City of Saint John

Community Energy Action Plan

November 2023

ActSJ

Pathway to Net-Zero

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Land Acknowledgements

The City of Saint John/Menaquesk is situated in the traditional territory of the Wolastoqiyik/Maliseet. The Wolastoqiyik/Maliseet along with their indigenous neighbours, the Mi'Kmaq/Mi'kmaw and Passamaquoddy/Peskotomuhkati signed Peace and Friendship Treaties with the British Crown in the 1700s that protected their rights to lands and resources.

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Contributors to ActSJ

The City of Saint John would like to acknowledge the community members and staff from across the city that contributed to the development of the ActSJ: Community Energy Action Plan.

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Message From the Mayor

We come together to work on a matter of great significance —the Community Energy Action Plan. This plan represents a collective effort that transcends boundaries, encompassing both our dedicated staff and our valued stakeholders. It is a testament to our determination to face the challenges of energy consumption and environmental impacts head-on.

Our city has always been defined by its resilience and strong sense of community. The Community Energy Action Plan embodies these qualities and signifies our determination to innovate, adapt, and thrive. It is a roadmap that will lead us towards a brighter and greener City of Saint John.

To our esteemed staff and stakeholders, I want to express my deep appreciation for your tireless work in developing and implementing this plan. Your expertise and devotion are the driving forces behind our progress, and I am profoundly grateful for your commitment.

To our citizens, I want to emphasize the crucial role you play in this endeavor. Your input, ideas, and engagement are invaluable as we work towards our goal. This plan is not just a vision; it is a promise to you, our children, and our future generations.

We are all in this together. By working hand in hand, we can create meaningful change and set an example for others to follow. Our collective efforts will make our city a shining example of sustainable environmental living and a beacon of hope for a better, greener world.

Your sincerity, proficiency, and enthusiasm are the cornerstones of our success. Thank you to everyone involved, for your commitment to our city and its future. Let us embark on this important journey with our best foot forward as we work together for a greener tomorrow.

With deepest appreciation,

Mayor Donna Noade Reardon

Executive Summary

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Executive Summary

ActSJ is the City of Saint John's response to the climate crisis. The plan lays out a feasible strategy for the community to achieve net-zero emissions by 2050 while increasing jobs, lowering energy bills, and improving quality of life. ActSJ is also in line with global efforts to limit global warming to 1.5 degrees Celsius.[1]

ActSJ builds upon over two decades of climate action and sustainability work by the City. Saint John's climate action efforts include a municipal deep energy retrofit program, a climate change vulnerability assessment report, a corporate climate action plan, and the securing of over $40 million in grants and over $14 million in loans from federal, provincial, and other agencies toward climate change mitigation and adaptation projects.

E.1 The Process

ActSJ maps a detailed pathway to net-zero emissions for Saint John with interim and 2050 targets, and analysis of financial impacts, risks, and co-benefits. The analysis has been informed at each stage by collaborative engagement with the public and relevant stakeholders.

The analysis began by evaluating the drivers that determine Saint John's energy consumption and greenhouse gas (GHG) emissions, answering the question, "Where are we now?" Analysis of future trajectories or "What happens in the next 30 years?" included a Business-as-Planned (BAP) Scenario, which evaluated what might happen if no additional policies or actions are put in place, and two low-carbon scenarios, which explored the implications of achieving GHG reductions consistent with science-based targets.[2]

The first low-carbon scenario (the NZE-1 Scenario) modelled strategies identified through context reviews and community engagement that could enable Saint John to achieve net-zero emissions by 2050 across all sectors. The second scenario (the NZE-2 Scenario) accelerates specific strategies to reach an interim target of 60% reduction in non-industrial emissions by 2030, as well as the net-zero by 2050 target.

The engagement activities throughout the development of ActSJ ensured that interested and affected parties (internal and external) informed and provided feedback to create an ActSJ that reflects the knowledge, input, and perspectives of the community.

[1] C40. "Race-to-Zero Campaign". https://www.c40.org/what-we-do/building-a-movement/cities-race-to-zero/

[2] For a discussion of science-based targets, see: Global Covenant of Mayors (2020). Science-Based Climate Targets: A Guide for Cities. Retrieved from: https://sciencebasedtargetsnetwork.org/wp-content/uploads/2020/11/SBTs-for-cities-guide-nov-2020.pdf

E.2 Community Emissions

In **2021**, the Saint John community consumed 83 million gigajoules of energy to:

- Heat and cool space;
- Run appliances and equipment;
- Fuel vehicles;
- Operate machinery inside all types of building—from homes to schools to office towers and industrial facilities;
- Provide municipal services like water and waste and move people and goods around; and
- Power industry.

These processes, as well as emissions from waste, created **4,811 kilotonnes of greenhouse gas (GHG) emissions**—equivalent to consuming about **64,000 tanker trunks worth of gasoline.**

Based on Saint John's 2021 population, this translates to **66.7 tCO_2e generated per person.** This is high compared to Canada's average GHG emissions per capita (17.7 tCO_2e in 2020); however, it is comparable to other fossil-fuel-producing communities.[3]

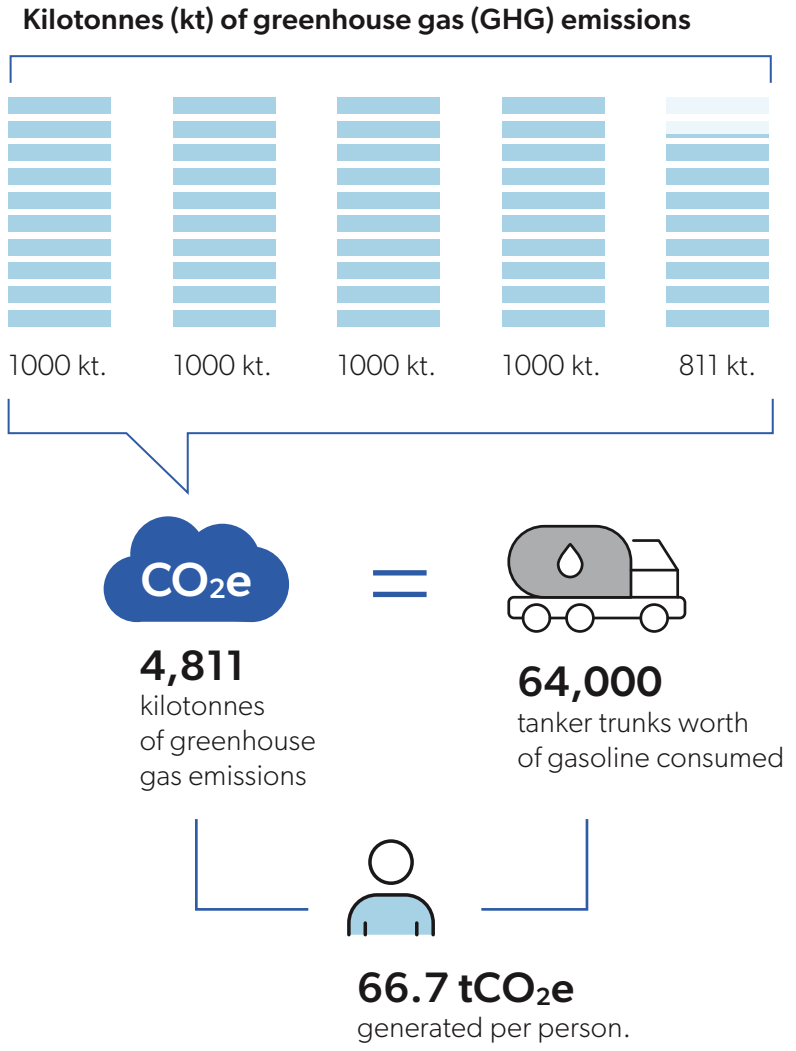


Figure E1 Diagram illustrating Saint John's GHG emissions in 2021.

[3] Many fossil-fuel-producing communities in Canada have much higher per capita emissions than the national average. For example: Athabasca County, AB, at 73.4 tCO_2e/capita; Medicine Hat, AB, at 62.8 tCO_2e/capita; and Sarnia, ON, at 60.7 tCO_2e/capita. Per capita emissions data is from the Municipal Energy and Emissions Database, available at meed.info.

The bulk of these emissions are from heavy industry. Buildings and transportation are the second- and third-largest sources of emissions, respectively. Composting waste, manufacturing and construction, and fugitive emissions[4] account for the remaining emissions.

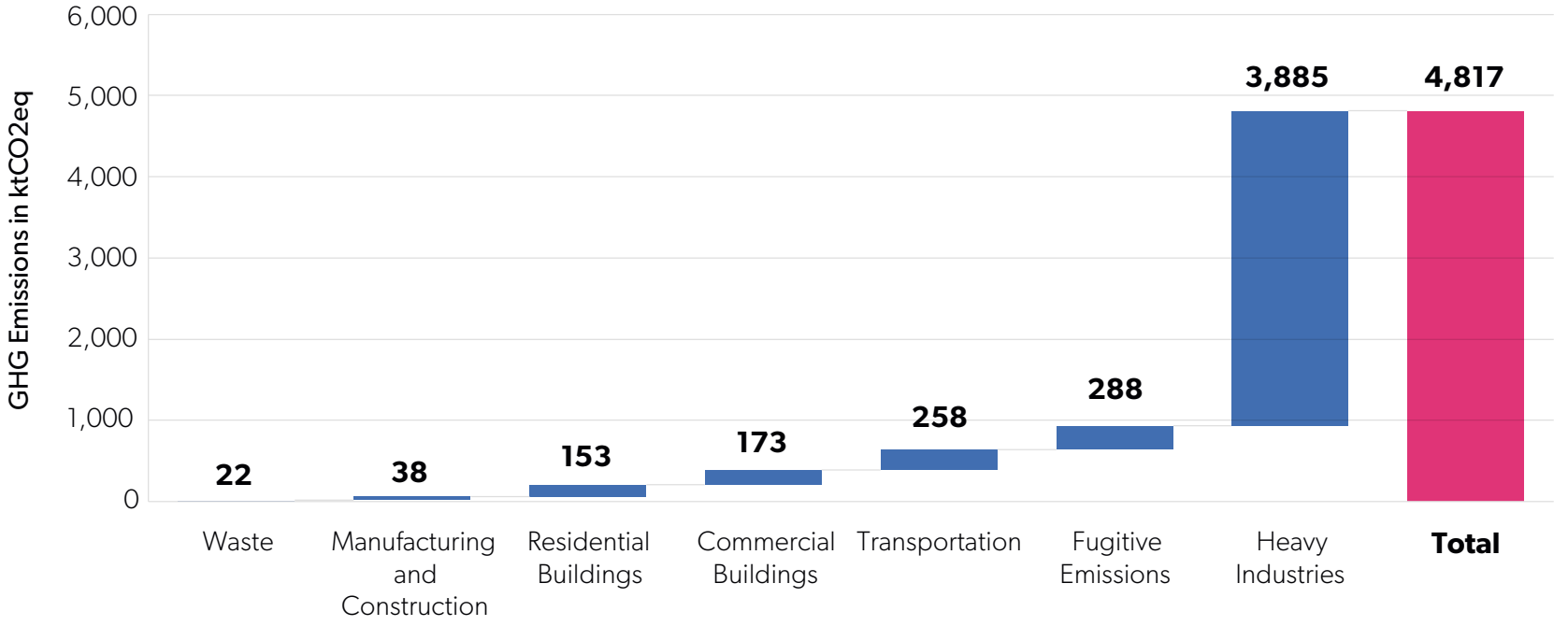


Figure E2 Saint John's GHG emissions by sector in 2021.

[4] Fugitive emissions are greenhouse gas emissions leaked into the atmosphere accidentally or intentionally, usually during the production, processing, handling, and distribution of fossil fuels.

The scale of industrial emissions may make it tempting to discount the remaining community emissions. However, Saint John's per capita emissions without heavy industries (8.9 tCO_2e) are comparable to other small Canadian cities, such as Moncton (11.871 tCO_2e), Fredericton (11.352 tCO_2e), and Victoria (9.256 tCO_2e), that are working to reduce community emissions to net zero.5 Cutting these emissions is important to limit the catastrophic impacts of the climate crisis and enable Canada to achieve its goal of net-zero by 2050. These emissions are from everyday energy use, like running vehicles and warming buildings. Everyone in Saint John contributes to them and can play a role in helping the community reach net zero.

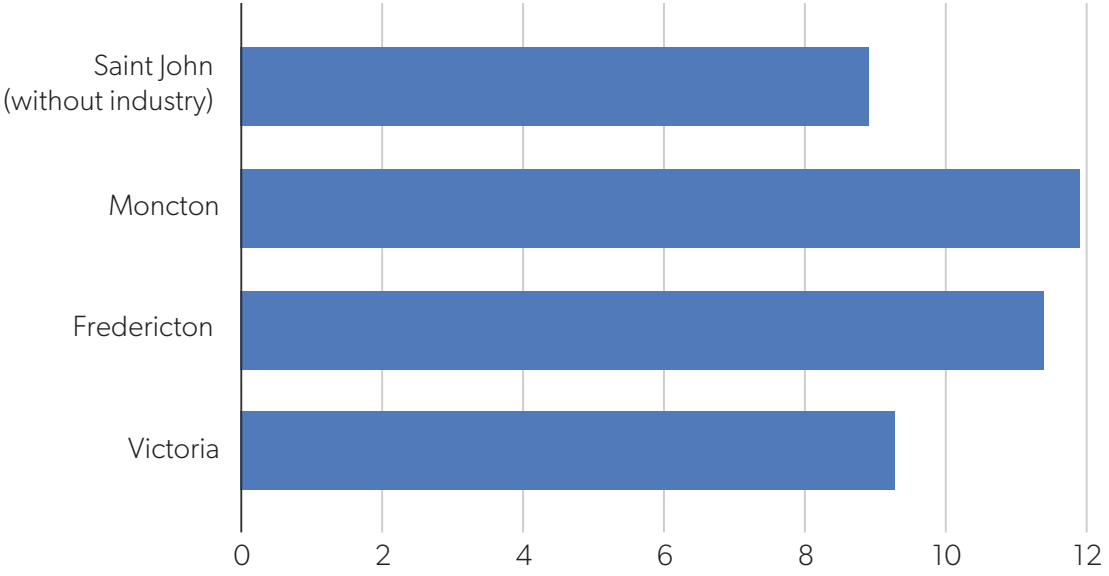


Figure E3 Saint John's per capita emissions without industry relative to other small Canadian cities.

[5] Per capita emissions data is from the Municipal Energy and Emissions Database, available at meed.info.

E.3 The Pathway

The ActSJ pathway is based upon the second low-carbon scenario (NZE-2), which is more ambitious than the first. The modelling results indicate that implementing ActSJ is technically and economically feasible, but it will also be challenging. If ActSJ is implemented in full, GHG emissions are projected to decline from 645 $ktCO_2e$ in 2021 to 35 $ktCO_2e$ in 2050—a decrease of 95%. Achieving these reductions will require collaboration across the Saint John community; changes to city policies, the development of new city programs, and raising awareness of ActSJ actions will also be essential. The plan relies on technologies available today; future technological advancements could enable accelerated GHG reductions and efficiency gains. At the same time, the City must incorporate new technologies into the plan with caution, as they could divert critical financial capital and capacity from proven solutions.

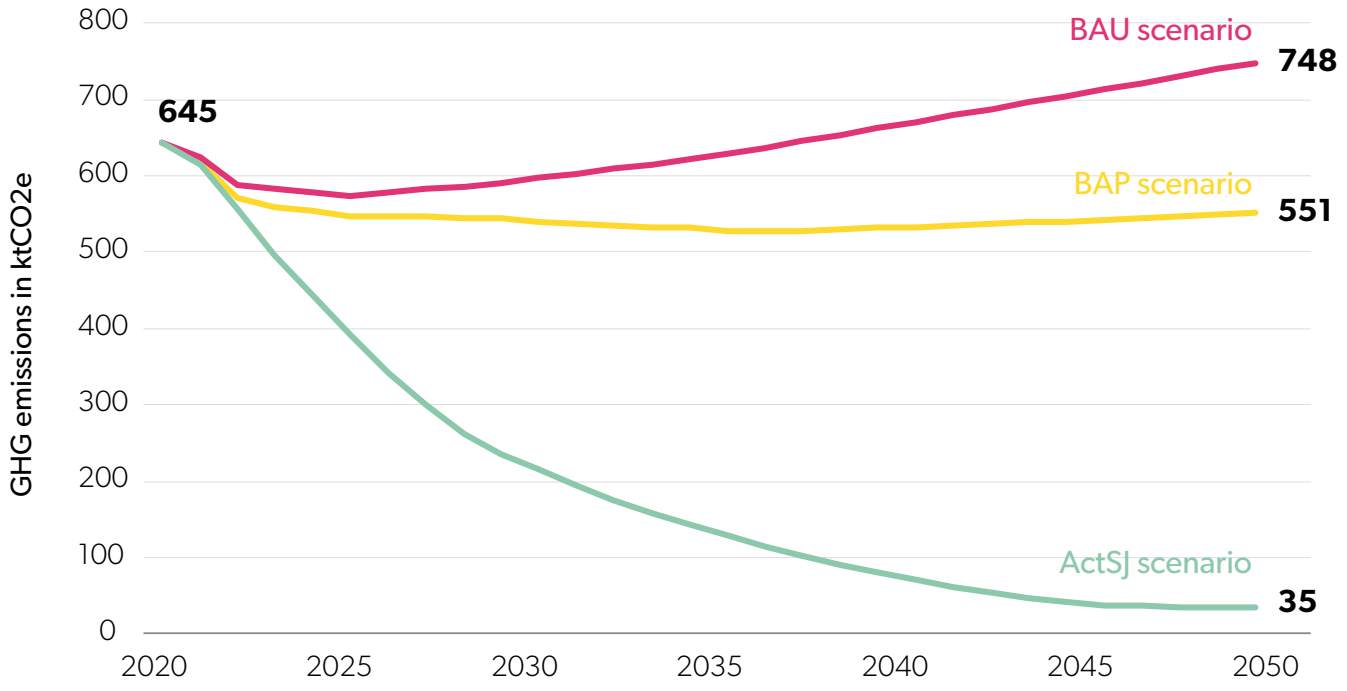


Figure E4 The ActSJ pathway trajectory for community emissions (without heavy industries) compared to BAU and BAP Scenarios.

Figure E5 (next page) illustrates the ActSJ pathway for non-industrial emissions from three different vantage points: energy use, energy efficiency, and energy source. The first chart on the left shows that energy consumption drops from 124 GJ per capita in 2021 to 35 GJ per capita in 2050. The second chart shows significant gains in energy efficiency and slightly lower overall energy consumption as Saint John grows. The final chart shows that over 80% of Saint John's energy needs will be met by renewables in 2050. ActSJ focuses on reducing energy use and improving energy efficiency in order to minimize the amount of renewable energy resources that have to be developed to decarbonize the community.

Energy use	Energy efficiency	Switch
Reducing or avoiding energy consumption in the first place	Improve the efficiency of the energy system (supply and consumption)	Fuel switch to zero carbon sources

Figure E5 The transformation of Saint John's energy system under the ActSJ pathway in three charts. This figure depicts community energy use and emissions without heavy industries.

E.4 Target and Milestones

By making a C40 Cities Race to Zero pledge, the City of Saint John joined cities from around the world in committing an emission reduction target aligned with 1.5 degrees of warming. To meet this goal, Saint John must reduce GHG emissions by 60% by 2030 and to net-zero by 2050.

Scenario modelling for ActSJ identified specific milestones to track the implementation of low-carbon strategies for each decade between 2021 and 2050 to enable the City to monitor progress against the pathway.

Table E1. GHG emissions milestones for BAP and ActSJ Scenarios in tonnes of carbon dioxide equivalentCO_2e), without heavy industries.

	2021	2023	2030	2040	2050	Cumulative (2023-2050)
BAP Scenario						
Total GHG emissions in tCO_2e	645,000	570,000	544,000	531,000	551,000	18,025,000
% change over 2021		– 11.5	– 15.6	– 17.5	– 14.5	
ActSJ Scenario						
Total GHG emissions in tCO_2e	645,000	558,000	236,000	81,000	35,000	4,887,000
% change over 2021		– 13.5	– 63.4	– 87.5	– 94.6	
GHG emissions per capita	8.91	7.65	2.53	0.76	0.27	
% change over 2021		– 14.2	– 68.0	– 91.4	– 96.9	

E.5 Implementation

ActSJ includes a high-level implementation guide with recommended policies, initiatives, and programs that will put Saint John on track to achieve net-zero emissions by 2050. The guide focuses on the following Big Moves:

Climate Action Big Moves

Big Moves are focal points for major emissions reductions in the community. They provide a framework for the actions in ActSJ.

