CORPORATE GREEN FLEET STRATEGY.DOCX

CITY of AIRDRIE
COMMUNITY & OPPORTUNITY

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Executive Summary

The City of Airdrie Green Fleet Strategy outlines a comprehensive roadmap to transition the City's municipal fleet toward a more sustainable and efficient future. As part of our commitment to reducing greenhouse gas emissions and achieving long-term environmental goals, this strategy aims to modernize fleet operations through the adoption of cleaner technologies, renewable fuels, and enhanced operational practices.

Currently, the municipal fleet consists of a diverse range of vehicles and equipment that contribute to the municipality's carbon footprint. Aging vehicles with heavy reliance on fossil fuels, and high maintenance costs present challenges that must be addressed to align with modern sustainability standards.

Key actions outlined in the strategy include transitioning to hybrid and electric vehicles, supported by the development of necessary charging infrastructure. In parallel, the adoption of renewable fuels, such as biofuels or hydrogen, will reduce emissions in vehicle categories where electrification is currently less viable.

Operational improvements, such as vehicle right sizing, implementing anti-idling policies and utilizing fleet management technologies, will further enhance efficiency and reduce fuel consumption. The strategy also prioritizes phased implementation to ensure a practical and scalable transition.

By reducing emissions, improving air quality, and enhancing operational efficiency, the Green Fleet Strategy delivers significant environmental, economic, and social benefits. It aligns with the City's vision for a sustainable future and reflects its stewardship in climate action. This document serves as a call to action for administration, emphasizing the importance of collaboration and commitment in achieving these ambitious but essential goals.

1. Introduction

Amid the pressing challenges of climate change and environmental degradation, the City of Airdrie is dedicated to advancing sustainable practices.

The Government of Canada's 2030 Emissions Reduction Plan outlines a commitment to achieve 100% zero-emission vehicle sales by 2035. Municipalities must take proactive steps to respond to the target for their fleets, especially as manufacturers adapt to this goal. In anticipation, municipalities across Alberta are at various stages of commitment and implementation to sustainable initiatives to reduce greenhouse gasses (GHG's) through municipal fleet assets. (Appendix A).

In December 2023, Airdrie City Council approved the City of Airdrie's Corporate Energy and GHG Reduction Strategy. This strategy details how energy consumption, utility costs, and project implementation expenses will be managed to achieve a 5% annual reduction in energy-related corporate emissions over the next five years (2024-2029).

The Green Fleet Strategy serves as a key initiative aimed at reducing corporate GHG emissions through improved internal processes, increased consideration and use of renewable fuels, and strategic investments in low and zero-emission vehicles and equipment.

By optimizing fleet operations and transitioning to cleaner technologies, this strategy seeks to significantly lower the carbon footprint while establishing a standard for responsible governance. Through collaboration, innovation, and a commitment to sustainability, the Green Fleet Strategy will lay the groundwork for a greener, more resilient future. This approach highlights that environmental stewardship is not merely an obligation, but a valuable opportunity for growth and improvement.

2. Purpose

In 2023, emissions from the City's fleet amounted to 2,130 tonnes of carbon dioxide equivalent (tCO2e), which represents 14% of the total corporate greenhouse gas (GHG) emissions.[1]

The Green Fleet Strategy is designed to reduce GHG emissions associated with the City's vehicle and equipment assets. This strategy aims to enhance operational efficiency through improved internal processes while prioritizing investments in low and zero-emission vehicles/equipment and exploring renewable fuel options.

The primary objectives of the Green Fleet Strategy include:

- Emissions Reduction: Aims to lower the carbon footprint of municipal operations by replacing traditional fossil fuel vehicles with zero-emission or low-emission alternatives and considering renewable fuel options.
- Cost Efficiency: By optimizing fleet operations and utilizing more efficient vehicles, municipalities can reduce fuel and maintenance costs over time.
- Sustainable Practices: Encourages the adoption of environmentally friendly practices in vehicle procurement, maintenance, and operation, fostering a culture of sustainability.

