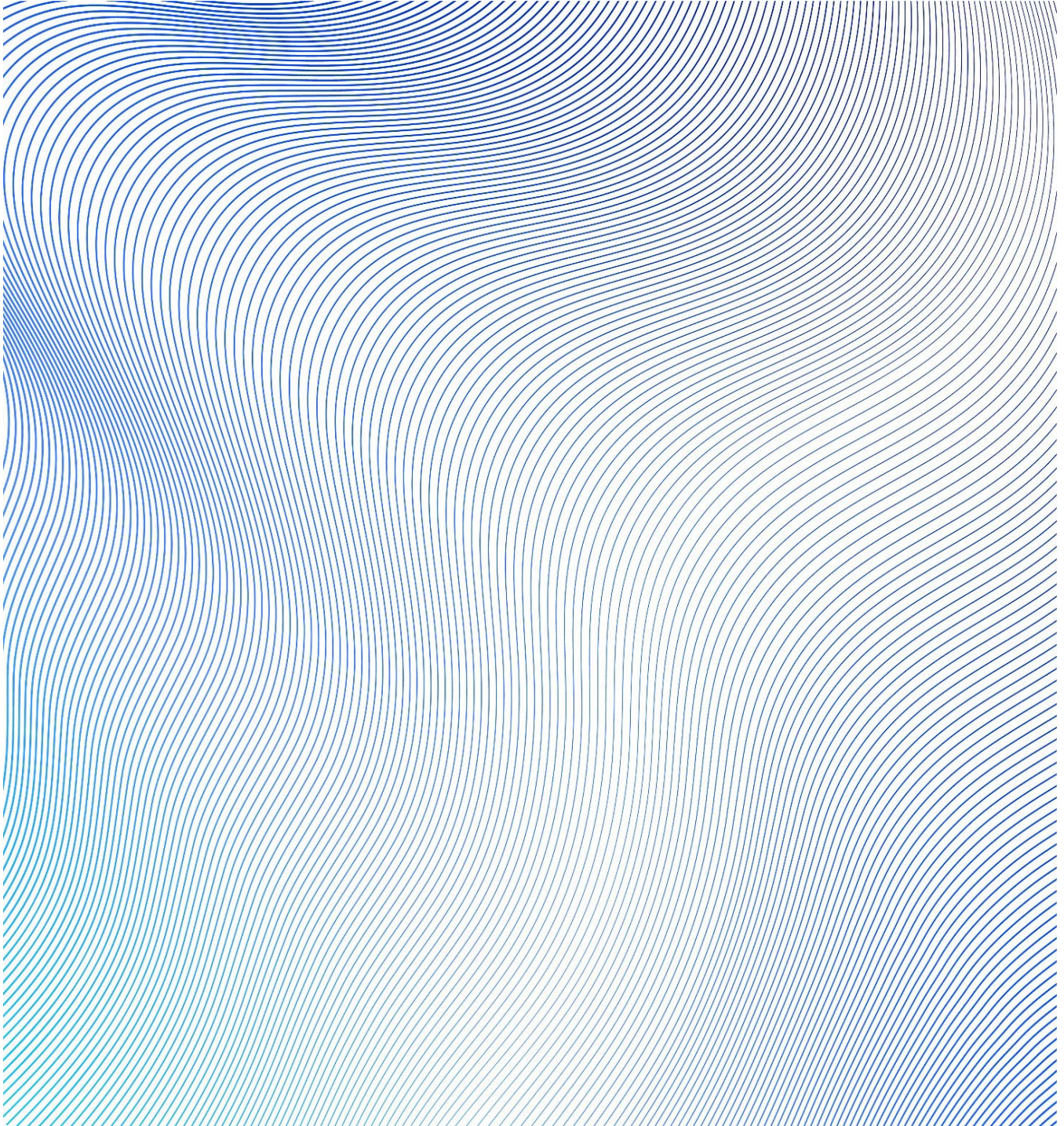


Saskatoon Climate Action Plan Technical Analyses Financial Analysis

Technical Memo



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Key Acronyms

BEB	Battery Electric Bus
BRT	Bus Rapid Transit
CAP	Climate Action Plan
CEEP	Community Energy and Emissions Planning
CER	Canada Energy Regulator (Canada's Energy Future 2023 datasets)
DHW	Domestic Hot Water
GHG	Greenhouse Gas
ICI	Industrial, Commercial, Institutional Sector
MAC	Marginal Abatement Cost
NBC	National Building Code
NECB	National Energy Code of Canada for Buildings
NPV	Net Present Value
SFD	Single-Family Dwellings

1 Introduction

As part of the commissioned technical analyses supporting the development of the updated Climate Action Plan (CAP), the financial analysis provides a consistent framework for assessing the relative cost-effectiveness and greenhouse gas (GHG) emissions reduction potential of proposed mitigation measures to support the City of Saskatoon (City) in identifying and prioritizing mitigation measures and in informing follow-up actions, including direct investment in measures under City control, as well as the development of policies and supportive mechanisms to enable and accelerate community-initiated mitigation actions where the City has direct influence.

2 Cost Benefit Analysis

The financial analysis began by identifying a list of GHG mitigation measures relevant to the actions in the CAP. The measures were then classified as either corporate or community measures based on implementation responsibility and refined into a final measures list consisting of 13 community measures and 10 corporate measures as shown in Table 1 and Table 2.

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Table 1. Community Investment GHG Mitigation Measures List

#	Measure
1	Construct a new commercial, institutional, or industrial (ICI) building to achieve a 40% improvement in energy efficiency
2	Construct a new single-family home to achieve a 40% improvement in energy efficiency
3	Install a rooftop solar PV system on a new ICI building
4	Install a rooftop solar PV system on a new single-family dwelling (SFD)
5	Upgrade the current lighting system in an ICI building with an energy-efficient option at the time of replacement
6	Replace existing space heating, cooling, and domestic hot water systems with heat pump systems in ICI buildings at the time of replacement
7	Replace existing space heating, cooling, and domestic hot water systems with heat pump systems in SFDs at the time of replacement
8	Conduct a deep retrofit of existing ICI buildings with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation
9	Conduct a deep retrofit of existing SFDs with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation
10	Install a rooftop solar PV system on an existing ICI building
11	Install a rooftop solar PV system on an existing single-family home
12	Replace a commercial vehicle with a zero-emission vehicle at the time of replacement and expand workplace and public charging infrastructure in proportion to the number of zero-emission commercial vehicles adopted each year
13	Replace a personal vehicle with a zero-emission vehicle at the time of replacement, and expand home, workplace, and public charging infrastructure in proportion to the number of zero-emission personal vehicles adopted each year

Table 2. Corporate Investment GHG Mitigation Measures List

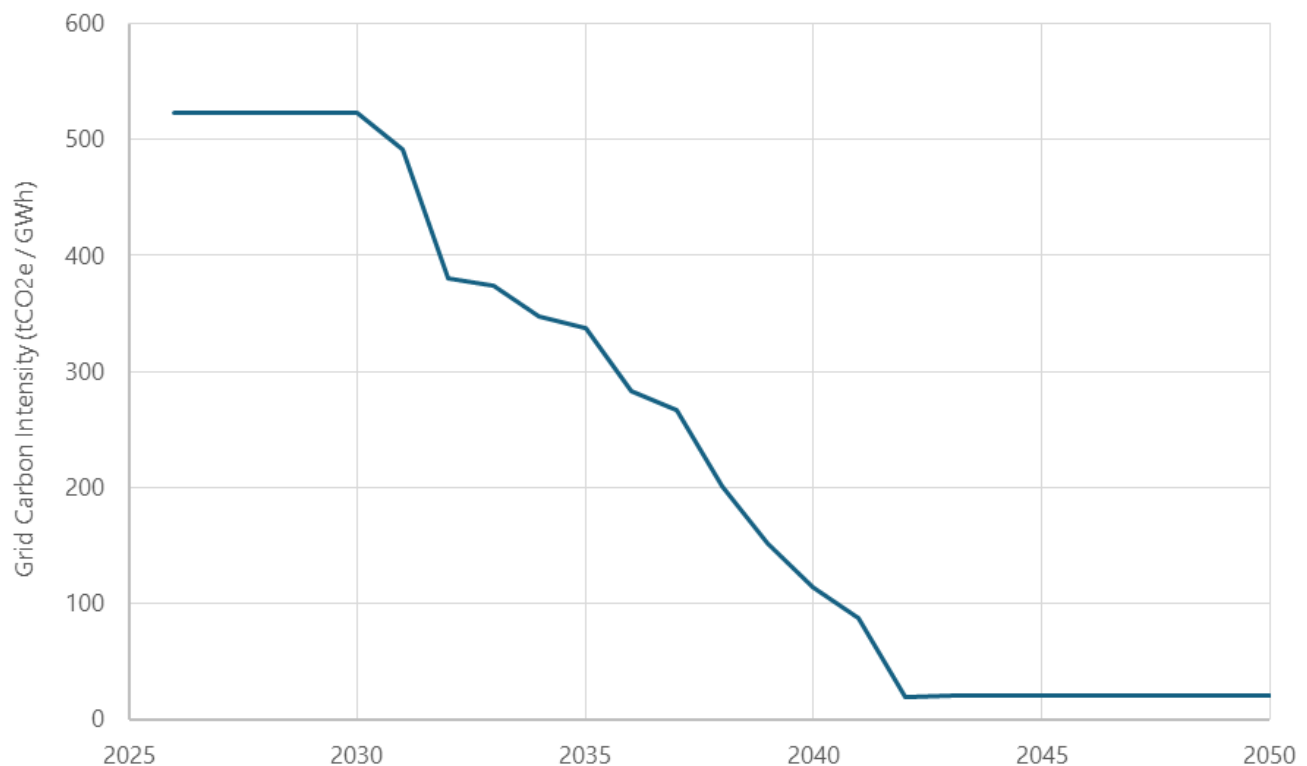
#	Measure
1	Install 48MW utility-scale solar PV systems
2	Construct a new municipal building to achieve a 40% improvement in energy efficiency
3	Electrify existing space heating and cooling systems and domestic hot water (DHW) systems in a municipal building at the time of replacement
4	Conduct a deep retrofit of an existing municipal building with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation
5	Install a total of 0.5 MW of rooftop solar PV on municipal buildings (new and existing)
6	Complete planned cycling and walking infrastructure projects to support mode shift
7	Complete the construction of the Link (Bus Rapid Transit) system in Saskatoon
8	Convert the entire Saskatoon Transit fleet to battery electric buses (BEB), upgrade the facility for on-site charging, and build on-route charging stations
9	Replace a light duty municipal fleet vehicle with a zero-emission alternative at the time of replacement, along with the rollout of charging infrastructure
10	Upgrade and expand the landfill gas collection system to ensure the landfill gas collection rate reaches and is maintained at a minimum of 50%

2.1 Marginal Abatement Cost

The cost-effectiveness of each mitigation measure is assessed using the marginal abatement cost (MAC), expressed in dollars per tonne of carbon dioxide equivalent reduced (\$/tCO₂e). The MAC represents the incremental cost of reducing one tonne of GHG emissions through implementation of a mitigation measure relative to a baseline scenario. For each measure, the MAC is calculated by dividing the total lifecycle cost premium relative to the baseline by the cumulative GHG emissions reductions achieved over the analysis period. Total lifecycle cost premium is calculated as the net present value (NPV) of incremental capital costs and operating costs or savings over the life of the measure (See Section 3: Appendix for detailed calculation methods and assumptions for each measure). Across all measures, the analysis applies the following two assumptions to reflect changes in marginal abatement costs under a grid emissions trajectory that decarbonizes overtime:

- All measures are implemented in 2026.
- The electricity grid emissions factor follows the decarbonized grid trajectory used in the Community Energy and Emissions Planning (CEEP) model developed for the GHG emissions modelling component of this project (as shown in Figure 1), based on electricity generation projections by energy source from the Canada Energy Regulator's (CER) Canada's Energy Future 2023 datasets and further refined based on input from SaskPower and the City (Additional details on the grid pathways established are provided in Section 4 of the GHG Emissions Modelling Technical Memo).

Figure 1. Electricity Grid Sensitivities



Conceptually, "Abatement Cost" is the ratio between cost premium and total GHG emissions reductions of a measure relative to its baseline, over the measure lifecycle. E.g., the abatement cost of "replacing existing space heating, cooling, and domestic hot water systems with heat pump systems in SFDs at the time of replacement" is calculated as the ratio between the total cost premium (capital and operating, in NPV) of heat pump systems

(relative to gas-fired systems) over their lifecycle, divided by their total (cumulative) GHG emissions reductions (relative to gas-fired systems) over their lifecycle. Given that energy rates and electricity carbon intensity are projected to significantly change over time, both the financial and the carbon performance of measures vary during their lifetime. In the building system electrification example, a heat pump system results in higher carbon emissions than a gas-fired system today, due to the high carbon intensity of the electricity grid. However, the same system would result in significant GHG emissions reductions in 2045, when the grid is cleaner. The abatement cost calculation uses total/cumulative values of financial and GHG performance over the measure lifetime (i.e., today's poor GHG performance and the future improved GHG performance). Therefore, the assumption that measures (particularly measures that involve fuel switching from natural gas to electricity) are implemented in 2026 is a key driver to abatement cost performance. With the expected trajectories of grid GHG intensity, fuel switching measures would result in more favorable (lower) abatement cost results if they were implemented later.

