EXECUTIVE SUMMARY – LOW EMISSIONS COMMUNITY

The Low Emissions Community report is a Business Plan for emissions reductions in the Saskatoon community. The report is in response to commitments made to address climate change locally in alignment with national and international bodies.

Impactful Strategies

The City of Saskatoon has a number of impactful strategies that complement emissions reductions actions, to create a Low Emissions Community. Impactful strategies that positively affect emissions reductions initiatives include the Green Strategy, the Growth Plan, Transition 2050, and the Official Community Plan. These strategies lay the groundwork for connecting emissions reductions to the corporate strategic plan.

Business Plan Approach

A climate change approach to business practice and lifestyle recognizes the importance of the three “P’s”: profit, planet and people. The experience of an increasing number of cities across North America and worldwide is showing that if a business approach recognizes only one of the three P’s the others suffer. Consequently, the Low Emissions Community Plan creates a balanced-scorecard approach to ensure long term benefits are achieved across all three pillars. Through this balanced-scorecard approach, Saskatoon will transition toward a low emissions community, occurring in a manner that maximizes the potential to achieve short-term benefits and avoid harmful economic, social or environmental disruptions.

The pillars are embedded into three strategic principles used to create recommendations for the Low Emissions Community report. Each strategic principle helps identify initiatives expected to have the highest impact. Estimates appropriate for a planning-level analysis on emissions impact, resourcing and other implications have been included and provide a very preliminary assessment of what is possible, including a what-if scenario for community uptake. Appendix A contains a visual representation, expected expenditure and payback periods for initiatives isolated by emissions reduction impact, optimal financial result and community readiness. It should be noted that further studies are planned and can be expected to adjust the outcomes reported for each strategic principle below.

1. Carbon Reductions – Based on an inventory of best practices created from a scan of municipalities and regions, the opportunities (Appendix B) applicable to Saskatoon that provide the best carbon reduction outcomes would result in reaching a 79% reduction in emissions by the City of Saskatoon as a corporation. The corporation contributes to the broader Saskatoon context and these top opportunities for the community as a whole result in an identified 8% reduction.
2. Business Plan Approach – By focussing on initiatives that deliver the strongest return-on-investment (ROI), quickest payback period and smallest capital investment, 18 initiatives emerged (Appendix C). These initiatives would result in a

65% reduction in emissions by the City of Saskatoon as a corporation and almost 4% reduction at the community level overall. To achieve these outcomes, the City of Saskatoon would need to focus on recognizing a consolidated resource allocation approach, optimizing newer technology, expanding services, and developing continuous improvement practices that deliver resource efficiency. These areas of focus will be further described in the Low Emissions Community report.

3. Community readiness – Adopting a strategy to achieve a Low Emissions Community is by nature, a community process. During engagement events through 2018, a number of initiatives were identified by the community as being more attractive than others (Appendix D). Not surprisingly, these initiatives are most likely to produce the quickest economic payback, and provide assistance for business operations. The top 12 community-centric opportunities result in emissions reductions of 53% for the Corporation with overall community emissions decreasing by 4%.

A weighted average was used to determine the initiatives that showed the best result for all three strategic principles (Appendix E). These included: the financial implications; the community level of readiness; the level of difficulty in proceeding on a regulatory level; number of years to implement; and the payback period. The most impactful initiatives for all three pillars appear to be realized through landfill gas well expansion and retrofitting projects, particularly related to water consumption and energy consumption. Projects currently being explored in the Corporation (Appendix F) will produce over 90% of emissions reductions required to meet Corporate targets, and 12% of the emissions reductions required to meet Community targets.

Next Steps

The next phase in developing the Low Emissions Community report includes mapping and modelling of emissions on a 'business as planned' scenario for Saskatoon and comparing this to a low emissions future. The mapping and modelling will project the effect of emissions reductions activities at the community level, and in the course of providing municipal services. It will also model the implications of enabling and policy initiatives identified through the analysis phase of the project (Appendix G). Financial projections will be transposed onto the modelling to produce Marginal Abatement Cost Curves (MACC). Available funding options for residents, businesses and the City of Saskatoon as a corporation will be identified where possible, and financing techniques explored. Timelines for implementation and measurements for success will be identified in order to report on the implementation results and develop the next set of targets in 2023 to lead to an 80% reduction in 2050.

The Low Emissions Community Plan is expected to be ready in June.

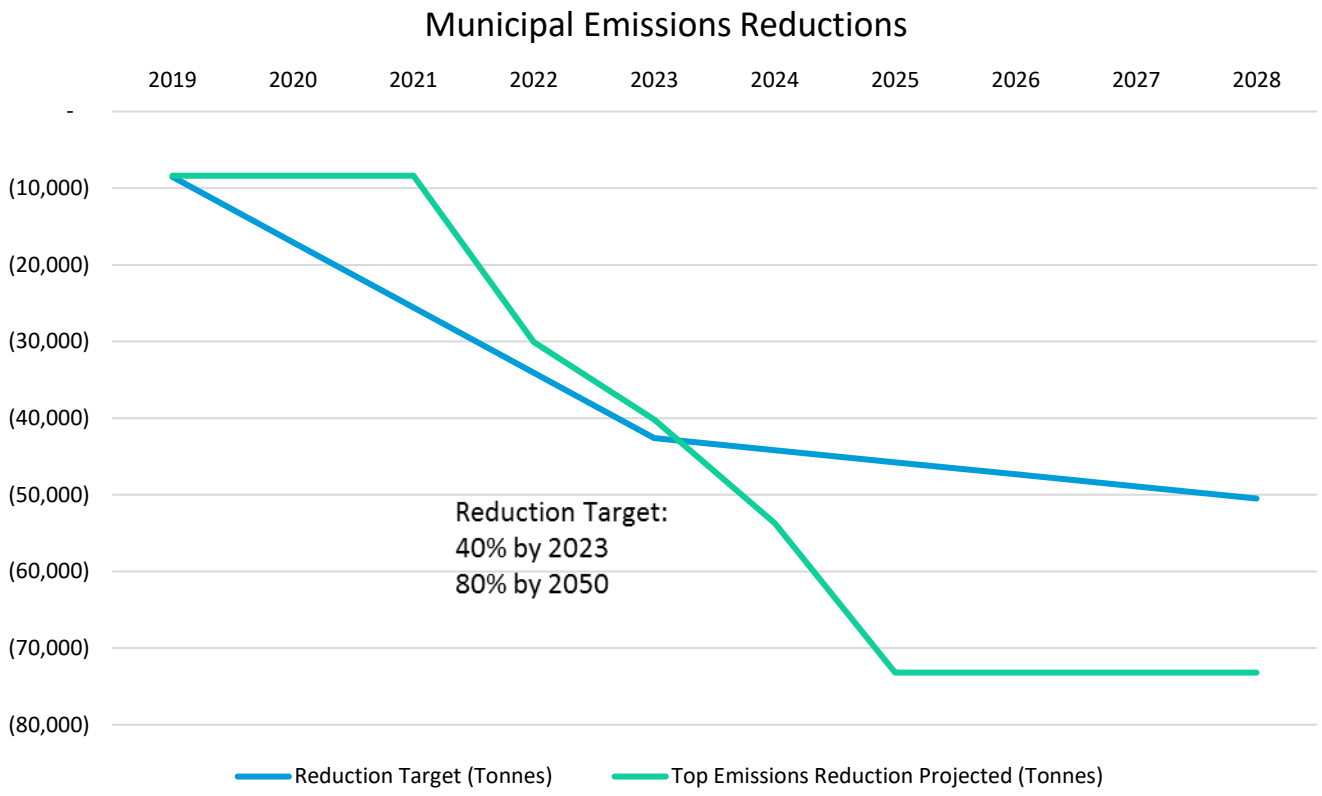
Resource Implications

Preliminary estimates of the municipal capital investment required to unleash the benefits of a Low Emissions Community, based on the recommended initiatives contained in this report, range from $163.6M (if focussing on 10 highest weighted initiatives) to $266.5M (if focussing on the initiatives providing the quickest payback and

most effective ROI).