[1] Data is based on city owned vehicles (including Airdrie Transit) only and excludes contracted services.

- Infrastructure Development: Supports the development of necessary infrastructure, such as charging stations for electric vehicles, and consideration of fueling stations for renewable fuels.
- Leadership and Awareness: By implementing a green fleet strategy, municipalities can lead by example, raising awareness about climate action and encouraging residents and businesses to adopt sustainable practices.
- Compliance and Funding: Helps municipalities align with regulatory requirements and access funding opportunities for green initiatives.

3. Current State

Airdrie's corporate fleet (2023) is comprised of approximately 151 vehicles and 290 pieces of equipment. The 2023 fleet composition is described below.

Vehicle Classification	Unit Count	Example Vehicles and Equipment
Light-Duty Vehicles	81	Passenger Cars, Vans, SUV's, Pick-up Trucks
Medium-Duty Vehicles	43	Construction and Low-Profile Dump Trucks, Accessible Transit
Medium-Duty Equipment	45	UTV's, Ride on Mowers
Heavy-Duty Vehicles	27	Dump and Vac Trucks, Fire Apparatus
Heavy-Duty Equipment	39	Graders, Loaders and Backhoes, Skid Steer/Forklift, Transit Busses (ICE)
Stationary Equipment	9	Backup Generators
Small Equipment	197	Push mowers, weed whackers, chainsaws
Total	151 Vehicles, 290 Equipment	

Previous initiatives aimed at reducing GHG emissions related to city fleet have included:

- Establishing a corporate vehicle pool for business travel.
- Implementing Automatic Vehicle Locator (AVL) technology to enhance fleet management.
- Utilizing lighter vehicle components to decrease the overall energy demand
- Choosing LED lighting to reduce power demands by ensuring essential lights stay on without the need to run the engine
- Collaborating with client groups to choose appropriately sized vehicles for specific business needs (e.g., selecting 4-cylinder turbo engines instead of V8s).
- In field testing of hybrid and electric vehicles
- Networking with peers and industry experts, and attending seminars to stay apprised of current and evolving technologies, opportunities, and challenges
- Offering annual externally provided equipment training that covers techniques and use, reducing wear and fuel consumption.

- Purchasing first hybrid pick-up truck in 2025.

3.1 Transit and Active Transportation

The City of Airdrie, in collaboration with nine other municipalities across Alberta, has partnered with Fortis Alberta and their consultants to conduct a feasibility study for electric buses. This initiative aims to provide an evidence-based assessment of Airdrie Transit operations, exploring the potential future implementation of electric bus technologies. The project is funded through Infrastructure Canada's Zero Emission Transit Fund, with additional contributions from Fortis Alberta. The final report is expected to be completed by January 31, 2025.

Active Transportation will also enhance the Green Fleet Strategy. Airdrie is currently developing its first Active Transportation Plan, which will establish a connected network of accessible routes, offering employees active travel options to reach various destinations and facilities within the city. This plan underscores the City's commitment to promoting healthy and environmentally friendly alternatives to motor vehicle use.

4. Operational Best Practices

Effective fleet management encompasses strategies that optimize vehicle use and enhance fuel efficiency while balancing operational needs.

The following operational practices should be viewed as ongoing:

- Vehicle Sharing: Minimizing the number of vehicles traveling to jobs, projects, or meeting sites whenever possible.
- Efficient Driving Behavior and Compliance with the Anti-Idling Policy: Utilizing AVL data to monitor vehicle usage and fuel consumption, ensuring staff drive safely and efficiently while adhering to the City's anti-idling policy. This will be complemented by targeted staff training on specific issues.
- Regular Maintenance and Repairs: Committing to proactive and regular maintenance of vehicles to maximize efficiency and extend their lifecycle.
- Education and Awareness: Providing training to City staff to facilitate change management and communicate the impacts of new technologies or policies on their roles.

4.1 Vehicle Acquisition and Replacement

Transitioning to a renewable fuel or zero emission fleet involves unique considerations across financial, logistical, technical, safety, and operational dimensions, necessitating strategic planning and careful implementation.