2.2 Annualized Emissions Reduction

The emissions reduction potential of each mitigation measure is assessed using the annualized emissions reduction metric (tCO₂e/year), calculated as the emissions reduction achieved by a measure relative to the baseline in a specific year. Although emissions reduction potential can also be evaluated using cumulative lifecycle GHG reductions, this metric was not selected because it can be misleading when measures differ in service life. For example, a measure with higher annual emissions reduction but a shorter useful life may appear less impactful under a cumulative metric than a measure that delivers smaller annual reductions over a longer period. The annualized metric instead provides a representative snapshot of emissions abatement in a given year and supports consistent comparison across measures. This approach also aligns the GHG inventories used to track overall progress towards GHG targets by tracking annual emissions.

Recognizing the substantial impact of electricity grid emissions intensity on the performance of mitigation measures, two reference years were selected to reflect differing stages of grid decarbonization.

- The year 2026 was selected to represent current conditions, based on the 2024 grid emissions intensity of 523 tCO₂e/GWh.
- The year 2045 was selected to represent a low-carbon condition when the grid emissions intensity is projected to decline and remain stable at 20 tCO₂e/GWh, referencing the decarbonized grid trajectory developed in the CEEP model (see Figure 1).

Figure 2. Example Annualized Emissions Reduction from Municipal Building Fuel Switching

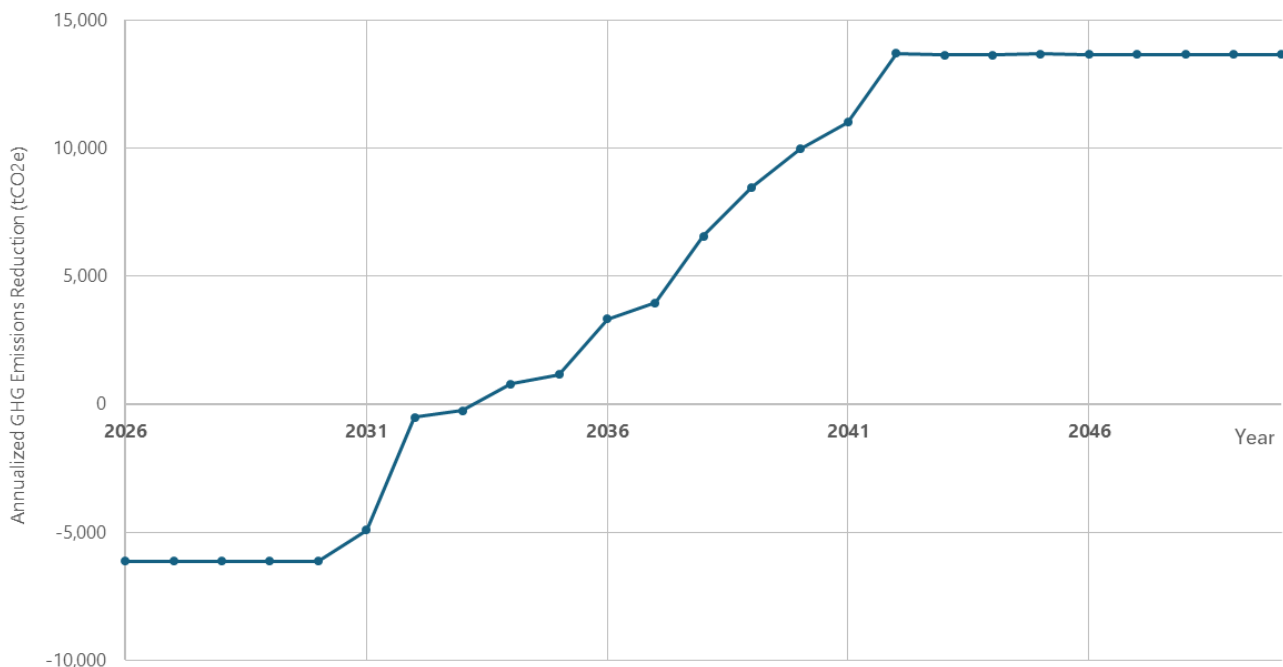


Figure 2 depicts how the annual emissions impact of the fuel-switching measure in municipal buildings changes over its study period. The measure assumes that when existing space heating and domestic hot water systems in municipal buildings reach the end of their service life, they are replaced with electric systems rather than like-for-like combustion-based systems. The 2026 implementation year assumption used in this analysis implies that this is the year when the replacement of mechanical systems takes place.

Electrification is not expected to deliver emissions reductions in the early years when the electricity grid is still carbon intensive. In 2026, switching to electric systems increases emissions, adding approximately 6,130 tCO₂e compared to the baseline case. As the electricity grid becomes cleaner over time, the measure begins to deliver net emissions reductions. This occurs when the grid emissions factor is projected to drop to approximately 347 tCO₂e/GWh in 2034, representing the turning point when electrification begins to outperform combustion-based systems in terms of emissions reduction. Emissions reductions continue to grow as the grid further decarbonizes. By 2045, the measure is estimated to reduce 13,664 tCO₂e of community emissions annually compared to the baseline.

Leveraging annualized emissions reduction metrics helps inform decisions about the implementation timeline of a measure based on its emissions reduction potential. For the abatement cost calculation, the cumulative emissions reduction over the study period, in this example, calculated by summing the annual emissions reductions from 2026 to 2045, is used as the emissions reduction input. This ensures that all measures are evaluated under the same electricity grid intensity trajectory, while the cumulative metric helps normalize differences in the lifespans of individual measures, allowing them to be compared consistently based on their cost effectiveness.

2.3 Considering Different Scenarios

Alongside the impact of grid emissions intensity on emissions reduction metrics, evolving utility rates represent another key variable influencing cost outcomes. Changes in the relative prices of electricity and natural gas over

time, driven by macroeconomic conditions, energy markets, regulatory frameworks, and political factors, will materially affect the operating costs or savings associated with the measures. Building on the two grid conditions outlined in Section 2.2, and aligning utility rate assumptions with the grid decarbonization scenarios to ensure internal consistency between emissions and cost projections, two scenarios were developed for the analysis:

- **Current Conditions Scenario:** Uses the grid emissions intensity of 523 tCO₂e/GWh (current grid intensity) for the annualized emissions reduction metric. Abatement cost is calculated using utility rates based on 2025 values, with 3% growth rate for electricity and 2% for natural gas over the period 2026–2050 (as shown in Figure 3), along with the electricity grid intensity trajectory shown in Figure 1.
- **Low-Carbon Scenario:** Uses a grid emissions intensity of 20 tCO₂e/GWh (expected grid intensity in 2045) for the annualized emissions reduction metric. Abatement cost is calculated using electricity grid intensity trajectory shown in Figure 1 in combination with utility rates based on CER projections over the period 2026–2050 (as shown in Figure 4). Under the CER projections and compared to the set of utility rates used in the current conditions scenario, electricity rates are more flattened, while natural gas prices increase at a higher escalation rate, narrowing the gap between electricity and natural gas over time. These energy rate assumptions reflect a forward-looking context in which climate action accelerates and grid emissions continue to decline. It is worth noting that the CER projected utility rates and the current rates are not aligned in the year 2026. Therefore, at the starting point, the gap between natural gas and electricity for the same building types is wider under the CER projected utility rates.

Figure 3. 2026–2050 Utility Rates under Current Conditions Scenario

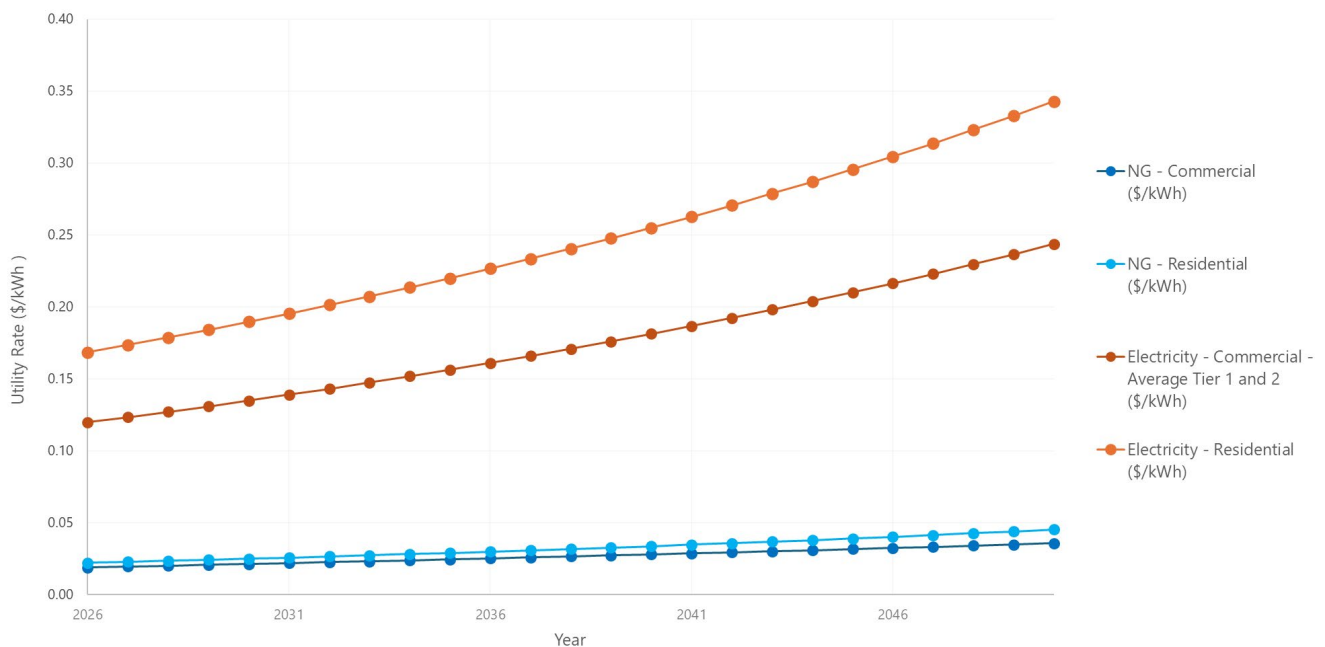
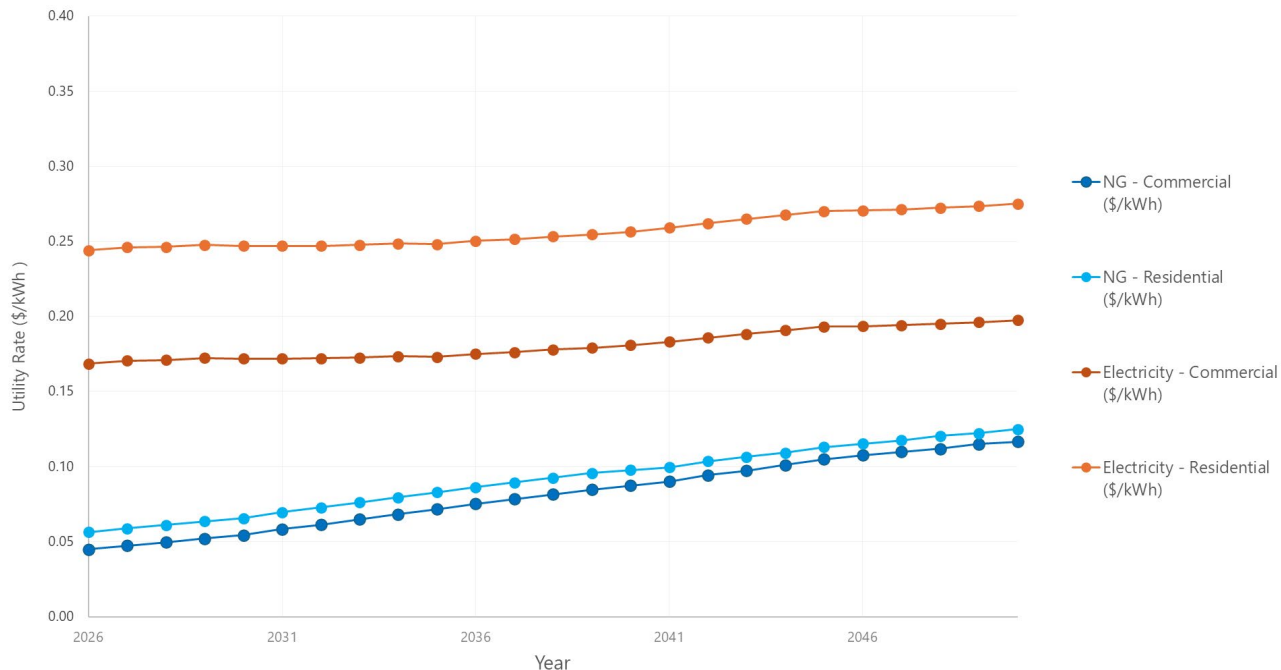


Figure 4. 2026-2050 CER Projected Utility Rates under Low-Carbon Scenario



Although the intent is to assess how abatement costs and annualized emissions reductions vary between the two scenarios, data granularity constraints and alignment with existing study results mean that, for the two corporate measures listed in Section 2.5, their values remain unchanged across the two scenarios.