E.6 Financials

Achieving net-zero emissions requires community-wide investments; these are opportunities for new and existing businesses, including companies providing heat pumps, building retrofits, renewable energy technologies, energy storage, electric vehicles, and energy controls. Some of these investments will occur as a result of natural turnover of stocks, such as the replacement of an aging gasoline vehicle with an electric vehicle, or investments by home and business owners in energy efficiency retrofits. The increased local demand for these products and services will stimulate the local economy and create local jobs

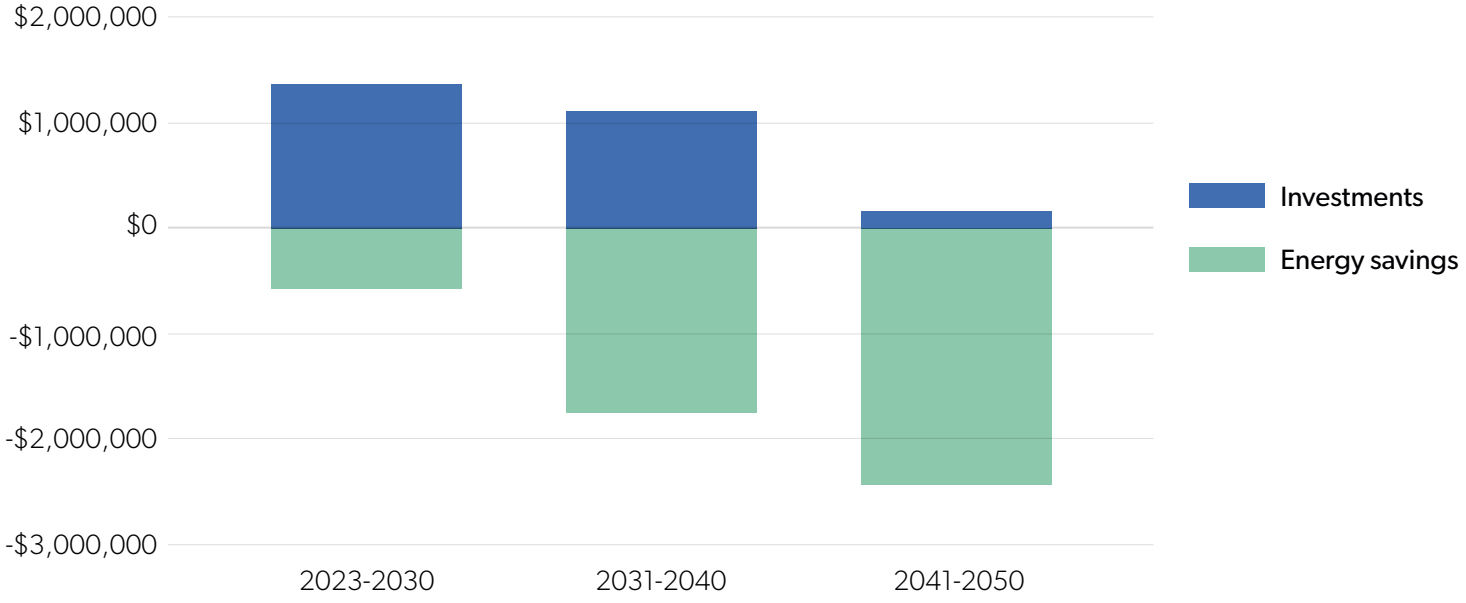


Figure E6 Capital investment and energy expenditures by decade, undiscounted.

ActSJ investments also unlock other benefits for the community, including major energy savings for residents and local businesses. Total community-wide investments up to 2050 amount to $2.6 billion while reduced energy expenditures create savings of $4.8 billion over the same period. The short-term cost versus long-term gain nature of the energy transition highlights the important role that financing mechanisms will play in enabling and accelerating investments opportunities outlined throughout ActSJ.

Figure E6 illustrates how near-term coordinated investments across community sectors result in community wide energy savings which significantly outweigh the initial investments when compared to the BAP Scenario; these savings grow in time as buildings, transportation and industry becomes more efficient relative to the BAU Scenario.

From an economic perspective, climate action is a no-regret policy with many opportunities for new and existing businesses.

E.7 Conclusion

ActSJ identifies the 17 strategies, bundled into six Big Moves and additional governance and communications moves that, taken together, could reduce Saint John's GHG emissions to almost net-zero by 2050. These strategies have varying implementation, financial, and risk profiles. Some must be led and implemented by the City of Saint John while others will be undertaken by the City's partners, private businesses, or residents. The whole community will need to mobilize to achieve ActSJ's outcomes. The City can play a central role in rallying residents, businesses, and organizations around a shared vision and targets.

Striving for net-zero is an intricate goal, marked by barriers, risks, and promising opportunities. Challenges and risks could come in the form of financial constraints, technological constraints, difficulties fostering internal and community participation, political shifts and economic fluctuations. In addition to reducing GHG emissions, ActSJ has the potential to act as an economic catalyst, bringing in investment and creating jobs, while offering collective benefits for the environment, community well-being, and quality of life.

The work must start now and be monitored and adapted over the coming years to achieve Saint John's net-zero goals.

1.

Introduction

1. Introduction

The Climate Context

In October 2018, the Intergovernmental Panel on Climate Change (IPCC) provided a stark warning about how the climate crisis will harm people and our planet: climate change poses risks for health, economic growth, public safety, infrastructure, livelihoods, and biodiversity.

The IPCC urged governments to take action to limit global warming to 1.5 degrees Celsius (°C) above pre-industrial levels.[6] Reaching this target will allow humanity to avoid the most harmful impacts of climate change. However, keeping global warming below 1.5°C will require bold and swift changes to global economic and energy systems to reduce carbon emissions to zero by 2050, if not earlier. Cities are responsible for the majority of emissions. By making immediate changes to buildings, land-use, transportation, and waste systems, cities can play a critical role in limiting global warming.

Saint John Rising to the Challenge

In response to the IPCC's warning of the rapidly intensifying climate emergency, Saint John has committed to doing its part in reducing emissions to avoid the most catastrophic impacts of climate change. As a coastal city, Saint John is acutely aware of the threats posed by climate change, including rising sea levels, increasing temperatures, and higher intensity precipitation events. These impacts lead to severe inland and coastal flooding, accelerated rates of coastal erosion and loss of land.[7]

In November 2021, the City joined the "Race to Zero" campaign, which includes a pledge to:

a. Reach (net) zero greenhouse gas (GHG) emissions as soon as possible, by mid-century at the latest, in line with global efforts to limit warming to 1.5°C.

b. Set an interim target to achieve in the next decade, which reflects maximum effort toward or beyond a fair share of the 50% global reduction in CO_2 by 2030 identified in the IPCC Special Report on Global Warming of the 1.5°C Plan.

The ActSJ: Community Energy Action Plan is a directive resulting from the Race to Zero Pledge. ActSJ measures the size of the climate challenge in Saint John and identifies a pathway to reduce community emissions to net-zero by 2050. It is rooted in Saint John's unique local context, including the extensive work already done through existing and past environmental and climate-related policies, programs, and initiatives. The plan is informed by input from local industries and businesses, energy utilities, academia, environmental organizations, and the public.

The net-zero pathway will bring jobs and growth, stemming from necessary leaps in clean energy innovation and a global shift away from fossil fuels. Electricity will become the core of the energy system, and emerging low-emissions industries will flourish. The shift to a net-zero future will take monumental effort and dedication but taking climate action now will lead to a better life for the community and future generations.

[6] United Nations Framework Convention on Climate Change (2015). "The Paris Agreement". https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

[7] Atlantic Coastal Action Program (ACAP) Saint John (2020). "Understanding Climate Change in Saint John." https://saintjohn.ca/sites/default/files/2020-11/Understanding%20Climate%20Change%20in%20Saint%20John%20%282020%29.pdf

Timeline of Saint John's sustainability and climate action initiatives

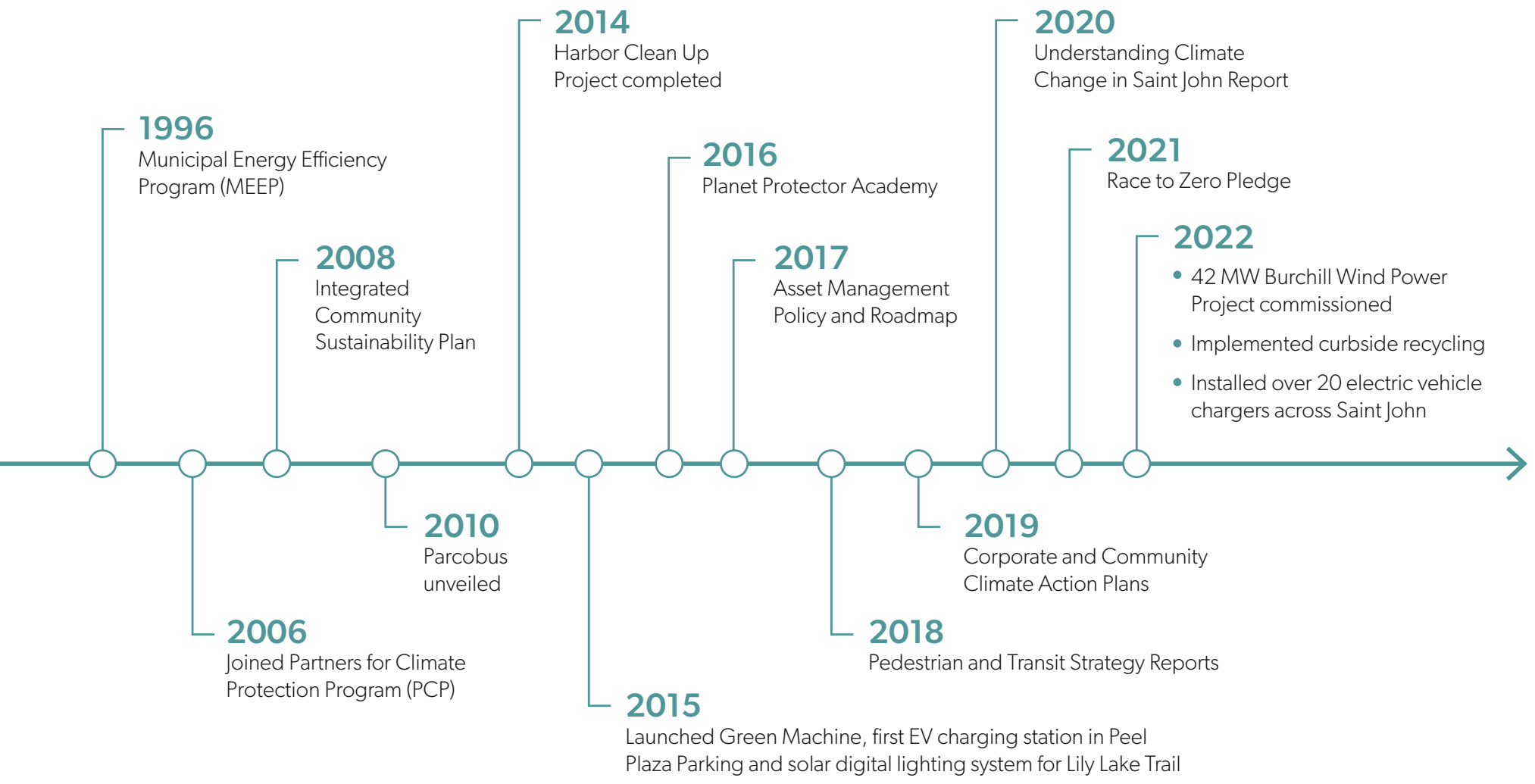


Figure 1 Timeline of Saint John's sustainability and climate action initiatives.

Converting Challenges to Opportunities

Saint John must overcome three key challenges to achieve net-zero emissions, including emissions from heavy industries, Saint John's reliance on fossil fuels, and local inequities. Each of these challenges is also an opportunity to improve life in Saint John.

Emissions From Industry

Almost all emissions generated in Saint John can be attributed to a small group of heavy industrial facilities. Some of the companies operating these facilities have net-zero aspirations. Decarbonizing these industries is an opportunity to innovate and bring in investments and local jobs while shifting away from fossil fuels. The City can support and encourage this industrial transition with advocacy and influence, but the ultimate responsibility for change lies with the industrial sector.

Reliance on Fossil Fuels

Fossil fuels are the main source of energy across all sectors. Vehicles run on gasoline and diesel while natural gas, wood, and fuel oil are used for space heating, water heating, and industrial processes.The community also takes a financial hit for its reliance on fossil fuels: gas and fuel oil prices are higher in New Brunswick compared to the national average.[8] To eliminate GHG emissions, Saint John must replace fossil fuels with renewable electricity. At the same time, the community can use energy more efficiently by adopting electric vehicles and electric heating systems, which are usually more efficient than their fossil-fuel counterparts. In the long run, transitioning to renewable electricity will lower energy bills for households and residents and make them less vulnerable to volatile oil prices. With its ambitions to achieve a net-zero emissions by 2050, Saint John Energy is the perfect partner for the City to accelerate this transition.[9]

Saint John Energy has several initiatives that align with the City's net-zero goals, including a heat pump rental program and a home upgrades Energy Loan Program.[10] Saint John Energy, with their partners Natural Forces and Tobique First Nation, recently commissioned the Burchill Wind Project, which consists of 10 wind turbines, with a total capacity of 42 megawatts; it is capable of supplying 15% of the city's electricity demand.

Local Inequities

Almost one-fourth of households (22%) in Saint John fall below the poverty line—8% more than in Canada in general (14%) and 5% more than in New Brunswick as a whole.[11] Additionally, Saint John's population is aging: more than 20% of residents are aged 65 years or older. Saint John also has a high rate of renting, relative to owner-occupied homes.

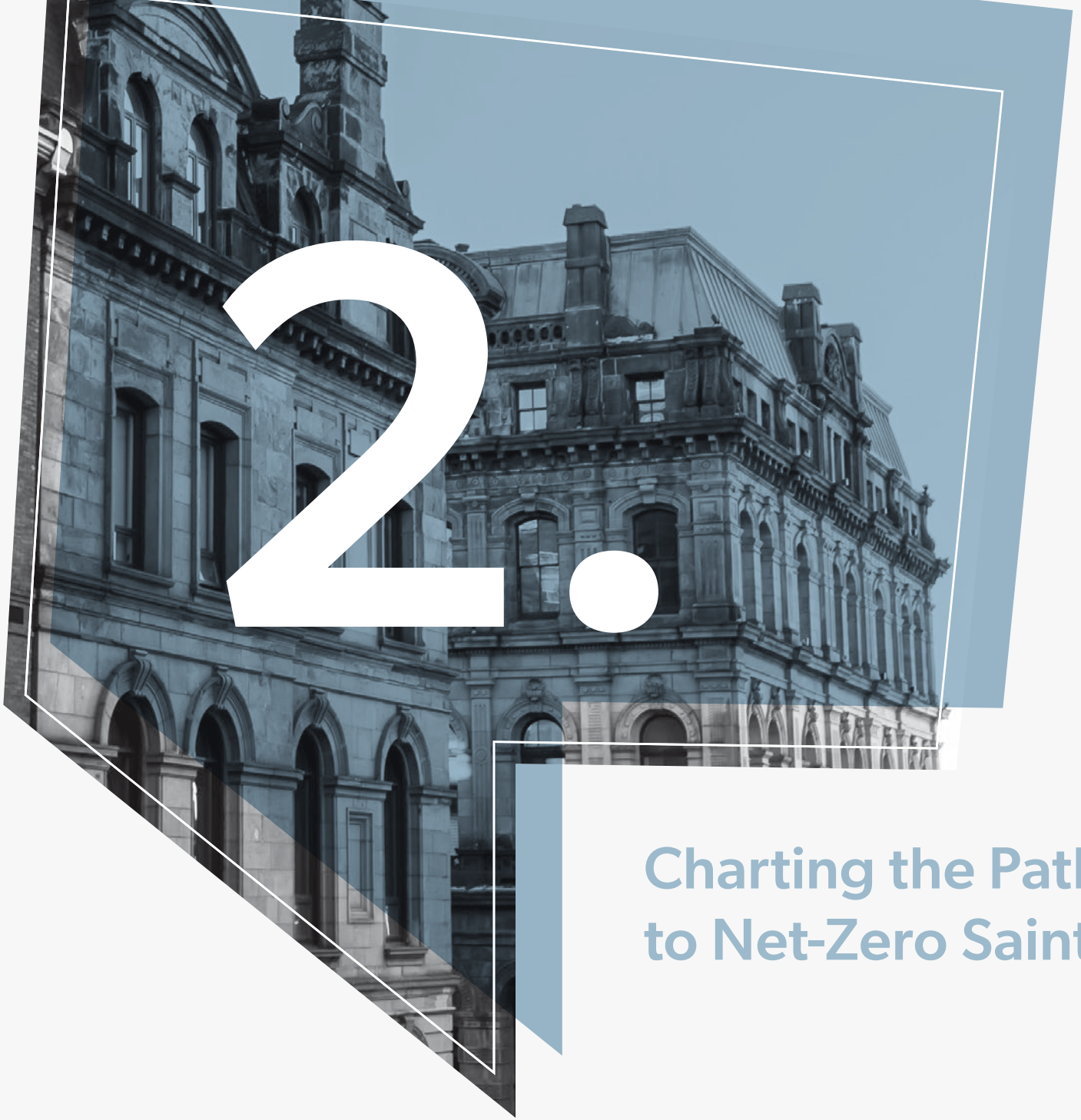
Each of these issues must be addressed for Saint John to have an equitable transition to net-zero in which everyone can participate and benefit. To ensure intergenerational equity, income inequality, housing affordability, and climate resilience are considered during the development of climate mitigation initiatives, the City can apply an equity lens. An equity lens is a tool to assess how different groups in the community could be affected by a greenhouse gas reduction initiative so that steps can be taken to enhance positive impacts and avoid negative ones.

[8] Statistics Canada. "Table 18-10-0001-01 Monthly average retail prices for gasoline and fuel oil, by geography." Accessed September 27, 2023. https://doi.org/10.25318/1810000101-eng

[9] Saint John Energy (2023). "Zero30 Roadmap." https://zero30.ca/

[10] Statistics Canada. "Profile table, Census Profile, 2021 Census of Population - Saint John, City." Accessed July 16, 2023. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&GENDERlist=1,2,3&STATISTIClist=1,4&HEADERlist=0&DGUIDlist=2021A00051301006&SearchText=Saint%20John

[11] University of New Brunswick. "Poverty 101: Looking for Answers." Accessed June 30, 2023. https://www.unb.ca/saintjohn/_assets/documents/promise/poverty101.pdf



2.

Charting the Pathway to Net-Zero Saint John

2. Charting the Pathway to Net-Zero Saint John

ActSJ was developed using a systematic approach that integrates technical modelling with a comprehensive engagement process, as illustrated in Figure 2. The interaction between these two processes ensures that the plan is achievable and evidence-based while being rooted in the local context and responsive to community concerns.

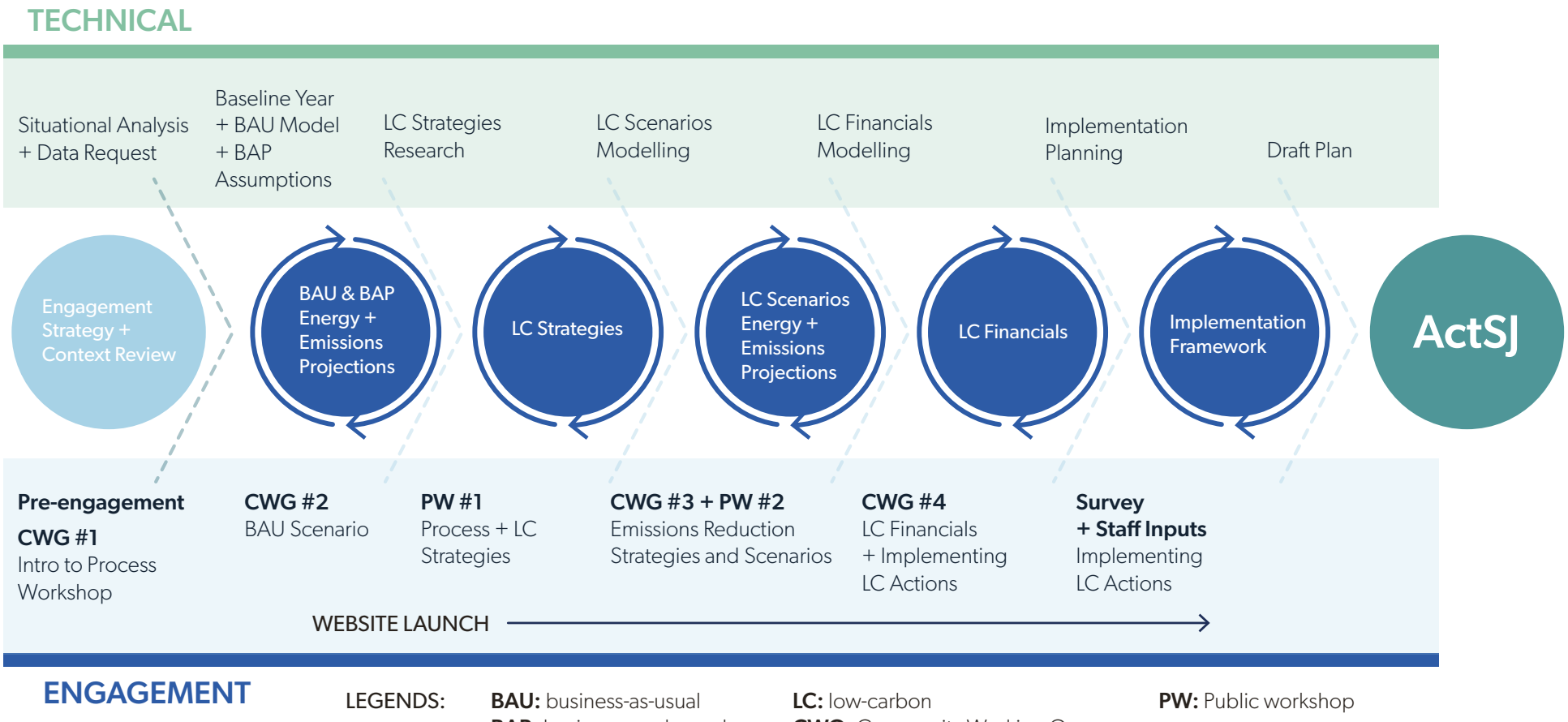


Figure 2 The process for developing ActSJ.