The Fleet Capital Committee (FCC) was formed in 2022 to promote a collaborative approach in reviewing and recommending new and replacement vehicles and equipment. The FCC brings together individuals with diverse expertise, experiences, and responsibilities within the City, aiming to ensure effective communication of all research and information. When reviewing new and replacement vehicles for purchase, the FCC will consider:

4.1.1 Right-Sizing

- **Current Fleet Utilization**: Analyze how often each vehicle is used, including mileage, fuel consumption, and maintenance costs. This data helps identify underutilized vehicles that may be candidates for reassignment or elimination.
- **Operational Needs**: Assess the specific requirements of different departments within the municipality. Consider the types of services provided, the geographic area covered, and the types of vehicles needed for various tasks.
- **Vehicle Types and Suitability**: Ensure that the fleet includes the right mix of vehicle types for the tasks at hand. This could involve upgrading to more efficient vehicles, adopting electric vehicles, or utilizing those powered by renewable fuels to better align with current operational needs.
- **Future Growth and Changes**: Anticipate future needs based on projected growth or changes in service delivery. This foresight can help avoid over-committing resources or underestimating future vehicle requirements.

4.1.2 Technology Readiness

- **Technology Readiness Levels (TRL):** Assess the maturity of the technology. This includes evaluating whether the technology is commercially available, in pilot testing, or still in development.
- **Infrastructure Compatibility:** Determine if existing infrastructure (like charging stations or fueling facilities) can support the new technology. This includes assessing the need for upgrades or new installations.
- **Operational Reliability:** Evaluate the reliability of the technology in real-world conditions. This entails evaluating performance data, maintenance needs, and the capability to meet service demands under all weather conditions.
- **Training and Expertise:** Ensure that personnel are trained to operate and maintain the new technology.
- **Support and Maintenance:** Assess the availability of parts and vendor support for maintenance. Reliable access to service and components is crucial for minimizing downtime.
- **Regulatory Compliance:** Confirm that the technology meets local, provincial, and federal regulations regarding emissions and safety standards.

4.1.3 Infrastructure

- **Charging Stations**: Charging stations are required to support hybrid and electric vehicles.
- **Fueling Stations**: Renewable fuels like hydrogen, natural gas, or propane, require dedicated fueling stations. Could consider partnerships with local fuel stations.
- **Storage systems:** Each type of fuel requires specific storage systems to ensure safety, manage supply, and enable efficient transportation. Could be managed by a third party.

- **Maintenance Facilities**: Fleet shop and/or service centers equipped to handle the specific needs of zero-emission vehicles, including specialized tools and training for technicians.
- **Incentives and Funding**: Government grants and incentives can help fund the development of necessary infrastructure, making it more feasible for municipalities and private entities to invest.
- **Data Management Systems**: IT systems for monitoring usage, maintenance needs, and performance metrics of the infrastructure to optimize operations.

4.1.4 Financial Impacts

- **Upfront Costs**:
    1. Electric vehicles (EVs) generally have higher initial costs compared to internal combustion engine (ICE) vehicles due to battery costs, manufacturing costs and ongoing research and development. Savings are often realized in operating costs.
    2. Hydrogen fuel cell vehicles are typically more expensive due to the cost of fuel cell technology and limited production scale and have similar operating costs to ICE.
    3. Natural gas and propane vehicles have specialized fuel systems resulting in higher initial costs.
- **Charging Infrastructure Investment**: The installation of charging stations includes the physical infrastructure and could include upgrades to facility electrical systems. Similarly, the development of fueling stations for hydrogen, natural gas, and propane vehicles is crucial for supporting the transition to renewable fuels.
- **Total Cost of Ownership (TCO)**: A comprehensive measure that includes all costs associated with owning and operating a vehicle over its lifetime.
- **Cost-Benefit Analysis**: A lifecycle cost-benefit analysis will evaluate the initial investment against long-term advantages, such as reduced emissions and operational savings.
- **Regulatory Landscape**: The varying and changing regulations, incentives, and mandates at provincial and federal levels can complicate transition planning.