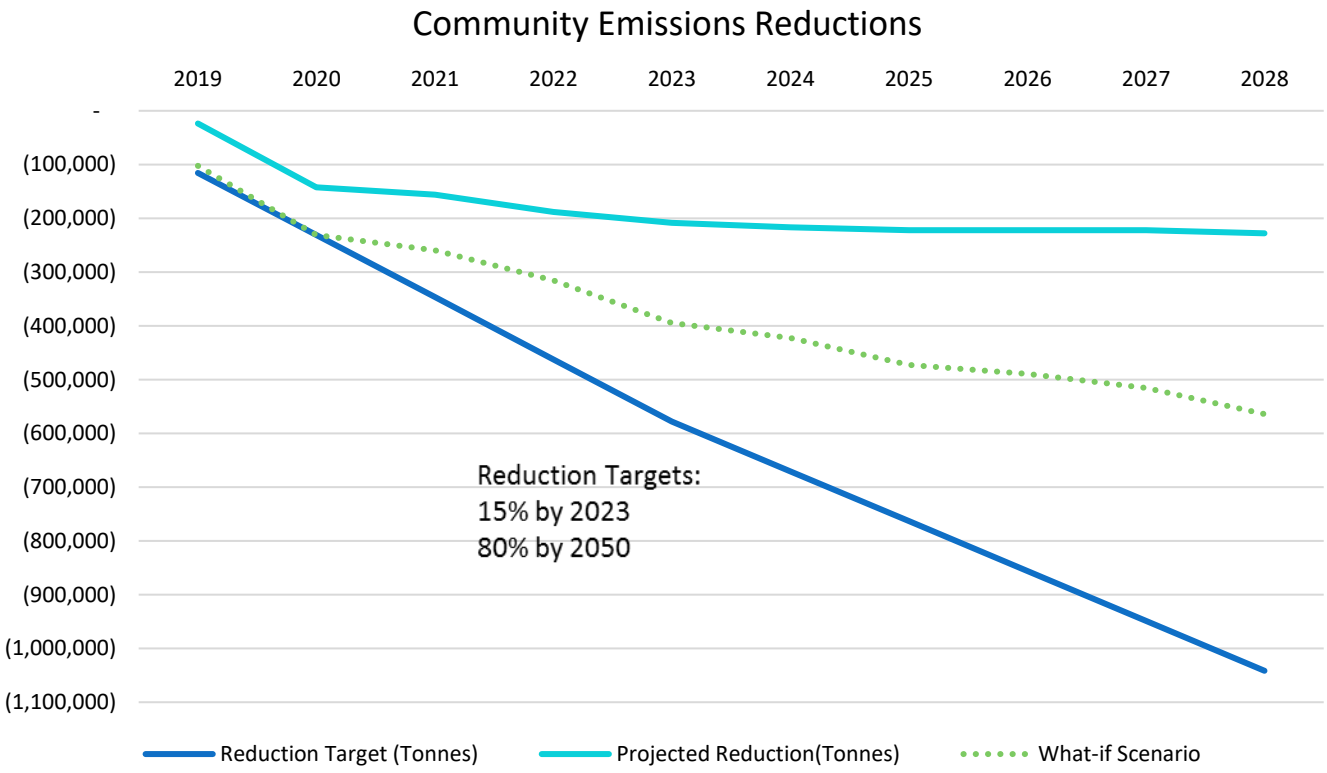
In addition to realizing future balanced-scorecard benefits, the Low Emissions Community Plan is anticipated to reduce the financial exposure of the City of Saskatoon and broader community to a future Carbon Price. The Saskatchewan Provincial Government is expected to release a climate change strategy in January 2019, to respond to the call from the Canadian Federal Government to reduce emissions and impose a carbon pricing strategy. However, the climate change strategy is not expected to include a price on carbon. In the absence of a carbon pricing strategy, the Federal Government is mandating the Federal Carbon Pricing Backstop program, effective in April 2019. Emissions reductions should decrease the carbon price liability for the community, particularly related to energy consumption and fuel costs. See Appendix H for more details around the carbon price impacts for Saskatoon at a municipal level.

Appendix A: Emissions Reductions and Targets



The community Emissions reductions include a what-if scenario in order to visualize the possibilities of other items not considered in the original projections analysis. These possibilities include the following:

1. SaskPower reaching their 40% renewables target by 2030.
2. Increased uptake of residential and commercial businesses of renewable energy renovations.
3. Increased uptake of active transportation.
4. An increase in use of public transit.
5. Large scale deep energy retrofits within one entire residential neighbourhood.
6. Increased uptake for residential LED replacement programs.



Appendix B – Opportunities with most Impactful Emissions Reductions

Corporate Opportunities

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions reductions	Implementation length (years)	Payback period (years)	NPV
Energy	Complete the small-scale hydro project at the weir	19,480	$ 355	7	16.00	+
Waste	Improve efficiency and collection of landfill gas collection/generation system (where feasible) LFG expansion project	18,603	$ (220)	4	NA	+
Parks, Gardens, Green Space	Afforestation Plant additional trees and greenspace in unused areas to capture carbon, such as boulevards, right of ways, industrial areas, etc	8,750	$ 1,206	6	NA	-
Energy	Install solar PV on civic buildings	6,240	$ 554	1	25.00	-
Buildings & Infrastructure	Retrofit existing civic buildings with an equipment focus (includes making all city facility lighting LED indoors, toilets, faucets, etc) *EPC including lighting, HVAC, water and COGEN upgrades/retrofits*	5,931	$ (872)	11	10.00	+
Buildings & Infrastructure	Require LED street lighting for all new and existing neighbourhoods.	5,743	$ (2,250)	5	3.40	+
Policy, Planning, Development	Strategic infill development - specific geographies with specific timeframes (such as North Downtown development, whereas the Growth Plan is an overarching strategy). Ensure this Opp includes the UofS masterplan and Riverlanding and City Centre Plans. **For example:** Adopt the North Downtown Masterplan, a sustainable infill neighbourhood design	5,365	$ (11,415)	15	5.00	+

Transportation	Implement electric vehicles Fleet. A green fleet policy that includes life cycle considerations before procuring/renting equipments and vehicles: e.g. determine which vehicles and equipment are least costly after taking into account capital costs, maintenance costs, resale costs, fuel costs, carbon pricing, and GHG emissions. *Convert City-owned buses, vehicles, and equipment to electric (where feasible)*	4,793	$ 23,596	6	25.00	-
Energy	Construct a pilot project that converts waste wood into sequestered biochar	4,343	$ 8,290	5	NA	-
Energy	Create a Feed-In-Tariff Program to allow customers who install renewable power to receive a price for the electricity they produce that reflects actual installation costs plus a modest profit.	3,120	$ 431	4	NA	-
Policy, Planning, Development	Incorporate specific environmental and climate change provisions into the City's Official Community Plan and Environmental Policy	2,130	$ 33	1	NA	-
Total		**84,497**	**$ 19,707**			
	% Emissions reductions	79%				

Community Opportunities

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions reductions	Implementation length (years)	Payback period (years)
Buildings & Infrastructure	Installation of residential and commerical Air source heat pumps or Ground source heat pumps / Geothermal When combined with a highly efficient building envelope, air source heat pumps are a cost effective way to heat buildings with renewable electricity. Provide support and education to increase their use in Saskatoon. Ground source heat pumps are a clean and energy-efficient technology for heating and cooling buildings utilizing heat in the ground.	54,107	$ 280	2	NA
Transportation	Champion carpooling, ridesharing and car sharing programs. Play a leading role in providing incentives to Car Shares (e.g. no parking costs throughout the City, more Car Share designated parking spaces, and financial assistance to start-up organizations such as the Car Share Co-op).	11,043	$ 252	2	3.32
Buildings & Infrastructure	Use Incentivizes: local industry to certify projects through third-party certification programs (e.g. LEED, Passive House, BOMA, Living Building Challenge, Other).	9,299	$ 62	5	NA
Policy, Planning, Development	Install solar/ renewables. Retrofit ICI sector building envelopes. Retrofit ICI sector appliances etc. Loans for retrofits and renewables should be available; this eases the implementation cost for the community.	9,004	$ (2,180)	4	25.00

Buildings & Infrastructure	Incentivize the use of "smart" Thermostats	8,285	$ 97	2	3.07
Parks, Greenspace and & Land use	Increased tree planting in residential neighborhoods	7,205	$ 160	5	NA
Transportation	Adhere to restrictions on polluting vehicles. - would require partnership with SGI (modelled after AirCare program in BC).	6,500	NA	2	NA
Buildings & Infrastructure	Install energy efficient appliances	5,764	$ 3,607	3	NA
Transportation	Utilize Municipal incentive for ultra-low and zero-emission vehicles."electric vehicle purchase program" (similar programs in ontario and BC) - community emissions reductions/ municipality provides the incentive. Work with car dealerships to bring in more electric vehicles, and provide maintenance support for those vehicles. Invest in and create policies for infrastructure to support low and zero emission vehicles	5,380	$ 209	3	115.29
Policy, Planning, Development	One Saskatoon neighborhood Adopts a “Smart City” pilot that integrates a smart grid, smart metres, battery storage (including electric vehicles), and smart transport networks. The program would be organized and run by the municipality; neighborhood residents and business would implement and take advantage of incentives.	5,365	$ (5,736)	7	4.35
Policy, Planning, Development	Implement a model low carbon neighbourhood that includes renewable energy generation, public and active transportation networks, mixed-use zoning, urban agriculture, green buildings, district energy, and green space.	5,365	$ 13	2	2.84
Waste	Utilize Recovery Park: Use item reuse centre, swap and share programs. Utilize Construction and Demolition site at Recovery Park.	4,717	$ -	2	NA

Transportation	Make use of Active Transportation Network.	3,845	NA	3	NA	
Energy	Combined heat and power projects for Municipal buildings - example St. Paul's Hospital Potential for CHP in RUH and City Hospitals to experience similar costs and yield similar results. Not included in this option.	3,551	$ 42	15	6.00	
Transportation	Adopting the anti-idling policy/bylaw. The cost and emissions reductions based on education and implementation for 25 local businesses.	2,262	$ 587	2	NA	
Buildings & Infrastructure	Implement Existing Building Improvements / Retrofits Develop initiatives that support improvements to existing homes (start as pilot project) Implement a large scale retrofit strategy (i.e. that examines building envelope retro-commissioning, blower-door testing, PACE financing, deep energy retrofits) including: 1. building envelope retro-commissioning 2. deep energy retrofits Provide retrofit incentives to make energy and water improvements to existing buildings (residential properties and Industrial, Commercial and Institutional facilities)	2,237	$ 6,760	10	12.44	
Buildings & Infrastructure	Incentive program for implementing energy efficiency in affordable housing. the project is a corporate-owned initiative; the emissions reductions will fall to community (owned by Sask Housing Authority - Provincial body)	2,175	$ (58)	5	2.00	
Energy	Use of LED replacement program/subsidy where households get affordable/free LEDs for household lighting.	2,175	$ (506)	3	1.53	
Buildings & Infrastructure	Transition 2050 - High energy poverty program that will provide incentives (resources/ technical assistance) spefically to low income households.	1,672	$ (76)	5	NA	
Policy, Planning, Development	Implement recommendations of LAP's for development. Ensure the recommendations are adequately resourced (i.e., salary and oversight).	533	$ 188	2	NA	