2.4 Marginal Abatement Cost Curve

On the MAC curve, the horizontal (x) axis represents the annualized GHG emissions reduction associated with each mitigation measure. Measures are displayed cumulatively from left to right, starting at zero, with all values shown as positive to reflect total emissions reduction potential. The width of each measure represents its magnitude of annualized GHG emissions reduction, with wider bars indicating greater reduction potential.

The vertical (y) axis represents the marginal abatement cost. Unlike the x-axis, the y-axis includes both negative and positive values. A measure with a negative MAC indicates that it generates incremental NPV savings compared to the baseline while reducing emissions. Measures with a positive MAC represent a net cost, indicating that additional investment is required relative to the baseline to reduce one tonne of GHG emissions. Measures are ordered from left to right, progressing from those with the greatest net cost savings (negative MAC) to those with increasing net costs (positive MAC).

A MAC Curve is not an absolute measure and is not intended to be used to estimate project costs. Costs of implementing individual measures differ because the assumptions underlying the results differ from the initial analysis. For example, the cost, availability, efficiency, and nature of individual measures can change rapidly as they become more widely adopted or as technology evolves. MAC Curves provides useful information about relative cost-effectiveness, within a given set of assumptions, but policymakers must pay close attention to the underlying assumptions when considering specific courses of actions.

2.5 Information Sources

The development of the Marginal Abatement Cost Curve is informed by a range of data sources, including City budget requests and approved capital plans, studies commissioned by the City, and information shared internally

by relevant City project managers. Where data gaps existed, these inputs were filled by the Introba team's previous project data and desktop research.

In addition to the diversity of information sources, inputs were derived using different approaches. Based on discussions with the project team, cost data were expected to be drawn directly from available sources where possible, while GHG calculations were conducted independently where feasible. For certain measures, cost calculations were undertaken due to data limitations in existing studies, while GHG inputs were drawn from up-to-date reference sources used to inform ongoing projects and planning, to maintain consistency. It should be noted that for measures that abatement costs and/or emissions reductions are sourced directly from existing studies the results remain unchanged under the variable assumptions applied in the two scenarios described in Section 2.3. Measures that sourced abatement costs directly from other references include:

- The corporate measure to convert the entire Saskatoon Transit fleet to battery electric buses (BEB) fleet, upgrade the facility for on-site charging, and build on-route charging stations uses data to calculate abatement costs and the representative value for annualized emissions reductions, sourced from the *Saskatoon Transit Full Fleet ZEB Implementation Plan (2025)*.
- The corporate measure to replace a light duty municipal fleet vehicle with a zero-emission alternative at the time of replacement, along with the rollout of charging infrastructure uses data to calculate abatement costs and the representative value for annualized emissions reductions, sourced from the *Saskatoon Zero Emission Vehicle Adoption Feasibility Study*.

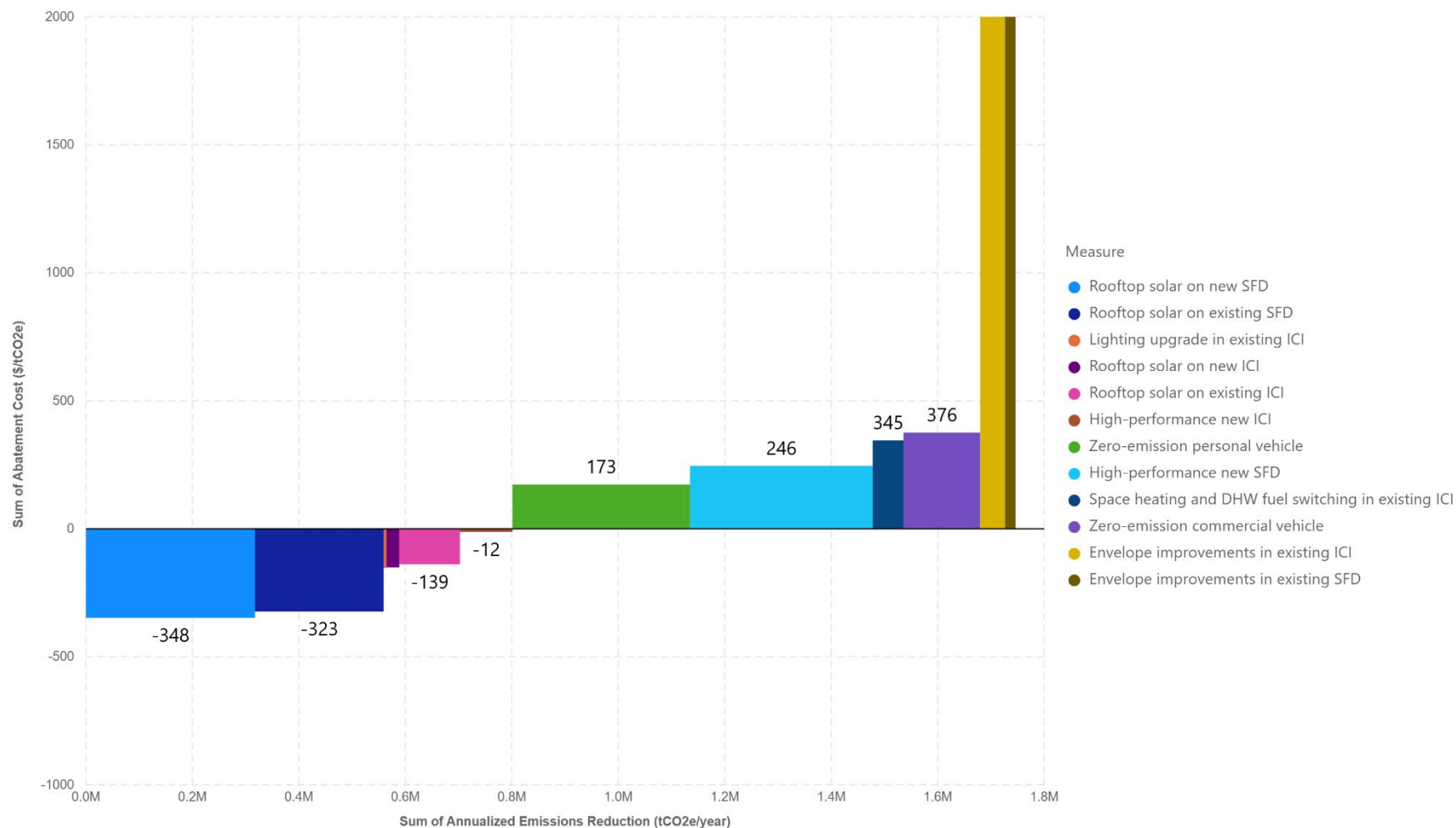
This combination of data sources and data derivation methods results in a heterogeneous set of inputs. Accordingly, the MACC results are subject to significantly inherent uncertainty. Despite these limitations, efforts were made to promote consistency wherever possible. Specifically, inputs and assumptions were aligned, where feasible, with the CEEP modelling results, which form a key component of the updated CAS.

2.6 Results

This section presents the MACC results for corporate and community mitigation measures under the two scenarios described in Section 2.3. Note that measures with relatively small annualized GHG emissions reductions may appear as very thin bars in the MACC figures. In addition, measures with exceptionally high positive abatement costs are capped at the maximum value of the y-axis to enable appropriate comparison and visualization across measures. The MACC figures were developed using Power BI. For measures that have limitations in visualization within the report, two additional reference sources are provided. The underlying data are included in the tables within this report, and the Power BI files have been provided to the City separately. The accompanying tables list GHG mitigation measures and the key inputs underpinning the results, including annualized GHG emissions reductions, marginal abatement costs, and the NPV of incremental costs and total GHG emissions reductions used in the MAC calculations.

2.6.1 Community Investment Marginal Abatement Cost Curves

Figure 5. Community Investment Marginal Abatement Cost Curve – Current Conditions Scenario



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Table 3. Summary of Community Investment GHG Mitigation Measures and MACC Inputs under Current Conditions Scenario

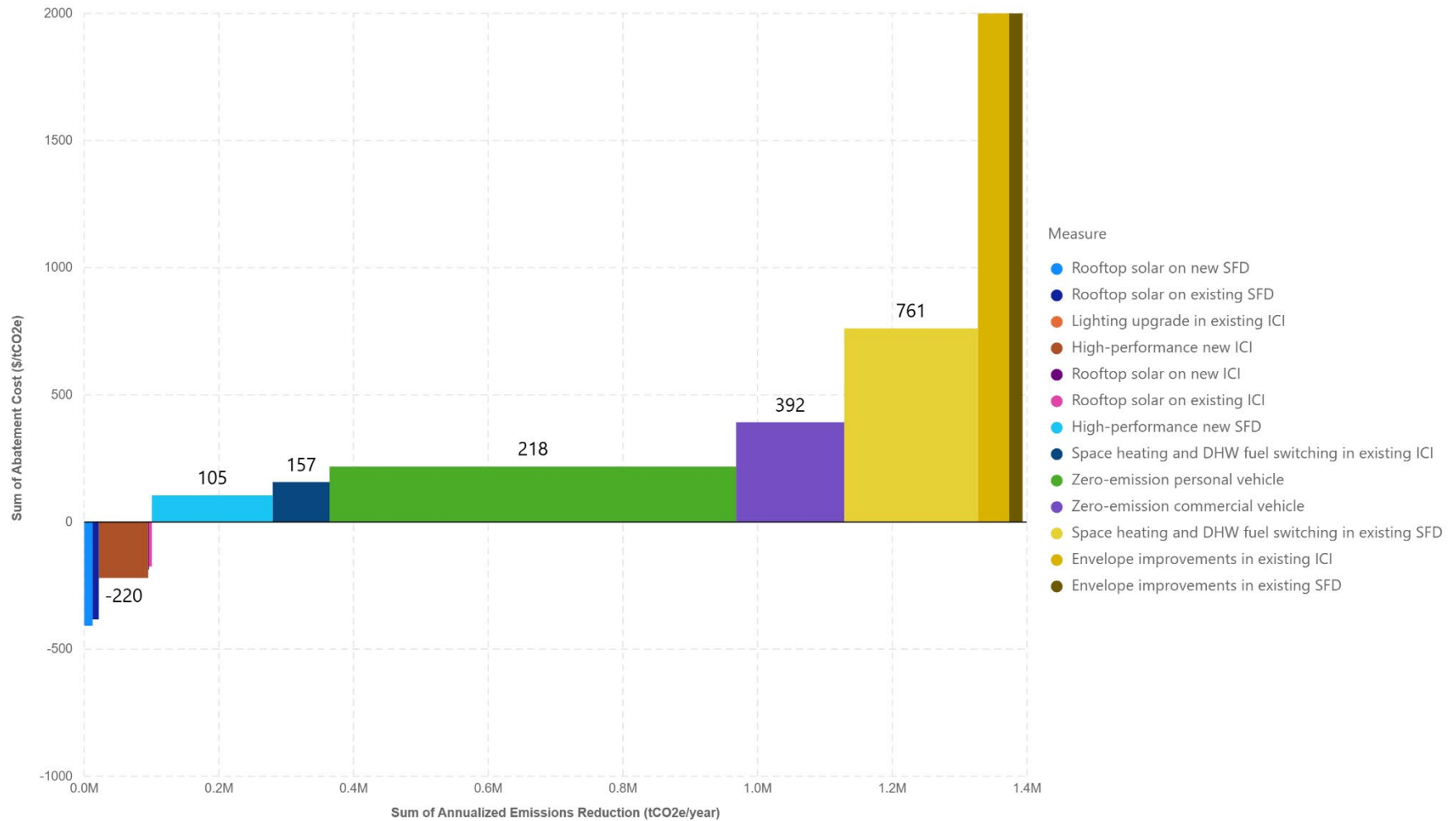
#	Measure	Sector	Annualized GHG Emissions Reduction (tCO ₂ e)	Abatement Cost (\$/tCO ₂ e)	NPV of Incremental Cost (\$)	Cumulative GHG Emissions Reduction over the Measure Lifecycle (tCO ₂ e)
1	Install a rooftop solar PV system on a new single family dwelling (SFD)	Buildings	317,606	(348)	(1,232,171,726)	3,543,509
2	Install a rooftop solar PV system on an existing single family home	Buildings	241,768	(323)	(870,497,955)	2,697,391
3	Upgrade the current lighting system in an ICI building with an energy-efficient option at the time of replacement	Buildings	5,068	(153)	(6,757,132)	44,052
4	Install a rooftop solar PV system on a new ICI building	Buildings	24,327	(151)	(41,058,563)	271,415
5	Install a rooftop solar PV system on an existing ICI building	Buildings	113,831	(139)	(176,240,806)	1,270,000
6	Construct a new ICI building to achieve a 40% improvement in energy efficiency	Buildings	98,763	(12)	(24,173,987)	2,100,529
7	Replace a personal vehicle with a zero-emission vehicle at the time of replacement, and expand home, workplace, and public charging infrastructure in proportion to the number of zero-emission personal vehicles adopted each year	Transportation	333,433	173	1,076,007,681	6,228,233
8	Construct a new single-family home to achieve a 40% improvement in energy efficiency	Buildings	343,134	246	1,532,926,434	6,221,391
9	Replace existing space heating, cooling, and domestic hot water systems with heat pump systems in ICI buildings at the time of replacement	Buildings	57,895	345	485,385,975	1,408,702
10	Replace a commercial vehicle with a zero-emission vehicle at the time of replacement and expand workplace and public charging infrastructure in proportion to the number of zero-emission commercial vehicles adopted each year	Transportation	143,997	376	839,410,755	2,234,713
11	Conduct a deep retrofit of existing ICI buildings with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation	Buildings	46,456	3,131	3,635,822,259	1,161,398
12	Conduct a deep retrofit of existing SFDs with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation	Buildings	19,922	11,064	5,510,543,966	498,057