5. Emerging Technologies and Fuels

Airdrie has identified opportunities to enhance its fleet through the exploration of emerging technologies and fuels. Detailed descriptions of these technologies and fuels can be found in Appendix B.

5.1 Electric Technologies

In recent decades, electric transportation technologies have rapidly evolved and gained traction in the municipal sector. These innovations significantly reduce or eliminate tailpipe emissions

while greatly enhancing energy efficiency. The current electric vehicle technologies available include:

- Mild Hybrid Electric Vehicles (MHEV)
- Hybrid Electric Vehicles (HEV)
- Plug-in Hybrid Electric Vehicles (PHEV)
- Battery Electric Vehicles (BEV)
- Hydrogen Fuel Cells (FCEV)

5.2 Renewable Low-Carbon Fuels

Transitioning to low-carbon fuels is one of the quickest methods to decrease emissions in the short term. This process involves shifting a fleet's fuel consumption from traditional fossil fuels to renewable energy sources. Options include:

- Biodiesel
- Ethanol
- Compressed Natural Gas (CNG)
- Renewable Natural Gas (RNG)

6. Charting the Path to a Greener Municipal Fleet

The Green Fleet Strategy will necessitate a coordinated and strategic approach to researching, assessing, and implementing opportunities within Airdrie's fleet operations. The goal is to reduce the city's carbon footprint, enhance air quality, and exemplify leadership in environmental stewardship. By pursuing these short-, medium-, and long-term actions, Airdrie can effectively transition to a green fleet while maintaining operational continuity and sustainability.

6.1 Recommended Approach

Short-Term (2025-2027)
Initiatives encompass more immediate actions that can be implemented to begin reducing the City's carbon footprint. Even with the fleet's ongoing expansion due to growth, these short-term strategies will lead to a small reduction in greenhouse gas emissions compared to the business-as-usual (BAU) scenario.
• **Develop Green Fleet Framework:** Create a framework with a focus on reduced GHG's as a key consideration when replacing or purchasing new fleet vehicles and equipment. • **Data Gathering:** Using new fleet management software to collect baseline data in a manner that facilitates tracking relevant Key Performance Indicators. • **Explore Renewable Fuels:** Investigate renewable fuel options for the existing fleet.

- **Infrastructure Planning:** Develop guidelines for installation of charging stations at municipal facilities for operational use.
- **Consider Hybrid Vehicles:** Evaluate the practicality of incorporating hybrid vehicles as alternatives.
- **Optimize Fleet:** Assess vehicle usage to identify underutilized vehicles that could be redeployed or eliminated further lowering emissions.

Medium-Term (2028-2033)

These measures, while requiring more time and resources, are crucial for achieving substantial reductions (~17% compared to BAU), and ensuring long-term environmental sustainability.

- **Expand the Green Fleet**: Replace older, higher-emission vehicles with electric, hybrid, or renewable fuel vehicles across additional departments.
- **Enhance Charging Infrastructure**: Increase the availability of charging stations to support the growing fleet.
- **Employee Education**: Expand educational efforts for employees to include new vehicle technologies.
- **Employee Training**: Implement employee training programs to enhance knowledge and skills in GHG reduction techniques and sustainable practices.

Long-Term (2034-2055)

This approach involves comprehensive and sustained efforts over a longer period, resulting in the most significant impact (~57%) on reducing emissions.