Community is central to the ActSJ development process. While the endorsement of the CEAP rests with Saint John's City Council, it required extensive input from the community to ensure it aligned with local conditions, constraints, and opportunities.

Engagement

The ActSJ engagement process was designed and carried out to gather input from key interested and affected groups, including industry, utilities, city staff, residents, non-profit organizations, academics, and community members. Engagement activities included two public workshops, four Community Working Group (CWG) workshops, a community survey, and discussions with city staff. Community members were also invited to follow along with the process though a dedicated Shape Your City platform.

To learn more about the engagement process, the engagement activities and how feedback from each activity informs the overall plan, please review Annex I: Engagement Summary.

Technical Modelling

Along with the community input described above, ActSJ was informed by an analysis of Saint John's current and projected energy use and emissions in a reference scenario, modelled by SSG's CityInSight energy, emissions, and finances model.

Drawing on data about local demographics, buildings, transportation, land use, industry, waste and wastewater, the consulting team used the model to create a picture of Saint John's energy use and GHG emissions in space from stocks (e.g., cars, furnaces, waste), which change over time (based on changes in population, jobs, and land-use patterns). The baseline year energy and emissions inventory, developed for the year 2021, is calibrated against observed data from utilities and other sources. The year 2021 was chosen as it is the most recent year with a robust and complete dataset.

Figure 3 (next page) illustrates a baseline year (current emissions level), a Business-as-Planned (BAP) Scenario (reference scenario) and GHG reductions from actions, which combined represent a net-zero scenario. The remaining area shaded in grey is a carbon budget or carbon liability. This area represents the remaining emissions the community can emit in order to achieve its GHG reduction goals. Historically, organizations have focussed on point-in-time targets such as x% reduction by 2030 or 2050; but it's actually annual GHG emissions that drive climate change. Consequently, lowering emissions in line with the net-zero scenario is essential.

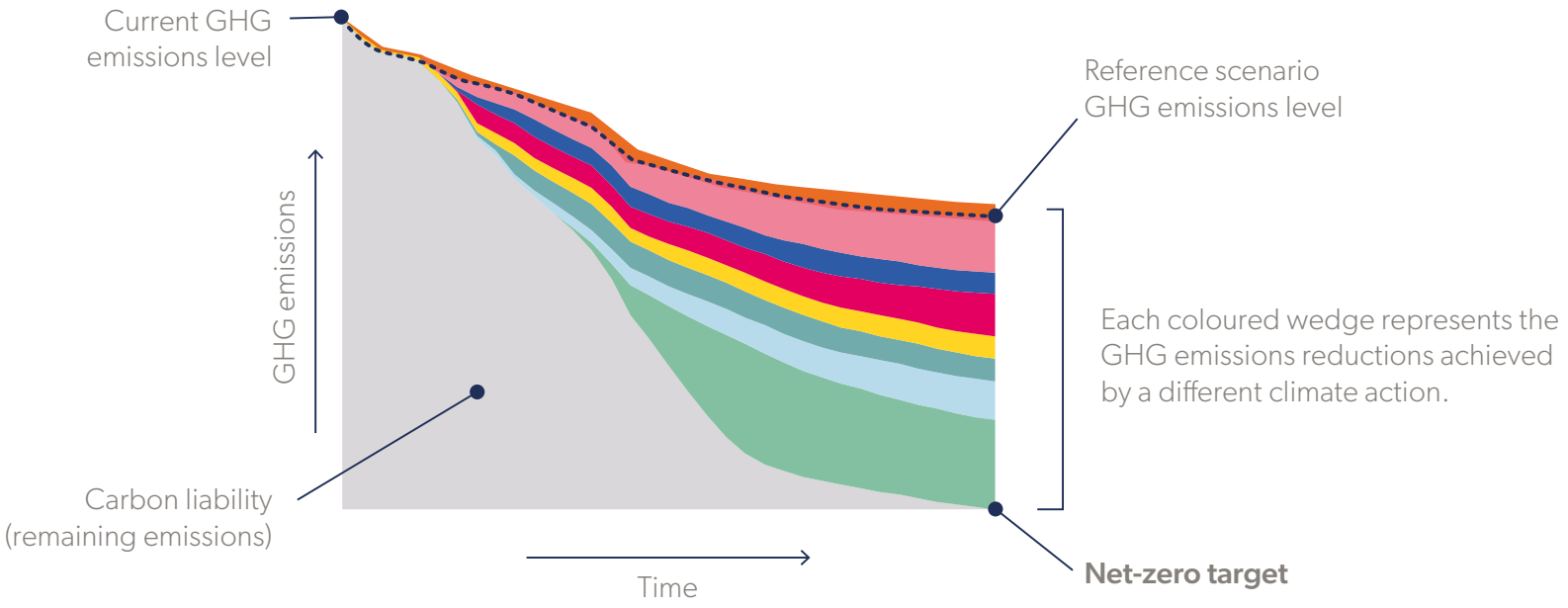


Figure 3 A conceptual representation of a net-zero scenario pathway.

Emissions reduction actions were entered into the model to test their impact on energy use, emissions, and costs relative to the reference scenario, and identify when and in what order actions could be implemented to minimize costs and maximize benefits. Through this process, the consulting team developed net-zero scenarios consisting of an optimal bundle of actions—selected based on technical analysis and community input—that informed the ActSJ plan.

The model also helped assess the financial impacts of the net-zero scenarios relative to the reference scenario, including the costs of and returns on investments, maintenance of equipment, household and business energy bills, and how much employment would be created by climate actions.

The scenarios generated by the model are not a prediction, but plausible, evidence-based projections on how the future may evolve based on data and assumptions about the key drivers of emissions and critical trends (e.g., rate of technological change, energy prices) in Saint John. Modelling is an important tool to help communities understand the type and scale of action necessary to drive major emissions reductions. In this case, the scenario helped the City identify the Big Moves necessary for a net-zero transition.

For additional information on the technical modelling process, its inputs, and assumptions, please review Annex II: Modelling Data, Methods, and Assumptions.

Summary of scenarios and strategies

Drawing on input from the City and Community Working Group, the consulting team developed four scenarios for Saint John ActSJ. The scenarios are summarized in Table 1.

Table 1. Descriptions of the scenarios.

Scenario Label	Title	Description
BAU	**Business-as-usual**	A scenario that extrapolates current demographic patterns into the future to illustrate energy use and GHG emissions if no additional plans, policies, programs, and projects are implemented.
BAP	**Business-as-planned**	A reference scenario that extrapolates current demographic patterns into the future while taking into account existing and approved plans, legislations and targets that would affect energy use and emissions.
NZE-1	**Net-zero emissions 1**	A scenario that selects and models actions to dramatically decrease GHG emissions and improve energy efficiency across all sectors, with a target of achieving net-zero emissions by 2050.
NZE-2	**Net-zero emissions 2**	A scenario where some actions are accelerated and expanded to model achieving a fair-share interim target of 60% emissions reductions by 2030, and net-zero emissions by 2050. NZE-2 is more ambitious than NZE-1.

A set of emission reduction strategies was identified based on literature and steps other cities were undertaking. Following the definition of the scenarios, modelling assumptions and parameters were developed for each strategy to reflect the current energy and low-carbon dimensions, and localized to Saint John through a series of engagement activities. These strategies are described in the following table.

Table 2. Scenarios and strategies.

Big Move 1: Decarbonizing Industry

Strategy	BAP Scenario	NZE-1 Scenario	NZE-2 Scenario
Improve industrial efficiency	Current efficiency held constant from base year	Industrial efficiency improved 50% overall with more efficient processes and equipment by 2040	Same as NZE-1 Scenario
Decarbonize heavy industries	Emissions generation rates held constant from base year	Heavy industries reduce emissions by 30% by 2030 and reach net zero by 2050	Same as NZE-1 Scenario

Big Move 2: Increasing Use of Active and Public Transportation

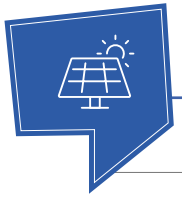
Strategy	BAP Scenario	NZE-1 Scenario	NZE-2 Scenario
Expand active transportation mode	No change, mode share held constant	Increase share of active trips to 20% of all trips by 2050	Same as NZE-1 Scenario
Expand public transit services	No change, mode share held constant	Increase share of ridership to 15% of all trips by 2050	Same as NZE-1 Scenario
Reduce personal use vehicle ownership	No change in personal use vehicle ownership	Reduce personal vehicle ownership by 5% by 2030	Same as NZE-1 Scenario

Big Move 3: Shifting to Low-emission Vehicles and Transport Fuels

Strategy	BAP Scenario	NZE-1 Scenario	NZE-2 Scenario
Electrify transit	Transition to a fully green fleet by 2032	Same as BAP Scenario	Same as BAP Scenario
Switch to zero-emissions personal and commercial vehicles	6% of new light-duty vehicle sales will be electric vehicles by 2025 and 50% by 2030	100% of new light-duty vehicle sales will be electric vehicles by 2035. 100% of new mid-to-heavy-duty vehicle sales will be electric vehicles by 2040	Same as NZE-1 Scenario for light-duty vehicle sales 100% of new mid-to-heavy-duty vehicle sales will be zero-emissions by 2030 (electric and hydrogen)
Switch to low-emissions fuel	No change	Aviation and marine fuel converted to low-emissions fuel like biofuels and renewable jet fuel by 2045 Offer renewable shore power for ships when in dock	Same as NZE-1 Scenario

Big Move 4: Electrifying and Improving Energy Efficiency in Buildings

Strategy	BAP Scenario	NZE-1 Scenario	NZE-2 Scenario
All new construction is net zero	All new residential and commercial buildings are substantially more efficient and electric by 2030	100% of new residential and commercial buildings are net-zero ready from 2030	Same as NZE-1 Scenario
Deep retrofits for existing buildings	1% of building stock is renovated annually, resulting in 10% reduction in energy use intensity (EUI)	100% of existing buildings are retrofitted by 2040 to achieve 50% thermal savings and 20% electricity savings	Same as NZE-1 Scenario
Switch to clean fuels for building energy use	60% of residential buildings switched to heat pumps and electric water heaters by 2050 40% of commercial buildings switched to heat pumps and electric water heaters by 2040	100% of buildings switched to heat pumps and electric water heaters by 2040	Same as NZE-1 Scenario



Big Move 5: Generating Renewable Energy

Strategy	BAP Scenario	NZE-1 Scenario	NZE-2 Scenario
Meet local energy needs through local renewable energy generation	50kW rooftop solar installed annually from 2022 to 2050 5 MW total ground mount solar installed from 2024 to 2028 42 MW total wind power installed by 2023	30% rooftops in Saint John installed with solar photovoltaics by 2050 25 MW total ground mount solar or solar farms installed by 2040 Additional 30 MW total wind power installed by 2040 Additional 15 MW energy storage installed by 2030 Central Peninsula 15 MW district energy system installed by 2030.	Increase rooftop solar capacity to reach 40 MW by 2030 and 160 MW by 2050 148 MW total ground mount solar or solar farms installed by 2030 145 MW total wind power installed by 2030
Decarbonize the power grid	Grid emissions intensity remains the same as base year	Net-zero emissions grid by 2035	Net-zero emissions grid by 2030

Big Move 6: Reducing Waste

Strategy	BAP Scenario	NZE-1 Scenario	NZE-2 Scenario
Reduce amount of waste entering the landfill	Waste generation per capita is held constant No change in waste diversion rate	Waste generation per capita decreased by 20% from baseline by 2030 Increase diversion rate to 80% by 2030	Same as NZE-1 Scenario
Reduce water consumption	Water consumption per capita is held constant	Water consumption per capita reduced by 30% by 2040	Same as NZE-1 Scenario

3.

Exploring a Low-Carbon Future for Saint John

3. Exploring a Low-Carbon Future for Saint John

Saint John Today

Saint John is home to several large, energy-intensive industrial facilities and, consequently, energy consumption in Saint John is dominated by the industrial sector. In addition to using energy to operate facilities, industries require energy for industrial processes. For instance, refineries use energy to operate distillation units that separate refinery streams into their petroleum components, while pulp and paper facilities require thermal energy to evaporate drying pulp and paper.

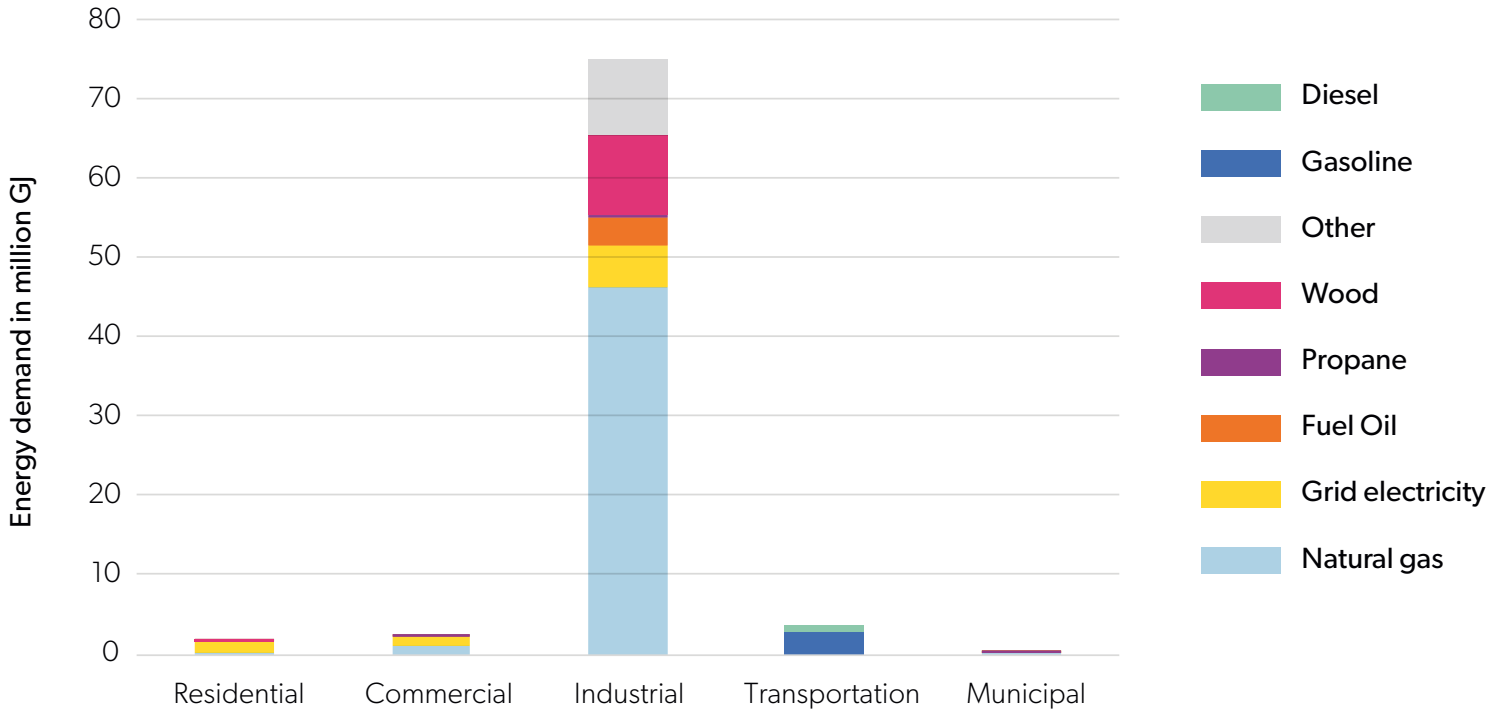


Figure 4 Saint John's energy demand by sector and by fuel type in baseline year 2021, with heavy industries.

Out of the 83 million GJ of energy used In Saint John in 2021, more than half was natural gas (15%), followed by wood (12.7%), other industrial fuels (11.4%) and grid electricity (9.7%). The resulting GHG emissions in 2021, attributed to the use of fossil fuels and waste emissions, is estimated to be 4,817 kilotonnes of carbon dioxide equivalent ($ktCO_2e$) in 2021.

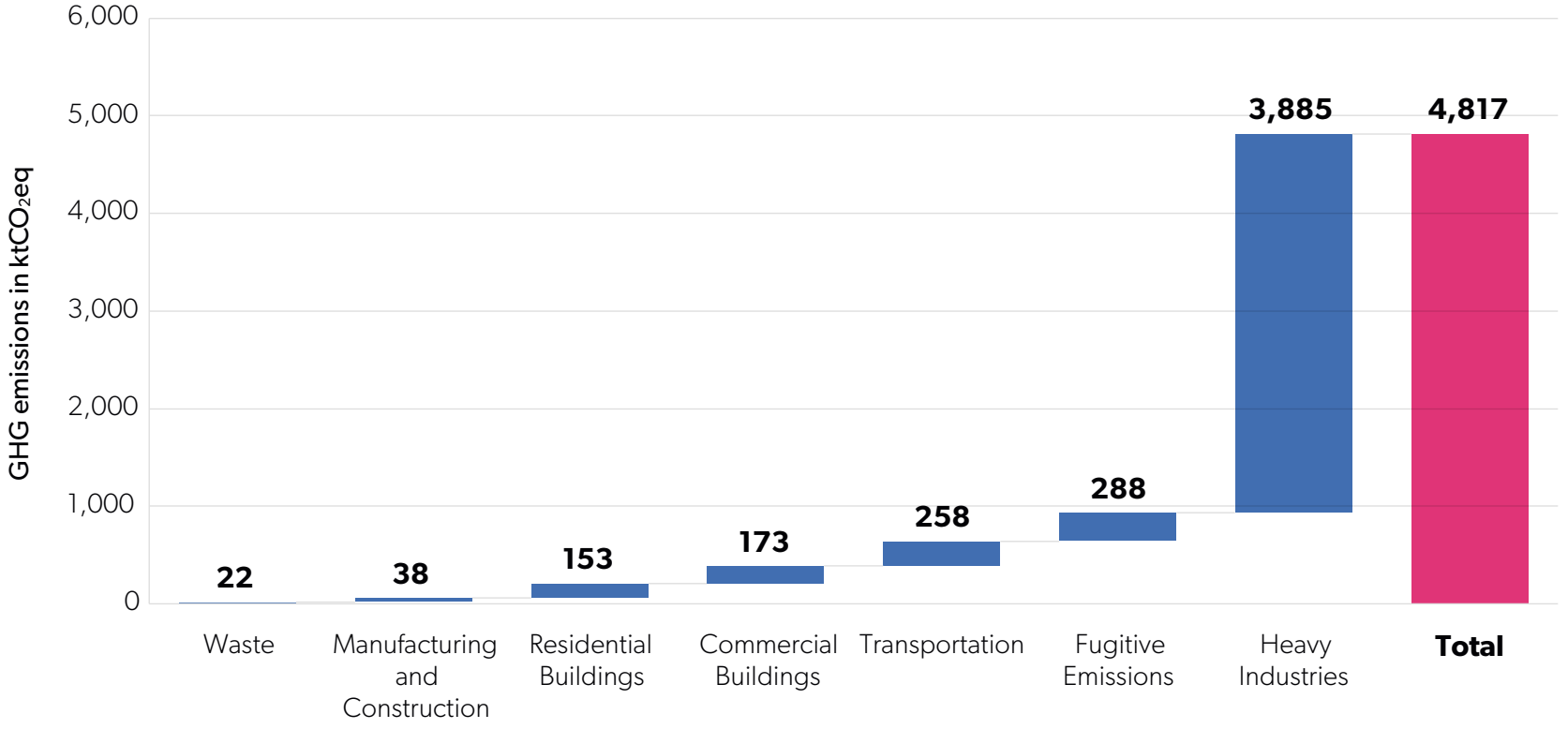


Figure 5 Saint John's GHG emissions by sector in baseline year 2021.

