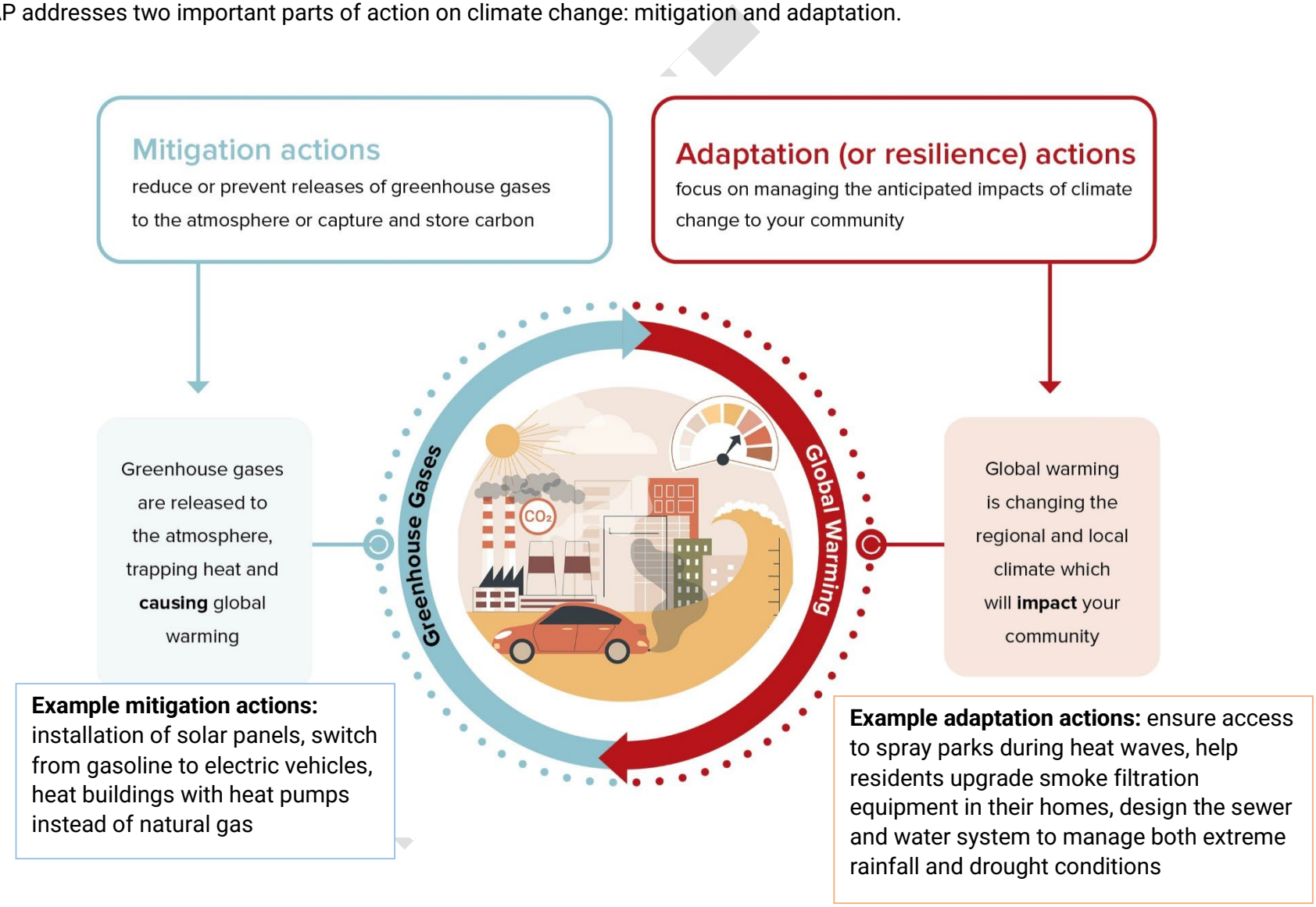
What are greenhouse gases?

- Greenhouse gases (GHGs) are gases that trap heat inside the atmosphere.
- They allow sunlight to pass through to the Earth's surface, but they prevent the heat generated from escaping the atmosphere.
- The most common GHGs are carbon dioxide, methane, nitrous oxide and water vapor

[1] May also be expressed as kilo-tonnes ($ktCO_2eq$ = 1,000 tonnes) or mega-tonnes ($Mt\ CO_2eq$ = 1,000,000 tonnes).

4. Adaptation vs Mitigation

The CCAP addresses two important parts of action on climate change: mitigation and adaptation.



5. Future Climate Projections

In comparison to the baseline period of 1976-2005, we could see the following changes to the climate in Spruce Grove by the 2060's.

Hotter Summers

Warmest maximum temperature of 36°C
(historically: 31°C)

3 heat waves per year
(historically: none)

24 days in a year above 30°C
(historically, 3 days)

One day per year below -30°C
(historically: 8)

88 winter days (where temperatures drop below -5°C)
(historically: 130 days)

An average of 68 freeze-thaw cycles per year
(historically: 89)

Water Stress

A 168-day long frost-free season per year
(historically: 128 days)

Increased drought risk due to hotter summers and invariable summer precipitation

More Extreme Weather

Increase in high intensity rain storms
(20% increase in days with >10 mm rain)

More extreme wind and lightning

6. Prioritizing Climate Change Actions

This plan identified many possible actions to help the City move forward on its path of climate change adaptation and GHG emission reduction. To help assess which actions the city should take further action on, a type of 'cost benefit analysis' was conducted.

Every potential action was ranked on a 1-5 scale of both benefits and costs

Action Benefits:

Effectiveness	How much of an effect would this action have?
Co-Benefits	For adaptation actions – are there any GHG mitigation 'co-benefits' to this action? For GHG mitigation actions – are there any climate adaptation 'co-benefits' to this action?
Additional Benefits	Are there other benefits to this action?
Equity	Does this action help multiple groups of people, or, does it specifically assist disadvantaged or underserved people?
Flexibility	Can we change our mind about this action later, or are we locked in?

Action Costs:

Upfront costs	What are the 'startup' costs of this action?
Ongoing costs	What are the maintenance costs of this action?
Negative Side Effects	Are there negative side effects to this action?
Feasibility	Are there technological or political barriers to this action?
Acceptability	Is public support in favour or against this action?