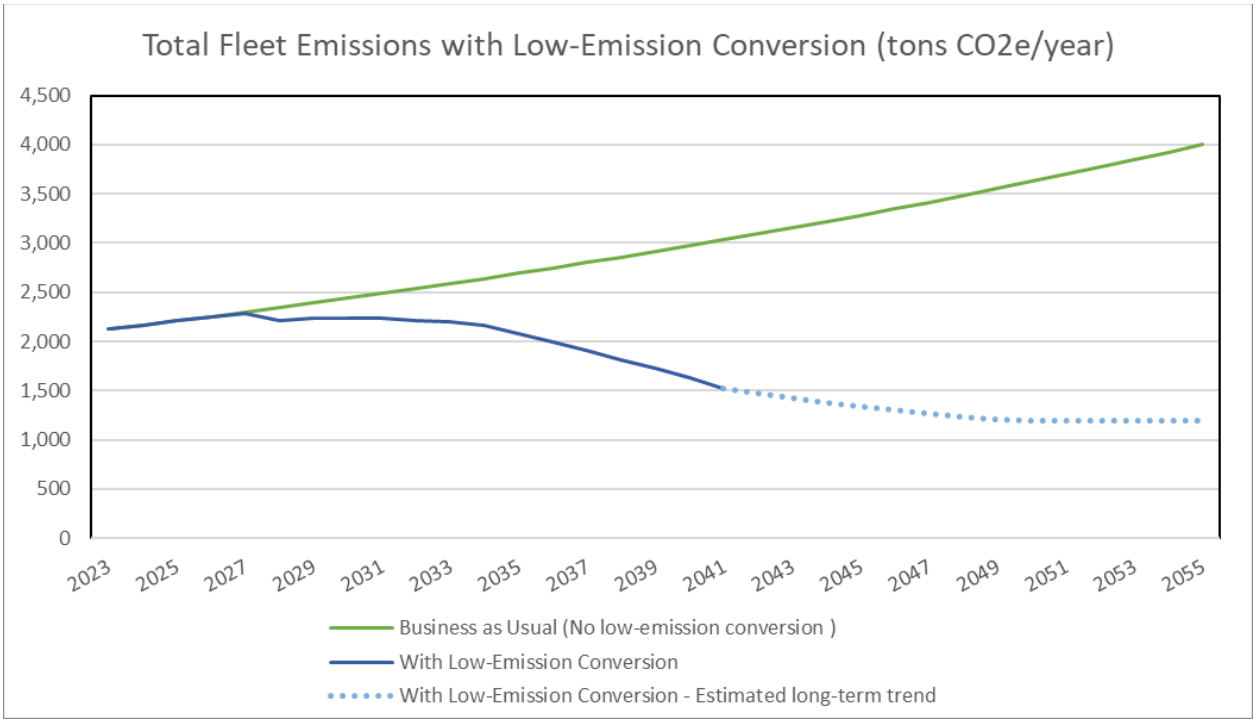
- **Comprehensive Fleet and Equipment Transition:** Pursue a full conversion of the municipal fleet and equipment from traditional internal combustion engines to electric, hybrid, hydrogen fuel cells, or other alternative and emerging technologies.
- **Integrate Renewable Energy**: Consider incorporating renewable energy sources for EV charging stations to further minimize the fleet's carbon footprint.
- **Adopt Future Technologies**: Explore the integration of innovative transportation and fleet management technologies.
- **Commit to Continuous Improvement**: Regularly monitor key performance indicators, evaluate technological advancements, and adjust the fleet to enhance efficiency, reduce costs, and meet future sustainability objectives.

6.2 Forecasted GHG Reductions

The results presented are derived from a snapshot of data. These results are significantly shaped by a series of critical assumptions (Appendix C). These assumptions include projected growth rates, the average expected lifespan of vehicles and equipment, and historical trends. Each of these factors plays a vital role in determining the outcomes, and any variations in these assumptions could lead to different results. Therefore, it is important to consider these underlying assumptions when interpreting the data and the projected greenhouse gas reductions.

Recommended Approach	Business as usual (BAU)	GHG Reduction Compared to BAU
Short-Term (2025-2027)	8% increase	0.2%
Medium-Term (2028-2033)	20% increase	17%

Long-Term (2034-2055) (estimated as of 2040)	34% increase	57%



7. Conclusion

The City of Airdrie Green Fleet Strategy represents a vital commitment to sustainability and environmental stewardship. By implementing this strategy, the City aims to reduce greenhouse gas emissions, enhance operational efficiency, and consider the use of renewable fuels alongside low and zero-emission vehicles.