Based on Saint John's 2021 population, this translates to 66.7 tCO_2e generated per person. While this is high compared to Canada's average GHG emissions per capita (17.7 tCO_2e) in 2020, it is comparable to other fossil-fuel producing communities.[12]

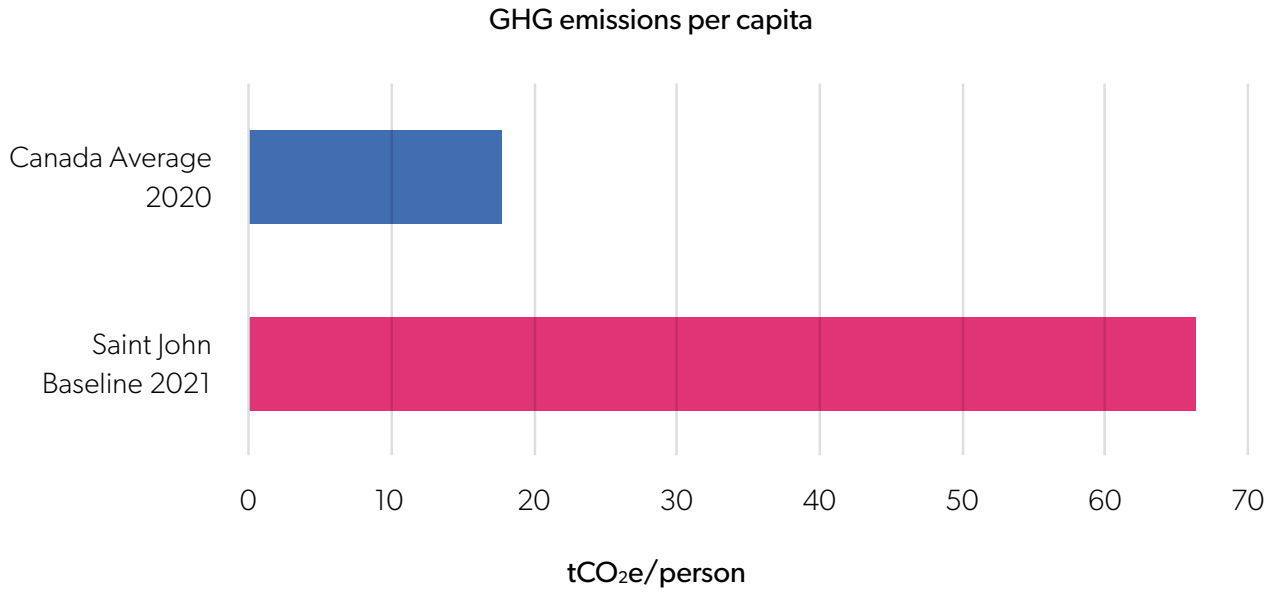


Figure 6 Saint John's per capita emissions in baseline year 2021.

[12] Many fossil-fuel-producing communities in Canada have much higher per capita emissions than the national average. For example: Athabasca County, AB, at 73.4 tCO2e/capita; Medicine Hat, AB, at 62.8 tCO2e/capita; and Sarnia, ON, at 60.7 tCO2e/capita. Per capita emissions data is from the Municipal Energy and Emissions Database, available at meed.info.

The next figure shows the baseline energy consumption for Saint John, isolating the impacts from heavy industries. The total energy consumption in this case is 8.9 million GJ with the transportation sector as the highest energy consumer. Grid electricity and gasoline each account for about one-third of the fuel consumed. The resulting emissions is 645 $ktCO_2e$ in 2021.

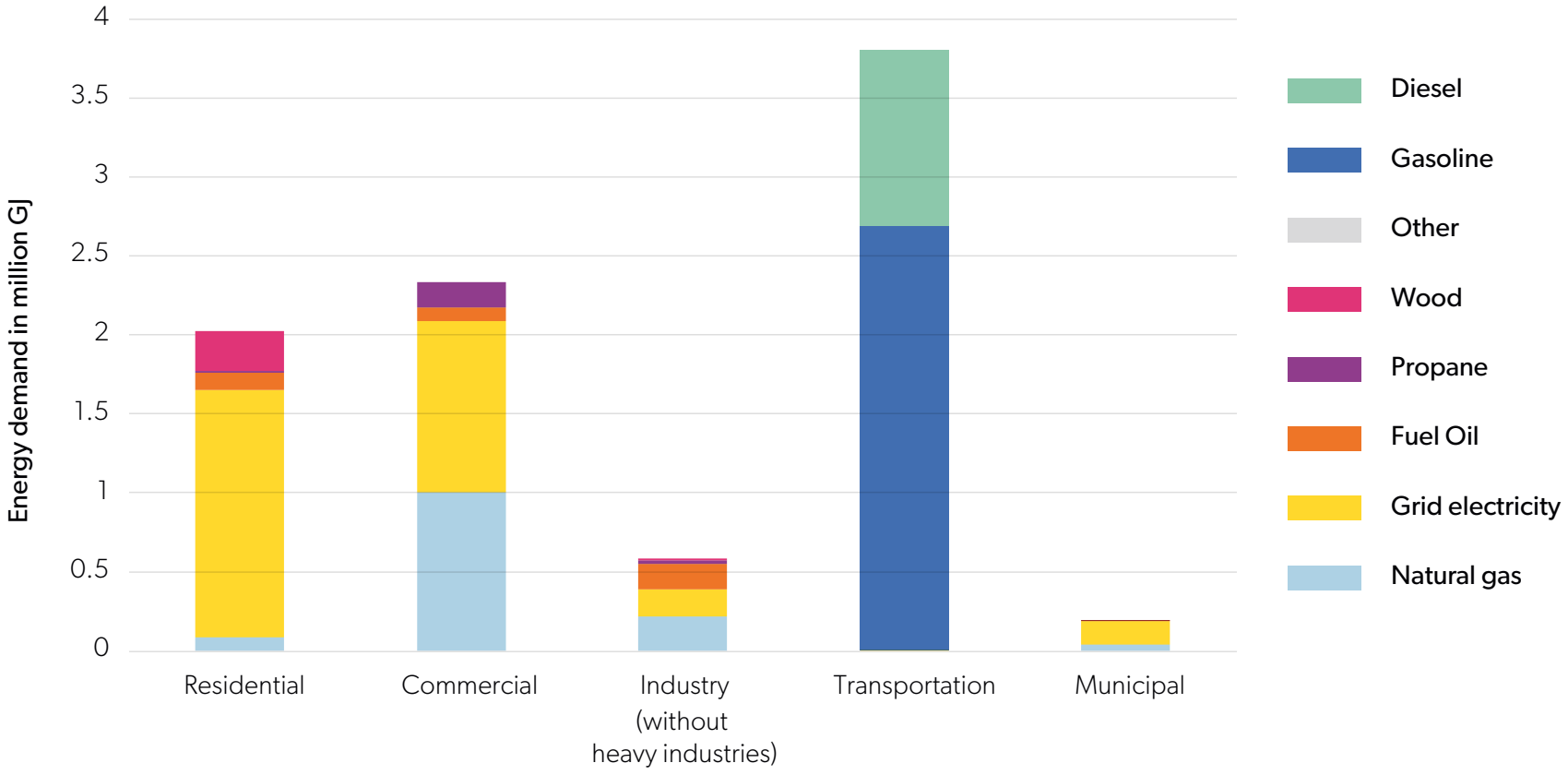


Figure 7 Saint John's energy consumption in baseline year 2021, without heavy industries.

What if no actions are taken?

In 2021, Saint John, including heavy industries, generated 4,817 $ktCO_2e$ of greenhouse gas emissions. What would Saint John's emissions look like in 2050 if no additional emissions reductions actions are taken? In this Business-as-Usual (BAU) Scenario, population, employment and number of households continue to grow while energy sources and consumption trends, transportation modes and patterns, and land-use plans are held constant. The model shows that without any intervention, emissions increase by 2% from 4,817 $ktCO_2e$ in 2021 to 4,920 $ktCO_2e$ in 2050.

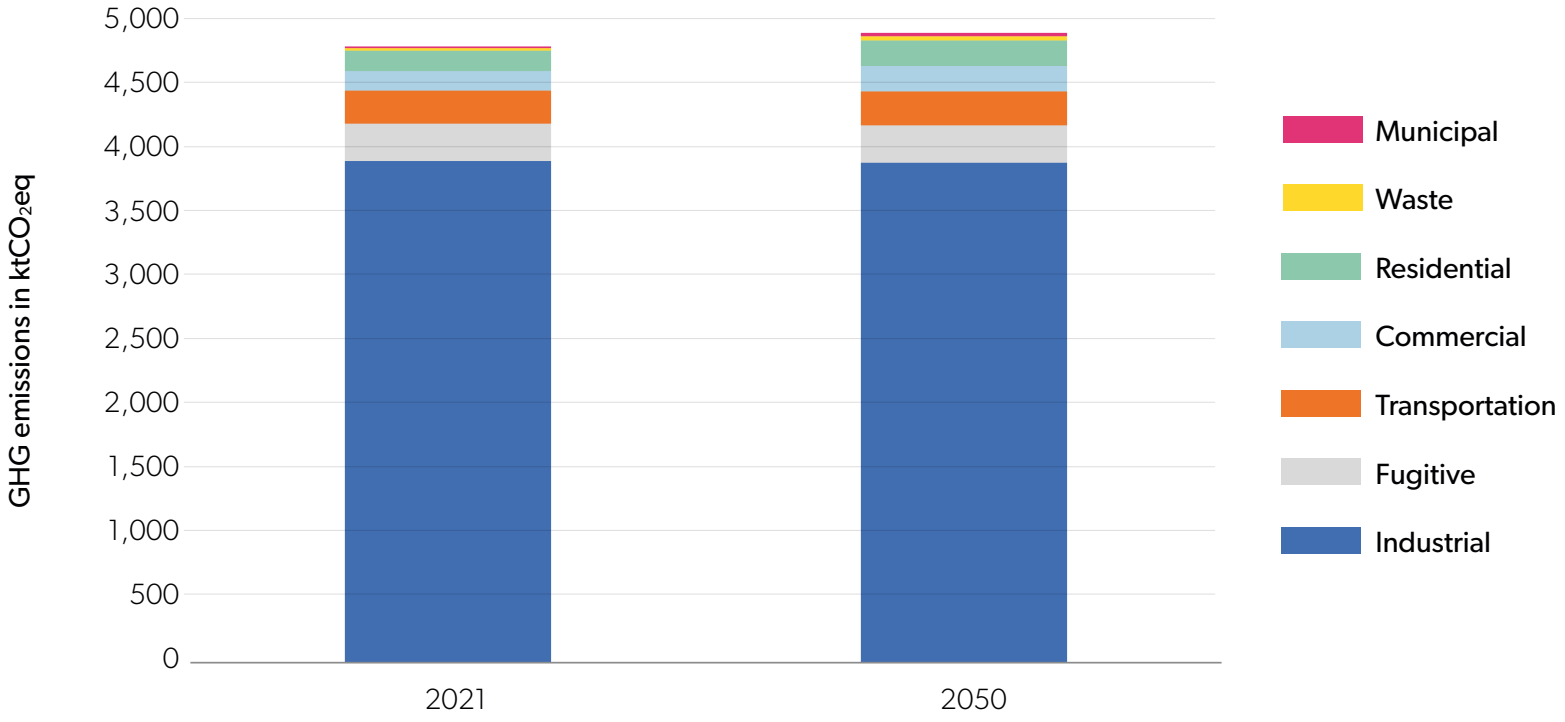


Figure 8 BAU Scenario GHG emissions by sector, 2021 and 2050.

What if only planned actions are taken?

The Business-as-Planned (BAP) Scenario illustrates Saint John's energy use and emissions trajectory if the community takes no additional action on climate change beyond the activities that are already underway or planned. This reference scenario accounts for current plans, policies, legislation, and regulations at the municipal, provincial, and federal levels, along with changes in population and jobs in Saint John but not pledges, promises, or ideas that have not yet been endorsed, passed through legislation, or budgeted for with committed capital and/or operational funding. For instance, provincial targets for electric vehicles are included in the BAP assumptions as these targets are supported by programs for expanding charging network infrastructure and incentives for businesses and individuals to purchase electric vehicles.

While some of the larger emitting facilities in the industrial sector have emissions reduction targets for 2030 and 2050, these pledges could change over time and are dependent on technologies which are not widely deployed or require further development; therefore, these pledges are accounted for in the net-zero scenarios instead of the BAP Scenario. Similarly, the Province of New Brunswick's Climate Change Plan includes a commitment to decarbonize the provincial power grid by 2035, but the pathway to achieving this target is unclear in terms of technologies or resources. Therefore, decarbonization of the grid is included in the net-zero scenarios, rather than the BAP Scenario.

Demographics growth trends are assumed to be the same as in the BAU Scenario. When these assumptions are combined with improved vehicle efficiency, improved heating equipment efficiency, and decreased heating demand as a result of a warming climate, the total energy use declines slightly by 0.6% by 2050.

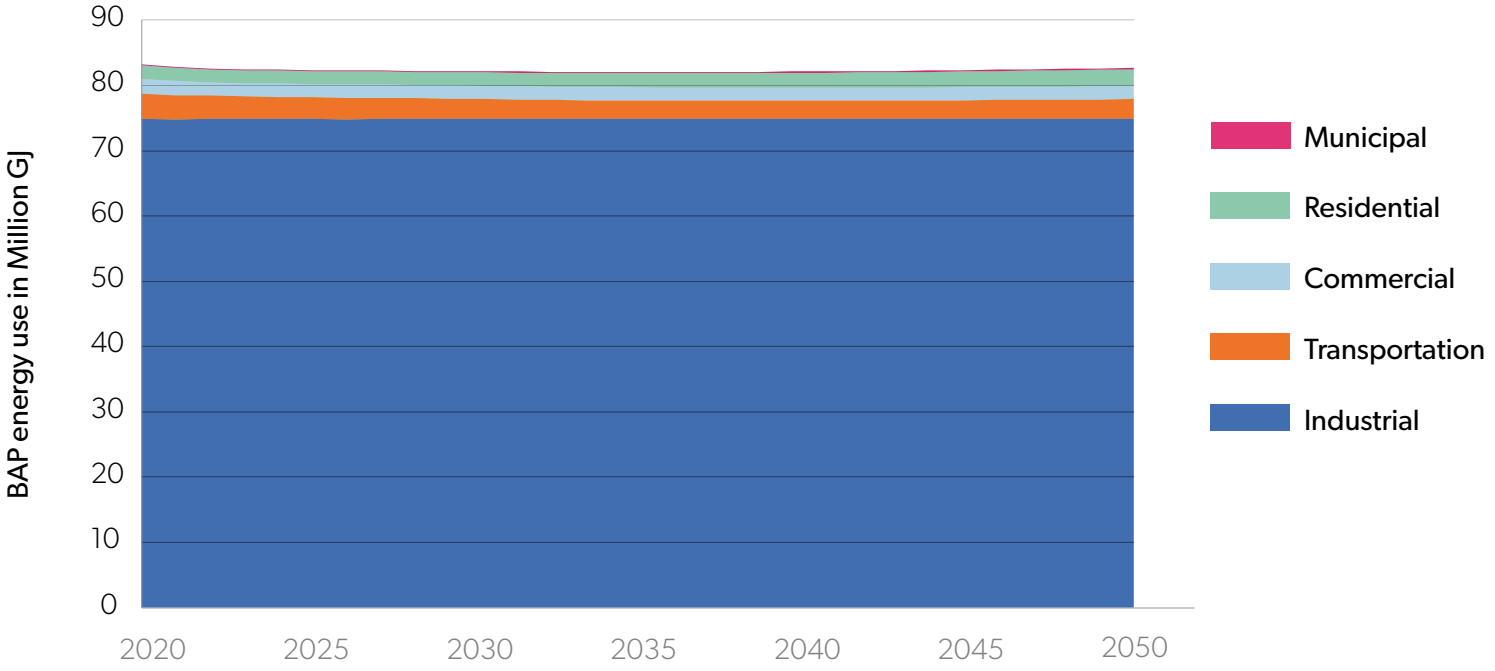


Figure 9 BAP Scenario energy use by sector, 2021-2050.

As energy use declines, GHG emissions associated with energy use and other activities in Saint John decline slightly by 2.1%.

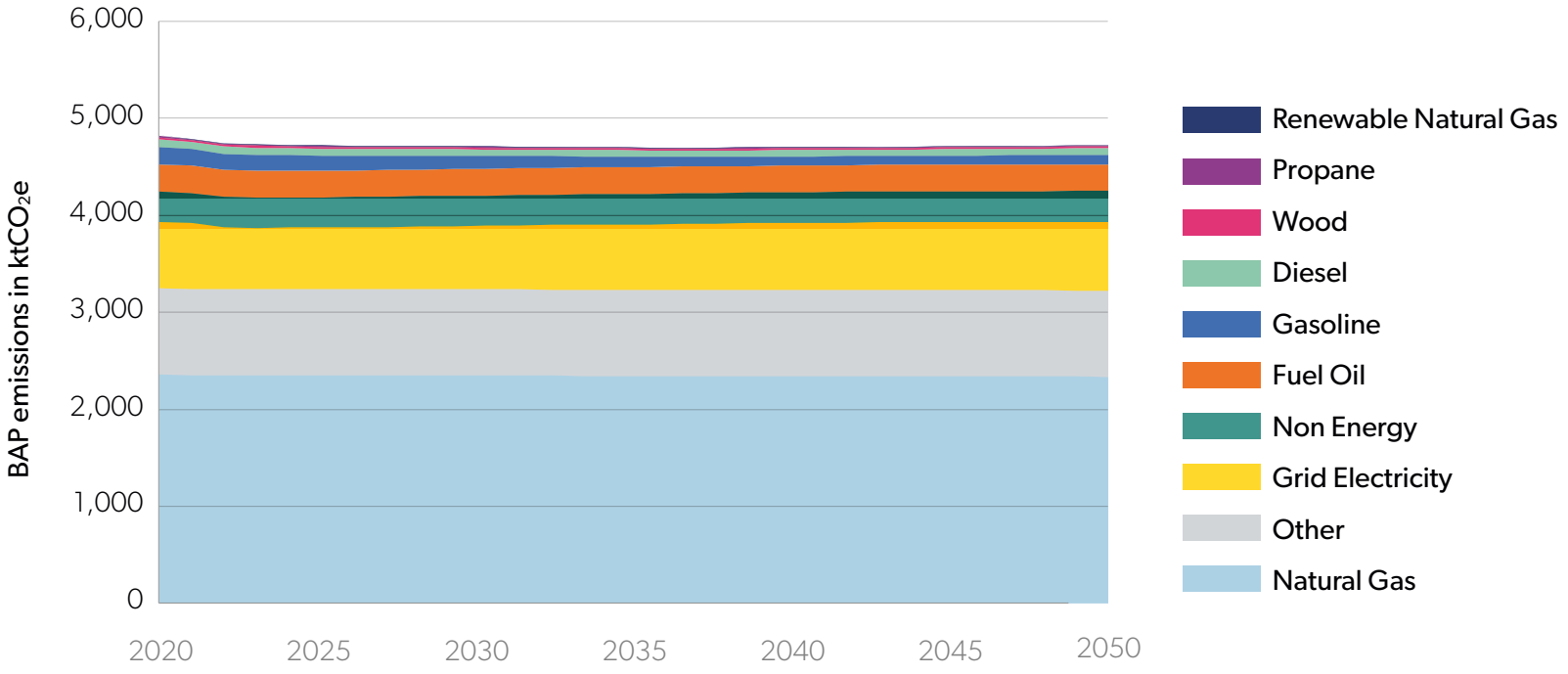


Figure 10 BAP Scenario emissions by fuel type, 2021-2050.

The industrial sector remains the highest energy user and highest GHG emitter throughout the planning period. With heavy industries dominating the energy and emissions landscape for Saint John, it may be tempting to discount community contributions. However, everyone in Saint John can and must play a role helping the community reach net zero. Figure 11 (next page) illustrates how community emissions trends evolve when the influence of heavy industries is removed.