Transportation	Use EV charging stations installed by the City.	388	$ 1,289	3	NA	
Energy	Implement distributed energy storage systems and/or combined heat and power projects, microgrid projects for new developments and ICI customers, complimented with utility-scale energy storage A microgrid is a localized grouping of distributed energy sources, like solar, wind, in-stream hydro, and biomass, together with energy storage or backup generation and load management tools. Many technologies contribute to grid flexibility: -Constant renewables; -Utility-scale storage; -Small-scale storage	253	$ (21,727)	5	25.00	
Water / Wastewater / Storm Water	Installation of indoor water efficient fixtures, appliances and equipment. This includes the following: 1. rebates for low flow toilets 2. water audits for residential and ICI customers including multi unit dwellings 3. rebates for low flow water fixtures and home improvements Require the installation of low-flow fixtures in all new construction and renovations. Link to building code/performance metrics Ensure that building standards and permit approval processes promote and support water conservation, including water-efficient design, infrastructure and technology and grey water system standards.	169	$ 12,460	10	NA	
Water / Wastewater / Storm Water	Implement grey water programs/projects in both new construction and renovations. Make new homes grey water ready. Outcomes of the pilots could be used to create guidelines, policies, procedures, training, etc. on grey water use in Saskatoon. Provide support and guidance for residents and businesses pursuing grey water systems; Train industry professionals on grey water requirements, strategies, and opportunities so that expertise exists locally;	79	$ 78,145	10	11.37	

Buildings & Infrastructure	Conduct energy & water efficiency audits on an annual basis for all commercial and/or multi-unit residential buildings.	19	$ 2,454,642	10	NA	
Total		**151,392**				
	% Emissions Reductions	8%				

Appendix C – Quickest Payback and Lowest Investment per tonne

Corporate Initiatives: Lowest $/tonne of reduction

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions reductions	Implementation length (years)	Payback period (years)	NPV
Water / Wastewater / Storm Water	Pilot and phase in use of rain water on public lands (parks, golf course, etc.), eventually expand rain water harvesting and irrigation to all city lands	1	$ (156,054)	4	NA	+
Policy, Planning, Development	Strategic infill development - specific geographies with specific timeframes (such as North Downtown development, whereas the Growth Plan is an overarching strategy). Ensure this Opp includes the UofS masterplan and Riverlanding and City Centre Plans. **For example:** Adopt the North Downtown Masterplan, a sustainable infill neighbourhood design	5,365	$ (11,415)	15	5.00	+
Water / Wastewater / Storm Water	Expand rain barrel rebate to include materials to build a custom rain harvesting system and Incentivize drip irrigation systems	100	$ (9,110)	2	3.50	+
Buildings & Infrastructure	Require LED street lighting for all new and existing neighbourhoods.	5,743	$ (2,250)	5	3.40	+
Buildings & Infrastructure	Support strategic tree placement around civic facilities and buildings Plant urban trees close to buildings - shading and reduction of wind speed from tree coverage can lower total annual heating and cooling loads by 5-10%	225	$ (1,979)	1	15.00	+
Transportation	Supply electric vehicle charging at all City facilities	282	$ (1,833)	5	5.00	+
Transportation	Optimization of fleet services operations (e.g., optimize locations for fuel fills and water fill/ all operations). This may mean site locations at ideal locations in the City (such as what Parks has done with some of their shed locations). Route optimization for civic services (including but not limited to - waste services, street sweeping, snow clearing, pothole repair, water repair, streetlight repair).	93	$ (980)	2	8.00	+

Buildings & Infrastructure	Retrofit existing civic buildings with an equipment focus (includes making all city facility lighting LED indoors, toilets, faucets, etc) *EPC including lighting, HVAC, water and COGEN upgrades/retrofits*	5,931	$ (872)	11	10.00	+
Buildings & Infrastructure	Use detailed smart meter data (water, gas, electricity) as a decision making tool and to monitor building performance.	1,351	$ (359)	1	6.00	+
Waste	Improve efficiency and collection of landfill gas collection/generation system (where feasible) LFG expansion project	18,603	$ (220)	4	NA	+
Total		**37,694**				
		% Emissions Reductions	35%			

Corporate Initiatives – Quickest payback period

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions reductions	Implementation length (years)	Payback period (years)	NPV
Water/ Wastewater	Implement rain water harvesting systems on City facilities Examine high-water use facilities for their potential to use rain water in their operations – e.g. through equipment washing, toilet flushing, irrigation, and/or to supplement other water needs	8	$ 11,013	5	(16.44)	-
Water/ Wastewater	Improve road cleaning and sweeping process to reduce water use - use harvested rain water for street cleaning involves installing rain harvesting system and using this to fill existing sweeping trucks Brush or sweep sidewalks and patios instead of using water for cleaning	21	$ 16,160	2	(3.54)	-
Water/ Wastewater	Set water use limits on outdoor spaces Use the LEED 2009 criteria for Water Efficient Landscaping requirements as a guideline for all new greenspaces	33	$ 1,276	1	2.00	-
Transportation	Right-size fleet vehicles. Choose the most efficient vehicle suitable for corporate service delivery needs.	939	$ 47	2	3.00	+
Buildings & Infrastructure	Require LED street lighting for all new and existing neighbourhoods.	5,743	$ (2,250)	5	3.40	+
Water / Wastewater / Storm Water	Expand rain barrel rebate to include materials to build a custom rain harvesting system and Incentivize drip irrigation systems	100	$ (9,110)	2	3.50	+
Policy, Planning, Development	Strategic infill development - specific geographies with specific timeframes (such as North Downtown development, whereas the Growth Plan is an overarching strategy). Ensure this Opp includes the UofS masterplan and Riverlanding and City Centre Plans. For example: Adopt the North Downtown Masterplan, a sustainable infill neighbourhood design	5,365	$ (11,415)	15	5.00	+

Transportation	Supply electric vehicle charging at all City facilities	282	$ (1,833)	5	5.00	+
Water / Wastewater / Storm Water	Offer a leak detection/alert program (through the purchase of leak detection sensors applied to all civic appliances and water fixtures) for City operations and facilities so that leaks can be identified by staff and repaired quickly.	1,461	$ 15	2	5.00	-
Buildings & Infrastructure	Use detailed smart meter data (water, gas, electricity) as a decision making tool and to monitor building performance.	1,351	$ (359)	1	6.00	+
Transportation	Improved telework / work from home policies	632	$ 61	1	6.00	+
Total		**15,933**				
	% Emissions Reductions	15%				

Community: Lowest investment per tonne of emissions reduced

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions reductions	Implementation length (years)	Payback period (years)
Energy	Implement distributed energy storage systems and/or combined heat and power projects, microgrid projects for new developments and ICI customers, complimented with utility-scale energy storage A microgrid is a localized grouping of distributed energy sources, like solar, wind, in-stream hydro, and biomass, together with energy storage or backup generation and load management tools. Many technologies contribute to grid flexibility: -Constant renewables; -Utility-scale storage; -Small-scale storage	253	$ (21,727)	5	25.00
Policy, Planning, Development	One Saskatoon neighborhood Adopts a “Smart City” pilot that integrates a smart grid, smart metres, battery storage (including electric vehicles), and smart transport networks. The program would be organized and run by the municipality; neighborhood residents and business would implement and take advantage of incentives.	5,365	$ (5,736)	7	4.35
Policy, Planning, Development	Install solar/ renewables. Retrofit ICI sector building envelopes. Retrofit ICI sector appliances etc. Loans for retrofits and renewables should be available; this eases the implementation cost for the community.	9,004	$ (2,180)	4	25.00

Energy	Use of LED replacement program/subsidy where households get affordable/free LEDs for household lighting.	2,175	$ (506)	3	1.53
Buildings & Infrastructure	Transition 2050 - High energy poverty program that will provide incentives (resources/ technical assistance) spefically to low income households.	1,672	$ (76)	5	NA
Buildings & Infrastructure	Incentive program for implementing energy efficiency in affordable housing. the project is a corporate-owned initiative; the emissions reductions will fall to community (owned by Sask Housing Authority - Provincial body)	2,175	$ (58)	5	2.00
Waste	Utilize Recovery Park: Use item reuse centre, swap and share programs. Utilize Construction and Demolition site at Recovery Park.	4,717	$ -	2	NA
Water / Wastewater / Storm Water	Utilize the Storm Water Utility credits for Industrial, Commercial and Institutional (ICI) customers. - reduce storm water drain usage The credit is to instal green infrastructure such as rainbarrels, look at how much of your landscape is permeable and a percentage of your stormwater rate is returned based on that percentage. The current utility credit/rebate does not often cover the cost of the improvement (i.e., the green improvement)	-	$ -	1	NA
Policy, Planning, Development	Implement a model low carbon neighbourhood that includes renewable energy generation, public and active transportation networks, mixed-use zoning, urban agriculture, green buildings, district energy, and green space.	5,365	$ 13	2	2.84
Energy	Combined heat and power projects for Municipal buildings - example St. Paul's Hospital Potential for CHP in RUH and City Hospitals to experience similar costs and yield similar results. Not included in this option.	3,551	$ 42	15	6.00
Total		**34,278**			
	% Emissions Reductions	1%			