Through ongoing collaboration, education, and innovation, the City will not only meet its climate goals but also set a positive example for the community. This proactive approach ensures that the fleet remains adaptable to future challenges while contributing to a healthier environment for all residents. Ultimately, the successful execution of this strategy will pave the way for a more sustainable and resilient future.

Appendix A – Municipal Fleet Strategies and Initiatives

Municipality	Comments
Calgary	The City of Calgary is exploring opportunities to reduce fuel consumption and lower fleet greenhouse gas emissions through a variety of programs and initiatives. There are no specific reduction targets for Fleet, the Green Fleet Strategy supports The City's Climate Strategy's goal of net zero emissions by 2050.
https://www.calgary.ca/environment/policies/green-fleet.html	
Edmonton	The City of Edmonton's corporate emissions target of becoming an emissions neutral corporation by 2040, refers to GHG emissions from City-owned and operated assets and operations. There are no fleet specific reduction targets.
https://www.edmonton.ca/city_government/environmental_stewardship/electric-vehicles	
Grande Prairie	In 2014, Council adopted a GHG emissions reduction target of 20% below 2009 baseline levels. This strategy commits the City of Grande Prairie to be carbon neutral in its operations by 2035.

	The Carbon Neutral Operations Plan includes A review of corporate fleet emissions and recommended actions.
https://cityofgp.com/sites/default/files/2022-01/grande_prairie_energy_strategy_april_2021.pdf	
Lethbridge	Energy Master Plan 2021 - Fleet initiatives are focused on reducing the total amount of diesel and gasoline used by City vehicles.
https://www.lethbridge.ca/media/lnydjuyt/energy-conservation-master-plan-strategy.pdf	
Medicine Hat	No official Policy or Strategy
Red Deer	Through the Climate Adaptation Strategy -Reduce energy use and move towards using renewable energy sources -Improve air quality and reduce emissions.
https://www.reddeer.ca/city-services/environment-and-conservation/our-corporate-initiatives/emp/	
St Albert	No official Policy or Strategy
Strathcona County	Fleet Services will continue to utilize and improve upon life cycle costing, condition based and risk assessments to ensure the most economical cost for fleet units. Emphasis will be placed on right-sizing vehicles, including electric vehicles, to match their intended functions and reduce the impact on Strathcona County's carbon footprint.
https://www.strathcona.ca/files/files/cp-business-plan-fleet-services.pdf	

Appendix B - Electric Technologies and Renewable Fuels

Mild hybrid electric vehicles (MHEV) are equipped with internal combustion engines and a motor/generator in a parallel combination allowing the engine to be turned off whenever the car is coasting, braking, or stopped and which restart quickly. MHEV do not have an exclusive electric-only mode of propulsion.

Hybrid electric vehicles (HEV) use two or more distinct types of power, such as an internal combustion engine and an electric motor.

Non-chargeable hybrid vehicles (MHEV and HEV) are a good transition technology from gasoline powered vehicles to electric cars as they offer some of the benefits of electric vehicle without affecting the vehicle's range, driver habits (same vehicle fueling and driving experience) and avoiding driver range anxiety. This makes this technology as a viable alternative to a gasoline powered vehicle if a hybrid counterpart is available.

Plug-in hybrid electric vehicles (PHEV) are hybrid electric vehicles that use rechargeable batteries, or another energy storage device, which can be recharged by plugging it in to an

external source of electric power. The PHEV travels considerable distances in electric-only mode. Once the battery power is low (usually ~80% depleted), the gasoline internal combustion engine turns on and extends the range. These vehicles typically have the same range as their gasoline counterparts.

Plug-in hybrid electric vehicles (PHEV) and battery electric vehicles (BEV) require electricity to recharge the batteries therefore electricity is effectively a “fuel” in these types of vehicles. As such, the emissions from producing electricity should be taken into consideration when evaluating the benefits of this emerging technology.