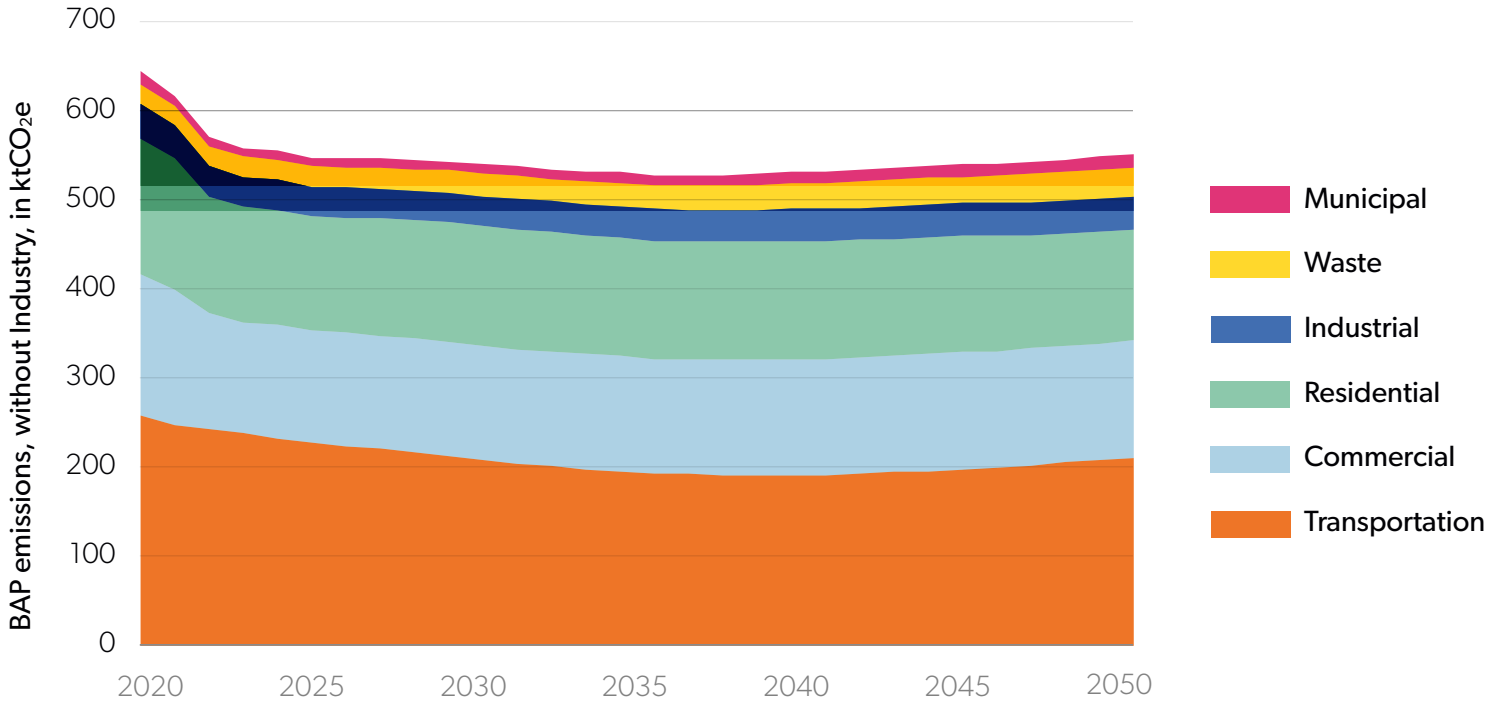


Figure 11 BAP Scenario emissions by sector, without heavy industries, 2021-2050.

Without heavy industries, community GHG emissions for Saint John start from a baseline of 646 $ktCO_2e$ in 2021 and are projected to decline by 14% to reach 551 $ktCO_2e$ by 2050. Transportation is the highest emitting sector, followed by commercial and residential sectors.

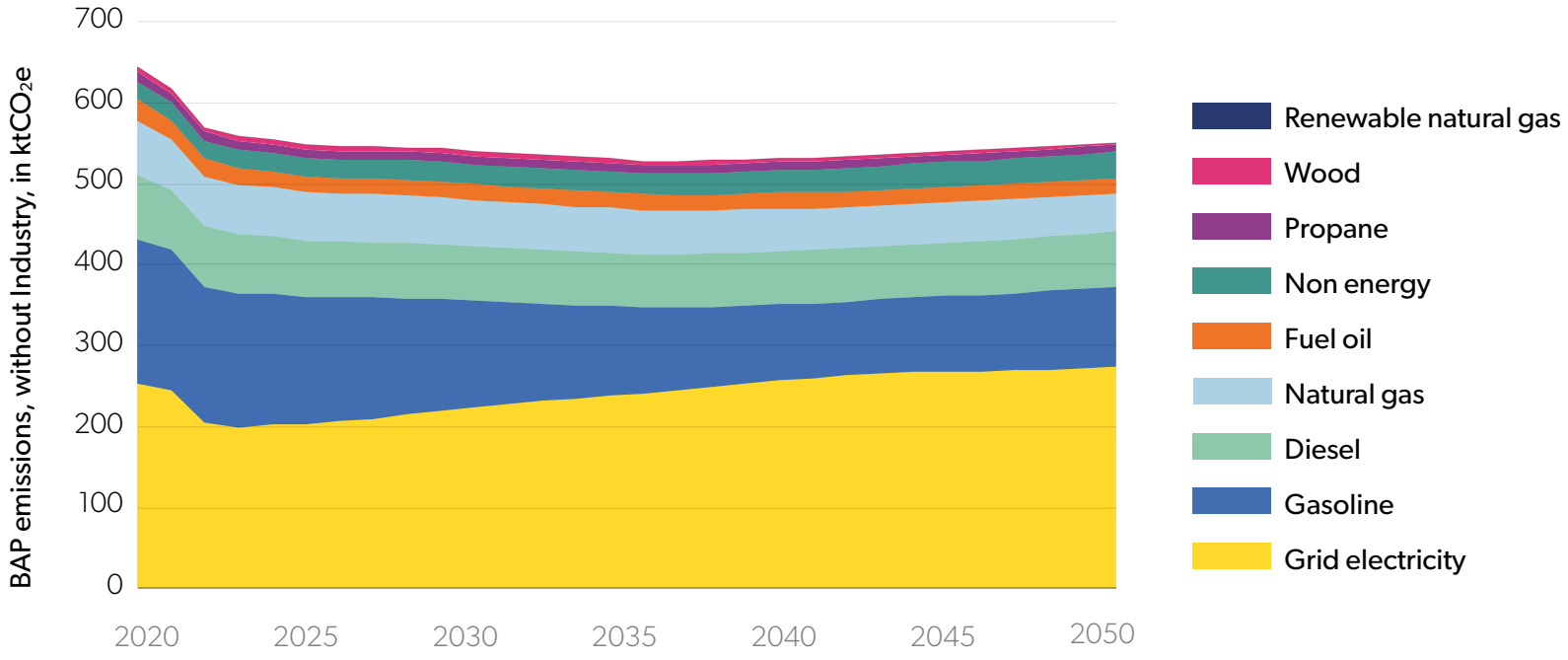


Figure 12 BAP Scenario emissions by fuel type, without heavy industries, 2021-2050.

Emissions reduction in the early years can be attributed to improved efficiencies in vehicles and the Burchill Wind Farm coming online in 2023. As more personal electric vehicles are purchased in the following years, electricity use starts to rise again and, because electricity continues to be generated using fossil fuels, it overtakes gasoline in transportation sector emissions.

Getting from BAP to Net Zero

The BAP Scenario modelling results (Figure 13) demonstrate that existing policies, regulations, programs, market trends, and efficiency improvements are not enough to realize Saint John's Race to Zero commitment. To eliminate as many GHG emissions as possible by 2050, comprehensive changes across all sectors are necessary. The challenge is daunting, but it is not impossible.

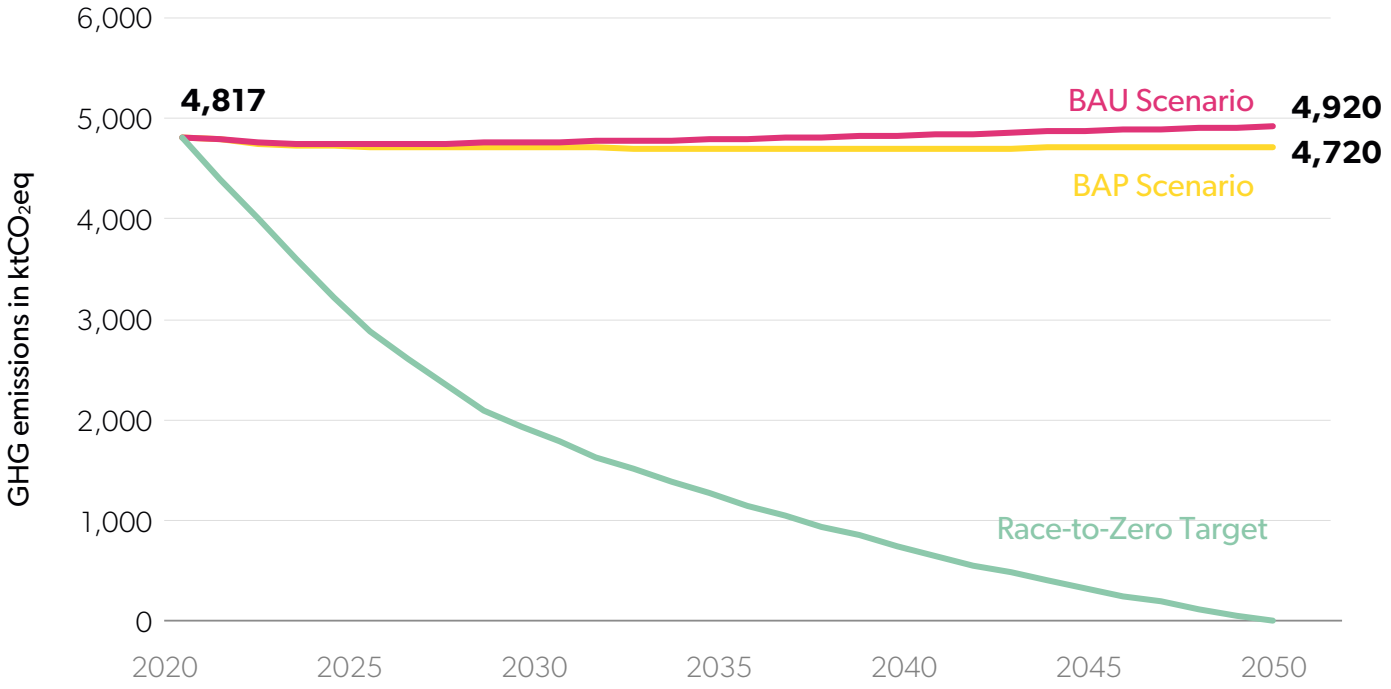


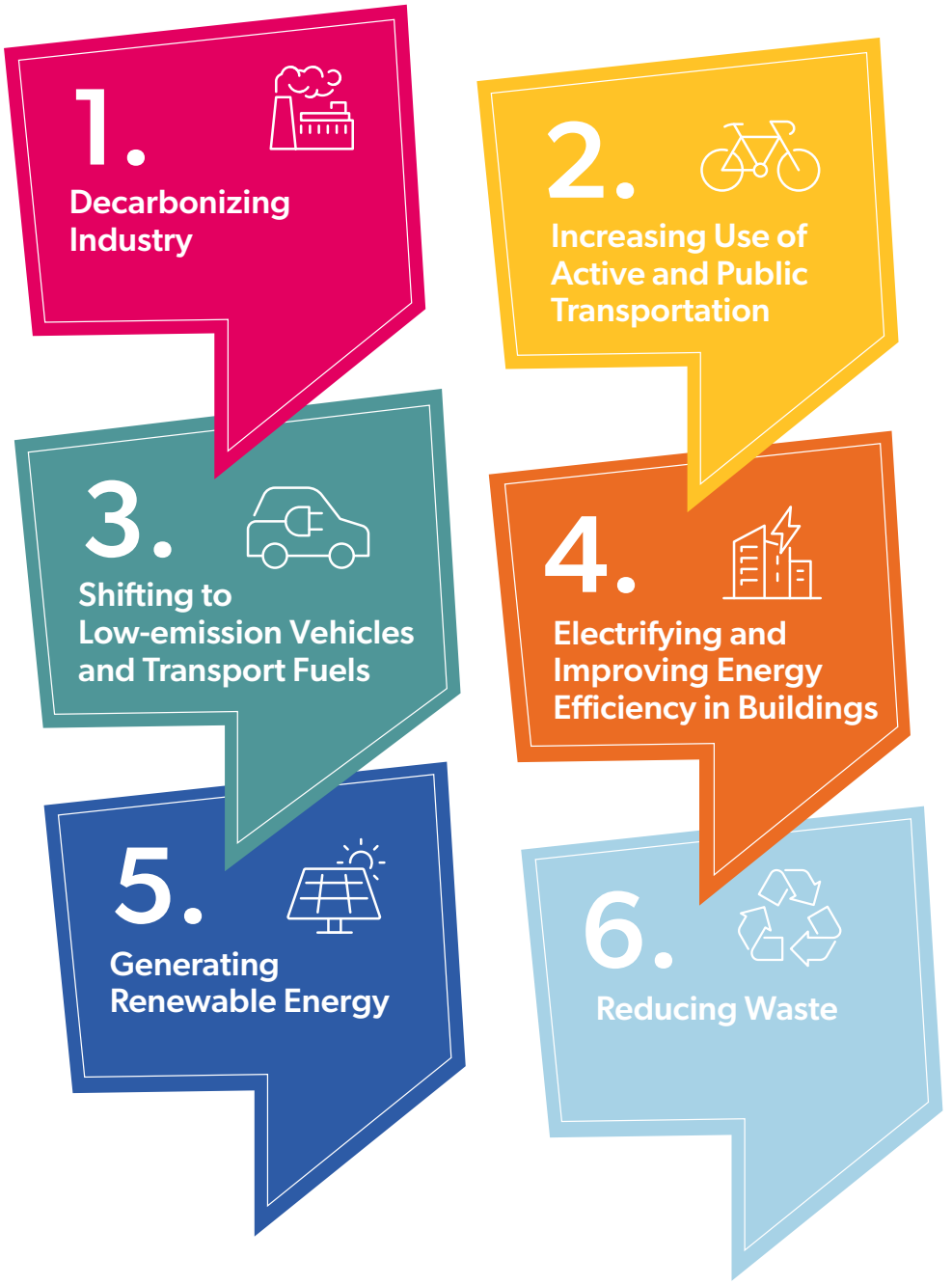
Figure 13 BAU and BAP Scenarios modelling results compared to Race-to-Zero target.

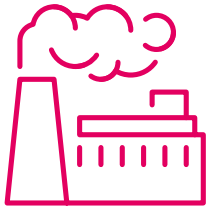
The Six Big Moves

To identify the most effective way for Saint John to achieve net zero, the consulting team identified potential actions in existing city plans and SSG's extensive catalogue of climate actions, in addition to conducting research to develop actions specifically for Saint John. The consulting team used a variety of factors to determine the level of ambition and timing for each action. These factors include, but are not limited to:

- The necessity of the action (in the sense of there being no alternatives) to reduce emissions and to optimize the potential impact of other actions;
- The "Avoid, Reduce, Replace, Remove and Offset" prioritization philosophy described in Appendix B (this includes the quantity and speed of emissions reductions);
- The City's authority or ability to carry out the action;
- Insights from city staff and engagement participants;
- Alignment with provincial and national targets and regulations, municipal plans, and plans of shared services operators, including Saint John Energy and Liberty Utilities.

The selected actions can be grouped into six Big Moves that, together, will limit the amount of energy Saint John needs and enable it to meet energy demand with clean energy. By reducing energy needs first, Saint John can decrease the amount of renewable energy that must be generated.





1. Decarbonizing Industry

Saint John's industrial sector represents the bulk of energy consumption and GHG emissions in the community. Unless the industrial sector can lower its emissions, Saint John will not reach its net-zero target.

Reducing emissions in the industrial sector depends on the industry type and its processes. For example, industries relying on petroleum and natural gas feedstock could consider transitioning to alternative, bio-based feedstocks. For industries that rely on generating high temperatures, one abatement option is to switch to low-carbon fuels. Industrial processes are highly integrated and production facilities have long lifetimes. Timely action, joint collaboration between the City and local industries and other levels of government, as well as innovative technologies, are necessary to accelerate the net-zero transition and avoid stranded investments.

The City must continue dialogue with industrial stakeholders to encourage industry to uphold its sustainability commitments and collaborate on solutions to mitigate economic risks associated with transitioning to a net-zero economy.

2. Increasing Use of Active and Public Transportation

Increasing walking, cycling, and transit use are also important strategies for avoiding emissions. An extensive and integrated active transportation and transit network can reduce the need for personal car trips and improve accessibility for everyone. Increased walking and cycling rates also improve public health.

MoveSJ, Saint John's Transportation Master Plan, has already laid the foundation for creating a transportation network that integrates active modes of transportation and supports sustainable development, healthy communities, and a vibrant urban centre. At the same time, PlanSJ, Saint John's Municipal Plan, seeks to increase density and create more walkable communities. Expediting the implementation of these existing plans, and adding on complementary infrastructure and services, will encourage a mode shift towards active and public transportation in alignment with Saint John's net-zero target.

3. Shifting to Low-emission Vehicles and Transport Fuels

Residents of Saint John, as in many Canadian cities, rely on gasoline- and-diesel-powered vehicles to get around. As an important transportation hub, Saint John relies on fossil fuels for trains, ships and planes moving goods and people in and out of the city. All of this transportation is fueled by high-carbon fuels like gasoline, diesel, marine fuel, and aviation fuel.

As a first step, Saint John must avoid or shift as many vehicle trips as possible to walking, cycling, or transit. The next step is to decarbonize the vehicles through electrification. Electric cars and other light-duty electric vehicles are almost at price parity with gasoline and diesel vehicles. Electric vehicles operate emissions-free if they are charged using infrastructure connected to renewable energy sources (e.g., solar, wind). Even if they use electricity that is not fully clean, electric motors are four to six times more efficient than gasoline and diesel vehicles. Medium and heavy-duty electric vehicles are increasingly available.[13] The same is true for marine and aviation vehicles. Both the maritime and aviation industries are developing zero-emissions vessels powered by zero-emissions fuels for large-scale deployment by 2050.[14,15]

4. Electrifying and Improving Energy Efficiency in Buildings

Building emissions come from all types of buildings, including homes, schools, offices, stores, and industrial spaces. Buildings and the systems within them, such as heating and cooling systems, are long-lasting assets. Depending on how efficient they are, the types of energy that they use, and how they are operated, buildings can become a significant source of GHG emissions.

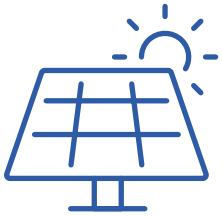
Existing buildings can be made more energy efficient through retrofits like increasing insulation and replacing windows and doors, weatherstripping, and swapping inefficient heating systems with more efficient options. When buildings are retrofitted to be more efficient they use less energy overall, whether the energy comes from a renewable source or not. This decreases emissions from the baseline, as well as the amount of renewable energy required to meet community needs.

For newer buildings, implementing net-zero or passive house standards limits emissions right from design and construction. The upfront capital cost of more efficient construction is offset by reduced energy bills over time.

[13] List of dealers and manufacturers for medium-and heavy-duty electric vehicles. Accessed July 15, 2023. https://californiahvip.org/vehiclecatalog/

[14] Durant, Isabelle. "Moving towards zero carbon emissions in maritime shipping." United Nations Conference on Trade and Development. November 4, 2019. https://unctad.org/news/moving-towards-zero-carbon-emissions-maritime-shipping

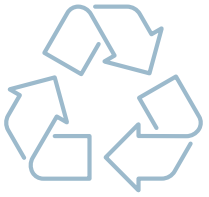
[15] Bergero, C., Gosnell, G., Gielen, D. et al. Pathways to net-zero emissions from aviation. Nat Sustain 6, 404–414 (2023). https://doi.org/10.1038/s41893-022-01046-9



5. Generating Renewable Energy

Renewable energy systems ensure that the buildings, industry, and transportation sectors can operate emissions-free. Saint John currently uses a mix of natural gas, wood, electricity,[16] fuel-oil, gasoline, and diesel to power its day-to-day activities. This mix largely remains the same under the BAP Scenario.

Decarbonizing these sectors will require replacement of natural gas and other fossil fuels with renewable energy sources such as wind, solar, and renewable natural gas. As technologies and consumer products evolve, new energy sources, such as tidal power and green hydrogen may also come online.[17]



6. Reducing Waste

Emissions from waste consist primarily of methane released by rotting organic waste in landfills and from wastewater treatment. The majority of methane comes from historical waste, which slowly decomposes and releases methane over time. Today's waste effectively becomes tomorrow's emissions, and the emissions of years to come. The most effective way to reduce waste emissions is through a combination of waste reduction and waste diversion strategies.

Reducing water consumption has impacts on energy demand. When less water is consumed, less water needs to be treated, reducing the energy used to treat and transport the water, along with the amount of wastewater, which emits methane, a potent greenhouse gas. Water consumption is reduced with efficiency measures including leak detection technology and end-use equipment improvements like smart meters.

[16] Current imported electricity in Saint John is not emissions-free and has a grid intensity of 290 grams of CO2e per kilowatt-hour.
[17] Green hydrogen is hydrogen generated by renewable energy or from low-carbon power.

How will the Big Moves change Saint John's projections?

Analysis for the CEAP incorporated two low-carbon scenarios, called the **Net-Zero Energy 1 (NZE-1) Scenario** and **Net-Zero Energy 2 (NZE-2) Scenario**. Each low-carbon scenario includes targets for the six Big Moves and the energy system. Demographic trends are consistent with the BAU and BAP Scenarios. NZE-2 is more ambitious than NZE-1 and is the scenario upon which ActSJ is based. The assumptions for each scenario are detailed above in Table 2.