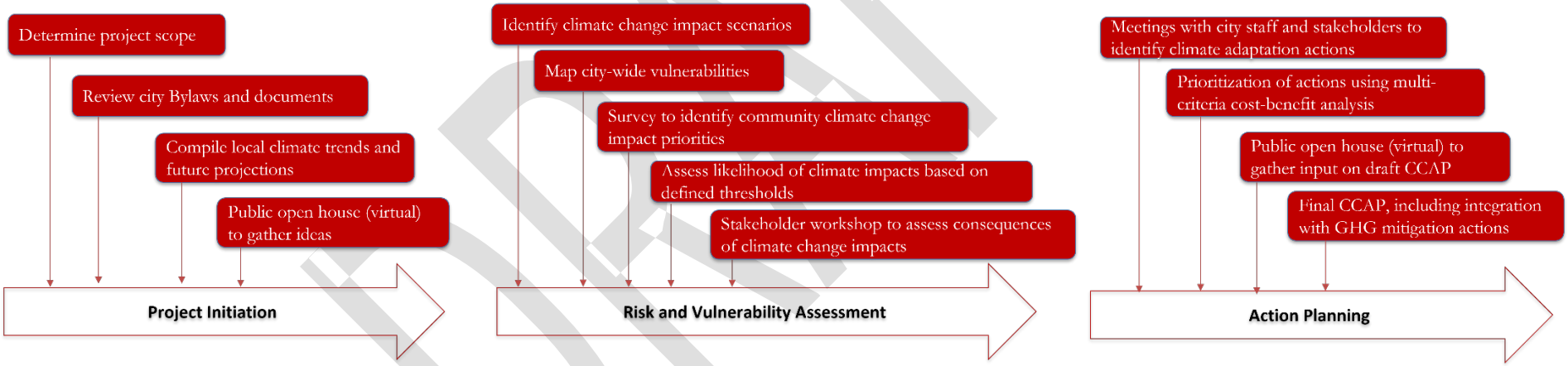
If the benefit score of an action is higher than its cost score, it has been recommended for further assessment by the city.

7. Adaptation Planning

The climate adaptation planning process sought to help us identify the most pertinent risks and opportunities facing our city as a result of climate change.

a. Process

A risk-based approach was used to identify and prioritize climate change risks and opportunities. The process followed recognized best practices for climate change risk assessment, notably the newly released ISO 14092 Standard which provides guidance on community climate adaptation planning, including climate change vulnerability and risk assessments in a community context. A summary of the methodology is provided below.



For additional details see the City of Spruce Grove Climate Change Vulnerability and Risk Assessment – Technical Report

b. Priority Climate Change Risks and Opportunities

The table below provides a summary of the climate change VRA results. Potential benefits are shown with an asterisk (*):

Climate impact	Description (impact threshold)	Priority level
Drought	Palmer Drought Severity Index (PDSI) value of -2 or below	High
Heat wave	Three consecutive days of temperatures above +30°C	High
Longer construction season*	Frost-free season of 168 days (5.5 months) in length	High
Freezing Rain	A freezing rain event	High
Hailstorm	A hailstorm with 45 mm diameter hailstones	High
Water supply shortage	North Saskatchewan River flow rate of 25 m3 per second	Medium
High winds	A windstorm with gusts of 110km per hour	Medium
Increased water demand	Mean maximum summer temperature of 26.2°C	Medium
Invasive tree species	The coldest minimum temperature in a year does not drop below -30°C	Medium
Reduced winter recreation	88 winter days (temperatures below -5°C) in any given year	Medium
Lightning	One year with 60 hours of lightning activity	Medium
Increased space cooling	282 cooling degree days in a year	Medium
Wildfire smoke	One year with 9 days (216 hours) of wildfire smoke	Medium
Freeze-thaw cycles	68 freeze-thaw cycles in any given year	Medium
Ground level ozone	Mean maximum summer temperature of 26.2°C	Medium
Urban flooding	One day (24-hours) with 114mm of rainfall	Medium
Heavy snowfall	Snow accumulation of 50cm	Medium
Increased summer recreation*	Frost-free season of 168 days (5.5 months) in length	Medium
Increased agricultural productivity*	Annual Corn Heat Units (CHU) of 2400	Medium
Reduced space heating demand*	4171 heating degree days in a year	Medium
Cold stress	One very cold day with temperatures -30°C or less	Low
Tornado	An EF3+ tornado	Low
River flooding	North Saskatchewan River flow rate of 5,800 m3 per second	Low
Wildland fire	Wildfire penetrates the municipal boundary causing damage	Low

Actions are identified below to reduce the impact of high and medium priority risks, and to take advantage of the high and medium priority opportunities. No actions are identified in this report relating to the risks identified as low priority.

8. Climate Adaptation Actions

i. Action Themes

Adaptation actions for the city are organized into the following themes:

- City Buildings and Infrastructure (CBI)
- City Services (CS)
- Homes, Businesses and Local Economy (HBE)
- Water Management and Natural Infrastructure (WN)

ii. High and Moderate Priority Areas Addressed

The high and moderate priority areas that an action would help improve resiliency for are noted individually.

iii. Action Type

Action types are organized into the following groups:

- **Assessment**: analysis or research to gather information about potential climate changes, impacts or solutions
- **Engagement**: conduct public outreach or educate residents about climate impacts and adaptation.
- **Operations**: new or modified operational procedures or practices
- **Partnership**: establish new or strengthen existing partnerships with external stakeholders
- **Plan**: plans or strategies to either establish new direction, or embed climate resilience into existing plans or strategies
- **Policy**: establishing or updating rules and regulations to provide direction for projects, initiatives, or programs
- **Project**: implementation to advance climate resilience, such as the purchase or upgrade of an asset or infrastructure
- **Program**: new or updated program with ongoing implementation
- **Resourcing**: establish new positions, hire new staff, and/or modify job descriptions or roles

All action types may require some amount of engagement with the public.

iv. Up-Front Action Cost

The up-front action cost describes the approximate cost range to kickstart the action. Other costs may be required to maintain an action over time.

Score	Cost
$	<$25,000
$$	$25,000-$100,000
$$$	$100,000-$200,000
$$$$	$200,000-$500,000
$$$$$	>$500,000

v. Equity Benefit

How many and what groups of people benefit from this action.

Cost	Definition
Poor	Affects a small group of people who may already have resources available to them
Fair	
Good	Affects many members of the public
Very Good	Affects all members of the public, or, specifically assists vulnerable or marginalized groups of people
Exceptional	

b. City Buildings and Infrastructure

The buildings owned by Spruce Grove help the city offer services to residents, including recreation, road maintenance, and utilities. The city also owns or has influence over important infrastructure such as roads, trails, water and sewage infrastructure, and public parks. The actions described below help to improve resilience for both buildings and infrastructure.