Note:

- The numbering shown here corresponds to the order of measures presented in the figure, from left to right, based on abatement cost from lowest (cost savings) to highest (costs). This numbering differs from Table 1 and the ordering of measures presented in the Appendix. When cross-referencing, please refer to the second column ("Measure") rather than the numbering.
- Community mitigation measure 8: Replace existing space heating, cooling, and domestic hot water systems with heat pump systems in SFDs at the time of replacement is not presented in the figure due to its negative annualized GHG emissions reduction under the current conditions scenario.

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Figure 6. Community Investment Marginal Abatement Cost Curve – Low-Carbon Scenario



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Table 4. Summary of Community Investment GHG Mitigation Measures and MACC Inputs under Low Carbon Scenario

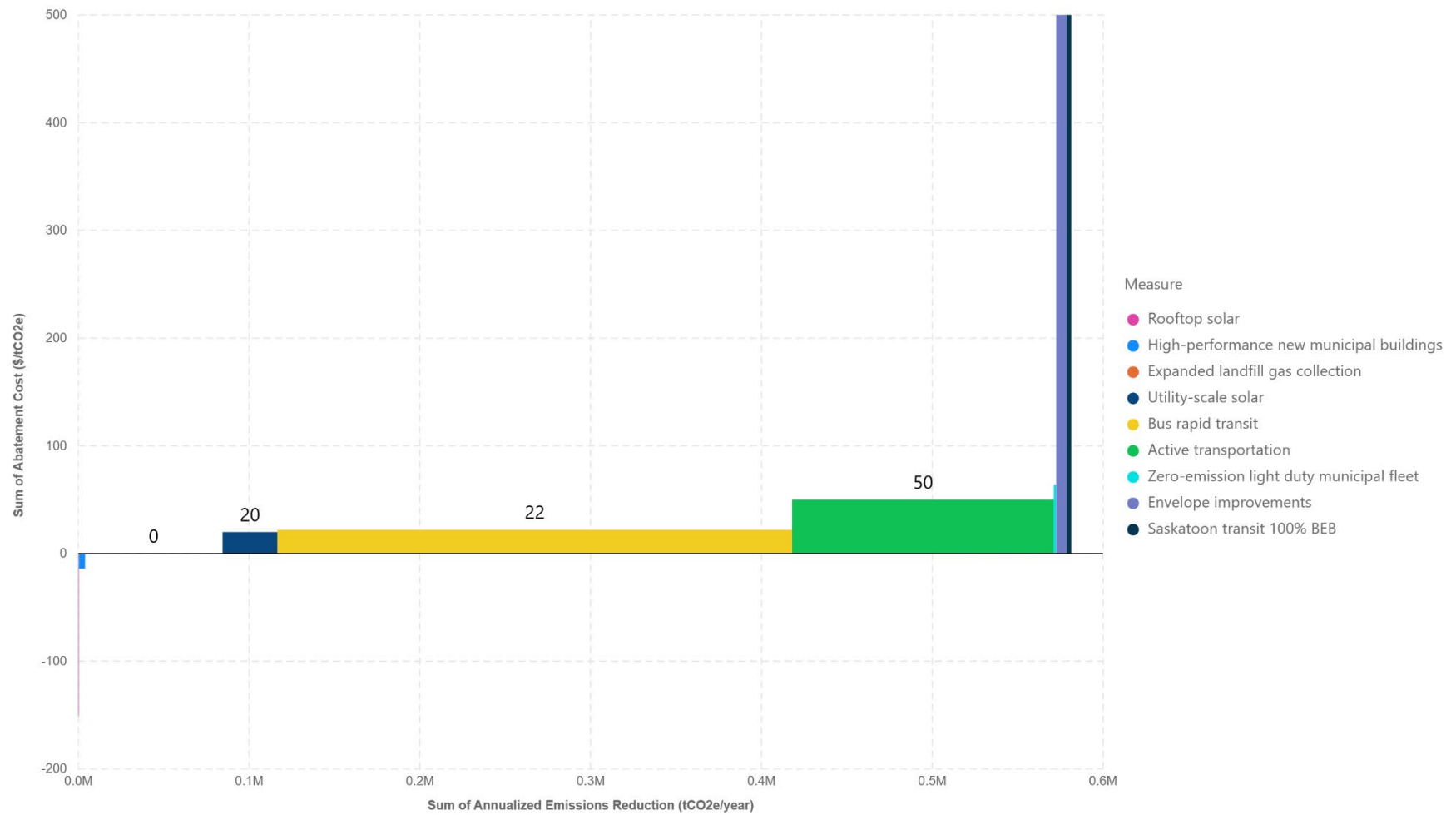
#	Measure	Sector	Annualized GHG Emissions Reduction (tCO ₂ e)	Abatement Cost (\$/tCO ₂ e)	NPV of Incremental Cost (\$)	Cumulative GHG Emissions Reduction over the Measure Lifecycle (tCO ₂ e)
1	Install a rooftop solar PV system on a new single family dwelling (SFD)	Buildings	12,306	(408)	(1,446,011,925)	3,543,509
2	Install a rooftop solar PV system on an existing single family home	Buildings	9,367	(383)	(1,033,277,425)	2,697,391
3	Upgrade the current lighting system in an ICI building with an energy-efficient option at the time of replacement	Buildings	196	(332)	(14,615,435)	44,052
4	Construct a new ICI building to achieve a 40% improvement in energy efficiency	Buildings	73,171	(220)	(462,876,737)	2,100,529
5	Install a rooftop solar PV system on a new ICI building	Buildings	943	(188)	(50,973,673)	271,415
6	Install a rooftop solar PV system on an existing ICI building	Buildings	4,410	(175)	(222,635,485)	1,270,000
7	Construct a new single-family home to achieve a 40% improvement in energy efficiency	Buildings	179,468	105	652,367,442	6,221,391
8	Replace existing space heating, cooling, and domestic hot water systems with heat pump systems in ICI buildings at the time of replacement	Buildings	84,567	157	221,084,560	1,408,702
9	Replace a personal vehicle with a zero-emission vehicle at the time of replacement, and expand home, workplace, and public charging infrastructure in proportion to the number of zero-emission personal vehicles adopted each year	Transportation	603,703	218	1,359,046,074	6,228,233
10	Replace a commercial vehicle with a zero-emission vehicle at the time of replacement and expand workplace and public charging infrastructure in proportion to the number of zero-emission commercial vehicles adopted each year	Transportation	160,468	392	874,997,988	2,234,713
11	Replace existing space heating, cooling, and domestic hot water systems with heat pump systems in SFDs at the time of replacement	Buildings	198,718	761	1,054,768,108	1,386,820
12	Conduct a deep retrofit of existing ICI buildings with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation	Buildings	46,456	2,929	3,401,449,363	1,161,398
13	Conduct a deep retrofit of existing SFDs with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation	Buildings	19,922	10,834	5,395,854,289	498,057

Note:

- The numbering shown here corresponds to the order of measures presented in the figure, from left to right, based on abatement cost from lowest (cost savings) to highest (costs). This numbering differs from Table 1 and the ordering of measures presented in the Appendix. When cross-referencing, please refer to the second column ("Measure") rather than the numbering.

2.6.2 Corporate Investment Marginal Abatement Cost Curves

Figure 7. Corporate Investment Marginal Abatement Cost Curve – Current Conditions Scenario



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Table 5. Summary of Corporate Investment GHG Mitigation Measures and MACC Inputs under Current Conditions Scenario

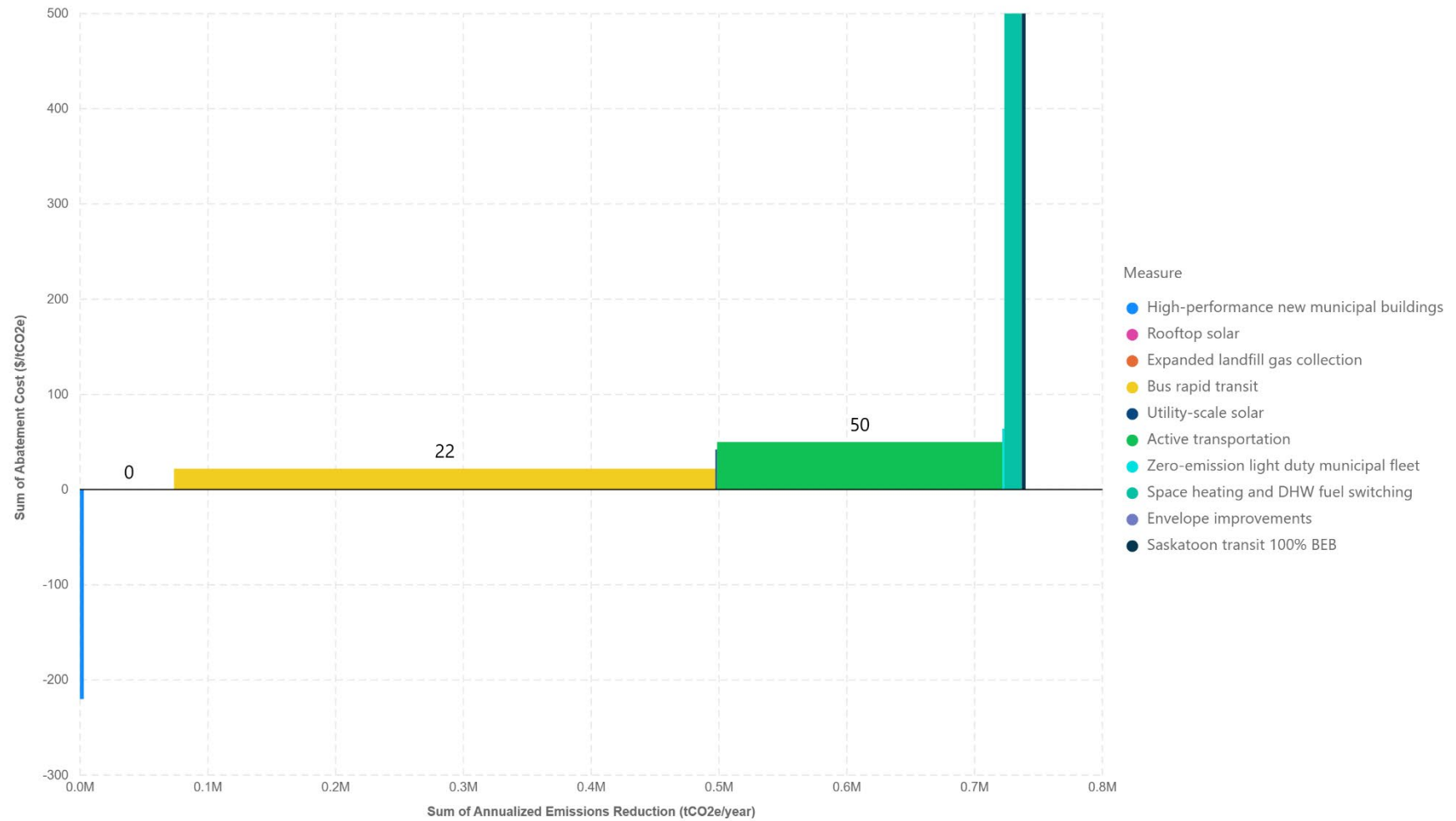
#	Measure	Sector	Annualized GHG Emissions Reduction (tCO ₂ e)	Abatement Cost (\$/tCO ₂ e)	NPV of Incremental Cost (\$)	Cumulative GHG Emissions Reduction over the Measure Lifecycle (tCO ₂ e)
1	Install a total of 0.5 MW of rooftop solar PV on municipal buildings (new and existing)	Buildings	358	(151)	(604,914)	3,999
2	Construct a new municipal building to achieve a 40% improvement in energy efficiency	Buildings	3,526	(14)	(1,149,144)	80,463
3	Upgrade and expand the landfill gas collection system to ensure the landfill gas collection rate reaches and is maintained at a minimum of 50%	Waste	80,530	0	607,494	1,910,669
4	Install 48MW utility-scale solar PV systems	Energy	32,232	20	7,319,505	359,611
5	Complete the construction of the Link (Bus Rapid Transit) system in Saskatoon	Transportation	301,315	22	195,653,500	8,716,456
6	Complete planned cycling and walking infrastructure projects to support mode shift	Transportation	153,252	50	243,103,167	4,908,694
7	Replace a light duty municipal fleet vehicle with a zero-emission alternative at the time of replacement, along with the rollout of charging infrastructure*	Transportation	1,419	64	1,013,980	15,796
8	Conduct a deep retrofit of an existing municipal building with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation	Buildings	6,158	4,824	331,435,170	68,706
9	Convert the entire Saskatoon Transit fleet to battery electric buses (BEB) fleet, upgrade the facility for on-site charging, and build on-route charging stations*	Transportation	2,725	5,316	217,300,000	40,876