Community: Quickest payback for investment

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions reductions	Implementation length (years)	Payback period (years)
Energy	Use of LED replacement program/subsidy where households get affordable/free LEDs for household lighting.	2,175	$ (505.56)	3	1.53
Buildings & Infrastructure	Incentive program for implementing energy efficiency in affordable housing. the project is a corporate-owned initiative; the emissions reductions will fall to community (owned by Sask Housing Authority - Provincial body)	2,175	$ (57.67)	5	2.00
Policy, Planning, Development	Implement a model low carbon neighbourhood that includes renewable energy generation, public and active transportation networks, mixed-use zoning, urban agriculture, green buildings, district energy, and green space.	5,365	$ 13.29	2	2.84
Buildings & Infrastructure	Incentivize the use of "smart" Thermostats	8,285	$ 96.59	2	3.07
Transportation	Champion carpooling, ridesharing and car sharing programs. Play a leading role in providing incentives to Car Shares (e.g. no parking costs throughout the City, more Car Share designated parking spaces, and financial assistance to start-up organizations such as the Car Share Co-op).	11,043	$ 252.34	2	3.32
Policy, Planning, Development	One Saskatoon neighborhood Adopts a “Smart City” pilot that integrates a smart grid, smart metres, battery storage (including electric vehicles), and smart transport networks. The program would be organized and run by the municipality; neighborhood residents and business would implement and take advantage of incentives.	5,365	$ (5,736.25)	7	4.35

Energy	Combined heat and power projects for Municipal buildings - example St. Paul's Hospital Potential for CHP in RUH and City Hospitals to experience similar costs and yield similar results. Not included in this option.	3,551	$ 42.18	15	6.00
Water / Wastewater / Storm Water	Implement grey water programs/projects in both new construction and renovations. Make new homes grey water ready. Outcomes of the pilots could be used to create guidelines, policies, procedures, training, etc. on grey water use in Saskatoon. Provide support and guidance for residents and businesses pursuing grey water systems; Train industry professionals on grey water requirements, strategies, and opportunities so that expertise exists locally;	79	$78,145.13	10	11.37
Buildings & Infrastructure	Implement Existing Building Improvements / Retrofits Develop initiatives that support improvements to existing homes (start as pilot project) Implement a large scale retrofit strategy (i.e. that examines building envelope retro-commissioning, blower-door testing, PACE financing, deep energy retrofits) including: 1. building envelope retro-commissioning 2. deep energy retrofits Provide retrofit incentives to make energy and water improvements to existing buildings (residential properties and Industrial, Commercial and Institutional facilities)	2,237	$ 6,760.33	10	12.44
Total		**40,275**			
	% Emissions Reductions	1%			

Appendix D – Community Supported

Corporate Initiatives

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions reductions	Implementation length (years)	Payback period (years)	NPV
Buildings & Infrastructure	Use detailed smart meter data (water, gas, electricity) as a decision making tool and to monitor building performance.	1,351	$ (359)	1	6.00	+
Transportation	Improved telework / work from home policies	632	$ 61	1	6.00	-
Energy	Lights Out Computers Off Electronic Devices Off Policy One-Year Education campaign	138	$ 39	1	7.42	-
Policy, Planning, Development	Incorporate specific environmental and climate change provisions into the City's Official Community Plan and Environmental Policy	2,130	$ 33	1	NA	-
Energy	Increase the power saving settings on all computers	NA	NA	1	NA	-
Parks, Gardens, Green Space	Expand Community, Allotment, Vacant Lot, and Boulevard Gardening opportunities. Designate and reserve uncontaminated land in each neighbourhood for intensive food production. Create incentives for farmers to use this land and for people to obtain their food from these sources.	NA	NA	3	50.00	-
Waste	Improve efficiency and collection of landfill gas collection/generation system (where feasible) LFG expansion project	18,603	$ (220)	4	NA	+
Buildings & Infrastructure	Require LED street lighting for all new and existing neighbourhoods.	5,743	$ (2,250)	5	3.40	+

Transportation	Continue to create improvements to transit. Improving public transportation; including through conventional buses, bus rapid transit, and light rail	1,000	$ 120,000	5	NA	-
Energy	Complete the small-scale hydro project at the weir	19,480	$ 355	7	16.00	+
Policy, Planning, Development	Develop and implement a Climate Action Plan for the corporation Establish an implmentation plan to reduce reductions in GHG emissions from all City operations	1,065	$ 2,160	10	NA	-
Buildings & Infrastructure	Retrofit existing civic buildings with an equipment focus (includes making all city facility lighting LED indoors, toilets, faucets, etc) EPC including lighting, HVAC, water and COGEN upgrades/retrofits	5,931	$ (872)	11	10.00	+
Total		**56,073**				
	% Emissions Reductions	53%				

Community Initiatives

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions	Implementation length (years)	Payback period (years)
Water / Wastewater / Storm Water	Utilize the Storm Water Utility credits for Industrial, Commercial and Institutional (ICI) customers. - reduce storm water drain usage The credit is to instal green infrastructure such as rainbarrels, look at how much of your landscape is permeable and a percentage of your stormwater rate is returned based on that percentage. The current utility credit/rebate does not often cover the cost of the improvement (i.e., the green improvement)	-	-	1	NA
Waste	Utilize Recovery Park: Use item reuse centre, swap and share programs. Utilize Construction and Demolition site at Recovery Park.	4,717	$ -	2	NA
Buildings & Infrastructure	Incentivize the use of "smart" Thermostats	8,285	$ 96.59	2	3.07
Transportation	Champion carpooling, ridesharing and car sharing programs. Play a leading role in providing incentives to Car Shares (e.g. no parking costs throughout the City, more Car Share designated parking spaces, and financial assistance to start-up organizations such as the Car Share Co-op).	11,043	$ 252.34	2	3.32

Buildings & Infrastructure	Installation of residential and commerical Air source heat pumps or Ground source heat pumps / Geothermal When combined with a highly efficient building envelope, air source heat pumps are a cost effective way to heat buildings with renewable electricity. Provide support and education to increase their use in Saskatoon. Ground source heat pumps are a clean and energy-efficient technology for heating and cooling buildings utilizing heat in the ground.	54,107	$ 279.58	2	NA
Energy	Use of LED replacement program/subsidy where households get affordable/free LEDs for household lighting.	2,175	$ (505.56)	3	1.53
Buildings & Infrastructure	Install energy efficient appliances	5,764	$ 3,607.01	3	NA
Water / Wastewater / Storm Water	Utilize the Storm Water Utility credit to residents, so that homeowners can receive tax reductions for reducing storm water runoff from their property (i.e. through the use of rain barrels, rain gardens, drainage improvements, and minimal hardscaping). - reduce storm water drain usage The stormwater fee is currently flat rate because it is area based. There is currently no incentives for residents.	NA	NA	3	NA
Buildings & Infrastructure	Transition 2050 - High energy poverty program that will provide incentives (resources/ technical assistance) spefically to low income households.	1,672	$ (75.94)	5	NA
Buildings & Infrastructure	Use Incentivizes: local industry to certify projects through third-party certification programs (e.g. LEED, Passive House, BOMA, Living Building Challenge, Other).	9,299	$ 61.83	5	NA
Parks, Greenspace and & Land use	Increased tree planting in residential neighborhoods	7,205	$ 160.00	5	NA

Buildings & Infrastructure	Implement Existing Building Improvements / Retrofits Develop initiatives that support improvements to existing homes (start as pilot project) Implement a large scale retrofit strategy (i.e. that examines building envelope retro-commissioning, blower-door testing, PACE financing, deep energy retrofits) including: 1. building envelope retro-commissioning 2. deep energy retrofits Provide retrofit incentives to make energy and water improvements to existing buildings (residential properties and Industrial, Commercial and Institutional facilities)	2,237	$ 6,760.33	10	12.44
Total		**106,504**			
	% Emissions Reductions	3%			

Appendix E – Overall Highest Scoring Opportunities

Corporate Initiatives

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions reductions	Implementation length (years)	Payback period (years)	NPV
Waste	Improve efficiency and collection of landfill gas collection/generation system (where feasible) LFG expansion project	18,603	$ (220)	4	NA	+
Buildings & Infrastructure	Retrofit existing civic buildings with an equipment focus (includes making all city facility lighting LED indoors, toilets, faucets, etc) *EPC including lighting, HVAC, water and COGEN upgrades/retrofits*	5,931	$ (872)	11	10.00	+
Buildings & Infrastructure	Require LED street lighting for all new and existing neighbourhoods.	5,743	$ (2,250)	5	3.40	+
Transportation	Implement electric vehicles Fleet. A green fleet policy that includes life cycle considerations before procuring/renting equipments and vehicles: e.g. determine which vehicles and equipment are least costly after taking into account capital costs, maintenance costs, resale costs, fuel costs, carbon pricing, and GHG emissions. Convert City-owned buses, vehicles, and euipment to electric (where feasible)	4,793	$ 23,596	6	25.00	-
Buildings & Infrastructure	Use detailed smart meter data (water, gas, electricity) as a decision making tool and to monitor building performance.	1,351	$ (359)	1	6.00	+
Transportation	Improved telework / work from home policies	632	$ 61	1	6.00	-
Transportation	Right-size fleet vehicles. Choose the most efficient vehicle suitable for corporate service delivery needs.	939	$ 47	2	3.00	+
Energy	Increase the power saving settings on all computers	NA	NA	1	NA	-
Buildings & Infrastructure	Reduce number of / improve efficiency of vending machines	NA	NA	2	NA	-
Energy	Implement smart plug systems in City facilities	NA	NA	1	NA	-
Total		**37,991**				
	% Emissions Reductions	36%				