Action No.	Action	Action type	Upfront Costs	Equity	Mitigation Benefits
1-1	Ensure appropriate budget and staff for inspections, maintenance and repair of infrastructure exposed to climate risks	Resourcing	$	Good	None or minor
1-2	Ensure appropriate budget and staff for inspections, maintenance and repair of buildings and facilities exposed to climate risks	Resourcing	$	Good	None or minor
1-3	Consider increasing freezing rain risk in snow and ice management policies	Policy	$$	Good	None or minor
1-4	Develop climate resilience design standards for city buildings and infrastructure	Policy	$$	Fair	Moderate
1-5	Incorporate climate risk assessment in building inspections	Procedure	$	Good	None or minor
1-6	Install a weather and climate monitoring station	Project	$$	Good	None or minor
1-7	Install shade and extreme weather shelters in public areas	Project	$$$$	Very good	None or minor
1-8	Increased the size and connectivity of the active transportation network	Project	$$$$$	Very good	Significant
1-9	Develop a covered storage area for corporate vehicles	Project	$$$	Fair	None or minor
1-10	Construct additional outdoor cooling stations and water fountains	Project	$$$	Good	None or minor
1-11	Install back-up power at critical city buildings and facilities	Project	$$$$$	Good	Somewhat
1-12	Continue lightning protection installation on city buildings	Project	$$$	Fair	None or minor
1-13	Pilot Climate Resilience Retrofits on City Buildings	Project	$$$$	Fair	Moderate
1-14	Purchase an additional sanding truck	Project	$$$$	Good	None or minor

c. City Services

City Services refers to the ways that Spruce Grove can educate or provide support to local residents. This ranges from health and safety related responses such as the Winter Emergency Response Program to education and recreation-based services. The actions described below are services the city can offer to build climate resilience for the City and for local residents.

Action No.	Action	Action Type	Upfront Costs	Equity	Mitigation Benefits
2-1	Update the Winter Emergency Response Program to assist unsheltered people during extreme weather events	Program	$$$	Exceptional	None or minor
2-2	Improve the climate resilience of locations used for refuge during states of local emergency by assisting with the installation of climate resilience features	Project	$$$	Exceptional	None or minor
2-3	Develop an education program for residents to build awareness and improve communications about local climate change impacts and adaptation	Engagement	$$$	Good	Somewhat
2-4	Encourage residents to create climate resilient home gardens	Engagement	$$	Good	Somewhat
2-5	Enhance existing neighbourhood social resilience programs, including the Spruce Grove Neighbour Network and Block Party Program	Program	$	Exceptional	None or minor
2-6	Increase opportunities for indoor recreation activities and programming during times of extreme heat and poor air quality	Operations	$	Good	None or minor
2-7	Increased shoulder season outdoor recreation programs and opportunities	Operations	$	Very good	None or minor
2-8	Increase monitoring of outdoor rinks and ice conditions and provide real-time updates to residents.	Operations	$	Good	None or minor
2-9	Educate residents about the benefits of native ground cover and create an awards program	Engagement	$$	Good	Somewhat
2-10	Develop a City Climate Policy for requiring consideration of climate adaptation and mitigation in all budget decisions, procurements and projects	Policy	$	Good	Somewhat

d. Home, Businesses and Local Economy

These actions involve interaction between the city and either homes or businesses. At a larger scale, this involves the whole economy. These actions are focused on bylaws, policies, procedures, and interaction with other levels of government.

Action No.	Action	Action Type	Upfront Costs	Equity	Mitigation Benefits
3-1	Allow watering of privately owned trees during water restrictions to avoid untimely death/damage to trees	Policy	$	Good	Considerable
3-2	Encourage construction companies to build to better than code regarding climate resilience	Partnership	$	Good	Somewhat
3-3	Provide grants or other incentives to residents, businesses and non-profits to implement climate resilience measures at the home and property level	Program	$$	Very good	Somewhat
3-4	Create an Urban Agriculture Plan to provide guidance on local food production and agricultural development	Plan	$$	Very good	Very good
3-5	Incorporate climate change into the Water Network Master Plan to determine future requirements for water storage	Plan	$$$$	Very good	Somewhat
3-6	Work with communities in the region to advocate for improved design standards for new home construction	Partnership	$	Good	Somewhat

e. Water management and natural infrastructure

One key city service is management of water flow throughout the city. This includes potable and stormwater management. These services can be provided either through traditional engineering methods or through incorporation of natural infrastructure considerations into local policies.

Action No.	Action	Action Type	Upfront Costs	Equity	Mitigation Benefits
4-1	Update the Parks and Open Space Master Plan by completing the natural areas inventory and considering actions to manage climate risks	Plan	$$$	Good	Somewhat
4-2	Increase inspections, maintenance and management of the stormwater system and asset management program	Operations	$	Good	None or minor
4-3	Update flood mapping and develop a stormwater management plan that considers projected changes in extreme rainfall	Plan	$$$	Good	None or minor
4-4	Plant climate resilient tree species, including those that are pest resistant, drought tolerant, wind resistant and good for shading	Operations	$$	Good	Somewhat
4-5	Enhance management of plant diseases as well as both invasive and desirable insect and plant species	Operations	$	Good	Somewhat
4-6	Increase funds for tree planting and management to plant more trees and increase tree survival rates	Resourcing	$$	Very good	Somewhat
4-7	Expand xeriscaping efforts in the city by increasing use of native grass and shrub species	Operations	$$	Good	Somewhat
4-8	Increase City participation in watershed protection planning	Partnership	$	Good	None or minor

9. Greenhouse Gas Mitigation Context:

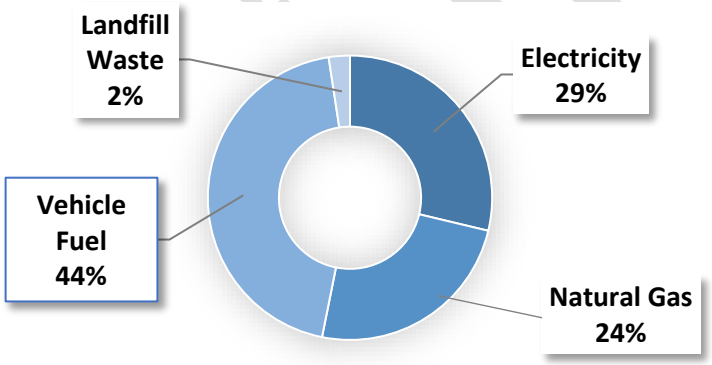
a. What are Greenhouse Gases?

Greenhouse gases, often shortened to GHGs, are gases that trap heat inside the atmosphere. They allow sunlight to pass through to the Earth's surface, but they prevent the heat generated from escaping the atmosphere. The most common GHGs are carbon dioxide, methane, nitrous oxide and water vapor

b. Where do GHGs come from?

In our current way of living, all of us participate in activities that produce GHGs. When carbon-based fuels like coal, natural gas, gasoline or diesel are burned to produce energy – either directly (such as in car) or to produce electricity, GHGs are released into the air.