Note:

1. The numbering shown here corresponds to the order of measures presented in the figure, from left to right, based on abatement cost from lowest (cost savings) to highest (costs). This numbering differs from Table 1 and the ordering of measures presented in the Appendix. When cross-referencing, please refer to the second column ("Measure") rather than the numbering.
2. Corporate mitigation measure 3: Electrify existing space heating and cooling systems and domestic hot water (DHW) systems in municipal buildings at the time of replacement is not presented in the figure due to its negative annualized GHG emissions reduction under the current conditions scenario.
3. An asterisk (*) denotes measures for which annualized emissions reductions and/or abatement costs are sourced directly from external studies. For these measures, values do not vary between scenarios (see Section 2.5 for further details).

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Figure 8. Corporate Investment Marginal Abatement Cost Curve – Low-Carbon Scenario



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Table 6. Summary of Corporate Investment GHG Mitigation Measures and MACC Inputs under Low Carbon Scenario

#	Measure	Sector	Annualized GHG Emissions Reduction (tCO ₂ e)	Abatement Cost (\$/tCO ₂ e)	NPV of Incremental Cost (\$)	Cumulative GHG Emissions Reduction over the Measure Lifecycle (tCO ₂ e)
1	Construct a new municipal building to achieve a 40% improvement in energy efficiency	Buildings	2,992	(220)	(17,695,702)	80,463
2	Install a total of 0.5 MW of rooftop solar PV on municipal buildings (new and existing)	Buildings	14	(188)	(750,993)	3,999
3	Upgrade and expand the landfill gas collection system to ensure the landfill gas collection rate reaches and is maintained at a minimum of 50%	Waste	70,606	(0)	(595,342)	1,910,669
4	Complete the construction of the Link (Bus Rapid Transit) system in Saskatoon	Transportation	423,628	22	195,653,500	8,716,456
5	Install 48MW utility-scale solar PV systems	Energy	1,249	42	14,935,161	359,611
6	Complete planned cycling and walking infrastructure projects to support mode shift	Transportation	223,259	50	243,103,167	4,908,694
7	Replace a light duty municipal fleet vehicle with a zero-emission alternative at the time of replacement, along with the rollout of charging infrastructure*	Transportation	1,419	64	1,013,980	15,796
8	Electrify existing space heating and cooling systems and domestic hot water (DHW) systems in a municipal building at the time of replacement	Buildings	13,664	1,663	219,151,609	131,807
9	Conduct a deep retrofit of an existing municipal building with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation	Buildings	239	4,572	314,144,288	68,706
10	Convert the entire Saskatoon Transit fleet to battery electric buses (BEB) fleet, upgrade the facility for on-site charging, and build on-route charging stations*	Transportation	2,725	5,316	217,300,000	40,876
Note:						
1.	The numbering shown here corresponds to the order of measures presented in the figure, from left to right, based on abatement cost from lowest (cost savings) to highest (costs). This numbering differs from Table 1 and the ordering of measures presented in the Appendix. When cross-referencing, please refer to the second column ("Measure") rather than the numbering.					
2.	An asterisk (*) denotes measures for which annualized emissions reductions and/or abatement costs are sourced directly from external studies. For these measures, values do not vary between scenarios (see Section 2.5 for further details).					

2.7 Observations

2.7.1 General Findings

Across both community and corporate investment mitigation measures, the results indicate that grid emissions intensity has a strong influence on estimated GHG reductions, particularly for measures involving fuel switching and electricity generation in the building and energy sectors, respectively. Taking the three fuel switching measures as examples, as shown in Table 7, two of the three measures would not contribute to emissions reductions if implemented now with a grid emissions factor of 523 tCO₂e per GWh, but they would deliver emissions reductions once the grid is decarbonized to 20 tCO₂e per GWh. In contrast, measures focused on efficiency conservation, such as building envelope improvements, public transit initiatives that reduce personal vehicle use, and landfill gas capture, are less sensitive to assumptions regarding grid emissions intensity and demonstrate more consistent GHG reduction potential across the two scenarios.

In terms of the impact of the two sets of utility rates applied under the two scenarios, fuel switching measures are the most affected among the measures analyzed because they induce both a decrease in natural gas consumption and an increase in electricity use. Under the low carbon scenario, with CER projected utility rates applied, the abatement costs of the two community measures decrease by 54 percent and 40 percent, respectively, compared to the current conditions scenario. The change in the corporate fuel switching measure does not demonstrate a reduction of the same magnitude, with the caveat that the calculations are grounded in different case studies and data sources. However, the same downward trend is observed. Taken together, utility rates play an essential role in determining the cost effectiveness of fuel switching measures. It is also worth highlighting that the measures are assumed to have an implementation timeline beginning in 2026. If implementation were to occur in later years, ongoing grid decarbonization and a narrowing price differential between natural gas and electricity would result in lower abatement costs. The abatement cost is calculated as the ratio of the total lifecycle incremental cost (relative to the baseline) to the cumulative GHG emissions reductions over the measure's lifecycle. Taking the corporate measure "Electrify existing space heating and cooling systems and domestic hot water (DHW) systems in a municipal building at the time of replacement" as an example, between 2016 and 2033, the high grid GHG intensity in Saskatoon results in negative GHG savings compared to the baseline. If implementation begins in 2034, cumulative GHG savings would increase while the cost premium declines, the resulting abatement cost would be lower than the current estimate.

Table 7. Comparison of Fuel Switching Measures under Two Scenarios

Category	Measure	Annualized Emissions Reduction(tCO ₂ e)	Annualized Emissions Reduction(tCO ₂ e)	Abatement Cost (\$/tCO ₂ e)	Abatement Cost (\$/tCO ₂ e)
		Current Conditions Scenario	Low Carbon Scenario	Current Conditions Scenario	Low Carbon Scenario
Corporate	Electrify existing space heating and cooling systems and domestic hot water (DHW) systems in a municipal building at the time of replacement	Negative (-6,130)	13,664	1,778	1,663
Community	Replace existing space heating, cooling, and domestic hot water systems with heat pump systems in ICI buildings at the time of replacement	57,895	84,567	345	157
Community	Replace existing space heating, cooling, and domestic hot water systems with heat pump systems in SFDs at the time of replacement	Negative (-45,461)	198,718	1,274	761

2.7.2 Community Investment Marginal Abatement Cost Curves Findings

For community measures, estimated annual GHG emissions reductions show noticeable differences between the two scenarios. Using the current grid emissions intensity, the measures with the greatest GHG reduction potential include high-performance new single-family dwellings (SFDs), zero-emission vehicle adoption for both personal and commercial vehicles, and rooftop solar on SFDs. Of these five measures, rooftop solar on both new and existing SFDs exhibits negative abatement costs.

Applying the low-carbon grid emissions, the profile of measures delivering the highest GHG emissions reductions shifts. While zero-emission vehicle adoption and high-performance new SFDs continue to rank among the measures with the largest GHG reduction potential, retrofit measures in existing buildings become more prominent. In particular, fuel switching in existing SFDs ranks as the second highest measure in terms of annual GHG emissions reductions, while fuel switching in existing ICI buildings ranks fifth. Overall, these results indicate that under higher grid emissions intensity assumptions, renewable alternative measures deliver greater emissions reduction potential, whereas over the longer term, as the grid decarbonizes, retrofits to existing buildings that leverage fuel-switching to electricity contribute a larger share of GHG reductions.

In terms of abatement cost, deep retrofit measures such as fuel switching and envelope improvements in existing ICI buildings and SFDs, along with the transition to zero emission commercial vehicles, rank among the highest.

2.7.3 Corporate Investment Marginal Abatement Cost Curves Findings

For corporate measures, the largest annual GHG emissions reductions are achieved through bus rapid transit (BRT), active transportation, and expanded landfill gas collection under both grid emissions intensity scenarios. Among these, expanded landfill gas collection achieves a break even cost per tonne of GHG emissions reduced. While bus rapid transit and active transportation have positive abatement costs, these remain relatively low at \$22/tCO₂e and \$50/tCO₂e, respectively, under both scenarios.

Rooftop solar and high-performance new municipal buildings exhibit negative marginal abatement costs, indicating net lifecycle cost savings relative to the baseline in both analytical scenarios. In contrast, envelope-focused deep retrofits of existing municipal buildings and the transition of Saskatoon Transit to a 100% battery electric fleet show extremely high abatement costs, exceeding \$4,500/tCO₂e and \$5,000/tCO₂e, respectively.

3 Appendix – Detailed Calculation Methods and Assumptions

Table 8 and Table 9 document all the community and corporate investment mitigation measures considered¹, along with the detailed calculation methodology, including baseline scenario descriptions, cost and GHG estimation approaches, and data sources. These tables are intended to provide additional details on key inputs, assumptions, and methods used to support the marginal abatement cost curve results.

For rooftop solar measures, some may fall within Saskatoon Light and Power service area. Potential revenue losses to Saskatoon Light and Power, secondary to solar measures, are not factored in the MAC assessment. Likewise, potential revenue gains from EV charging or building system electrification has also not been factored into the MAC assessment.

¹ The corporate measure to convert the entire Saskatoon Transit fleet to hydrogen fuel cell electric buses is not included in the final mitigation measure list in Table 2 due to its negative cumulative lifecycle GHG reductions. For documentation completeness, Table 9 includes the measure and provides context.

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Table 8. Calculation Methodology and Data Sources for Community Investment Mitigation Measures

Community Measure 1.	Construct a new commercial, institutional, or industrial (ICI) building to achieve a 40% improvement in energy efficiency (meeting BC Energy Step Code Step 3 for Part 3 buildings).
Baseline	Construct a new ICI building to meet the performance requirements of NECB 2015 (BCBC 2018).
Approach	Incremental capital costs are calculated by applying the unit total incremental cost (expressed in \$/m ²) required to achieve high performance relative to baseline performance, based on results from a retail archetype in Climate Zone 7a, sourced from the 2018 Energy Step Code Metrics Report for the baseline and the 2022 report for the adopted measure. The cost premium is then scaled to the community level using the total new ICI building floor area in Saskatoon.
	Incremental operating savings are estimated based on changes in electricity and natural gas consumption at the community level, multiplied by the corresponding utility rates. Electricity costs are calculated using the Tier 2 rate for commercial loads not exceeding 75 kVA. Natural gas costs include both commodity and delivery charges based on applicable commercial rates. Community-level energy consumption changes are calculated by applying the differences in electricity and natural gas EUIs between the high-performance and the baseline scenario and scaling these differences using the total new ICI building floor area.
	GHG reductions are calculated by applying grid electricity and natural gas emissions factors to changes in electricity and natural gas use at the community level, resulting from buildings constructed to meet higher energy efficiency performance.
Data Source(s)	- Energy Step Code 2018 Metrics Research - BC Energy Step Code Metrics Report Update - BC Energy Step Code and Zero Carbon Step Code: A Best Practices Guide for Local Governments

Note: The results are based on BC Step Code studies. Although the selected climate zone aligns with the City, the archetype, energy performance baseline, and high performance building scenario do not fully reflect local conditions. As such, the results should be interpreted with caution, and further study is recommended.