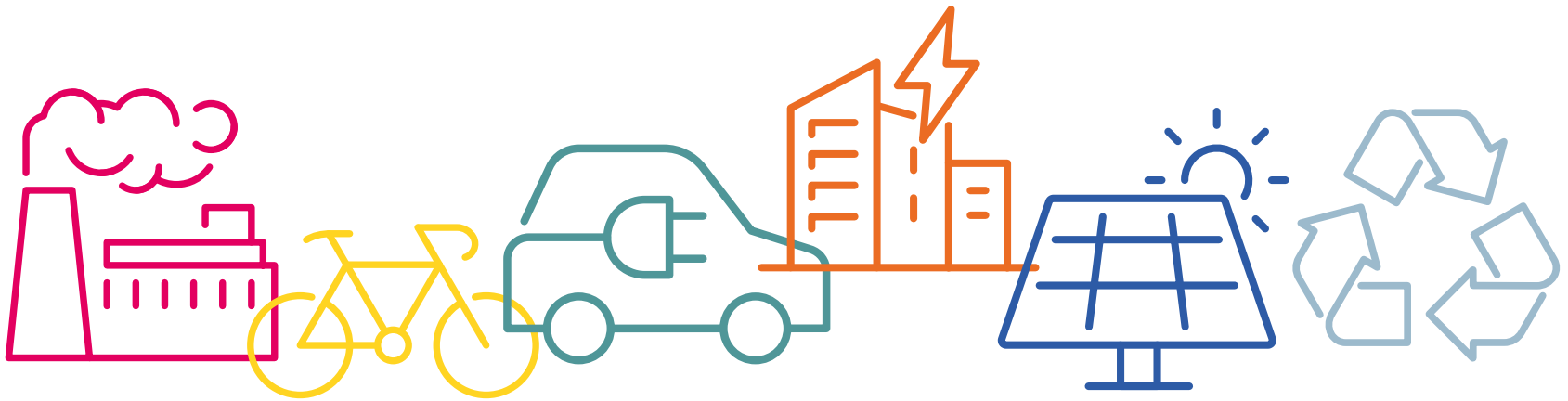
NZE-1: The First Low-Carbon Scenario

The first low-carbon scenario modelled incorporates two key assumptions:

1. The industrial sector fully decarbonizes by 2050.
2. The provincial grid becomes net-zero by 2035.

These assumptions are combined with a set of targets within the six Big Moves areas.

Figures 14 and 15 (next pages) illustrate projections of energy use for the NZE-1 Scenario out to 2050. The industrial sector is the largest energy consumer, accounting for about 90% of the energy use in Saint John throughout the projection period. Consumption in this sector is projected to decrease by about one-third from 2025 to 2040, and then stay constant for the next ten years.



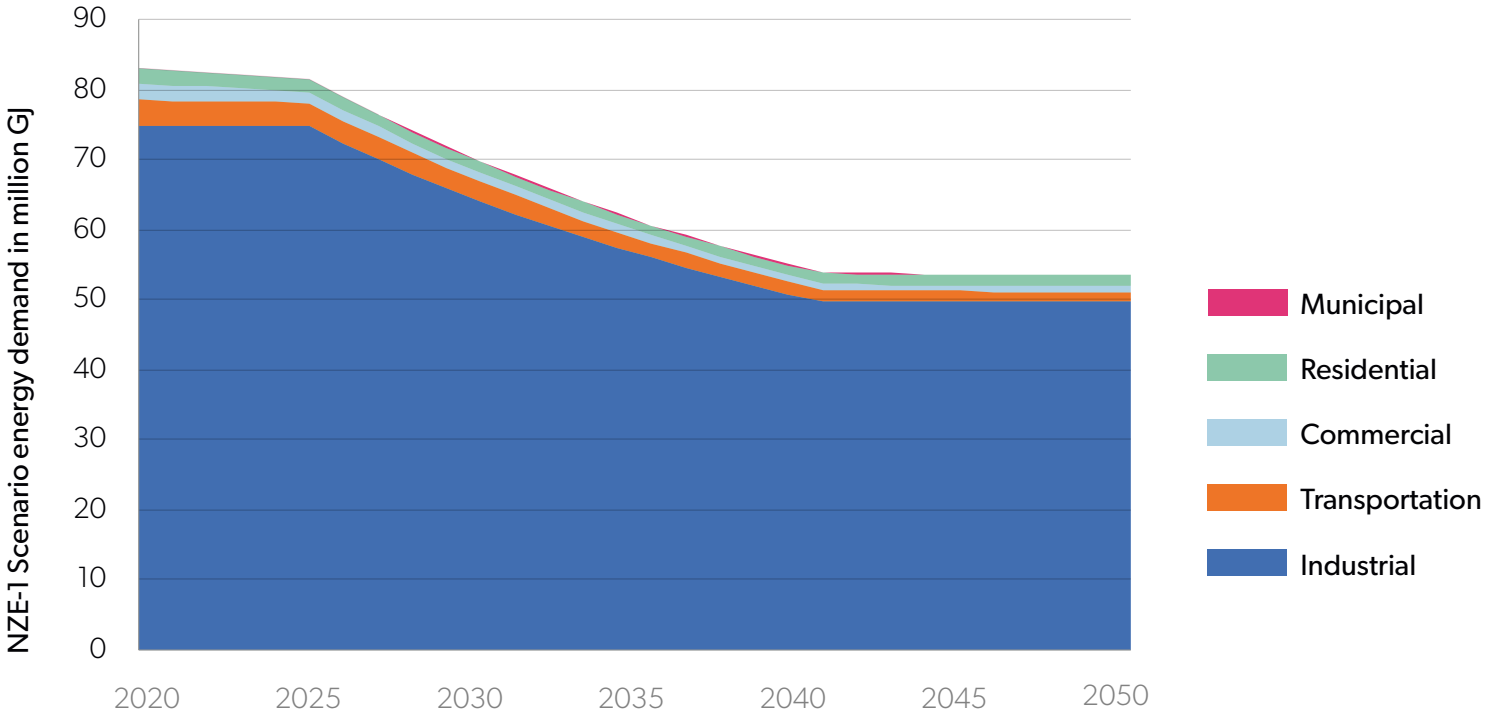


Figure 14 NZE-1 Scenario energy demand by sector, with heavy industry, 2021-2050.

Figure 15 shows the modelled GHG emissions for the NZE-1 Scenario out to 2050 by fuel type. It is projected that emissions from all fuel types will drop to almost zero by 2050.

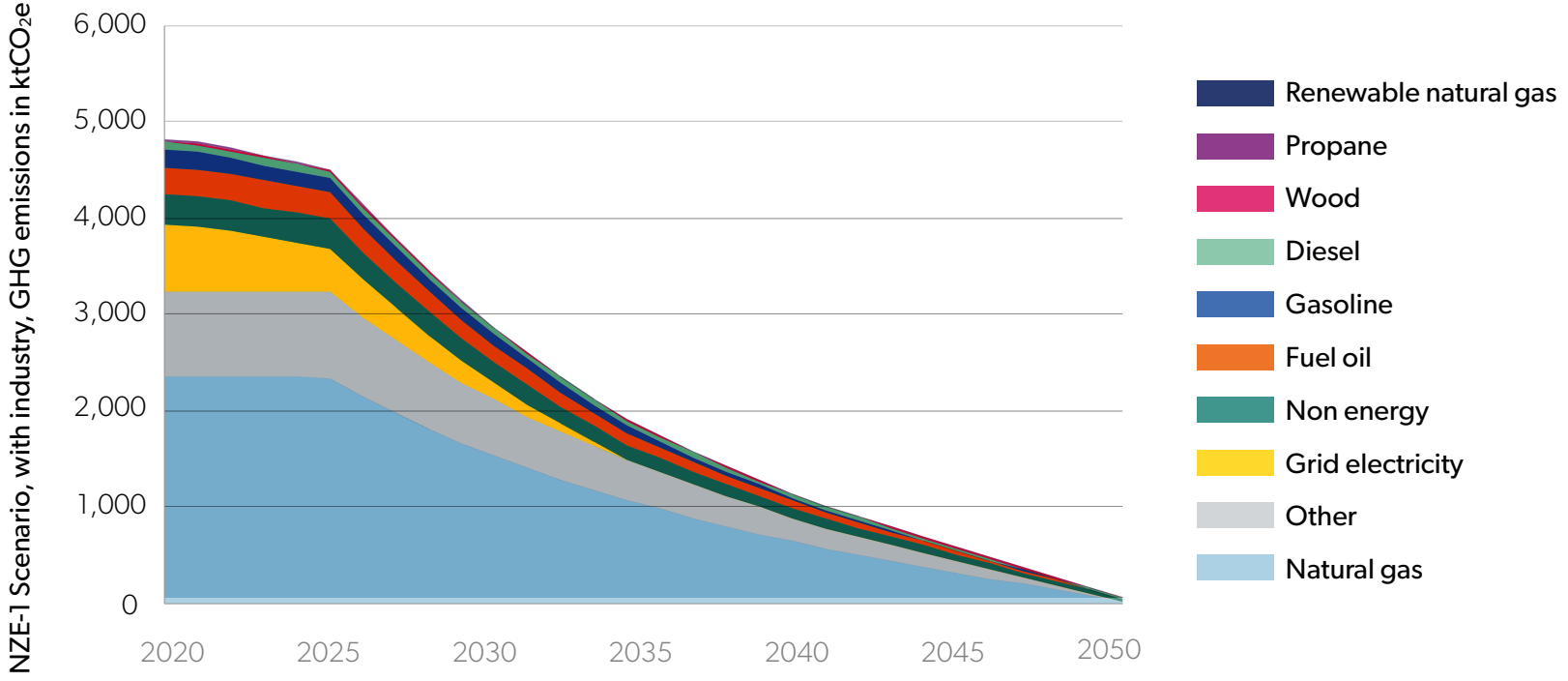


Figure 15 NZE-1 Scenario GHG emissions by fuel type, 2021-2050.

With the NZE-1 Scenario, Saint John comes close to achieving net-zero emissions by 2050. Residual GHG emissions of 57 $ktCO_2e$ in 2050 will primarily be due to:

- Remaining organic waste decaying in Crane Mountain Landfill;
- A small number of remaining combustion engine vehicles; and
- Some industrial operations that have not been decarbonized.

These residual emissions are relatively small and can be offset, or addressed in future ActSJ iterations with new policies or technologies.

While the NZE-1 Scenario meets the 2050 net-zero target, it falls short of the interim target, which is to reduce emissions by 60% by 2030 compared to baseline emissions in 2021. Engagement with the City's project team and the Community Working Group (CWG) members identified opportunities to close the gap, including Saint John Energy's newly approved Zero30 Roadmap.[18] Community members also raised concerns regarding the industrial sector's ability to sufficiently reduce emissions in time to meet the interim and 2050 targets, as well as the limited influence the City might have to drive deep change in this sector. The second net-zero scenario (NZE-2) was developed to incorporate this feedback.

Renewable Natural Gas as a Transition Fuel

The NZE-2 Scenario for ActSJ considered the introduction of renewable natural gas into natural gas pipelines while buildings are undergoing electrification. Renewable natural gas, or RNG, is derived from biogas or biomethane, which is produced from landfills, agricultural waste, and wastewater from treatment facilities.[19] It can be used as a substitute for natural gas in vehicles, electricity, or heating. In theory, RNG is considered carbon neutral as it is derived from plants. In reality, RNG is methane captured from organic waste, and emits carbon dioxide when burned. This means that unlike energy sources such as solar and wind, RNG still creates greenhouse gas emissions when used. Therefore, while RNG is considered as a potential transition fuel in ActSJ, designing a system that depends on RNG or delaying transition to a system that does not depend on natural gas because of the promise of RNG, would delay climate change mitigation.[20]

[18] Saint John Energy. "Zero30 Roadmap." May 26, 2023. https://zero30.ca/

[19] FortisBC. "Renewable Natural Gas." https://www.fortisbc.com/services/sustainable-energy-options/renewable-natural-gas

[20] Grubert, Emily.(2020) "At scale, renewable natural gas systems could be climate intensive: the influence of methane feedstock and leakage rates." Environmental Research Letters. Vol. 15 No. 8 https://iopscience.iop.org/article/10.1088/1748-9326/ab9335/pdf

NZE-2: The Second, More Ambitious, Low-Carbon Scenario

The NZE-2 Scenario assumes an expansion of renewable energy production and an accelerated transition of medium- and heavy-duty vehicles to put Saint John on track to meet the interim 2030 target of 60% emissions reduction for non-industrial emissions.

For the NZE-2 Scenario, the key assumption is that Saint John Energy and NB Power are able to provide the community with a net-zero emissions grid by 2030, which is five years earlier than the provincial goal for 2035. This change has a cascading effect across all sectors, since a large share of Saint John buildings and vehicles would be electrified by this date. Demographic trends and other Big Moves assumptions are the same as in NZE-1 Scenario.

The energy demand trajectory resulting from the implementation of these accelerated actions is depicted in Figure 16.

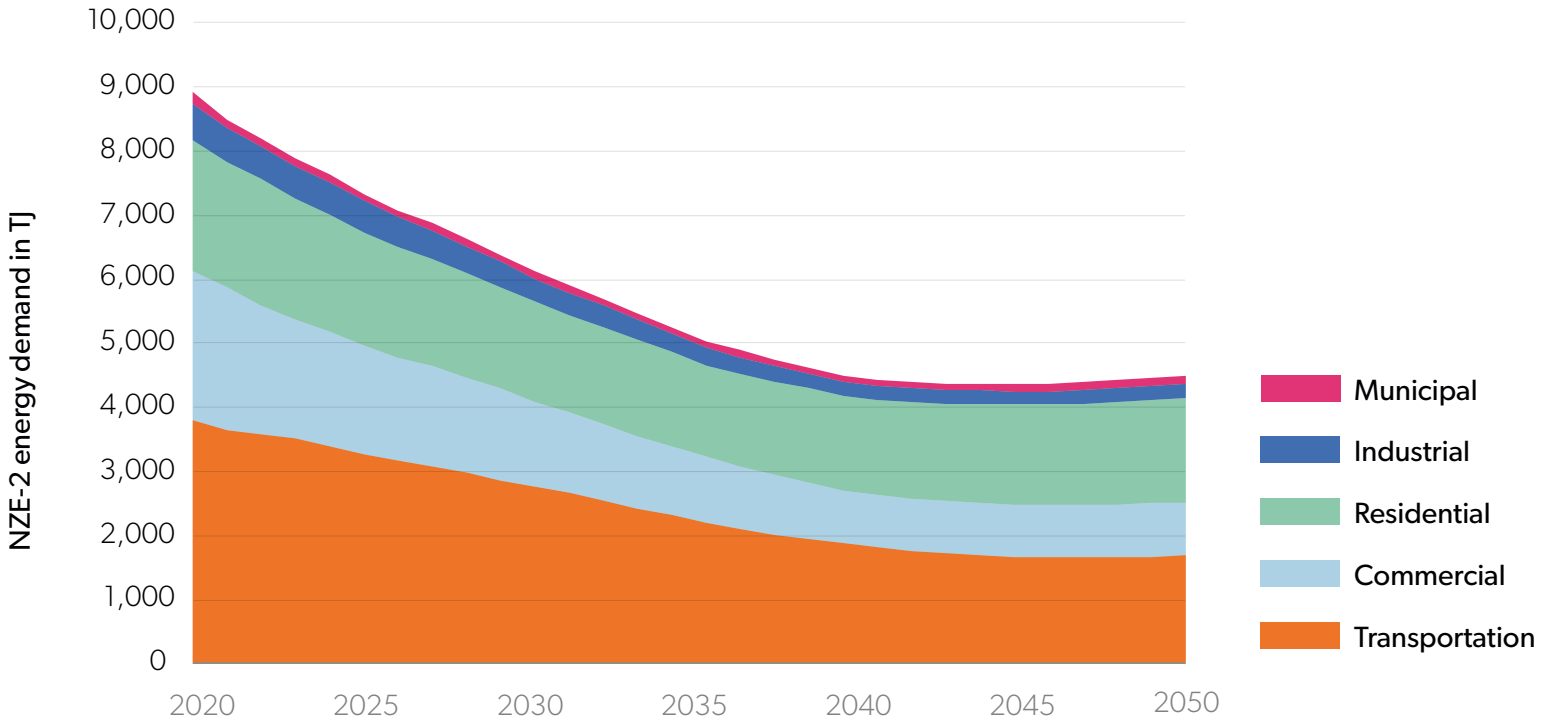


Figure 16 NZE-2 Scenario community energy demand by sector, without heavy industries, 2021-2050.

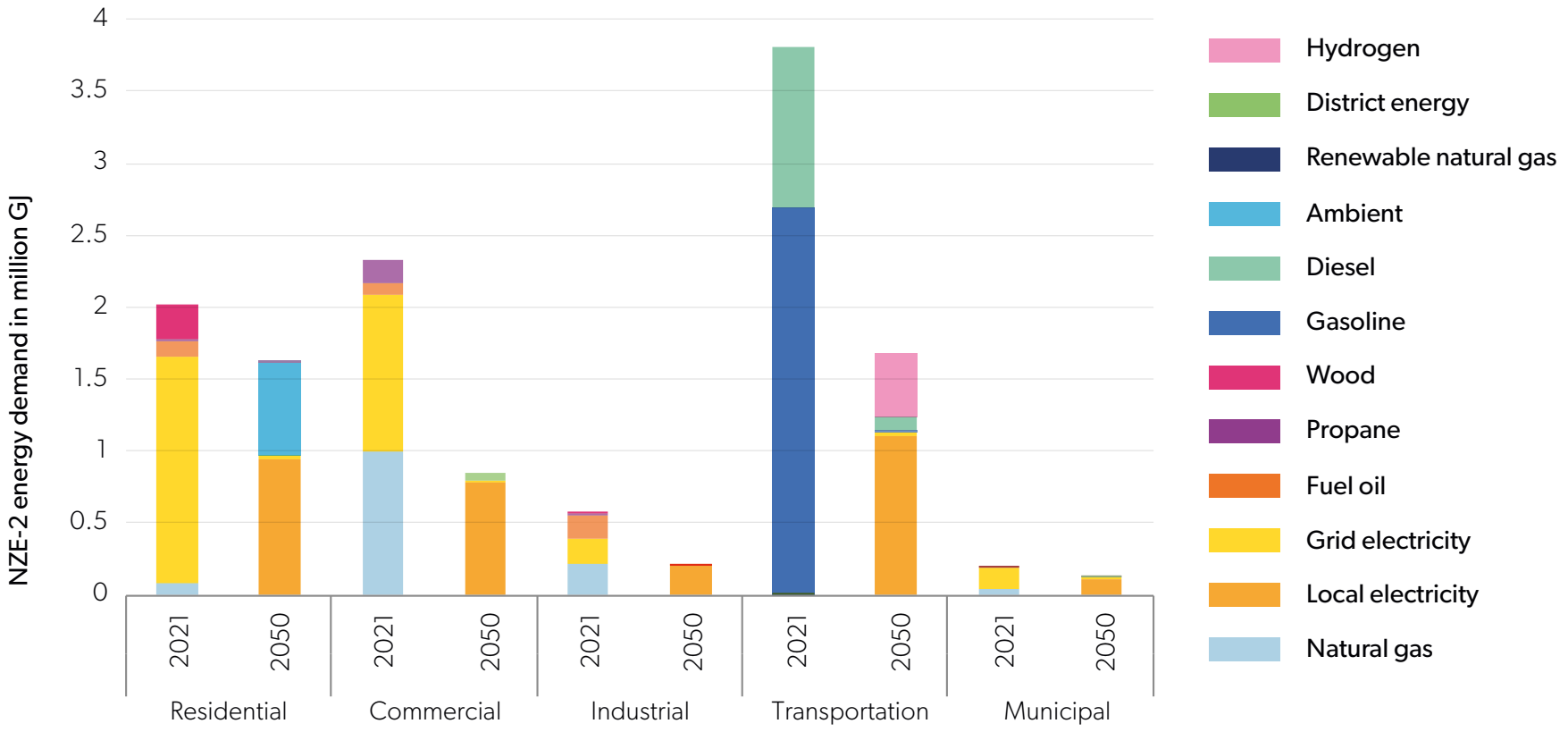


Figure 17 NZE-2 Scenario community energy demand by sector and by fuel, without heavy industries, 2021-2050.

The energy-use trajectory in the NZE-2 Scenario is fairly similar to the NZE-1 Scenario as assumptions for energy consumption in both scenarios are identical, except in the case of medium- and heavy-duty commercial vehicles where hydrogen-based technologies were only modelled in NZE-2 Scenario.

The largest difference between the NZE-1 and the NZE-2 Scenarios is found in local energy generation, as shown in Figure 18. By 2050, the NZE-2 Scenario model projects twice as much wind power and three times as much solar power as projected for the NZE-1 Scenario.