Below you can see what type of fuels produce GHGs in Spruce Grove:



c. GHG Sources In Daily Life

Gasoline and diesel produce 99% of the vehicle fuel GHGs in the city (with the remainder from propane and electric or hybrid vehicles).

When organic matter like food, garden waste, or anything that could be composted is buried in a landfill, it can produce methane, which is a very strong GHG. This produces 2% of GHGs in Spruce Grove.

Homes and businesses use electricity and natural gas. As an example of where that energy is used, in a typical single family detached home, the biggest sources of GHGs are:

- Space Heating – 70%
- Water Heating – 20%
- Appliances and Lights – 10%

d. GHG Source Sectors

The vast majority **— 98%—** of GHGs in Spruce Grove come from community activities: homes, businesses, road transportation, and solid waste.

The remaining GHG emissions **—2%—** come from City operations – from operating city-owned buildings and parks, operating city-owned vehicles and equipment, the movement of water and sewage throughout the city, and powering streetlights and public signs.

Spruce Grove GHG source sectors are shown below, ordered from highest to lowest GHG contribution in 2020.

Spruce Grove GHG Emission Source Sectors

	Sector Name	Description	Estimated City GHG Emissions in 2020
Community	**Community Transportation & Land Use**	Vehicles	44.6%
	Homes	Energy use in homes	29.4%
	Businesses	Energy use in businesses	12.9%
	Solid Waste	Landfilled organic waste	2.4%
Municipality	**City Buildings**	Energy for city buildings	1.2%
	City Fleet	Fuel and energy for city vehicles and equipment	0.2%
	Lights & Signs	Streetlights, signs, etc	0.2%
	Water & Sewage	Water and sewage pumping	0.2%
Both	**Energy Supply**	Local renewable energy production	Not measured
	Carbon Sinks	'Natural' Carbon Sinks	Not measured

e. Current and Predicted Spruce Grove GHGs

In 2019, citywide GHG emissions were 450,000 tC02eq. Said another way, our GHG emissions were 12 tC02eq per person (tC02eq/p). On a per person basis, this is lower than the Canadian average, but higher than values in other developed countries such as France and Sweden.

Location	GHG emissions per person in 2019 (tC02eq/p)[1]
Canada	20
Edmonton	15
Spruce Grove	**12**
France	7
Sweden	5

[1]statista.com

In order to decide on a path to reducing GHGs in our city in our future, we created a projection of what would be likely to happen without any future action on the part of the city from 2020 until 2050 ('**the reference case**'). This projection took into account our own growth forecasts about population and city size as well as historical energy use trends in Alberta. This projection includes the assumption that energy efficiency will continue to improve at the same speed that it has in the past.

In this predicted future, GHG emissions **per person** would go down to 10 tc02eq/p by 2030 and to 9 tC02eq/p by 2050. However, for reasons including expected population growth in the City over the next 30 years, **total** city GHG emissions would go up by 40% between 2020 and 2050.

f. What has the city already done?

The City completed its first GHG emissions inventory for the year 1996, and the City has been a partner in the Canadian Partners for Climate Protection GHG emission reduction program since 2003. Since that time, the City has take measures to reduce both 'corporate' and 'community' GHG emissions. The 2011 Environmental Sustainability Action Plan, which the CCAP replaces, kickstarted an array of changes to improve environmental sustainability and reduce GHGs in the areas of land use and natural areas, transportation, waste, water, and energy.

Since that first 1996 GHG Inventory, the population of the city has increased by 2.6 times. GHG emissions per person have dropped from **19 tC02eq/p** in 1996 to **12tC02eq** by 2019, which is a **37% reduction over 23 years**. Total GHG emissions have gone up, but slower than total population growth: since 1996, total city GHGs have increased by 1.7 times.

The City's current GHG emission goals were set in 2016. When interpreted on a per person basis, this would result in GHG emissions of **9 tC02eq/p by 2035.** While the current goal only extends to 2035, if they city continued on this path, GHG emissions would reach **6 tC02eq/p by 2050**.

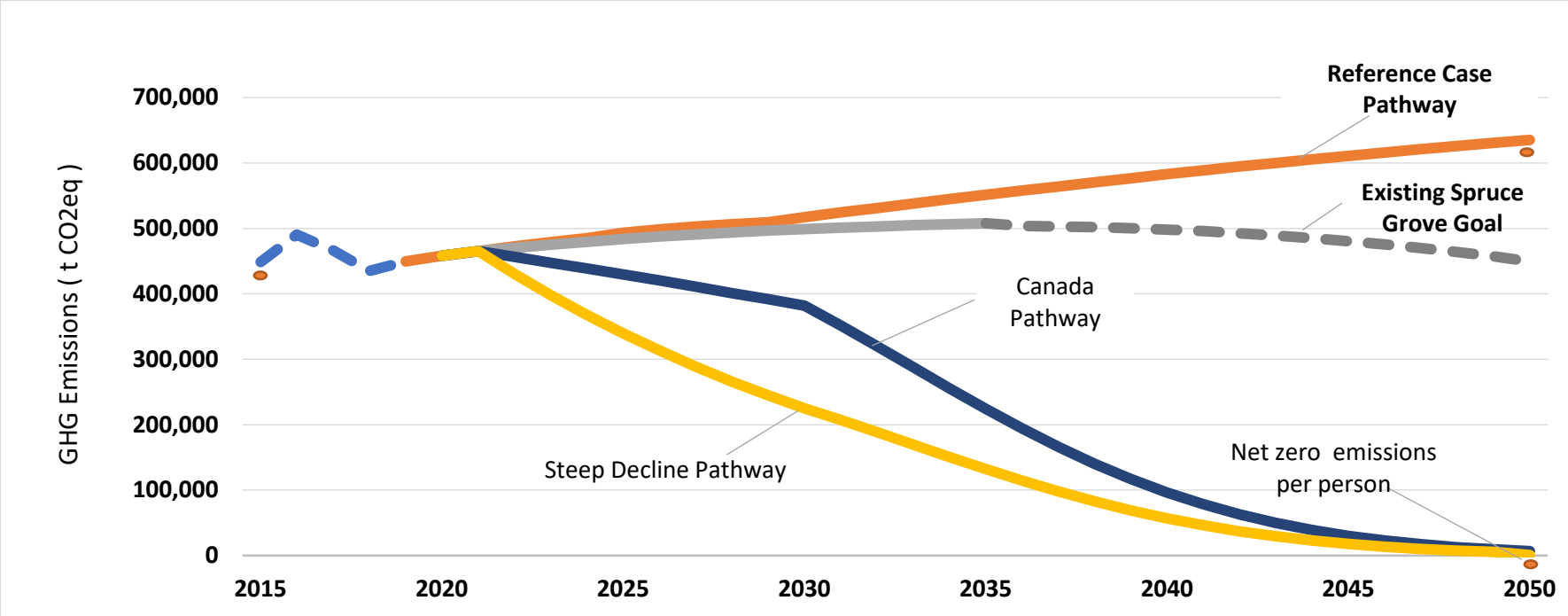
g. Public Engagement

Spruce Grove residents had the opportunity to participate in a number of workshops and surveys in 2021 regarding the CCAP. One important question was about the level of ambition the City should take in terms of reducing its greenhouse gas reductions. Approximately 40% of participants felt that the city should take no additional steps to reduce GHGs. The remaining 60% of survey and workshop participants wanted the city to take more action than it currently is to reduce GHGs, with ~25% wanting the city to have 'moderately high' levels of ambition, and ~35% wanting the city to be very ambitious and reach net zero emissions by 2050. Of those surveyed, 60% of individuals aged 25-44 wanted at least moderate GHG goals, beyond the city's current targets. Survey respondents aged 65 and older were more likely than younger participants to think that current levels of GHG reduction ambition are appropriate for the City.