Community Measure 2.	Construct a new single-family home to achieve a 40% improvement in energy efficiency (meeting BC Energy Step Code Step 4 for Part 9 buildings).
Baseline	Construct a new single-family home to meet the performance requirements of NECB 2015 (BCBC 2018).
Approach	Incremental capital costs are estimated by dividing the total increase in construction costs (\$) by the floor area of the archetype (a medium single-family dwelling with a total area of 237 m ² , two storeys with a basement) in Fort St. John (Climate Zone 7A) to determine the unit construction cost premium. This premium is then scaled to the community level using the total floor area of new single-family homes in the City.
	Incremental operating costs are estimated based on changes in electricity and natural gas consumption at the community level, multiplied by the corresponding utility rates. Applicable residential energy charges are used for calculating electricity costs. Natural gas costs include both the residential commodity charge and the delivery charge. Community-level energy consumption changes are determined by applying the differences in

	electricity and natural gas EUIs between the high-performance and baseline scenarios and scaling them using the total floor area of new single-family homes in the City.
	GHG reductions are calculated by applying grid electricity and natural gas emissions factors to changes in electricity and natural gas use at the community level, resulting from buildings constructed to meet higher energy efficiency performance.
Data Source(s)	- Energy Step Code 2018 Metrics Research - BC Energy Step Code Metrics Report Update - BC Energy Step Code and Zero Carbon Step Code: A Best Practices Guide for Local Governments

Note: The results are based on BC Step Code studies. Although the selected climate zone aligns with the City, the energy performance baseline and high performance home scenario do not fully reflect local conditions. As such, the results should be interpreted with caution, and further study is recommended.

Community Measure 3.	Install a rooftop solar PV system on a new ICI building.
Baseline	Rooftop solar PV is not considered, and the electricity demand of the new ICI building is met entirely by grid-supplied electricity.
Approach	Incremental capital costs are calculated by applying a unit capital cost for rooftop solar PV systems to the estimated total installed capacity across new ICI buildings at the community level. Total installed capacity is estimated by multiplying the projected number of new ICI buildings in Saskatoon by an assumed installed rooftop solar PV capacity of 50 kW per ICI building. The number of new ICI buildings is derived by dividing the total projected new ICI building floor area from 2026 to 2050, consistent with the estimates used in the CEEP model, by the assumed commercial building floor area of 6,000 m². A unit capital cost of \$2.9/W (range: \$2.6–\$3.2/W) is applied to reflect the relatively small system sizes, as suggested by Saskatoon Light and Power. Incremental operating costs are estimated as avoided purchases of grid electricity from SaskPower, equivalent to the annual electricity generation associated with the calculated total community installed rooftop solar PV capacity on new ICI buildings. Annual electricity generation is estimated by applying the capacity factor of the reference rooftop solar PV system (ACT Arena Rooftop) and scaling it to the expected total installed capacity. Note that net metering credits are not considered in this analysis. Avoided electricity costs are calculated using the average of Tier 1 and Tier 2 SaskPower commercial electricity rates for loads not exceeding 75 kVA. Ongoing O&M costs are excluded because they are relatively small compared to avoided electricity costs and, for simplicity, in this screening-level analysis. GHG reductions are calculated by applying the grid electricity emissions factor to the electricity demand savings resulting from the estimated total community installed rooftop solar PV capacity on new ICI buildings.
Data Source(s)	- Renewable Energy Marginal Abatement Cost Curve Analysis (internal) - Solar Panels Cost in Canada (2025) - Summary of CEEP Aligned Building Inputs (internal)
Community Measure 4.	Install a rooftop solar PV system on a new single family dwelling (SFD).
Baseline	Rooftop solar PV is not considered, and the electricity demand of the new SFD is met entirely by grid-supplied electricity.

Approach	Incremental capital costs are calculated by applying a unit capital cost for rooftop solar PV systems to the estimated total installed capacity across new single family homes at the community level. Total installed capacity is estimated by multiplying the projected number of new SFDs in Saskatoon by an assumed installed rooftop solar PV capacity of 7 kW per SFD, as suggested by Saskatoon Light and Power. The number of new single family homes is derived by dividing the total projected new building floor area from 2026 to 2050 for single family detached and attached, consistent with the estimates used in the CEEP model, by the assumed single family home floor area of 160 m². A higher-end unit capital cost of \$3/W (range: \$2.6–\$3.2/W) is then applied to reflect the relatively small system sizes and customized rooftop installations associated with single family homes, as well as the expectation of lower costs for new homes compared with existing homes.
	Incremental operating costs are estimated as avoided purchases of grid electricity from SaskPower, equivalent to the annual electricity generation associated with the calculated total community installed rooftop solar PV capacity on new SFDs. Annual electricity generation is estimated by applying the capacity factor of the reference rooftop solar PV system (ACT Arena Rooftop) and scaling it to the expected total installed capacity. Note that net metering credits are not considered in this analysis. Avoided electricity costs are calculated using the energy charge for residential. Ongoing O&M costs are excluded because they are relatively small compared to avoided electricity costs and, for simplicity, in this screening-level analysis.
	GHG reductions are calculated by applying the grid electricity emissions factor to the electricity demand savings resulting from the estimated total community installed rooftop solar PV capacity on new SFDs.
Data Source(s)	- Renewable Energy Marginal Abatement Cost Curve Analysis (internal) - Solar Panels Cost in Canada (2025) - Summary of CEEP Aligned Building Inputs (internal)
Community Measure 5.	Upgrade the current lighting system in an ICI building with an energy-efficient option at the time of replacement.
Baseline	Existing lighting systems are replaced at the end of life with a like-for-similar option, with no additional efforts to improve energy efficiency.
Approach	Incremental capital costs are calculated by applying the unit capital cost premium for lighting measure (expressed per m²) between the measure-adopted scenario and the like-for-similar (LFS) scenario, based on results from a previous study conducted using a small office building archetype. The cost premium is then scaled to the community level using the total existing ICI building floor area in Saskatoon.
	Incremental operating costs are estimated based on changes in electricity and natural gas consumption at the community level, multiplied by the corresponding utility rates. Electricity costs are calculated using the Tier 2 rate for commercial loads not exceeding 75 kVA, reflecting that the baseline small office building in the analysis has annual electricity consumption exceeding the 14,500 kWh threshold. Natural gas costs include both commodity and delivery charges based on applicable commercial rates. Community-level energy consumption changes are calculated by applying the differences in electricity and natural gas EUIs between the measure-adopted scenario and the LFS scenario and scaling these differences using the total existing ICI building floor area.
	GHG reductions are calculated by applying the grid electricity and natural gas emissions factors to the changes in electricity and natural gas usage at the community level, resulting from the adoption of the lighting measure.
Data Source(s)	- Building Retrofits Measure-Level Results (internal)

Community Measure 6.	Replace existing space heating, cooling, and domestic hot water systems with heat pump systems in ICI buildings at the time of replacement.
Baseline	Existing space heating, cooling, and DHW systems in ICI buildings are replaced at the end of life with LFS combustion-based systems.
Approach	Incremental capital costs are calculated by applying the unit capital cost premium for the fuel switching measure (expressed per m ²) between the measure-adopted scenario and the LFS scenario, based on results from a previous study conducted using a small office building archetype. The cost premium is then scaled to the community level using the total existing ICI building floor area in Saskatoon.
	Incremental operating costs are estimated based on changes in electricity and natural gas consumption at the community level, multiplied by the corresponding utility rates. Electricity costs are calculated using the Tier 2 rate for commercial loads not exceeding 75 kVA, reflecting that the baseline small office building in the analysis has annual electricity consumption exceeding the 14,500 kWh threshold. Natural gas costs include both commodity and delivery charges based on applicable commercial rates. Community-level energy consumption changes are calculated by applying the differences in electricity and natural gas EUIs between the measure-adopted scenario and the LFS scenario and scaling these differences using the total existing ICI building floor area.
	GHG reductions are calculated by applying the grid electricity and natural gas emissions factors to the changes in electricity and natural gas usage at the community level, resulting from the adoption of the fuel switching measure.
Data Source(s)	- Building Retrofits Measure-Level Results (internal)
Community Measure 7.	Replace existing space heating, cooling, and domestic hot water systems with heat pump systems in SFDs at the time of replacement.
Baseline	Existing space heating, cooling, and DHW systems in single family homes are replaced at the end of life with LFS combustion-based systems.
Approach	Incremental capital costs are calculated by applying the unit capital cost premium for the fuel-switching measure (expressed per m ²) between the measure-adopted scenario and the LFS scenario, based on results from a previous study conducted using a single-family detached building archetype. The cost premium is then scaled to the community level using the total existing single family residential floor area in Saskatoon.
	Incremental operating costs are estimated based on changes in electricity and natural gas consumption at the community level, multiplied by the corresponding residential utility rates. Electricity costs are calculated using applicable residential electricity energy charges, while natural gas costs include both residential commodity and delivery charges. Community-level energy consumption changes are calculated by applying the differences in electricity and natural gas EUIs between the measure-adopted scenario and the LFS scenario and scaling these differences using the total existing single family residential floor area.
	GHG reductions are calculated by applying the grid electricity and natural gas emissions factors to the changes in electricity and natural gas usage at the community level, resulting from the adoption of the fuel switching measure.

Data Source(s)	- Building Retrofits Measure-Level Results (internal)
Community Measure 8.	Conduct a deep retrofit of existing ICI buildings with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation.
Baseline	During major renovations, existing ICI buildings are assumed to undergo LFS envelope upgrades sufficient to meet code requirements.
Approach	Incremental capital costs are calculated by applying the unit capital cost premium for the envelope measure (expressed per m ²) between the measure-adopted scenario and the LFS scenario, based on results from a previous study conducted using a small office building archetype. The cost premium is then scaled to the community level using the total existing ICI building floor area in Saskatoon.
	Incremental operating costs are estimated based on changes in electricity and natural gas consumption at the community level, multiplied by the corresponding utility rates. Electricity costs are calculated using the Tier 2 rate for commercial loads not exceeding 75 kVA, reflecting that the baseline small office building in the analysis has annual electricity consumption exceeding the 14,500 kWh threshold. Natural gas costs include both commodity and delivery charges based on applicable commercial rates. Community-level energy consumption changes are calculated by applying the differences in electricity and natural gas EUIs between the measure-adopted scenario and the LFS scenario and scaling these differences using the total existing ICI building floor area.
	GHG reductions are calculated by applying the grid electricity and natural gas emissions factors to the changes in electricity and natural gas usage at the community level, resulting from the adoption of the envelope measure.
Data Source(s)	- Building Retrofits Measure-Level Results (internal)
Community Measure 9.	Conduct a deep retrofit of existing SFDs with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation.
Baseline	During major renovations, existing SFDs are assumed to undergo LFS envelope upgrades sufficient to meet code requirements.
Approach	Incremental capital costs are calculated by applying the unit capital cost premium for the envelope measure (expressed per m ²) between the measure-adopted scenario and the LFS scenario, based on results from a previous study conducted using a single-family detached building archetype. The cost premium is then scaled to the community level using the total existing single family residential floor area in Saskatoon.
	Incremental operating costs are estimated based on changes in electricity and natural gas consumption at the community level, multiplied by the corresponding residential utility rates. Electricity costs are calculated using applicable residential electricity energy charges, while natural gas costs include both residential commodity and delivery charges. Community-level energy consumption changes are calculated by applying the differences in electricity and natural gas EUIs between the measure-adopted scenario and the LFS scenario and scaling these differences using the total existing single family residential floor area.