Community Initiatives

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonne Emissions reduction	Implementation (years)	Payback period (years)
Buildings & Infrastructure	Installation of residential and commerical Air source heat pumps or Ground source heat pumps / Geothermal When combined with a highly efficient building envelope, air source heat pumps are a cost effective way to heat buildings with renewable electricity. Provide support and education to increase their use in Saskatoon. Ground source heat pumps are a clean and energy-efficient technology for heating and cooling buildings utilizing heat in the ground.	54,107	$ 280	2	NA
Policy, Planning, Development	Install solar/renewables. Retrofit ICI sector building envelopes. Retrofit ICI sector appliances etc. Loans for retrofits and renewables should be available; this eases the implementation cost for the community.	9,004	$ (2,180)	4	25.00
Buildings & Infrastructure	Incentivize the use of "smart" Thermostats	8,285	$ 97	2	3.07
Buildings & Infrastructure	Install energy efficient appliances	5,764	$ 3,607	3	NA
Transportation	Utilize Municipal incentive for ultra-low and zero-emission vehicles."electric vehicle purchase program" (similar programs in ontario and BC) - community emissions reductions/ municipality provides the incentive. Work with car dealerships to bring in more electric vehicles, and provide maintenance support for those vehicles. Invest in and create policies for infrastructure to support low and zero emission vehicles	5,380	$ 209	3	115.29

Policy, Planning, Development	One Saskatoon neighborhood Adopts a “Smart City” pilot that integrates a smart grid, smart metres, battery storage (including electric vehicles), and smart transport networks. The program would be organized and run by the municipality; neighborhood residents and business would implement and take advantage of incentives.	5,365	$ (5,736)	7	4.35
Energy	Combined heat and power projects for Municipal buildings - example St. Pauls Hospital Potential for CHP in RUH and City Hospitals to experience similar costs and yield similar results. Not included in this option.	3,551	$ 42	15	6.00
Energy	Use of LED replacement program/subsidy where households get affordable/free LEDs for household lighting.	2,175	$ (506)	3	1.53
Water / Wastewater / Storm Water	Utilize the Storm Water Utility credit to residents, so that homeowners can receive tax reductions for reducing storm water runoff from their property (i.e. through the use of rain barrels, rain gardens, drainage improvements, and minimal hardscaping). - reduce storm water drain usage The stormwater fee is currently flat rate because it is area based. There is currently no incentives for residents.	NA	NA	3	NA
Water / Wastewater / Storm Water	Utilize the Storm Water Utility credits for Industrial, Commercial and Institutional (ICI) customers. - reduce storm water drain usage The credit is to instal green infrastructure such as rainbarrels, look at how much of your landscape is permeable and a percentage of your stormwater rate is returned based on that percentage. The current utility credit/rebate does not often cover the cost of the improvement (i.e., the green improvement)	NA	NA	1	NA
Total		**93,631**			
	% Emissions Reductions	3%			

Appendix F – Opportunities Currently Being Explored in Saskatoon

Corporate Opportunities

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions reductions	Implementation length (years)	Payback period (years)	NPV
Energy	Complete the small-scale hydro project at the weir	19,480	$ 355	7	16.00	+
Parks, Gardens, Green Space	Afforestation Plant additional trees and greenspace in unused areas to capture carbon, such as boulevards, right of ways, industrial areas, etc	8,750	$ 1,206	6	NA	-
Energy	Install solar PV on civic buildings	6,240	$ 554	1	25.00	-
Buildings & Infrastructure	Retrofit existing civic buildings with an equipment focus (includes making all city facility lighting LED indoors, toilets, faucets, etc) *EPC including lighting, HVAC, water and COGEN upgrades/retrofits*	5,931	$ (872)	11	10.00	+
Policy, Planning, Development	Incorporate specific environmental and climate change provisions into the City's Official Community Plan and Environmental Policy	2,130	$ 33	1	NA	-
Water / Wastewater / Storm Water	Offer a leak detection/alert program (through the purchase of leak detection sensors applied to all civic appliances and water fixtures) for City operations and facilities so that leaks can be identified by staff and repaired quickly.	1,461	$ 14.98	2	5.00	+
Buildings & Infrastructure	Use detailed smart meter data (water, gas, electricity) as a decision making tool and to monitor building performance.	1,351	$ (359)	1	6.00	+
Policy, Planning, Development	Develop and implement a Climate Action Plan for the corporation Establish an implmentation plan to reduce reductions in GHG emissions from all City operations	1,065	$ 2,160	10	NA	-
Transportation	Continue to create improvements to transit. Improving public transportation; including through conventional buses, bus rapid transit, and light rail	1,000	$ 120,000	5	NA	-
Transportation	Improved telework / work from home policies	632	$ 61	1	6.00	-
Energy	Implement virtual net metering to support more opportunities/flexibility for renewable energy (i.e. solar)	624	$ 1,751	2	NA	-

Buildings & Infrastructure	Champion adoption of BOMA BEST / Energy label for our facilities and website	450	$ 2,189	10	25.00	-
Energy	Install solar thermal on City facilities, where appropriate (e.g. indoor and outdoor swimming pools) (9 civic pools in sasktoon not including paddling pools)	52	$ 43,960	3	25.00	-
Policy, Planning, Development	Incorporate GHG emissions as one evaluation criterion for managing contaminated soils. By including evaluation of GHG emissions in this strategy, you are essentially influencing the choice of how to manage soils. Since the big GHG costs are linked to handling of the soils, the influence will likely be to forgo moving of soils (dig and dump) to preferring in situ management options, which may include long term monitoring. Incentivize addition of soil organic matter	7	$ 9,000	25	NA	-
Policy, Planning, Development	Implementing the Growth Plan 1. increasing density - efficiency factor of MU vs SUD 2. increasing intensity of landuse - i.e., mode share for transportation options more likely to include greater active transportation options if infrastructure and facilities are provided for cycling, walking and other non-vehicular modes. be active and public. 3. Improve Future Development standards to become more efficient and environmental. i.e., increasing size of pipes but not putting more pipes in (reducing sprawl).	NA	NA	15	NA	-
Total		**49,172**	**$ 180,052**			
	Emissions Reductions %	53%				

Community Opportunities (including Waste)

Sector	Mitigation Opportunity	TOTAL Emissions Reductions Impact tCO2e	$ per tonnes of emissions reductions	Implementation length (years)	Payback period (years)	NPV
Waste	Utilize Recovery Park: Use item reuse centre, swap and share programs. Utilize Construction and Demolition site at Recovery Park.	4,717	$ -	2	-	-
Energy	Combined heat and power projects for Municipal buildings - example St. Paul's Hospital Potential for CHP in RUH and City Hospitals to experience similar costs and yield similar results. Not included in this option.	3,551	$ 42.18	15	6.00	-
Waste	PAYT - Pay as you throw utility + city wide organics combined - for single family dwellings Adopt Variable Unit Pricing for garbage, with relatively low costs for small bins/amount of waste and high costs for large bins.	26,000	$ 773	2	NA	-
Waste	Recovery Park initiaitve: Increase support for item reuse, swapping, and sharing programs. Set up facilities so that used materials are made available for re-use or upcycling (i.e. furniture, appliances, construction materials), Provide recycling and re-use options for construction and demolition waste.	22,985	$ 1,223	4	NA	-
Waste	Improve efficiency and collection of landfill gas collection/generation system (where feasible) LFG expansion project.	18,603	$ (220)	4	NA	+
Waste	Consider opportunities to process organic waste (and waste water) using anaerobic digestion / methane digesters	8,300	$ 36	6	NA	-
Waste	Implement Organics Waste Program for multi-unit residences - Bylaw based.	3,156	$ 169	3	NA	-
Waste	Mandate new civic buildings and retrofit projects to divert a specific percentage (based on policy development done for recovery park) of their construction waste from the landfill and reuse a certain percentage of building materials in redevelopment projects. - Policy development included in recovery park project.	343	$ 1,212	4	NA	-
Total		**87,656**	**$ 3,235**			
	Emissions Reductions	2%				

Appendix G – Most Impactful Enabling and Policy Opportunities

Currently these initiatives do not have any emissions reduction projections associated to them as an RFP proponent will be selected within the next week to do highly detailed energy mapping and financial modelling. This sophisticated modelling contract will be used to determine how policy changes, educational programs and behavioural changes over time will reduce emissions.