h. Two Science Based GHG Reduction Pathways

Two potential GHG reduction pathways have been modelled for City Council to consider. Both of these pathways are based on recent climate science, consider the principles of equity, and consider all GHG emissions that are produced within the City. Each pathway has its own benefits and drawbacks to consider.

Both of the two modelled pathways show Spruce Grove meeting net zero GHG emissions by 2050. The key difference is related to the 2030 GHG target. In the **'Steep Decline Pathway'** GHG emissions fall rapidly from 2022 to 2030, with relatively fewer reductions required until 2050. In the **'Canada Pathway'**, GHG emissions fall relatively more slowly from 2022 to 2030, but then drop quickly after that until 2050.



Steep Decline Pathway

This pathway is based on analysis of the global GHG reductions required by 2030 to only temporarily increase global temperatures to 1.5°C above pre-industrial levels by 2100, followed by a reduction back underneath 1.5°C through removal of GHGs from the atmosphere. This method also recommends faster reduction of GHG emissions from more developed countries than in less developed countries.

In the Steep Decline Pathway, the GHG reduction targets are 4.5 t CO2eq/p by 2030, and 0 (zero) t C02eq/person by 2050. Under this scenario, GHG emissions per person would need to fall by about 77% relative to 2020 by the end of 2033.

Canada Pathway

This pathway is based on Canada's 2021 commitment to cut its GHG emissions by 40-45% below 2005 levels by 2030, and to achieve net-zero emissions by 2050. This commits Canada to doing its part to avoid the worst impacts of climate change.

In the Canada Pathway, the GHG reduction targets are 7.6 tCO2eq/p by 2030, and 0 (zero) t C02eq/person by 2050. Under this scenario, GHG emissions per person would need to fall by about 61% relative to 2020 by the end of 2033.

Path Comparison

The Canada Path requires fewer emission reductions over the next 10 years. However, as a result, the Canada Path results in 37% more total GHG emissions by 2050 than the Steep Decline Pathway. In order to be consistent with the goal of limiting global temperature increases to 1.5°C, 'negative emissions' would need to be implemented way within the City after 2050.

Spruce Grove GHG Pathways	2030	2050
'Business As Usual' tC02eq/p estimate	10.3	8.6
'Existing City Targets' tC02eq/p goal	9.1	6.1
'Steep Decline Pathway' tC02eq/p goal	4.5	0
'Canada Pathway' tC02eq/p goal	7.6	0

10. Greenhouse Gas Mitigation Actions

a. Carbon Budgets

In order to help manage and track GHG emission reductions over time, Spruce Grove will implement a 'Carbon Budget' system. A carbon budget is similar to a financial budget, because it describes the amount of GHG emission that can be 'spent' over a particular time period.

There will be three carbon budget cycles in the CCAP:

- Budget 1 (B1) from 2022-2025
- Budget 2 (B2) from 2026-2029
- Budget 3 (B3) from 2030-2033

As the City moves forward in time towards our GHG emission reduction goals, each carbon budget is smaller than the previous budget.

b. GHG Reduction Modelling Overview

Detailed modelling of the two GHG pathways has been conducted on the GHG Pathway Reference Case. As a guiding principle to conduct this modelling, emissions reductions were shared equally across all sources, In other words, all GHG sectors were expected to deliver the same percentage reductions in each year.

The other two goals being balanced during this modelling process were the need to 'meet' the required emission reduction target for each model, as well as to suggest modifications that could possibly be achieved. The percentage reduction targets use assumptions about both what would be technically feasible as well as information on historical uptake of grant programs, etc. that are offered by organizations and governments.

As a result, for the Community 'Steep Decline Pathway' modelling results, only 60% of required emissions could be modelled using tools available to Spruce Grove. If the city adopted this pathway as its goal, it could work to reduce this gap by working with other levels of government, which have different abilities than Spruce Grove does to reduce the greenhouse gas emissions from many different sectors.

The tables below show outcomes that could be achieved through many different methods. For specific suggestions on how Spruce Grove can accomplish these outcomes, please see the CCAP Action Identification and Prioritization Technical Report.

A comparison of the GHG emissions reductions required in each carbon budget, and overall, are shown below.

Community Wide Emissions Reductions Required*

	Budget 1 2022-2026	**Budget 2** 2027-2030	**Budget 3** 2031-2033	**Total**
Steep Decline Pathway	394 ktC02eq	905 ktC02eq	1,320 ktC02eq	2,619 ktC02eq
Canada Pathway	157 ktC02eq	393 ktC02eq	769 ktC02eq	1,319 ktC02eq

*values are in comparison to the 'GHG Reference Case' pathway

c. GHG Modelling Results Summary

A summary of GHG modelling from 'community' GHG emissions is shown below. This includes the sectors of Road Transportation, residential, local business and industry, and solid waste, and 2020 produced 98% of the city's GHG emissions.

Community GHG Modelling Results

	Steep Decline				Canada Path			
Summary table information	B1	B2	B3	Total	B1	B2	B3	Total
Emissions Reductions Required	387.7 ktC02eq	888.9 ktC02eq	1,300 ktC02eq	**2,576 ktC02eq**	155 ktC02eq	384 ktC02eq	757 ktC02eq	1,300 ktC02eq
Emissions Reductions Achieved	76.4 ktC02eq	432.5 ktC02eq	1,040 ktC02eq	**1,548 ktC02eq**	67.2 ktC02eq	369 ktC02eq	896 ktC02eq	1,330 ktC02eq
Percentage of required emissions achieved by 2033	20%	49%	80%	**60%**	43%	96%	118%	**102%**

For comparison, below is a summary of the GHG modelling results from 'corporate' GHG emissions. This includes the sectors of City Buildings, City Fleet, Lights and Signs, and Water and Sewage. These areas produced 2% of the city's GHG emissions in 2020.