	GHG reductions are calculated by applying the grid electricity and natural gas emissions factors to the changes in electricity and natural gas usage at the community level, resulting from the adoption of the envelope measure.
Data Source(s)	- Building Retrofits Measure-Level Results (internal)
Community Measure 10.	Install a rooftop solar PV system on an existing ICI building.
Baseline	Rooftop solar PV is not considered, and the electricity demand of the ICI building is met entirely by grid-supplied electricity.
Approach	Incremental capital costs are calculated by applying a unit capital cost for rooftop solar PV systems to the estimated total installed capacity across existing ICI buildings at the community level. Total installed capacity is estimated by multiplying the number of existing ICI buildings in Saskatoon, derived from existing building stock data provided by the City, by an assumed installed rooftop solar PV capacity of 50 kW per ICI building. A unit capital cost of \$3.0/W (range: \$2.6–\$3.2/W) is applied to reflect the relatively small system sizes, as suggested by Saskatoon Light and Power, and the complexity of design and installation compared to new ICI buildings. Incremental operating costs are estimated as avoided purchases of grid electricity from SaskPower, equivalent to the annual electricity generation associated with the calculated total community installed rooftop solar PV capacity on existing ICI buildings. Annual electricity generation is estimated by applying the capacity factor of the reference rooftop solar PV system (ACT Arena Rooftop) and scaling it to the expected total installed capacity. Note that net metering credits are not considered in this analysis. Avoided electricity costs are calculated using the average of Tier 1 and Tier 2 SaskPower commercial electricity rates for loads not exceeding 75 kVA. Ongoing O&M costs are excluded because they are relatively small compared to avoided electricity costs and, for simplicity, in this screening-level analysis. GHG reductions are calculated by applying the grid electricity emissions factor to the electricity demand savings resulting from the estimated total community installed rooftop solar PV capacity on existing ICI buildings.
Data Source(s)	- Renewable Energy Marginal Abatement Cost Curve Analysis (internal) - Solar Panels Cost in Canada (2025) - Summary of CEEP Aligned Building Inputs (internal)
Community Measure 11.	Install a rooftop solar PV system on an existing single family home.
Baseline	Rooftop solar PV is not considered, and the electricity demand of the existing single family home is met entirely by grid-supplied electricity.
Approach	Incremental capital costs are calculated by applying a unit capital cost for rooftop solar PV systems to the estimated total installed capacity across existing single family homes at the community level. Total installed capacity is estimated by multiplying the number of existing single family homes in Saskatoon, derived from existing building stock data provided by the City, by an assumed installed rooftop solar PV capacity of 5 kW per SFD. A higher-end unit capital cost of \$3.2/W (range: \$2.6–\$3.2/W) is applied to reflect the relatively small system sizes and customized rooftop installations typical of single-family homes, as well as the expectation of higher costs for retrofits to existing homes compared with new construction.

	Incremental operating costs are estimated as avoided purchases of grid electricity from SaskPower, equivalent to the annual electricity generation associated with the calculated total community installed rooftop solar PV capacity on existing single family homes. Annual electricity generation is estimated by applying the capacity factor of the reference rooftop solar PV system (ACT Arena Rooftop) and scaling it to the expected total installed capacity. Note that net metering credits are not considered in this analysis. Avoided electricity costs are calculated using the energy charge for residential. Ongoing O&M costs are excluded because they are relatively small compared to avoided electricity costs and, for simplicity, in this screening-level analysis.
	GHG reductions are calculated by applying the grid electricity emissions factor to the electricity demand savings resulting from the estimated total community installed rooftop solar PV capacity on existing single family homes.
Data Source(s)	- Renewable Energy Marginal Abatement Cost Curve Analysis (internal) - Solar Panels Cost in Canada (2025) - Summary of CEEP Aligned Building Inputs (internal)
Community Measure 12.	Replace a commercial vehicle with a zero-emission vehicle at the time of replacement and expand workplace and public charging infrastructure in proportion to the number of zero-emission commercial vehicles adopted each year.
Baseline	Commercial vehicles are replaced at the end of life with like-for-similar ICE vehicles.
Approach	Incremental capital costs are based on the cost premium associated with replacing commercial ICE vehicles with BEVs, as well as the capital costs of associated charging infrastructure. The vehicle cost premium is estimated using the purchase price difference between comparable ICE and BEV postal delivery trucks/vans and freight trucks and is scaled to the community level based on the estimated number of gasoline trucks. The number of gasoline trucks is derived by dividing total gasoline HDV emissions in 2025, aligned with the CEEP model, by the assumed annual emissions of a typical gasoline commercial vehicle (4.3 tCO₂e per vehicle per year). To determine this value, an average of two data points is used. The first value is obtained from a survey of the Government of Canada's federal vehicle fleet, which includes light-, medium-, and heavy-duty vehicles. Based on an assessment of 5,412 vehicles, the analysis indicates that achieving federal fleet electrification targets by 2030–2035 could result in annual CO₂ emissions reductions of 19,214 tonnes, corresponding to approximately 3.55 metric tonnes of CO₂ per vehicle per year. The second value is obtained from Natural Resources Canada's transportation energy use database, specifically Table 9 for Saskatchewan ("Road Transportation Secondary Energy Use and GHG Emissions by Energy Source"), which reports freight road transportation GHG emissions of 5.0 metric tonnes of CO₂ per vehicle in 2022. Charging infrastructure costs are estimated using an assumed ratio of 21 new EVs per charging port. It is further assumed that 90 percent of installed chargers are Level 2 units and 10 percent are DCFC. Total charging infrastructure capital costs are calculated by multiplying the number of required chargers by their respective unit costs. Incremental operating costs are estimated as the net difference between increased electricity costs for vehicle charging and avoided gasoline fuel costs. Total electricity and gasoline consumption are calculated based on assumed fuel efficiencies for BEVs and gasoline vehicles and the annual VKT of gasoline HDVs in 2025. Electricity costs are calculated using the Tier 2 electricity rate for commercial loads not exceeding 75 kVA, and gasoline costs are assumed at \$1.5 per liter. Fuel costs are escalated at an assumed annual rate of 3 percent over the 15-year study period. GHG reductions are calculated as the avoided emissions from displaced gasoline vehicle use, based on total gasoline HDV emissions in 2025 aligned with the CEEP model, net of emissions associated with increased electricity consumption for vehicle charging. Electricity-related emissions are calculated by applying the grid electricity emissions factor to the total electricity consumption associated with the transition.

Data Source(s)	- Ford Transit Cargo Van - Freightliner Cascadia - Ford E-Transit Cargo Van - Freightliner eCascadia - Federal vehicles and fleets - Natural Resources Canada Transportation Sector Saskatchewan - Electric Vehicle Charging Infrastructure for Canada
Community Measure 13.	Replace a personal vehicle with a zero-emission vehicle at the time of replacement, and expand home, workplace, and public charging infrastructure in proportion to the number of zero-emission personal vehicles adopted each year.
Baseline	Personal vehicles are replaced at the end of life with like-for-similar ICE vehicles.
Approach	Incremental capital costs are based on the cost premium associated with replacing personal ICE vehicles with BEVs, as well as the capital costs of associated charging infrastructure. The vehicle cost premium is estimated using the purchase price difference between comparable ICE and BEV models from the same manufacturer (Honda) and is scaled to the community level based on the estimated number of gasoline LDVs. The number of gasoline LDVs is derived by dividing total gasoline LDV emissions in 2025, aligned with the CEEP model, by the assumed annual emissions of a typical gasoline vehicle (3.6 tCO₂e per vehicle per year). To determine this value, an average of two data points is used. The first value is drawn from a US EPA source, which identifies a typical passenger vehicle as emitting approximately 4.6 metric tonnes of CO₂ per year. The second value is drawn from Natural Resources Canada's transportation energy use database, specifically Table 9 for Saskatchewan ("Road Transportation Secondary Energy Use and GHG Emissions by Energy Source"), which reports passenger road transportation emissions of 2.6 metric tonnes of CO₂ per vehicle in 2022. Charging infrastructure costs are estimated using an assumed ratio of 21 new EVs per charging port. It is further assumed that 90 percent of installed chargers are Level 2 units and 10 percent are direct current fast chargers (DCFC). Total charging infrastructure capital costs are calculated by multiplying the number of required chargers by their respective unit costs. Incremental operating costs are estimated as the net difference between increased electricity costs for vehicle charging and avoided gasoline fuel costs. Total electricity and gasoline consumption are calculated based on assumed fuel efficiencies for BEVs and gasoline vehicles and the annual VKT of gasoline LDVs in 2025. Electricity costs are calculated using the Tier 2 electricity rate for commercial loads not exceeding 75 kVA, and gasoline costs are assumed at \$1.50 per liter. Fuel costs are escalated at an assumed annual rate of 3 percent over the 15-year study period. GHG reductions are calculated as the avoided emissions from displaced gasoline vehicle use, based on total gasoline LDV emissions in 2025 aligned with the CEEP model, net of emissions associated with increased electricity consumption for vehicle charging. Electricity-related emissions are calculated by applying the grid electricity emissions factor to the total electricity consumption associated with the transition.
Data Source(s)	- Honda New Vehicle Inventory - Greenhouse Gas Emissions from a Typical Passenger Vehicle - Natural Resources Canada Transportation Sector Saskatchewan - Electric Vehicle Charging Infrastructure for Canada

Table 9. Calculation Methodology and Data Sources for Corporate Investment Mitigation Measures

Corporate Measure 1.	Install 48MW utility-scale solar PV systems.
Baseline	The annual electricity demand equivalent to the output of a 48 MW solar PV system is met by electricity delivered through Saskatoon Light & Power.
Approach	Incremental capital costs are estimated using the assumed installed capacity of 48 MW and the base year installed unit capital cost for utility scale solar PV systems sourced from National Laboratory of the Rockies (NREL). Total project cost savings (The net present value of total costs) from the Renewable Energy Marginal Abatement Cost Curve Analysis, is not used because the reported value would benefit from further review and there is insufficient information to understand the underlying assumptions related to capital and operating cost components.
	Incremental operating savings are calculated as avoided purchases of electricity from Saskatoon Light & Power, net of ongoing solar PV operation and maintenance (O&M) costs. Avoided electricity purchases are quantified by multiplying the annual electricity generation of the assumed 48 MW utility-scale solar PV system by Saskatoon Light & Power reseller rate (Rate Code E33) in 2026, which is then escalated at an assumed annual rate of 3% under the current conditions scenario and 1.25% under the low carbon scenario over the analysis period. Annual electricity generation is determined by scaling up the reference solar PV system, the Saskatoon Regional Waste Management Centre, used in the Renewable Energy Marginal Abatement Cost Curve Analysis. Ongoing solar PV O&M costs are calculated based on the assumed installed capacity of 48 MW and base-year unit fixed O&M cost data from the NREL source.
	GHG reductions are estimated by applying the grid electricity emissions factor to the annual electricity generation of the assumed 48 MW solar PV system
Data Source(s)	- Annual Technology Baseline: Utility-Scale PV - Renewable Energy Marginal Abatement Cost Curve Analysis (internal) - Saskatoon Light & Power Reseller Rates
Corporate Measure 2.	Construct a new municipal building to achieve a 40% improvement in energy efficiency (meeting BC Energy Step Code Step 3 for Part 3 buildings).
Baseline	Construct a new municipal building to meet the performance requirements of NECB 2015 (BCBC 2018).
Approach	Incremental capital costs are calculated by applying the unit total incremental cost (expressed in \$/m ²) required to achieve high performance relative to baseline performance, based on results from an office archetype in Climate Zone 7a, sourced from the 2018 Energy Step Code Metrics Report for the baseline and the 2022 report for the adopted measure. The cost premium is then scaled to the total projected new corporate building floor area from 2026 to 2050, aligning with the estimate used in the Community Energy and Emissions Planning (CEEP) model.
	Incremental operating savings are estimated based on changes in electricity and natural gas consumption at the community level, multiplied by the corresponding utility rates. Electricity costs are calculated using the Tier 2 rate for commercial loads not exceeding 75 kVA. Natural gas costs include both commodity and delivery charges based on applicable commercial rates. Community-level energy consumption changes are calculated by applying the differences in electricity and natural gas EUIs between the high-performance and the baseline scenario and scaling these differences using the projected new corporate building floor area.

	GHG reductions are calculated by applying grid electricity and natural gas emissions factors to changes in electricity and natural gas use at the community level, resulting from buildings constructed to meet higher energy efficiency performance.
Data Source(s)	- Energy Step Code 2018 Metrics Research - BC Energy Step Code Metrics Report Update - BC Energy Step Code and Zero Carbon Step Code: A Best Practices Guide for Local Governments

Note: The results are based on BC Step Code studies. Although the selected climate zone aligns with the City, the archetype, energy performance baseline, and high performance building scenario do not fully reflect local conditions. As such, the results should be interpreted with caution, and further study is recommended.