Battery electric vehicles (BEV) or all-electric vehicles, are propelled by one or more electric motor, using electrical energy stored in rechargeable batteries. Compared with cars with internal combustion engines, electric cars are quieter and have no tailpipe emissions. In recent years, BEV range has been extended considerably. This allows for much wider BEV applications in a variety of functions.

Hydrogen Fuel Cells (FCEV) technology can produce electricity with zero tailpipe emissions presenting enormous environmental and sustainable energy benefits. Fuel cells are flexible in size, power density and application.

Fuel cell technology has been around since 1960’s but the adaptation of the technology has been slow. Only in recent years, supported by the focus on the zero-emissions technologies, hydrogen fuel cell has regained momentum as leading vehicle manufacturers including Honda, Toyota and Hyundai have launched their first mass-production hydrogen powered vehicles.

Hydrogen is the most abundant element in the universe. Canada is one of the world’s largest per capita producers of hydrogen and a global leader in the research and development of these technologies.

Hydrogen can be produced from several sources:

- **Fossil sources** include natural gas, coal and oil
- **Renewable energy sources** such as wind, solar, geothermal, and hydroelectric power

Biodiesel is renewable fuel made from virgin feedstocks and used vegetable oils. Biodiesel can be blended in a variety of ratios with conventional fossil diesel to obtain different blends or it can be used in higher blends. In Canada, primary feedstocks for biodiesel are used cooking oil, followed by canola oil and soybean oil. It is important to note that manufacturer vehicle specifications, biodiesel limitations and seasonality of use must be taken into consideration when implementing higher biodiesel blends.

Ethanol is obtained from the fermentation of sugar or converted starch contained in grains and other agricultural or Agri-forest feedstock. In Canada, ethanol is made principally from corn and wheat.

Ethanol is blended with gasoline to produce a fuel, which has environmental advantages when compared to gasoline. Most gasoline-powered vehicles manufactured since the 1980's can run on a blend of gasoline and up to 10 percent ethanol. Some vehicles (i.e., flex-fuel vehicles) are specially manufactured to operate on an ethanol blend that contains up to 85 percent ethanol and at least 15 percent gasoline (E85). The 15 percent gasoline is needed to assist in engine starting because pure ethanol can be difficult to ignite in cold weather.

Compressed Natural Gas (CNG) is composed of mostly methane, is one of the cleanest burning alternative fuels. It can be used in the form of compressed natural gas (CNG) or liquefied natural gas (LNG) to fuel cars and trucks. Canada is one of the largest producers of natural gas in the world. It can be found in abundance in porous rock formations. It is extracted from the ground, processed to remove impurities, and compressed to be stored and transported by pipeline.

Renewable Natural Gas (RNG) is a methane biogas – a gaseous product of the decomposition of organic matter obtained through biochemical process such as anaerobic digestion.

Appendix C – Trends and Assumptions

Vehicle & Equipment Classification

#	Vehicle & Equipment Type	Example	Quantity
1	Heaters (propane)	For fire hydrants, Hotsy pressure washers, portable office trailers, heaters and tiger torches	25 (estimate)
2	Heavy Duty Equipment	Loader, Excavator, Grader, Forklift/Skid steer, Roller, Tractor Backhoe, Blower	23
3	Heavy Duty Vehicles	Tandem Truck, VAC Truck,	17
4	Heavy Duty Vehicles	Fire apparatus	10

5	Light Duty Vehicles	Car/SUV/Van	80
6	Medium Duty Equipment	Ride on mower, Side by Side Utility Veh.	45
7	Medium Duty Vehicles	1 ton and up truck, Single axle truck	32
8	Rental Equipment [Diesel]	Various, not owned by the city	2 (estimate)
9	Rental Equipment [Dyed diesel]		10 (estimate)
10	Rental Equipment [Gas]		25 (estimate)
11	Small Diesel Power Equipment	Weed whackers, push mowers, water pumps, portable generators, chainsaws	1
12	Small Dyed Diesel Power Equipment		6
13	Small Gas Power Equipment		190
14	Stationary Equipment	Building power back-up generator	9
15	Transit Bus 40'	Transit bus 40'	8
16	Transit Bus 60'	Transit bus 60'	7
17	Transit Van	Transit van	11
	Total		**≈501**