Corporate GHG Modelling Results

	Steep Decline				Canada Path			
Summary table information	B1	B2	B3	Total	B1	B2	B3	Total
Emissions Reductions Required	6.6 ktC02eq	15.7 ktC02eq	20.7 ktC02eq	**43.0 ktC02eq**	22.6 ktC02eq	22.6 ktC02eq	22.6 ktC02eq	22.6 ktC02eq
Emissions Reductions Achieved	6.2 ktC02eq	17.0 ktC02eq	19.8 ktC02eq	**43.0 ktC02eq**	22.6 ktC02eq	22.6 ktC02eq	22.6 ktC02eq	22.6 ktC02eq
Percentage of required emissions achieved by 2033	94%	109%	96%	**100%**	74%	134%	96%	**105%**

Detailed GHG sector modelling results are described in the tables below.

d. Community Road Transportation & Land Use

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome By 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome By 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
R-T1	Annual reduction in average distances travelled	15% reduction for passenger vehicles and light trucks 2.5% reduction for medium trucks	**29%**	13%	12% reduction for passenger vehicles and light trucks 2.5% reduction for medium trucks	**47%**	22%
R-T2	Overall reduction in vehicle ownership	2.5% reduction for passenger vehicles, SUVs, light trucks, medium trucks	**10%**	5%	2.5% reduction for passenger vehicles, SUVs, light trucks, medium trucks	**20%**	10%
R-T3	Electricity used in electric vehicles comes from renewable sources	42% of electricity for all hybrid & electric vehicles is renewable	**3%**	2%	42% for all hybrid & electric vehicles	**7%**	3%
R-T4	Shift towards hybrid vehicles	42% for medium trucks	**4%**	2%	42% for medium trucks	**9%**	4%
R-T5	Shift towards electric vehicles	32%-39% for all private vehicles	**9%**	4%	32%-39% for all private vehicles	**17%**	8%
Total			54%	25%		101%	47%

*Due to interaction effects within the GHG emissions model, the sum of individual percentages may add up to more than the true sum of all actions modeled as a package

e. Community: Residential

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome by 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
R-H1A	Energy retrofits to existing homes	Energy savings from reference case of: 3-4% by 2025 12% by 2029 30% by 2033	**18%**	5%	Energy savings from reference case of: 3% by 2025 11% by 2029 23-25% by 2033	**51%**	13%
R-H1B	Energy retrofits to homes built after 2022	Energy savings from reference case of: 6% by 2025 33% by 2029 80% by 2033	**50%**	13%	Energy savings from reference case of: 5-6%% by 2025 30% by 2029 70% by 2033	**48%**	13%
R-H2A	Increased heating from renewable energy sources for existing homes	Energy savings from reference case of: 1-2% by 2025 3-5% by 2029 6-9% by 2033	**3%**	0.7%	Energy savings from reference case of: 1-2% by 2025 3-5% by 2029 6-9% by 2033	**5%**	1.4%
R-H2B	Increased heating from renewable energy sources for homes built after 2022	Energy savings from reference case of: 1-2% by 2025 4-6% by 2029 6-10% by 2033	**1%**	0.2%	Energy savings from reference case of: 1-2% by 2025 4-6% by 2029 6-10% by 2033	**2%**	0.4%
R-H3A	Increased energy from appliances, lighting, and space cooling from renewable energy	Energy savings from reference case of: 8% by 2025 24% by 2029	**9%**	2.4%	Energy savings from reference case of: 8% by 2025 24% by 2029	**18%**	4.7%

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome by 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
	sources for existing homes	50% by 2033			50% by 2033		
R-H3B	Increased energy from appliances, lighting, and space cooling from renewable energy sources for homes built after 2022	Energy savings from reference case of: 12% by 2025 48% by 2029 100% by 2033	**4%**	1%	Energy savings from reference case of: 12% by 2025 48% by 2029 100% by 2033	**9%**	2.3%
R-H4	Shift towards multi-family buildings in new construction	Between 2022 and 2033: -reduce the share of single family homes from 63% to 58% of homes -increase the share of apartments from 14% to 24% of homes	**1%**	0.2%	Between 2022 and 2033: -reduce the share of single family homes from 63% to 58% of homes -increase the share of apartments from 14% to 24% of homes	**1%**	0.4%
			55%	14.5%		**100%**	26%

*Due to interaction effects within the GHG emissions model, the sum of individual percentages may add up to more than the true sum of all actions modeled as a package

f. Community: Local Business and Industry

Industrial and Commercial Sectors:

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome by 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
R-IC1A	Improvements in overall **energy efficiency** in: -existing IC buildings	Energy savings from reference case of: 4% by 2025 12% by 2029 30% by 2033	**15%**	2.2%	Energy savings from reference case of: 3% by 2025 9% by 2029 22% by 2033	**44%**	6.6%
R-IC1B	Improvements in overall **energy efficiency** in: -post-2022 IC buildings	Energy savings from reference case of: 30% by 2025 55% by 2029 80% by 2033	**29%**	4.2%	Energy savings from reference case of: 6% by 2025 32% by 2029 60% by 2033	**68%**	10.1%
R-IC2A	Increased **heating** energy from renewable sources in -existing IC buildings	Energy savings from reference case of: 0.4% by 2025 1% by 2029 2% by 2033	**34%**	5%	Energy savings from reference case of: 0.4% by 2025 1% by 2029 2% by 2033	**66%**	9.9%
R-IC2B	Increased **heating** energy from renewable sources in -post-2022 IC buildings	Energy savings from reference case of: 0.5% by 2025 1.5% by 2029 2% by 2033	**0.2%**	<0.1%	Energy savings from reference case of: 0.5% by 2025 1.5% by 2029 2% by 2033	**0.4%**	<0.1%

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome by 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
R-IC3A	Increased renewable energy use to power **equipment, lighting and space cooling** -existing IC buildings	Energy savings from reference case of: 8% by 2025 24% by 2029 50% by 2033	**23%**	3%	Energy savings from reference case of: 8% by 2025 24% by 2029 50% by 2033	**45%**	6.7%
R-IC3B	Increased renewable energy use to power **equipment, lighting and space cooling** -post-2022 IC buildings	Energy savings from reference case of: 12% by 2025 48% by 2029 100% by 2033	**7%**	1%	Energy savings from reference case of: 12% by 2025 48% by 2029 100% by 2033	**14%**	2.0%
Total			**67%**	10%		**113%**	17%

*Due to interaction effects within the GHG emissions model, the sum of individual percentages may add up to more than the true sum of all actions modeled as a package