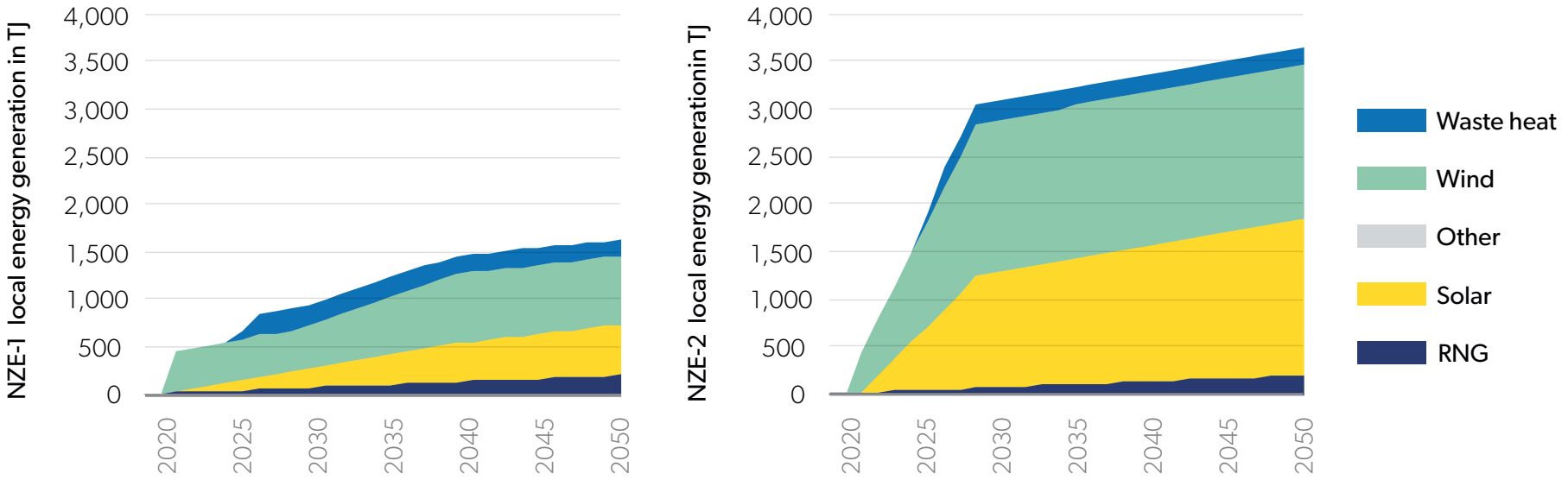


Figure 18 Local energy generation in the NZE-1 and NZE-2 Scenarios, 2021 - 2050.

The share of electricity supplied by local, renewable energy generation is higher in NZE-2 Scenario, at 97% compared to 36% in NZE-1 Scenario. The higher renewable share translates to the changes observed in Figure 19 where Saint John is now able to meet both the interim and 2050 targets.

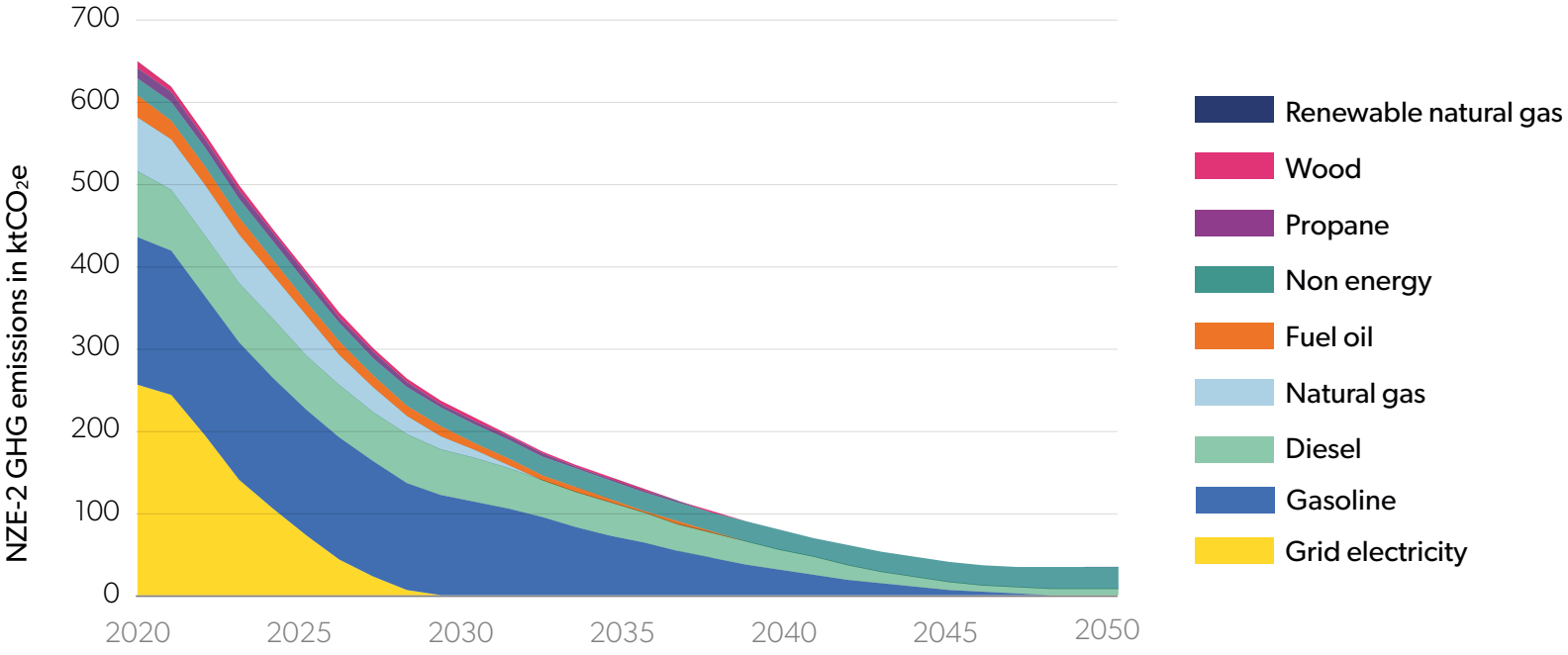


Figure 19 NZE-2 Scenario GHG emissions projection by fuel type, 2021-2050.

ActSJ is based upon implementing the NZE-2 Scenario.

4.

A Pathway to Net Zero

4. A Pathway to Net Zero

Deep reductions in GHG emissions across all sectors are required to meet Saint John's 2030 and 2050 targets. Achieving these goals is challenging, but not impossible. The strategies in ActSJ are based on best practices, currently available technologies, and community insights.

Every tonne of emissions matters. The rate of climate change is based on the total amount of greenhouse gases in the atmosphere, not just those from a particular year. Emissions must fall year-on-year until 2050, and the longer we delay, the steeper the cuts and the bigger the challenge we face. With temperatures already rising and extreme weather events becoming more frequent, every action in this plan is critical, even if it only represents a fraction of overall GHG reductions.

In some cases, one strategy also benefits another strategy. For example, increasing density allows for more effective and affordable transit and active transportation infrastructure, which in turn, enables people to use their cars less often for short trips. Strategies may also result in benefits beyond emissions reductions, such as improved air quality, reduced noise pollution (e.g., bikes, and electric vehicles generate less noise than internal combustion engine vehicles), and improved health outcomes (improved respiratory, mental, and physical health).

The Big Picture

If ActSJ is implemented in full, GHG emissions in Saint John are projected to follow the trajectory illustrated in Figure 20 (next page). The top line represents the BAP Scenario pathway, which models a future where no additional actions are taken. Each coloured wedge or section represents the emissions reduction from each strategy, which is interdependent with the other strategies. Combined, these strategies enable the ActSJ pathway. The gray area represents remaining GHG emissions. The ActSJ pathway builds on existing momentum for decarbonizing industries, greening electricity, and the growth of electric vehicles in the private vehicle fleet.

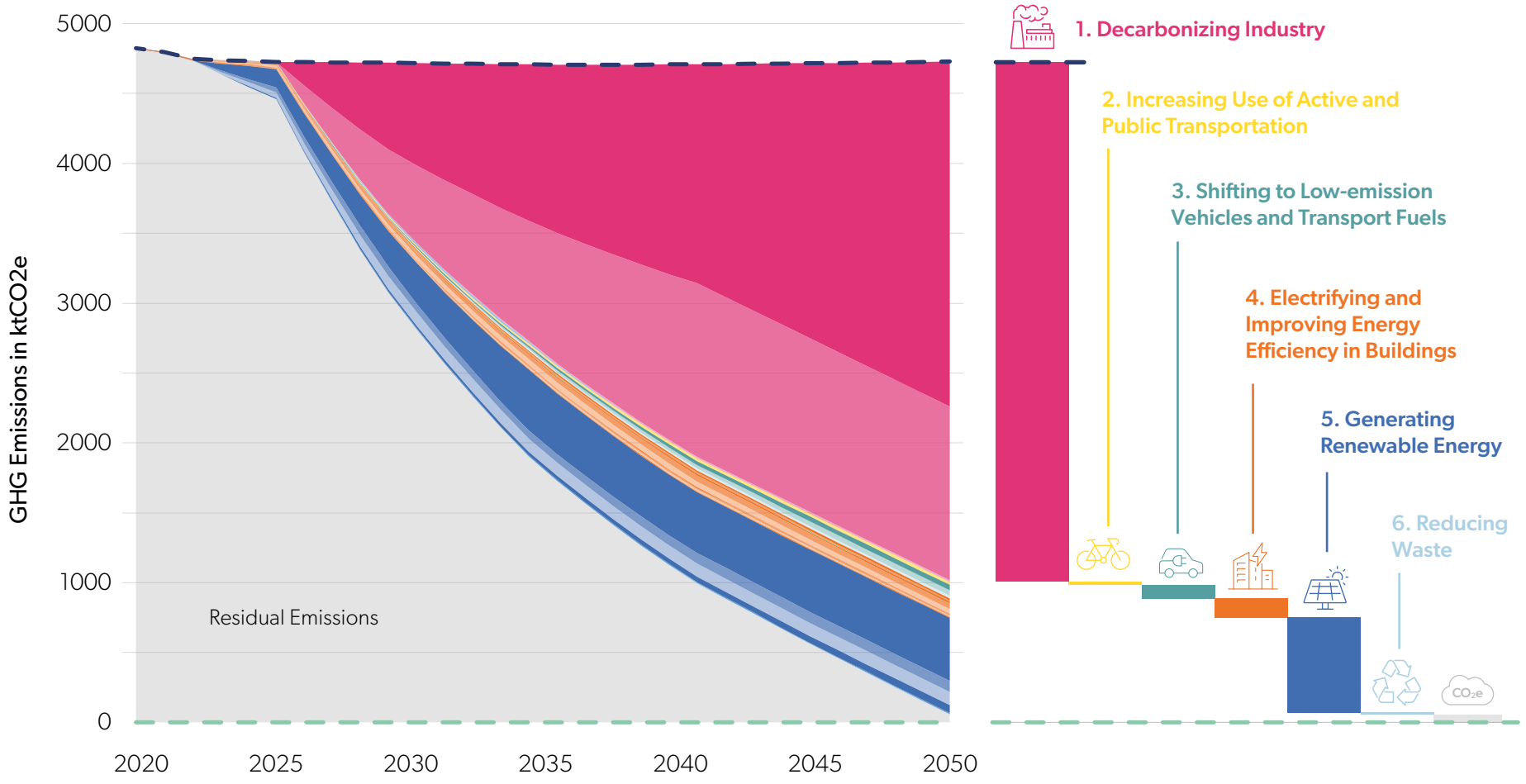
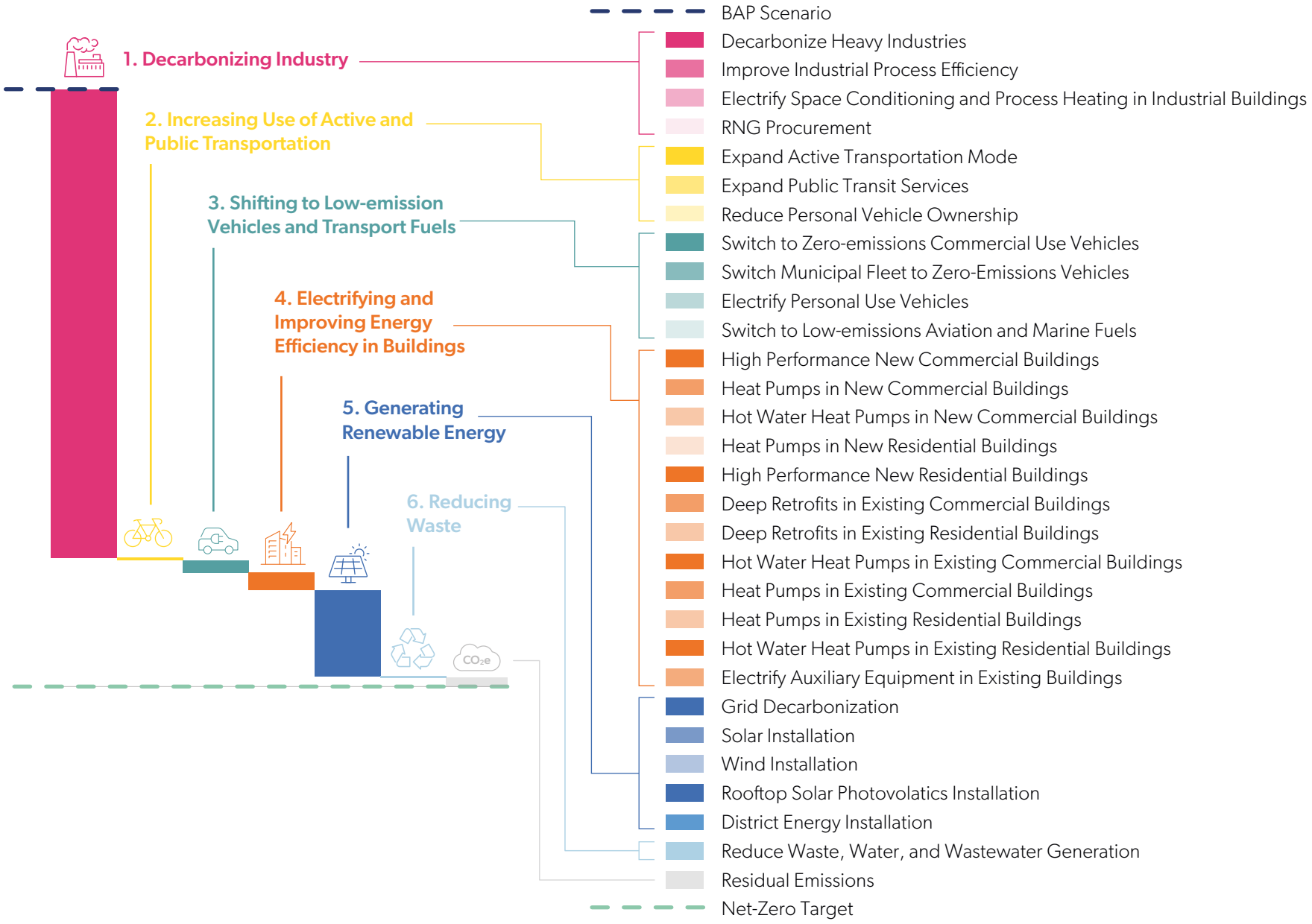


Figure 20 NZE-2 Low-Carbon Pathway, 2021-2050.

With this pathway, a small amount of residual emissions from the waste and transportation sectors remains in 2050, representing 1.2% of total community emissions in 2021. These emissions will need to be addressed with accelerated actions, new technologies, or carbon offsets in subsequent years.


1. Decarbonizing Industry
2. Increasing Use of Active and Public Transportation
3. Shifting to Low-emission Vehicles and Transport Fuels
4. Electrifying and Improving Energy Efficiency in Buildings
5. Generating Renewable Energy
6. Reducing Waste
CO2e
BAP Scenario
Decarbonize Heavy Industries
Improve Industrial Process Efficiency
Electrify Space Conditioning and Process Heating in Industrial Buildings
RNG Procurement
Expand Active Transportation Mode
Expand Public Transit Services
Reduce Personal Vehicle Ownership
Switch to Zero-emissions Commercial Use Vehicles
Switch Municipal Fleet to Zero-Emissions Vehicles
Electrify Personal Use Vehicles
Switch to Low-emissions Aviation and Marine Fuels
High Performance New Commercial Buildings
Heat Pumps in New Commercial Buildings
Hot Water Heat Pumps in New Commercial Buildings
Heat Pumps in New Residential Buildings
High Performance New Residential Buildings
Deep Retrofits in Existing Commercial Buildings
Deep Retrofits in Existing Residential Buildings
Hot Water Heat Pumps in Existing Commercial Buildings
Heat Pumps in Existing Commercial Buildings
Heat Pumps in Existing Residential Buildings
Hot Water Heat Pumps in Existing Residential Buildings
Electrify Auxiliary Equipment in Existing Buildings
Grid Decarbonization
Solar Installation
Wind Installation
Rooftop Solar Photovolatics Installation
District Energy Installation
Reduce Waste, Water, and Wastewater Generation
Residual Emissions
Net-Zero Target

Zooming in on Community Emissions Without Heavy Industries

The next wedge diagram removes the influence of heavy industries, providing a clearer picture of the role of community strategies in the net-zero transition.

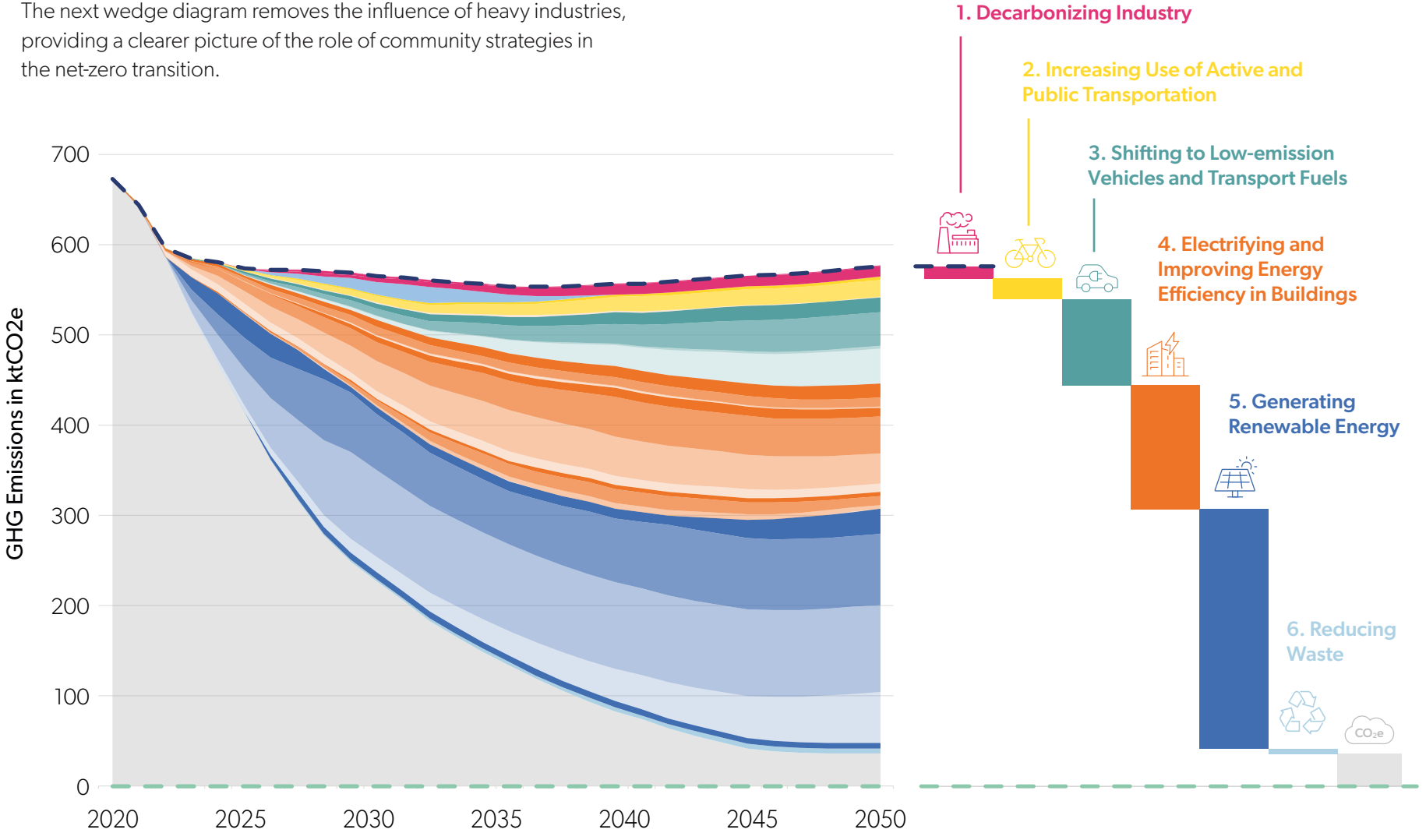
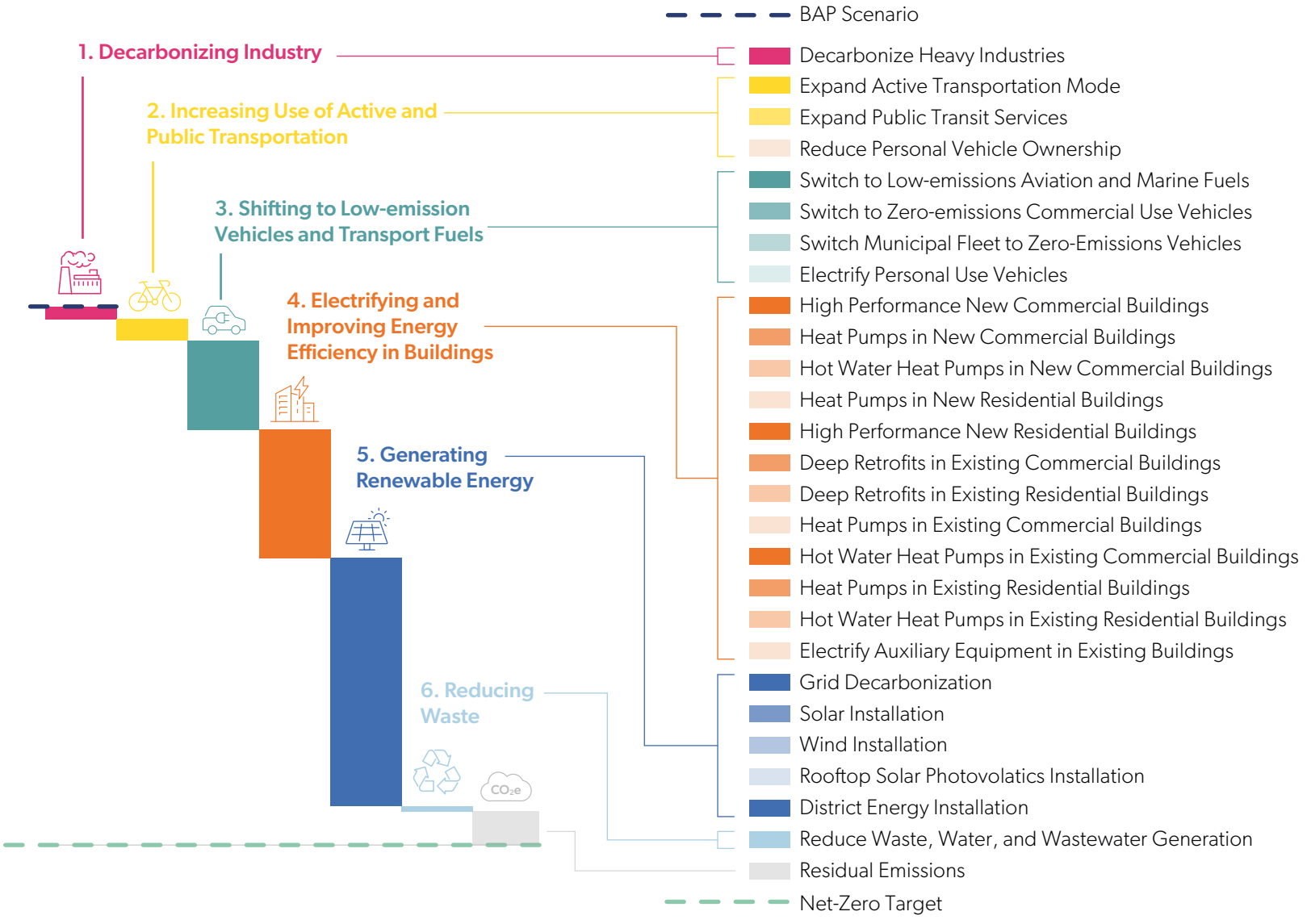


Figure 21 NZE-2 Scenario wedge diagram, without heavy industries, 2021-2050.