Ratings: # of Initiatives, Bylaw and Policy headings are rated from 1 to 5 as follows:

1 = Worst	Costs are high, benefits are low, community backlash anticipated, low emissions impact, complex implementation, more engagement required, policy and bylaw out of municipal jurisdiction
2 = Poor	Heavier policy/bylaw implementation, higher costs, less buy in, low impact/tonnes reduced, long implementation
3 = Medium	Will likely have policy/bylaw implementation impacts but within municipal jurisdiction, average cost, average buy in, average $/tonne
4 = Good	Higher buy in, good $/tonne, moderate timeline, lower costs
5 = Excellent	No bylaw or policy implications, short timelines, low cost, high buy in, impacts many initiatives

Sector	Mitigation Opportunity	# initiatives affected (1=few, 3=some, 5 = many)	Bylaw implications (scale 1-5)	Policy implications (scale 1-5)	Implementation length (years)
Parks, Gardens, Green Space	Natural Capital Assets Consider the monetary value of our community's natural & green spaces in City planning and financial decision-making.	4	3	3	0
Water / Wastewater / Storm Water	Develop a water conservation strategy for the corporation that identifies water conservation and water recycling opportunities, policies, programs and outreach. Will include Assessing whether there are opportunities to reduce water in the City's vehicle washing facilities. Develop a procedure that considers water conservation.	5	5	4	1
Water / Wastewater / Storm Water	Set a water conservation target for the community.	5	5	4	1
Energy	Establish a municipal Renewable Energy Target to reduce reliance on carbon intense power from the Provincial grid.	5	3	2	1
Policy, Planning, Development	Conduct community GHG Emission Inventories on a regular basis within the business/ corporation. GHG emissions inventories including emissions from all sectors within Saskatoon.	5	5	4	1
Policy, Planning, Development	Ensure that the City of Saskatoon's climate, land use, housing, transportation, asset management and other plans are aligned so that environmental and climate change objectives are met in an integrated way.	5	5	5	1
Policy, Planning, Development	Conduct corporate GHG Emission Inventories on a regular basis GHG emissions inventories including emissions from all City operations.	5	5	4	1
Parks, Gardens, Green Space	Set Biodiversity, Urban Forest, and Green Space Targets.	4	4	2	1
Buildings & Infrastructure	Subsidize training for architects, home builders, carpenters, electricians, plumbers, engineers, planners and other relevant building trades to learn about energy-efficient construction techniques and design.	4	5	4	1

Buildings & Infrastructure	Develop a homeowner education program for residents focused on energy-literacy, sustainability, and green buildings.	4	5	4	1
Policy, Planning, Development	develop design standards for solar-oriented neighbourhoods. Neighbourhood planning should require all lots to have a south exposure not blocked by other buildings. This is possible in a grid with east-west streets.	4	3	3	1
Transportation	Develop education/communication programs and initiatives that help change social norms and reduce dependence on car-focused trips in the community.	4	5	5	1
Water / Wastewater / Storm Water	Develop a water conservation strategy for the community that identifies water conservation and water recycling opportunities, policies, programs and outreach.	5	5	5	2
Buildings & Infrastructure	Implement a Building Code Work towards implementing mandatory performance measures for all new buildings, for example, through a community building code, policy, or minimum energy code. First goal of the code: net-zero buildings Next goal of the code: living buildings Implement a municipal STEP code. 1. Start by requiring EnerGuide 80, R2000 and/or EnergyStar buildings. 2. Then require net-zero-ready buildings. 3. Then require net-zero energy and emission buildings. 4. Incentivize the next step: living buildings Advocate for the province to adopt a building code that requires green building and energy efficiency/conservation.	5	2	1	2

Support Services	Offer grants and rebates for green improvements.	5	5	5	2
Support Services	Offer property tax abatements for green improvements.	5	5	5	2
Support Services	Provide utility incentives for green improvements.	5	5	5	2
Support Services	Offer subsidized loans for green improvements.	5	5	5	2
Support Services	Develop cost-sharing programs for green improvements.	5	5	5	2
Water / Wastewater / Storm Water	Develop a fund specifically for pilot projects. For example, a revolving fund could be put into place for initiatives that will conserve water and have a predictable pay-back period (to replenish the fund).	5	5	4	2
Water / Wastewater / Storm Water	Provide education and training to industry on the City's Low Impact Development (LID) Guidelines.	4	5	5	2
Buildings & Infrastructure	Sustainable Building Policy for civic buildings	4	3	2	2
Policy, Planning, Development	Develop Sustainable Neighbourhood Design Guidelines for New Subdivisions Promote land use strategies that maximize efficiency of urban services provision and reduce emissions of GHGs. Promote greater linkage between land uses and transit, as well as other modes of transportation.	4	4	3	2
Transportation	Impose restrictions on polluting vehicles. - would require partnership with SGI (modelled after AirCare program in BC).	4	2	2	2
Support Services	Improve the City's business model for utilities to ensure that energy, water, and waste reduction are supported and incentivized.	4	3	2	2
Support Services	Work with the provincial and federal governments to allocate carbon tax revenue to municipal programs.	4	4	1	2
Support Services	Enhance public education, training, and communications on climate change and sustainability. Programs need to recognize the linkage between environmental, social, and economic health.	4	5	5	2

Support Services	Develop a corporate green teams program Update the existing strategy: S:\7550 - Environmental Management - PROGRAMS\005 Corporate Sustainability\Green Teams	4	5	3	2
Water / Wastewater / Storm Water	Hire staff focused on water conservation Create a water use/reduction working group made up of City staff from various departments and divisions This cross-divisional group could hold a mandate to identify, support, and implement water conservation initiatives that will help the City of Saskatoon meet its water conservation objectives and target(s).	5	5	4	3
Water / Wastewater / Storm Water	Research potential Residential Water Use Restrictions	5	2	2	3
Energy	Develop a Community-Wide Solar Strategy that includes: 1. Solar ready building policy and design standards 2. PACE financing for solar installation 3. Rebates/subsidize structural engineering costs to ensure residential and commercial structures can support solar panels 4. internal empoyee solar task force to manage relationships and programs related to solar energy	5	5	5	3
Policy, Planning, Development	Building Code amendments that advance buliding performance, renewable energy infrastructure and energy production within the city Zoning bylaw exemptions should be made for set back and encroachment requirements for insulation retrofits. Allow new buildings/developments to provide car-sharing, transit incentives, and cycling facilities in lieu of parking spaces.	5	2	3	3
Buildings & Infrastructure	Provide training to City staff and contractors to learn about energy-efficient construction techniques and design.	4	5	5	3

Buildings & Infrastructure	Make amendments to the Zoning Bylaw (i.e. remove regulatory barriers and clarify existing language that is currently ambiguous) in order to advance green improvements, sustainable buildings, and renewable energy within the city.	4	1	4	3
Energy	Develop Community Energy Plans (CEPs) for new growth areas and regional centres to detail energy use requirements, establish a plan to reduce energy demand, consider alternative forms of energy generation, and improve building efficiencies and siting.	4	5	4	3
Policy, Planning, Development	Work with Regional Partners to identify environmental partnership opportunities in the areas of, for example, climate mitigation and adaptation planning, transportation, green infrastructure, and building and construction.	4	5	5	3
Policy, Planning, Development	Sustainability training for staff Offer environmental and sustainability training for City employees (both general/ awareness training, and specific/project-based training)	4	5	5	3
Support Services	Design Sustainable Procurement Guidelines for the City of Saskatoon so that businesses bidding on municipal projects are evaluated on their inclusion of sustainable products and services. Use purchasing power to promote reductions in GHG emissions by the suppliers of its goods and services, including sustainable procurement practices and bidding standards that encourage contactors to reduce GHG emissions A number of purchasing decisions can be influenced by implementing a sustainable procurement policy and procedures focused on both products (e.g. fixtures, building materials, janitorial and office supplies, equipment) and services (e.g. as procured through Requests for Proposals and Tenders). The savings--both environmental and financial--could be quite significant, due to better efficiency, lower water consumption, longer lifespan of products, and lower maintenance costs. Sustainable purchasing can also drive changes in behaviours that lower both financial and environmental impacts.	4	5	2	3

Policy, Planning, Development	Explore Property Assessed Clean Energy (PACE) financing for green improvements. e.g. www.paceab.ca Enabling	5	2	3	4
Energy	Implement a corporate wide Environmental Management System (EMS)	4	5	3	4
Buildings & Infrastructure	Incentivize local industry to certify projects through third-party certification programs (e.g. LEED, Passive House, BOMA, Living Building Challenge, Other). - Grant Program move to corporate	4	5	4	5
Energy	In order to support an increase in renewables, start investing in research and opportunities for short term and long term energy storage methods including wind power large scale and microwind	4	5	4	5
Buildings & Infrastructure	Support for energy & water efficiency audits on an annual basis for all commercial and/or multi-unit residential buildings.	5	3	2	10

Appendix H – Overview of the Federal Carbon Pricing Backstop and its Potential Implications to the City of Saskatoon

[1] INTRODUCTION

On October 23, 2018, the Government of Canada released additional details on its Pan-Canadian approach to pricing carbon pollution, which includes the federal carbon pricing "backstop." The backstop is established in legislation and applies to those provinces (and territories) who have not met minimum thresholds established by the federal government's coverage benchmark. The benchmark establishes minimum emissions pricing coverage that provinces must achieve. If a province's climate change plan does not meet the benchmark, then the backstop would apply, in whole or in part.

As a result, the Government of Canada announced that the backstop would apply in the provinces of Saskatchewan, Manitoba, Ontario, and New Brunswick because that these provinces had not developed plans that met the benchmark thresholds. In the case of Saskatchewan, the backstop would apply in part as the federal government is accepting some of Saskatchewan's climate plan (more on this in section 2).