Light Industry

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome by 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
R-I1	Improvements in overall energy efficiency in the construction and manufacturing industries	Energy savings from reference case of: 2% by 2025 7% by 2029 13% by 2033	**44%**	3.6%	Energy savings from reference case of: 2% by 2025 4% by 2029 7% by 2033	**56%**	4.5%
R-I2	Increased use of renewable energy for electricity the construction and manufacturing industries	Energy savings from reference case of: 14% by 2025 32% by 2029 50% by 2033	**42%**	3.4%	Energy savings from reference case of: 8% by 2025 14% by 2029 20% by 2033	**41%**	3.3%
Total			**87%**	7%		**100%**	8%

*Due to interaction effects within the GHG emissions model, the sum of individual percentages may add up to more than the true sum of all actions modeled as a package

g. Community: Solid Waste

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome by 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
R-SW1	Reduce waste generation annually from 0.36 tonnes/capita to:	0.35 t/capita by 2029 0.34 t/capita by 2033	**1%**	<0.1%	0.35 t/capita by 2033	**2%**	<0.1%
R-SW2	Increase waste diversion rate from 40% to:	46% by 2025 53% by 2029 61% by 2033	**32%**	0.8%	46% by 2025 53% by 2029 61% by 2033	**62%**	1.7%
R-SW3	Local landfill captures an increasing percentage of methane gas capture:	30% capture in 2025 50% capture in 2029	**68%**	1.8%	10% capture in 203	**11%**	0.3%
R-SW4	Annual reduction in organic composition of landfill waste	1% annual reduction between 2023-2033	**13%**	0.3%	1% annual reduction between 2023-2033	**25%**	0.7%
Total			**100%**	2.7%		**100%**	2.5%

*Due to interaction effects within the GHG emissions model, the sum of individual percentages may add up to more than the true sum of all actions modeled as a package

h. City Buildings

	Steep Decline Path			Canada Path		
Building	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
Agrena	In 2023+, reduce energy use by 20% In 2023+, meet 20% of natural gas energy demand with renewables In 2028+, meet 50% of electricity demand with renewables	**20%**	0.2%	Reduce energy use by 10% in 2026 In 2026+, meet 50% of energy demand with renewables	**36%**	0.4%
BPAC	In 2023+, reduce energy use by 20% In 2023+, meet 40% of natural gas demand with renewables In 2031+, meet 50% of electricity demand with renewables	**3%**	<0.1%	In 2028+, reduce energy use by 10% In 2023+, meeting 20% of all energy demand using renewables	**4%**	<0.1%
Brookwood Rink	In 2027+, reduce energy use by 20% In 2027+, meet 40% of natural gas demand with renewables	**0.1%**	<0.1%	In 2027+, reduce energy use by 10% In 2027+, meet 20% of total energy demand with renewables	**0.1%**	<0.1%

	Steep Decline Path			Canada Path		
Building	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
	In 2032+, meet 50% of electricity demand with renewables					
City Hall	In 2023+, reduce energy use by 20% In 2023+, meet 40% of natural gas demand with renewables In 2032+, meet 50% of electricity demand using renewables	**3%**	<0.1%	In 2025+, reduce energy use by 10% In 2025+, meet 10% of energy demand using renewables	**4%**	<0.1%
Eco Centre	In 2027+, reduce energy use by 20% In 2027+, meet 40% of natural gas demand with renewables In 2032+, meet 50% of electricity demand using renewables	**0.1%**	<0.1%	In 2027+, reduce energy use by 10% In 2027+, meet 20% of all energy demand with renewables	**<0.1%**	<0.1%
Elks Hall	In 2024+, reduce energy use by 20% In 2024+, meet 40% of natural gas demand with renewables	**1.4%**	<0.1%	In 2024+, reduce energy use by 10% In 2024+, meet 20% of all energy demand with renewables	**2%**	<0.1%

	Steep Decline Path			Canada Path		
Building	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
	In 2032+, meet 50% of electricity demand using renewables					
FCSS	In 2026+, reduce energy use by 20% In 2032+, meet 50% of all energy demand with renewables	**0.3%**	<0.1%	In 2026+, reduce energy use by 10% In 2026+, meet 20% of all energy demand with renewables	**<0.1%**	<0.1%
Fuhr Sports Park/ West District Park	In 2023+, reduce energy use by 20% In 2023+, meet 40% of natural gas demand with renewables In 2032+, meet 50% of electricity demand using renewables	**1.8%**	<0.1%	In 2023+, reduce energy use by 10% In 2023+, meet 25% of all energy demand with renewables	**3%**	<0.1%
Protective Services	In 2024+, reduce energy use by 10% In 2024+, meet 40% of natural gas demand with renewables In 2031+, meet 50% of electricity demand using renewables	**8%**	0.1%	No reduction in energy use In 2030+, meet 10% of total energy demand with renewables	**2%**	<0.1%

	Steep Decline Path			Canada Path		
Building	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
RCMP	In 2027+, reduce energy use by 20% In 2027+, meet 40% of natural gas demand with renewables In 2033+, meet 50% of electricity demand using renewables	**3%**	<0.1%	In 2030+, reduce energy use by 10% In 2030+, meet 10% of all energy demand with renewables	**2%**	<0.1%
Jubilee Spray Park	In 2026+, reduce energy use by 20% In 2026+, meet 40% of natural gas demand with renewables In 2033+, meet 50% of electricity demand using renewables	**0.7%**	<0.1%	In 2026+, reduce energy use by 10% In 2026+, meet 15% of all energy demand with renewables	**1%**	<0.1%
Library	In 2029+, reduce energy use by 20% In 2029+, meet 40% of natural gas demand with renewables In 2029+, meet 50% of electricity demand using renewables	**0.9%**	<0.1%	In 2028+, reduce energy use by 10% In 2028+, meet 15% of all energy demand with renewables	**1%**	<0.1%

	Steep Decline Path			Canada Path		
Building	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
Log Cabin	In 2024+, reduce energy use by 20% In 2024+, meet 40% of natural gas demand with renewables In 2032+, meet 50% of electricity demand using renewables	**0.4%**	<0.1%	In 2024+, reduce energy use by 20% In 2024+, meet 15% of all energy demand with renewables	**<0.1%**	<0.1%
PW Shop – Century Close	In 2024+, reduce energy use by 20% In 2024+, meet 40% of natural gas demand with renewables In 2032+, meet 50% of electricity demand using renewables	**7%**	0.1%	In 2025+, reduce energy use by 5% In 2025+, meet 15% of all energy demand with renewables	**11%**	0.1%
PW Shop – Schram St	In 2026+, reduce energy use by 20% In 2026+, meet 40% of natural gas demand with renewables In 2032+, meet 50% of electricity demand using renewables	**1.5%**	<0.1%	In 2026+, reduce energy use by 10% In 2026+, meet 15% of all energy demand with renewables	**2%**	<0.1%