Fleet Assumptions

Growth

- All equipment assumed to grow at 2% per year.
- Modeling assumes fractional equipment counts to estimate emissions, but actual impacts on fleet fuel use and emissions happen when new equipment is added.[2]

GHG Reduction by Vehicle/Equipment Classification

#	Vehicle/Equipment Classification	Average Expected Life	Annual GHG Reduction from Low-Emission Conversion,	GHG Reduction Technology Category	Low Emission Conversion Modeled to Start in

[2] Fractional equipment counts are used in modeling to represent parts of equipment rather than whole units. This approach helps in estimating impacts more accurately when dealing with large fleets or systems.

			Considering Fleet Growth [3]		
1	Heaters (propane)	10	0.5%	Cleaner fuel	2030
2	Heavy Duty Equipment	10	7.0%	H	2034
3	Heavy Duty Vehicles	10	7.0%	H	2034
4	Heavy Duty Vehicles (Fire)	10	4.5%	EV	2033
5	Light Duty Vehicles	10	1.0%	MHEV	2026
6	Medium Duty Equipment	10	3.0%	PHEV	2031
7	Medium Duty Vehicles	10	3.0%	PHEV	2031
8	Rental Equipment [Diesel]	N/A	23% One-time reduction	Cleaner fuel	2030
9	Rental Equipment [Dyed]	N/A	23% One-time reduction	Cleaner fuel	2030
10	Rental Equipment [Gas]	N/A	23% One-time reduction	MHEV	2027
11	Small Diesel Power Equipment	10	0.5%	Cleaner fuel	2028
12	Small Dyed Diesel Power Equipment	10	0.5%	Cleaner fuel	2028
13	Small Gas Power Equipment (	10	0.5%	Cleaner fuel	2027
14	Stationary Equipment	15	0.5%	Cleaner fuel	2030
15	Transit Bus 40'	20	4.5%	EV	2029
16	Transit Bus 60'	20	4.5%	EV	2030
17	Transit Van	8	4.5%	EV	2028

Low Emission Technology Types and Emission Reduction Factors

GHG Reduction Technology Type	Emission Reduction Factor[4]	Note
Hydrogen fuel (H)	90%	15% residual emissions assumed for grey or blue hydrogen

[3] Assuming each year, a certain percentage of vehicles are replaced with low-emissions ones. For example, if a vehicle lasts 20 years, 5% of those vehicles are replaced each year. Specific low-emission reductions are then applied to these replacements.

[4] The emission reduction factor used for each technology category limits the total potential reductions that can be achieved. The emission reduction factor will likely increase over time, but numbers available as of 2024 are used in the modeling. For example, the Government of Alberta has committed to make the grid and reach net zero emissions by 2050 but has not published interim targets between 2029 and 2050. The 0.36-ton GHG/MWh grid emission factor predicted 2029 is used in the modeling and assumed to be constant at 0.36 ton GHG/MWh after 2029.

Standard fuel to electricity (EV)	65%	Emission reduction given the emission intensity of the Alberta grid.
Internal combustion engine (ICE) to plugin hybrid electric vehicle (PHEV)	50%	Emission reduction halfway between EV and MHEV
ICE to mild hybrid electric vehicles (MHEV)	30%	Average of best case (40% reduction) and worst case (15% reduction) based on commercially available vehicles
Cleaner fuel	25%	The Canada's Clean Fuel Regulations regulated 15% reduction by 2030 was converted into an estimated 25% reduction by 2040
Idling reduction	5%	One-time annual fuel use reduction in certain vehicle/equipment category, modelled to happen in 2028; in practice reduced idling practices will be implemented between 2026 and 2030 across the fleet.