The backstop has two main components: (1) a carbon levy (or regulatory charge) applied to fossil fuels, and (2) an Output-Based Pricing System (OBPS) that applies to industrial facilities that emit above a certain threshold. The carbon levy on fossil fuels will apply to gasoline, diesel fuel, and natural gas, among other fuel sources.

The City of Saskatoon uses gasoline and diesel fuel to deliver various services and natural gas to heat its buildings. The application of the backstop in Saskatchewan will have financial implications to the corporation. Under the base-case, or business as usual scenario, estimates are that the plan could add additional gross costs of $2.1 million to the City of Saskatoon by year 2022. Saskatoon could reduce such costs by implementing various mitigation measures.

The purpose of this paper is to provide an overview of the federal approach and its implications to the City of Saskatoon. The goal is to educate the reader about how Canada's proposed plan will work and how it may impact the City of Saskatoon over the short-medium term. In doing so, this paper is organized as follows:

- Section 2 describes how federal pollution pricing will work and includes an explanation of the fuel charge and the OBPS.
- Section 3 explains how revenue generated from the federal plan will be returned to the provinces in which it applies, with a particular focus on Saskatchewan
- Section 4 addresses how the federal plan will apply to the City of Saskatoon and estimates the potential cost implications to it.

It goes beyond the scope of this paper to address the advantages and disadvantages of Canada's approach, the advantages and disadvantages of carbon pricing, or its potential impact on the economy.

[2] CANADA'S APPROACH TO PRICING POLLUTION

2.1 Background

As part of the Pan-Canadian Framework on Clean Growth and Climate Change, the Government of Canada released its "Pan-Canadian Approach to pricing carbon pollution in October 2016. This approach established the "benchmark," which outlines the criteria that carbon pricing systems implemented by provinces and territories must meet.[1]

The goal of the benchmark is to ensure that carbon pollution pricing applies to a broad set of emission sources with increasing stringency (or prices) over time. Under the federal benchmark, Saskatchewan, for example, would be required to place a price on 59% of its emissions, while the remaining 41% would be uncovered. The backstop will cover 62% of Saskatchewan's emissions.

The Government of Saskatchewan has opposed Canada's approach to carbon pricing. In December 2017, Saskatchewan released its own climate change plan, called "Prairie Resilience: A Made in Saskatchewan Climate Change Strategy."[2] Among other things, this plan did not place a broad based price on carbon pollution, but rather created an OBPS system that applies to facilities that emit more than 25,000 tonnes of CO2e per year. The Saskatchewan plan places a price on approximately 11% of its emissions.

Over the past two years, the Government of Canada gave provinces and territories time to implement their own pricing system that would be consistent with the benchmark. The federal plan allowed provinces to choose between (a) an explicit carbon tax, (b) a hybrid approach that includes a carbon levy and an OBPS, or (c) a cap-and-trade system.[3] If provinces or territories did not meet the benchmark, the federal government indicated that it would impose a carbon price backstop in those jurisdictions.

Canada's approach would apply, in whole or in part, in any province or territory that voluntarily adopts the federal system or that does not have in place a system that meets federal standards by January 1, 2019. In any given province or territory, for instance, the backstop could apply in its entirety, in part (as a means of "topping up" a non-compliant system) or not at all. Given that Saskatchewan's plan does not meet the federal benchmark, Canada announced that Saskatchewan will be subject, in part, to the federal backstop.

In June 2018, Parliament passed the *Greenhouse Gas Pollution Pricing Act*, creating the legislative and regulatory framework for the implementation of the backstop. The Act establishes the federal price on GHG emissions applicable, as of January 2019, to any province or territory that requests it, or that has not implemented a compliant carbon pricing regime.

2.2 The Carbon Price Backstop

As noted in section 1, the federal carbon pricing backstop consist of two main parts:

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[1] For more on the benchmark, see https://www.canada.ca/en/services/environment/weather/climatechange/technical-paper-federal-carbon-pricing-backstop.html

[2] For more details see, http://publications.gov.sk.ca/documents/66/104890-2017%20Climate%20Change%20Strategy.pdf

[3] The explicit carbon tax is used in British Columbia, while the hybrid approach is used in Alberta. Quebec (and formerly Ontario) uses a cap and trade approach.

1) A levy on fossil fuels, which will come into effect on April 1, 2019; and
2) An OBPS that applies to large industrial emitters, starting in January 2019.

Canada's plan sees prices applied at $20 per tonne of CO2e in 2019 and are expected to increase by $10 annually, eventually reaching $50 by 2022. Once the federal system goes into effect in a particular jurisdiction, the federal government intends that it will be kept in effect until at least 2022.

2.2.1 Levy on Fossil Fuels

Under the backstop, Canada is applying regulatory charges (or levies) to fossil fuels, including liquid fuels (e.g., gasoline, diesel, aviation fuel, methanol), gaseous fuels (e.g., propane, natural gas, ethane), and solid fuels (e.g., coal, coke). Rates for each fuel subject to the levy will be set such that they are equivalent to $20 per tonne of CO2e in 2019 and increase by $10 per tonne annually to $50 per tonne in 2022. The rates will be based on global warming potential factors and emission factors.

Table 2.2.1 shows the potential price increases on selected fuels over the next four years.

Table 2.2.1 Fuel Levy Increases

Carbon Price Backstop Fuel Price Effects				
	2019	**2020**	**2021**	**2022**
Fuel Type	**$20/tonne**	**$30/tonne**	**$40/tonne**	**$50/tonne**
Gasoline (cents/litre)	4.42	6.63	8.84	11.05
Diesel (cents/litre)	5.37	8.05	10.73	13.41
Natural Gas (cents/cubic metre)	3.91	5.87	7.83	9.79

In general, the levy would apply to fuels that are used in a backstop jurisdiction, irrespective of whether the fuels were produced in, or brought into, the jurisdiction. Generally, the levy will be applied early in the supply chain of each fuel used in a backstop jurisdiction, and will be payable by the producer or distributor. This means that consumers do not pay the fuel charge directly to the federal government

The fuel charges apply to most consumers of the fuel sources including municipalities. However, fuels used for farming and fuels used at a facility whose emissions are accounted for under the OBPS are exempt from the charge.

2.2.2. OBPS

While the fuel levy component of the backstop is relatively straightforward, the OBPS is somewhat more complicated. Basically, the objective of an OBPS is to minimize competitiveness and carbon leakage risks for activities for which those risks are high, while retaining the incentives to reduce emissions created by the carbon pricing signal.[4]

[4] For more see, https://www.canada.ca/en/services/environment/weather/climatechange/climate-action/pricing-carbon-pollution/output-based-pricing-system-technical-backgrounder.html

Instead of paying the charge on fuels that they purchase, industrial facilities in the system will face a carbon price on the portion of their emissions that are above a limit, which will be determined based on relevant output-based standards. The OBPS will apply to industrial facilities located in jurisdictions where the federal carbon pricing system applies and that emit 50 kilotonnes of carbon dioxide equivalent or more per year, with the possibility for smaller facilities (of 10 kilotonnes and above) to opt in.

Facilities that emit less than their annual limit will receive surplus credits from the Government for the portion of their emissions that are below their limit. A facility can trade surplus credits it earns, creating an incentive for facilities to reduce emissions below the limit when cost effective to do so.
The OBPS offers certain "Emissions Intensive Trade Exposed" (EITE) industries extra protection given that much of their revenues are generated in export markets. These industries include: cement, iron and steel manufacturing, lime, and nitrogen fertilizers,

In Saskatchewan, the federal backstop component of the OBPS will apply as a "top up" measure. Much of the OBPS will use the Government of Saskatchewan's plan. Saskatchewan plans to implement its output-based performance standards system on January 1, 2019. It will apply to large industrial facilities that emit 25,000 tonnes or more of carbon dioxide equivalent (CO2e) per year, with the exception of electricity generation and natural gas transmission pipelines. Saskatchewan estimates it will cover approximately 11 percent of the province's emissions.

The federal OBPS will apply to electricity generation and natural gas transmission pipelines, beginning in January 2019. This will cover facilities from those sectors that emit 50,000 tonnes of carbon dioxide equivalent (CO2e) per year or more, with the ability for smaller facilities that emit 10,000 tonnes of CO2e per year or more to voluntarily opt-in to the system over time.

According to Canada, direct proceeds from industrial facilities under the federal OBPS will support reductions in greenhouse gas emissions in Saskatchewan. Details on how this will occur will are expected to be released in late 2018 or early 2019.

Given that the backstop is expected to generate substantial revenues, how will those revenues be used? The next section of this paper addresses this issue.

[3] RETURNING PROCEEDS TO THE PROVINCE/TERRITORY OF ORIGIN

3.1 Background
One of the fundamental features of the backstop is that the Government of Canada intends to return all the revenues generated from the backstop to the province/territory where they originate.[5] This is known as revenue recycling.

In provinces where the backstop is being imposed, such as Saskatchewan, 90% of the revenues generated from the regulatory charge on fuel will be returned to individuals and

[5] The federal Goods and Services Tax (GST) or in some provinces the Harmonized Sales Tax (HST), will be applied to the fuel price after the carbon price backstop is levied. However, any increased revenues in the GST/HST resulting from the backstop are not applicable to this policy.

families through what Canada calls “Climate Action Incentive payments”. The remaining 10% will be dedicated to provide support to small and medium-sized businesses, not-for-profits, and Indigenous communities, and municipalities, universities, schools and hospitals (referred to as the “MUSH” sector).