	Steep Decline Path			Canada Path		
Building	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
PW Shop – Spruce Ridge Satellite	In 2026+, reduce energy use by 20% In 2026+, meet 40% of natural gas demand with renewables In 2032+, meet 50% of electricity demand using renewables	**0.1%**	<0.1%	In 2026+, reduce energy use by 10% In 2026+, meet 15% of all energy demand with renewables	**<0.1%**	<0.1%
Transit Building	In 2028+, reduce energy use by 20% In 2028+, meet 40% of natural gas demand with renewables In 2082+, meet 50% of electricity demand using renewables	**0.5%**	<0.1%	In 2028+, reduce energy use by 10% In 2028+, meet 15% of all energy demand with renewables	**<0.1%**	<0.1%
Aspenglen Rink	In 2026+, reduce energy use by 20% In 2026+, meet 50% of electricity demand using renewables	**<0.1%**	<0.1%	In 2026+, reduce energy use by 20% In 2026+, meet 20% of electricity demand using renewables	**<0.1%**	<0.1%

	Steep Decline Path			Canada Path		
Building	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
Henry Singer Park	In 2026+, reduce energy use by 20% In 2026+, meet 50% of electricity demand using renewables	**<0.1%**	<0.1%	In 2026+, reduce energy use by 10% In 2026+, meet 20% of electricity demand using renewables	**<0.1%**	<0.1%
Columbus Park	In 2026+, reduce energy use by 20% In 2026+, meet 50% of electricity demand using renewables	**0.1%**	<0.1%	In 2026+, reduce energy use by 20% In 2026+, meet 20% of electricity demand using renewables	**<0.1%**	<0.1%
Tunnel and Rink	In 2026+, reduce energy use by 20% In 2026+, meet 50% of electricity demand using renewables	**0.1%**	<0.1%	In 2026+, reduce energy use by 20% In 2026+, meet 50% of electricity demand using renewables	**<0.1%**	<0.1%
Civic Centre (not yet constructed)	When the Civic Centre opens in 2025, construct it to use 70% lower EUI than standard buildings of its type In 2025+, meet 5% of natural gas demand and 50% of electricity demand using renewables	**48%**	0.6%	When the Civic Centre opens in 2025, construct it to use 30% lower EUI than standard buildings of its type In 2025+, meet 15% of its total energy demand from renewable energy	**29%**	0.3%
Total		**100%**	1.2%		104%	1.3%

*Due to interaction effects within the GHG emissions model, the sum of individual percentages may add up to more than the true sum of all actions modeled as a package

i. City Fleet

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome by 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
R-F1	Reduction in average vehicle distance travelled	By 1-1.5% per year	**9%**	<0.1%	No reduction	**0**	0
R-F2	Improved fuel efficiency in tractors	Annual fuel efficiency improvement of 1.5%	**6.3%**	<0.1%	No reduction	**0**	0
R-F3	Incremental reduction of vehicle ownership	Reduction in 1-2 vehicles per vehicle type (passenger vehicle, light truck, medium truck, etc) per year	**17%**	<0.1%	No reduction	**0**	0
R-F4	Shift from gasoline and diesel vehicles to plug-in hybrid then full electric vehicles	Incremental shift in vehicle types towards electric vehicles (when available) and hybrid vehicles (when good electric options do not exist)	**10%**	<0.1%	Incremental shift in vehicle types towards electric vehicles (when available) and hybrid vehicles (when good electric options do not exist)	**17%**	<0.1%
R-F5	Shift from gasoline and diesel vehicles to full electric vehicles	Incremental shift in vehicles, including local transit buses, off-road construction and tractors/	**40%**	<0.1%	Incremental shift in vehicles, including off-road construction and tractors/	**77%**	0.1%

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome by 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
		equipment, towards full electric options			equipment, towards full electric options		
R-F6	Electricity for hybrid and electric vehicles is renewable	In 2033, shift to 100% renewable energy	**15%**	<0.1%	In 2033, shift to 50% renewable energy	**12%**	<0.1%
			97%	0.2%		100%	0.2%

j. City Lights and Signs

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome by 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
R-LS1A	Improve lighting energy efficiency of streetlights	Replace all remaining streetlight bulbs with LEDs by 2025	**47%**	<0.1%	Replace all remaining streetlight bulbs with LEDs by 2025	94%	**0.1%**
R-LS1B	Improve lighting energy efficiency of cross walks and road signs	Reaching 57% reduction by 2033	**3%**	<0.1%	Reaching 57% reduction by 2033	7%	**<0.1%**
R-LS1C	Improve lighting energy efficiency of traffic signals	Reaching 88% reduction by 2033	**11%**	<0.1%	Reaching 88% reduction by 2033	21%	**<0.1%**
R-LS2	Use renewable electricity for all lights and signs	Reaching 55% by 2033	**43%**	<0.1%	N/A	**0**	**0**
			104%	0.1%		**122%**	0.2%

k. Water and Sewage

		Steep Decline Path			Canada Path		
Result No.	**Objective**	**Desired outcome**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***	**Desired outcome by 2033:**	**GHG Reductions (% of Required Sector Total)***	**GHG Reductions (% of Required City Total)***
R-W1	Decrease energy use at all filling/ pump stations	By 55% in 2024	**16%**	<0.1%	By 20% in 2024	**11%**	<0.1%
R-W2	Increase the percentage of electricity from renewables sources	By 60% in 2025 at the Zone 1 and 2 pump houses and the truck fill station By 60% in 2023 at the Zone 2 pump house	**83%**	0.1%	By 30% in 2024 at the Zone 1 and 2 pump houses and the truck fill station By 30% in 2026 at the Zone 2 pump house	**96%**	0.1%
Total			**99%**	0.1%		**109%**	0.1%

11. Next Steps

Climate change is a comprehensive and wide-reaching topic. This report describes actions that Spruce Grove can take over the next 12 years to help prepare for a changing climate, and to do its part to help our residents live in ways that reduce the number of greenhouses we contribute to the atmosphere.

The plan described above is comprehensive, science-based, grounded in public engagement, and incorporates considerations of equity. It will help us to make our community safer, make current and future generations of residents healthier and more secure, make our economy more vibrant and stable, our environment more sustainable, and our society more inclusive and equitable. This plan is for us to turn into a reality.

12. Acknowledgements

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Internal Team Lead

Caitlin van Gaal, Environmental Advisor

City of Spruce Grove Staff

Members of the Public

- Workshop attendees
- Survey participants
- Spruce Grove Farmer's Market organizers and attendees
- Students from St. Peter the Apostle Catholic High School

Consultant Team

All One Sky Foundation

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Report Design

Avenir Creative Inc.

Downscaled Climate Projections

Prairie Climate Centre
From Risk to Resilience