Corporate Measure 3.	Electrify existing space heating and cooling systems and domestic hot water (DHW) systems in a municipal building at the time of replacement.
Baseline	Existing space heating and cooling systems and DHW systems are replaced with like-for-similar combustion based systems at the end of their service life.
Approach	The cost and benefit analysis is based on the case study results for the Access Transit Bus Storage and Dispatch Building. The study scope includes two buildings, both of which are one-story prefabricated steel structures. The 4,423 m² bus storage garage houses a fleet of 28 lift-equipped buses and includes locker rooms and washrooms for bus drivers, service rooms, and designated areas for refueling and bus washing. The dispatch office is a 1,300 m² building constructed in the early 1970s. The case study evaluates four retrofit scenarios. Minimum Upgrade Scenario 1, which focuses on ventilation system efficiency improvements and reduced air leakage, is used as the baseline. Minimum Upgrade Scenario 1b, which builds on Scenario 1 by replacing space heating and cooling systems and domestic hot water (DHW) systems with heat pumps, is used to represent fuel switching. Incremental capital costs are estimated using the unit capital cost premium between Scenario 1b and Scenario 1 for the reference building. This unit cost premium is then scaled to the community level using the total existing corporate building floor area baseline applied in the CEEP model. Incremental operating costs are estimated based on changes in electricity and natural gas EUIs between Scenario 1 and Scenario 1b. These EUI differences are scaled to the community level to estimate community-level energy use changes using the total corporate building floor area, and multiplied by electricity and natural gas utility rates to calculate the incremental operating costs. GHG reductions are calculated by applying the corresponding emissions factors to the community-level changes in electricity and natural gas use between Scenario 1 and Scenario 1b.
Data Source(s)	- Access Transit Bus Storage and Dispatch Building Case Study Report (internal) - Summary of CEEP Aligned Building Inputs (internal)
Corporate Measure 4.	Conduct a deep retrofit of an existing municipal building with an envelope focus, including roof, wall insulation, and windows, at the time of major renovation.
Baseline	At the time of major renovation, envelope upgrades in existing municipal buildings are limited to like-for-like replacement.

Approach	The cost and benefit analysis is based on the case study results for the Access Transit Bus Storage and Dispatch Building. The study scope includes two buildings, both of which are one-story prefabricated steel structures. The 4,423 m² bus storage garage houses a fleet of 28 lift-equipped buses and includes locker rooms and washrooms for bus drivers, service rooms, and designated areas for refueling and bus washing. The dispatch office is a 1,300 m² building constructed in the early 1970s. The case study evaluates four retrofit scenarios. For the assessment of envelope-focused retrofits, Minimum Upgrade Scenario 1b, which focuses on fuel switching, is used as the baseline. The Net Zero Energy Ready scenario builds on Scenario 1b by upgrading the walls and roof and is used to represent envelope improvements. Incremental capital costs are estimated using the unit capital cost premium between the two scenarios selected for the reference building. This unit cost premium is then scaled to the community level using the total existing corporate building floor area baseline applied in the CEEP model. Incremental operating costs are estimated based on changes in electricity and natural gas energy use intensity between the two scenarios. These EUI differences are scaled to the community level to estimate community-level energy use changes using the total corporate building floor area, and multiplied by electricity and natural gas utility rates to calculate the incremental operating costs. GHG reductions are calculated by applying the corresponding emissions factors to the community-level changes in electricity and natural gas use between Scenario 1b and the Net Zero Energy Ready scenario.
Data Source(s)	- Access Transit Bus Storage and Dispatch Building Case Study Report (internal) - Summary of CEEP Aligned Building Inputs (internal)
Corporate Measure 5.	Install a total of 0.5 MW of rooftop solar PV on municipal buildings (new and existing).
Baseline	The annual electricity demand equivalent to the output of a 0.5 MW rooftop solar PV system continues to be met by grid electricity supplied by SaskPower.
Approach	Incremental capital costs are estimated using an average installed cost per watt for rooftop solar PV systems in Saskatchewan, applied to the assumed 0.5 MW total rooftop solar PV capacity across municipal buildings. The unit cost includes solar panels, inverters, mounting hardware, and professional installation. A unit capital cost of \$2.9/W (range: \$2.6–\$3.2/W) is applied to reflect the relatively small system sizes, as suggested by Saskatoon Light and Power. Incremental operating costs are estimated as avoided purchases of grid electricity from SaskPower, equivalent to the annual electricity generation of the assumed 0.5 MW rooftop solar PV installed capacity. Annual electricity generation is the output of the rooftop solar PV system (ACT Arena Rooftop) in the Renewable Energy Marginal Abatement Cost Curve Analysis, scaled to the expected total installed capacity of 0.5 MW. Avoided electricity costs are calculated using the average of Tier 1 and Tier 2 SaskPower commercial electricity rates for loads not exceeding 75 kVA. Ongoing O&M costs are excluded because they are relatively small compared to avoided electricity costs and, for simplicity, in this screening-level analysis. GHG reductions are calculated by applying the grid electricity emissions factor to the electricity demand savings resulting from the 0.5 MW rooftop solar PV system.
Data Source(s)	- Renewable Energy Marginal Abatement Cost Curve Analysis (internal) - Solar Panels Cost in Canada (2025)

Corporate Measure 6.	Complete planned cycling and walking infrastructure projects to support mode shift.
Baseline	Mode share remains unchanged, with residents who might shift to active transportation if new facilities were available assumed to maintain how they currently move around.
Approach	Incremental capital costs are based on cost estimates for active transportation infrastructure from the City of Saskatoon Active Transportation Plan (2016), which provides projections for the 2016–2050 period. As the updated Active Transportation Plan is currently under development and the projections are not yet available, active transportation infrastructure completion data for the 2019–2025 period, as shared by the City, are used to update the projections. Capital costs for the 2026–2050 period are estimated by subtracting completed infrastructure from the original projections and scaling the costs based on updated projected kilometers of active transportation infrastructure.
	Incremental operating costs are assumed to be net-neutral, reflecting an offset between ongoing O&M costs associated with new cycling and pedestrian infrastructure and avoided O&M costs associated with baseline roadway infrastructure.
	GHG reductions are estimated based on reductions in vehicle kilometers travelled (VKT) attributable to increased active transportation from 2026 to 2050. According to the Handbook for Analyzing GHG Emissions Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity published by the California Air Pollution Control Officers Association, improved pedestrian infrastructure is assumed to reduce GHG emissions by 6.4% and improved cycling infrastructure by 0.8%, for a combined reduction of 7.2%. This reduction is applied to the total light-duty vehicle VKT, including both gasoline and electric vehicles, consistent with the VKT estimates used in the CEEP model. Resulting VKT reductions are then converted to GHG reductions using a passenger vehicle emissions factor of 0.00073 tCO ₂ e per kilometer.
Data Source(s)	- Active Transportation Plan (2016) - Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity - Active Transportation (2019-2025) (internal)
Corporate Measure 7.	Complete the construction of the Link (Bus Rapid Transit) system in Saskatoon.
Baseline	Mode share remains unchanged, with residents who might otherwise shift to the Link system assumed to maintain their existing travel behavior.
Approach	Incremental capital costs are based on the budget approved for the Bus Rapid Transit project for the 2024–2026 period.
	Incremental operating costs are drawn from the Saskatoon BRT Multiple Account Evaluation, a study conducted in 2018 that assessed the benefits, impacts, and costs of a BRT system. While the study evaluates a broad range of impacts beyond financial performance, including social, community, and transportation user benefits, this analysis uses the undiscounted totals for pavement maintenance costs avoided, fare revenues, and O&M costs. These values are divided by the study period of 20 years to estimate annual incremental operating savings attributable to the BRT system.
	GHG reductions are estimated based on reductions in VKT attributable to the implementation of the BRT system, net of incremental emissions from BRT bus operations. According to the Handbook for Analyzing GHG Emissions Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity published by the California Air Pollution Control Officers Association, the provision of BRT is assumed to reduce community-wide vehicle travel emissions by up to 13.8%. This reduction is applied to total annual LDV VKT in Saskatoon, including both gasoline and electric vehicles, consistent with VKT estimates used in the CEEP model. Resulting VKT reductions are converted to GHG reductions using a passenger vehicle emissions factor of 0.00073 tCO ₂ e per kilometer. Incremental emissions associated with BRT operations are estimated based on annual incremental

	bus VKT, calculated using the length of BRT corridors, estimated service span, and average headways, and multiplied by a diesel bus emissions factor of 0.00143 tCO ₂ e per kilometer.
Data Source(s)	- 2024/2025 Approved Capital Budget Project Details - Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity - BRT Network Cost Benefit Analysis
Corporate Measure 8.	Convert the entire Saskatoon Transit fleet to battery electric buses (BEB) fleet, upgrade the facility for on-site charging, and build on-route charging stations.
Baseline	The fleet continues to operate as 100% diesel buses, including projected fleet growth over the study period.
Approach	Cost and GHG reduction estimates for the full conversion of the Saskatoon Transit fleet to battery electric buses are drawn directly from the assessment prepared by the Canadian Urban Transit Research and Innovation Consortium (CUTRIC) to ensure consistency with the most recent, measure-specific analysis and with the assumptions and results that are expected to inform updates to the Saskatoon Transit 10-Year Fleet Renewal Strategy. Data are extracted from the outcomes of the base case scenario and scenario 1 (full BEB solution).
Data Source(s)	- Saskatoon Transit Full Fleet ZEB Implementation Plan 2025
Corporate Measure 9.	Convert the entire Saskatoon Transit fleet to hydrogen fuel cell electric buses (FCEB) fleet with hydrogen fueling infrastructure upgrades at the Civic Operations Centre.
Baseline	The fleet continues to operate as 100% diesel buses, including projected fleet growth over the study period.
Approach	Cost and GHG reduction estimates for the full conversion of the Saskatoon Transit fleet to zero-emission buses are drawn directly from the assessment prepared by the Canadian Urban Transit Research and Innovation Consortium (CUTRIC) to ensure consistency with the most recent, measure-specific analysis and with the assumptions and results that are expected to inform updates to the Saskatoon Transit 10-Year Fleet Renewal Strategy. The assessment analyzed four hydrogen production pathways: electrolytic, steam methane reforming (SMR), SMR with carbon capture and storage, and electrolytic with wind energy. It acknowledges that the latter three production pathways are not readily available in Saskatchewan. Therefore, data are extracted from the outcomes of the base case scenario and scenario 2 (full FCEB solution: electrolytic pathway).
Data Source(s)	- Saskatoon Transit Full Fleet ZEB Implementation Plan 2025

Note: This measure is not included in the final GHG reduction measure list because the results indicate it would not result in GHG reductions given the carbon intensive grid.

Corporate Measure 10.	Replace a light duty municipal fleet vehicle with a zero-emission alternative at the time of replacement, along with the rollout of charging infrastructure.
Baseline	Internal combustion engine (ICE) vehicles continue to operate and are replaced on a like-for-like basis at the end of their service life.
Approach	Cost and GHG reduction estimates for the zero emission vehicle transition are drawn directly from Chapter 4 of the Saskatoon Zero Emission Vehicle Adoption Feasibility Study for the municipal fleet. Data are extracted from the business as usual scenario and the technology leadership scenario to ensure consistency with the most up to date analysis, as well as with the assumptions and results expected to inform updates to the overarching Saskatoon Transportation Master Plan. In the analysis, estimates for vehicle costs and charging infrastructure costs are presented separately. Charging infrastructure costs are not included in this financial analysis because initial estimates indicate that costs between the business as usual and technology leadership scenarios are roughly offset over the study period, and the study also points out the potential opportunities to reduce the number of chargers required.
Data Source(s)	- Saskatoon Zero Emission Vehicle Adoption Feasibility Study (internal)
Corporate Measure 11.	Upgrade and expand the landfill gas collection system to ensure the landfill gas collection rate reaches and is maintained at a minimum of 50%.
Baseline	The landfill gas collection system continues to operate as is, with no major upgrades or expansion beyond routine operation and maintenance.
Approach	Incremental capital costs are based on the 2026–2035 budget requests for the landfill gas collection system expansion provided by the City. Incremental operating costs include three components: (1) estimated annual incremental electricity costs associated with the expanded landfill gas collection system, as provided by the City; (2) ongoing investment required to maintain landfill gas capture rates over time, as shared by the City; and (3) revenues from electricity sales generated by the captured landfill gas. Electricity sale revenues are calculated by applying an assumed power purchase agreement (PPA) rate to electricity generated from landfill gas, consistent with the constant generation assumptions used in the CEEP model, which assumes generation remains at current levels until 2031, when it becomes unfavorable from a GHG perspective, that is, when electricity generation from landfill gas becomes more carbon intensive than grid electricity. The PPA is derived by dividing reported electricity sales revenue of \$1,316,633 by electricity generation of 18,307,576 kWh in 2025, sourced from the Landfill Gas Project Update, resulting in a rate of \$0.072 per kWh. This rate is then escalated at an assumed annual rate of 1.25% until 2031. GHG reductions are calculated by accounting for emissions avoided through landfill gas capture and electricity generation, and additional emissions associated with the combustion of captured landfill gas. Emissions data are extracted directly from the CEEP model.
Data Source(s)	- Capital Costs and Incremental Annual Electricity Costs for Landfill Gas Capture (internal) - Ongoing Investment Required Shared in 10/08 Bi-Weekly Check-In Meeting (internal) - Landfill Gas Project Update