In Yukon and Nunavut, the backstop revenues will be returned to directly to those territorial governments, simply because they requested that the federal plan be implemented in those jurisdictions.

The proceeds from the OBPS will also be reinvested in the province or territory of origin. Further details on how these investments will be allocated are to be outlined in early 2019.

3.2 Rebates to Households.
According to Canada, under its proposed approach, individuals and families in Saskatchewan will receive a tax-free Climate Action Incentive payment after filing their 2018 tax return starting in early 2019.[6] The rebates are not income-tested and are based on the estimated consumption of fossil fuels by average households.

For Saskatchewan, Canada is also providing a 10% top for those households who live outside one of the province’s two CMA’s. This is intended to offer help residents living in these small and rural communities address their increased energy needs and reduced access to energy-efficient transportation options, such as public transit.

With this proposal, individuals will claim the payment on their tax return. This will involve filling out a short schedule identifying the number of adults and children in the family unit for which payments would be claimed. There will be one claim per family. The process and disbursement of rebates will be managed by the Canada Revenue Agency (CRA).

Table 3.2.1 shows what the rebates would like for Saskatchewan households. As the chart shows, rebates for a family of four living in either the Saskatoon or Regina CMA’s are estimated to exceed $600 in 2019 and $1,400 in 2022.

Table 3.2.1: Average Rebates to Saskatchewan Households

Carbon Price Backstop Rebates to Household $/Year				
Persons	**2019**	**2020**	**2021**	**2022**
First Adult	305	452	596	731
Spouse	152	225	297	364
Child	76	113	148	182
2nd Child	76	113	148	182
Family of Four	609	903	1189	1459

Perhaps the most confusing part of the household rebates is that, on average, they exceed the

[6] For explanation on these payments for Saskatchewan, see https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/saskatchewan.html

estimated fuel consumptions costs of households. This is because some, about 30% of residents, will pay more a year in carbon taxes than they will receive in rebates. On average these tend to be wealthier residents who may have to heat bigger homes or fuel larger vehicles.

As table 3.2.2 shows, the estimated average fuel levy consumption costs for Saskatchewan households. The table illustrates that the net rebate to households exceed $500 by 2022, when the carbon levy reaches $50/tonne of CO2e.

Table 3.2.2 Average Fuel Levy Costs to Saskatchewan Households

Carbon Price Backstop Costs to Household $/Year				
	2019	**2020**	**2021**	**2022**
Family of Four	403	588	768	946
Net Rebates	206	315	421	513

Rebates to individuals and households represent 90% of the estimated revenues generated by the backstop's fuel levy. The remaining 10% will be recycled to the business and institutional sectors of the economy. This section explores what that support may look like.

3.3 Rebates to Business and Institutions

According to Canada, it is estimated to return $445 million in fuel charge revenues over the next five fiscal years to small and medium sized businesses, indigenous communities, not-for-profit organizations, and public institutions.

Table 3.3.1 shows the estimated annual and total support that these organizations will receive over the next five years.

Table 3.3.1 Support for Saskatchewan's Institutions and Businesses

Support to Saskatchewan Non-Households ($ Millions)						
	2019/20	**2020/21**	**2021/2022**	**2022/23**	**2023/24**	**Total**
Institutional* Support	15	25	30	40	40	150
Small & Medium Business Support	30	45	60	80	80	295
Total Support	45	70	90	120	120	445

**Institutional refers to municipalities, universities, schools, hospitals, indigenous communities and not-for-profit organizations.*

Details are unknown on how this support will be provided to these organizations. Canada indicates that the details for these will be develop in early 2019. This support could help the City of Saskatoon reduce its potential cost implications from the implementation of the backstop's fuel levy. The next of this paper explores what the potential costs to the City of Saskatoon might be under a business as usual scenario.

[4] POTENTIAL IMPLICATIONS TO THE CITY OF SASKATOON

4.1 Background & Assumptions
The City of Saskatoon consumes gasoline and diesel fuel to operate its equipment and fleet. It also consumes natural gas to heat City-owned buildings. In order to estimate potential implications to the City of Saskatoon of the federal backstop, we obtained fuel usage data over a period of four years for gasoline, diesel fuel, and natural gas.

Subsequently, we took the four year average of the City's fuel consumption to establish a baseline estimate for 2018. We then forecast annual increases by using a weighted, three year rolling average of the percentage increase in fuel consumption for each fuel source. We assume a business as usual (BAU) approach to estimate future fuel consumption relative to baseline.

Finally, we apply the potential carbon price backstop annual price changes to the City's estimated fuel consumption to determine potential gross cost increases from years 2019 through 2022, on annual basis. The analysis uses gross costs simply because we cannot determine how much backstop generated revenue will be returned to the City by way of the federal plan. As the paper explained in the previous section, Canada will return an estimated $15 million to the "MUSH" section in Saskatchewan, but those details need to be determined.

4.2 City of Saskatoon Fuel Consumption Estimates
Table 4.2.1 shows the estimated fuel consumption of the City using diesel, gasoline, and natural gas. The City's diesel fuel consumption is about five times higher than its gasoline consumption under a BAU scenario.

Table 4.2.1: City of Saskatoon Estimates of Fuel Consumption

Fuel Type	2018e	2019f	2020f	2021f	2022f
Diesel (litres/year)	6,250,264	6,325,267	6,401,170	6,477,984	6,555,720
Gasoline (litres/year)	1,737,562	1,727,136	1,716,774	1,706,473	1,696,234
Natural Gas (m3/year)	10,582,307	10,467,259	10,617,808	10,555,791	10,546,953

In terms of fuel consumption by fleet type, Saskatoon Transit is the City's largest consumer of diesel fuel. Table 4.2.2 shows that Saskatoon Transit consumes on average about 4.4 million litres of diesel fuel per year. By 2022, this is anticipated to reach 4.7 million litres under BAU.

Table 4.2.2: City of Saskatoon Estimates of Diesel Fuel Consumption by Source

Fuel Type	2018e	2019f	2020f	2021f	2022f
Transit (litres/year)	4,476,809	4,526,054	4,580,367	4,635,331	4,690,955
City Fleet (litres/year)	1,773,455	1,799,213	1,820,804	1,842,653	1,864,765
Total (litres/year)	6,250,264	6,325,267	6,401,170	6,477,984	6,555,720

4.3 City of Saskatoon Estimates of Gross Cost Implications from Backstop
Table 4.3.1 shows the estimated gross cost increases to the City of Saskatoon by fuel source.

Based on the preceding fuel consumption estimates and the potential increase in fuel prices from the backstop, total gross cost increases to the City are estimated to be $2.1 million by 2022 (on annual basis) under a BAU scenario.

Table 4.3.1: City of Saskatoon Estimate of Gross Cost Increases from Backstop

Fuel Source	2019f	2020f	2021f	2022f
Diesel	$339,667	$515,294	$695,088	$879,122
Gasoline	$76,339	$113,822	$150,852	$187,434
Natural Gas	$409,270	$623,265	$826,518	$1,032,547
Total	$825,276	$1,252,382	$1,672,458	$2,099,103

Almost half of the City estimated gross cost increases are attributable to natural gas consumption. Chart 4.3.1 illustrates the share of potential cost increases by fuel source.

Chart 4.3.1: City of Saskatoon Share of Estimated Backstop Cost Increases

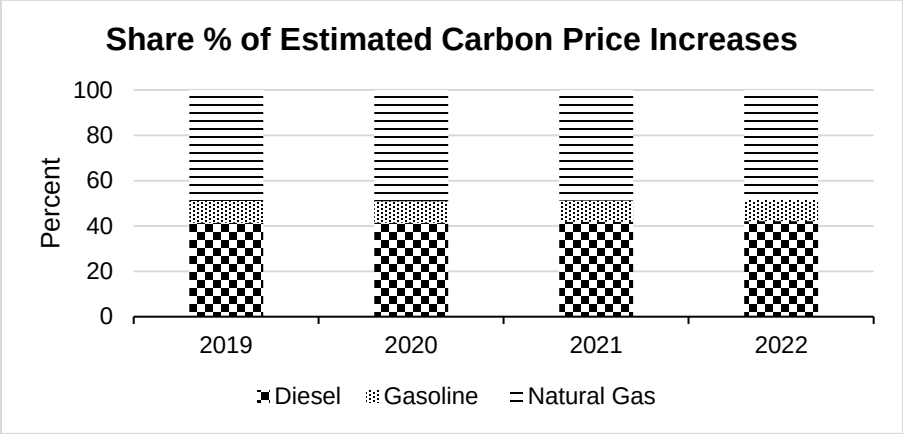

Table 4.3.2 shows the potential cost implications to Saskatoon Transit and the rest of the City fleet as a result of the backstop. As the chart shows, estimated cost increase for Saskatoon Transit under a BAU scenario are estimated to be about $630,000.

Table 4.3.2: City of Saskatoon Estimate of Gross Cost Increases from Backstop

Fuel Source	2019f	2020f	2021f	2022f
Transit	$243,049	$368,720	$497,371	$629,057
Fleet	$96,618	$146,575	$197,717	$250,065
Total	$339,667	$515,294	$695,088	$879,122