BAP Scenario
1. Decarbonizing Industry
2. Increasing Use of Active and Public Transportation
3. Shifting to Low-emission Vehicles and Transport Fuels
4. Electrifying and Improving Energy Efficiency in Buildings
5. Generating Renewable Energy
6. Reducing Waste
CO_2e
Decarbonize Heavy Industries
Expand Active Transportation Mode
Expand Public Transit Services
Reduce Personal Vehicle Ownership
Switch to Low-emissions Aviation and Marine Fuels
Switch to Zero-emissions Commercial Use Vehicles
Switch Municipal Fleet to Zero-Emissions Vehicles
Electrify Personal Use Vehicles
High Performance New Commercial Buildings
Heat Pumps in New Commercial Buildings
Hot Water Heat Pumps in New Commercial Buildings
Heat Pumps in New Residential Buildings
High Performance New Residential Buildings
Deep Retrofits in Existing Commercial Buildings
Deep Retrofits in Existing Residential Buildings
Heat Pumps in Existing Commercial Buildings
Hot Water Heat Pumps in Existing Commercial Buildings
Heat Pumps in Existing Residential Buildings
Hot Water Heat Pumps in Existing Residential Buildings
Electrify Auxiliary Equipment in Existing Buildings
Grid Decarbonization
Solar Installation
Wind Installation
Rooftop Solar Photovolatics Installation
District Energy Installation
Reduce Waste, Water, and Wastewater Generation
Residual Emissions
Net-Zero Target

The strategies in ActSJ reduce non-industrial energy demand in Saint John by half, from 8,933 TJ in 2021 to 4,481 TJ in 2050. This decrease is achieved before 2040; however, population growth causes a marginal increase in energy demand out to 2050.

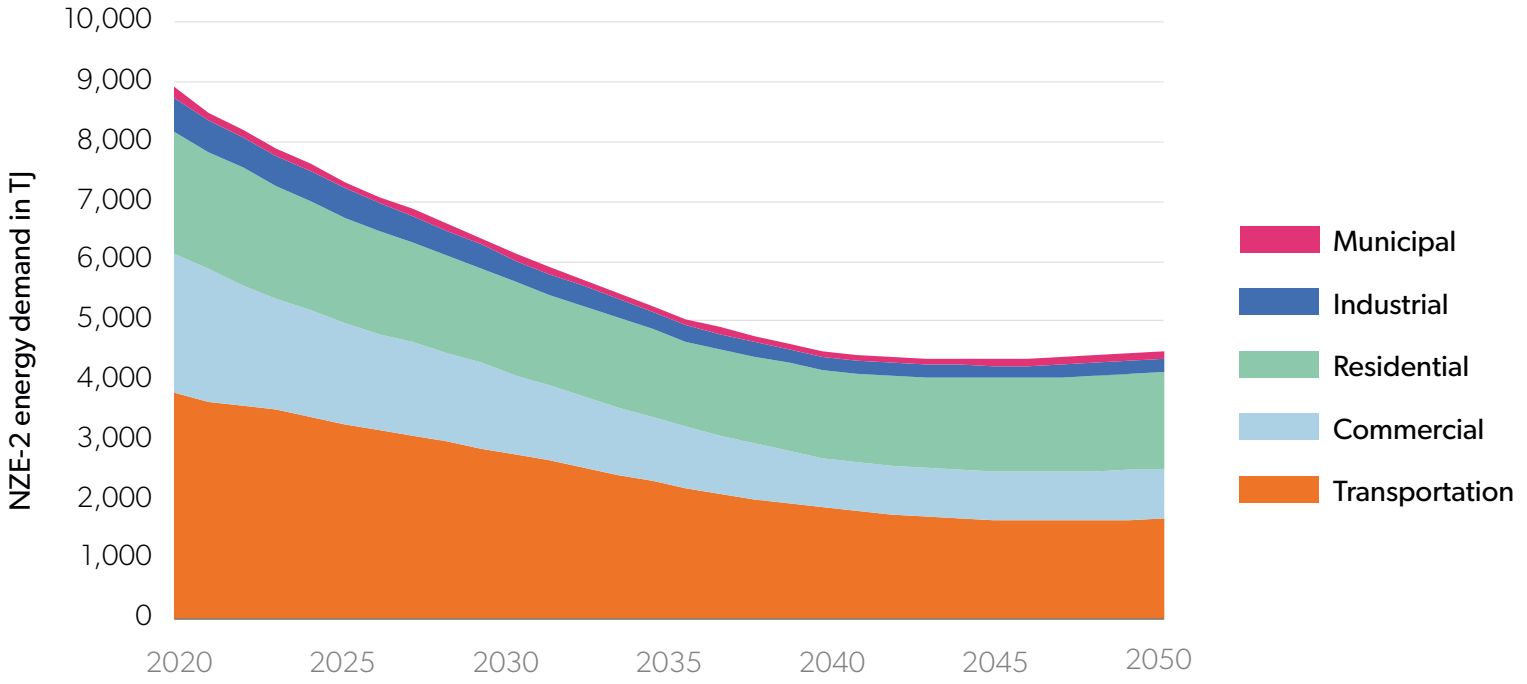


Figure 22 NZE-2 Scenario energy demand by sector, without heavy industries, 2021-2050.

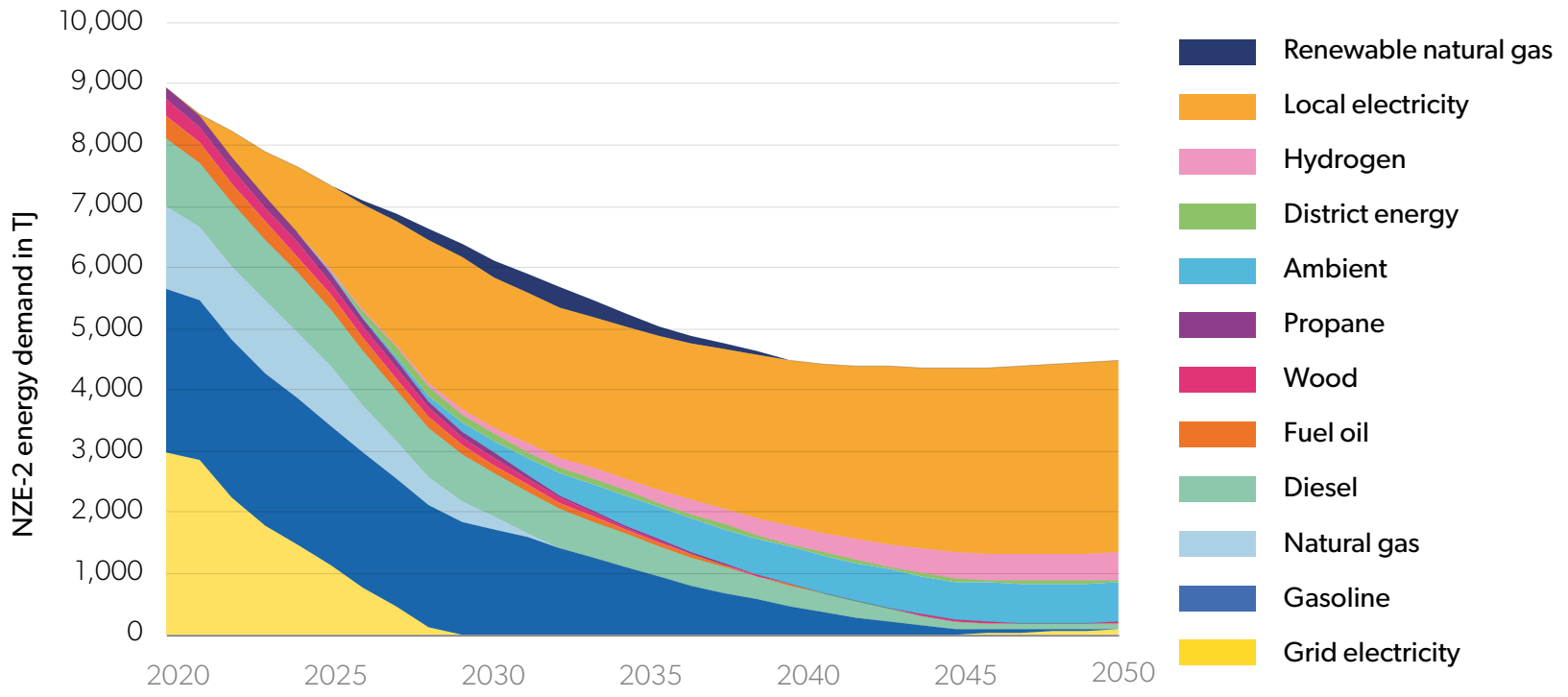


Figure 23 NZE-2 Scenario energy demand by fuel type, without heavy industries, 2021-2050.

The total impact of the ActSJ actions on non-industrial emissions is illustrated in Figure 24. Saint John's total annual emissions drop between 2021 and 2050, from 644 $ktCO_2e$ to well under 35 $ktCO_2e$. Emissions are projected to decrease in all sectors.

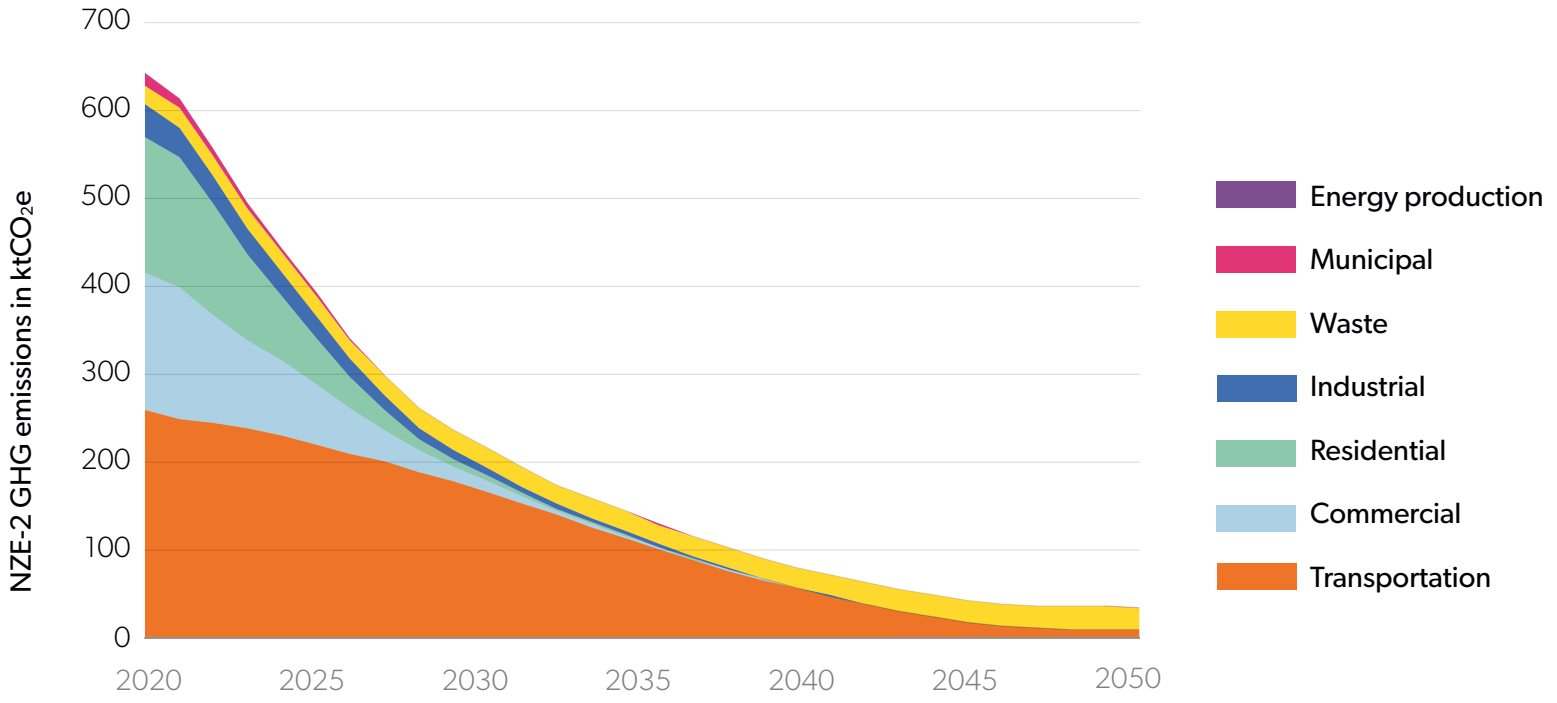


Figure 24 NZE-2 Scenario GHG emissions by sector, without heavy industries, 2021-2050.

Residential, commercial, and municipal buildings are almost entirely decarbonized; high-efficiency electric heat pumps and water heaters replace natural gas for space and water heating—the primary source of GHG emissions in the building sector. In the transportation sector, electrification of vehicles and switching to low-emissions fuel reduces GHG emissions.

While a small amount of heavy-duty vehicles and heavy machinery (in the industrial sector) use fossil-fuels in 2050, these vehicles and machinery will be replaced by zero-emissions options once they are retired post-2050.

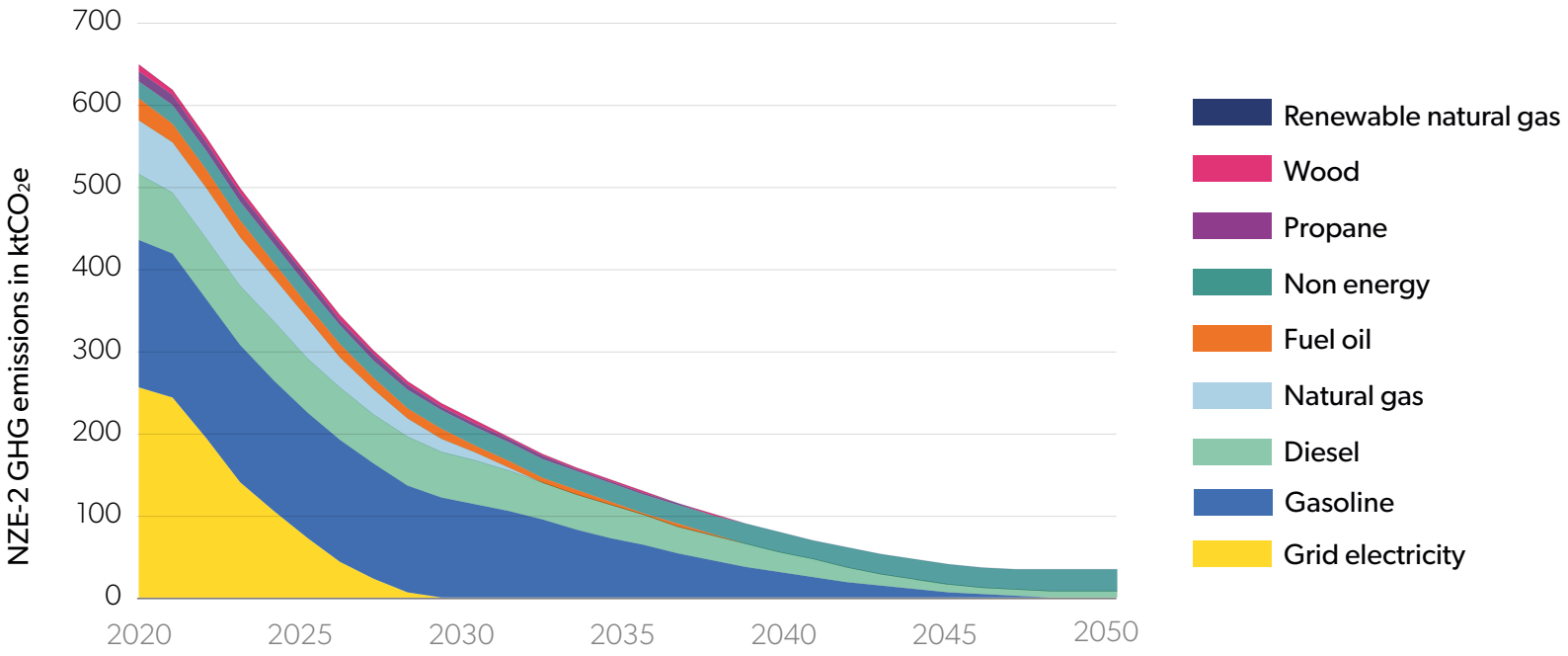


Figure 25 NZE-2 Scenario GHG emissions by fuel type, without heavy industries, 2021-2050.

Emissions from landfills constitute the largest portion of remaining emissions in the net-zero pathway, and will be a challenge to mitigate. Residual emissions could be addressed through additional measures such as carbon sequestration, new regulations, or deployment of new technologies. If such options do not become available by 2035, the City can purchase offsets to compensate for its outstanding emissions.

Carbon Offsets Are a Last Resort

A carbon offset is a reduction or removal of GHG emissions from the atmosphere that can be purchased to counteract or cancel out emissions from the purchaser. Carbon offset projects can take the form of afforestation and reforestation, regenerative agriculture, renewable energy installations, and methane capture at landfills and wastewater treatment plants. One carbon offset certificate, or carbon offset credit, represents one metric ton of carbon dioxide (CO_2) or its equivalent GHG (CO_2e) that is removed. Carbon offset credits can be exchanged between parties to offset emissions.[21]

Offsets are useful in the broader context of reducing emissions because they are designed to fund carbon reduction strategies that are not yet independently financially feasible. In this sense, they fund changes that move another entity closer to decarbonization; however, they should not be viewed as equivalent to reducing emissions locally. Every tonne of greenhouse gas emitted into the air contributes to climate change, even if it is offset. Additionally, the administration of offsets is complex and requires significant overhead and time. Not all work funded by offsets is successful in eliminating the promised emissions. Offsets are not an alternative to making the changes required to reduce emissions locally. Offsets should only be purchased in cases where there is no alternative.

[21] Adapted from Julia Yamamoto, "Carbon Offsets 101: A Guide for Going Carbon Neutral". March 21, 2022. https://www.onetrust.com/blog/carbon-offsets-101-guide-for-going-climate-neutral/

The Race to Zero pledge requires cities in wealthy nations like Canada to adopt a fair-share, science-based target,[22] reducing emissions to 2.9 tonnes per capita by 2030. The NZE-2 pathway puts Saint John on a trajectory to meet this target by 2030, and ultimately reduce emissions to 0.3 tCO_2e per capita by 2050.

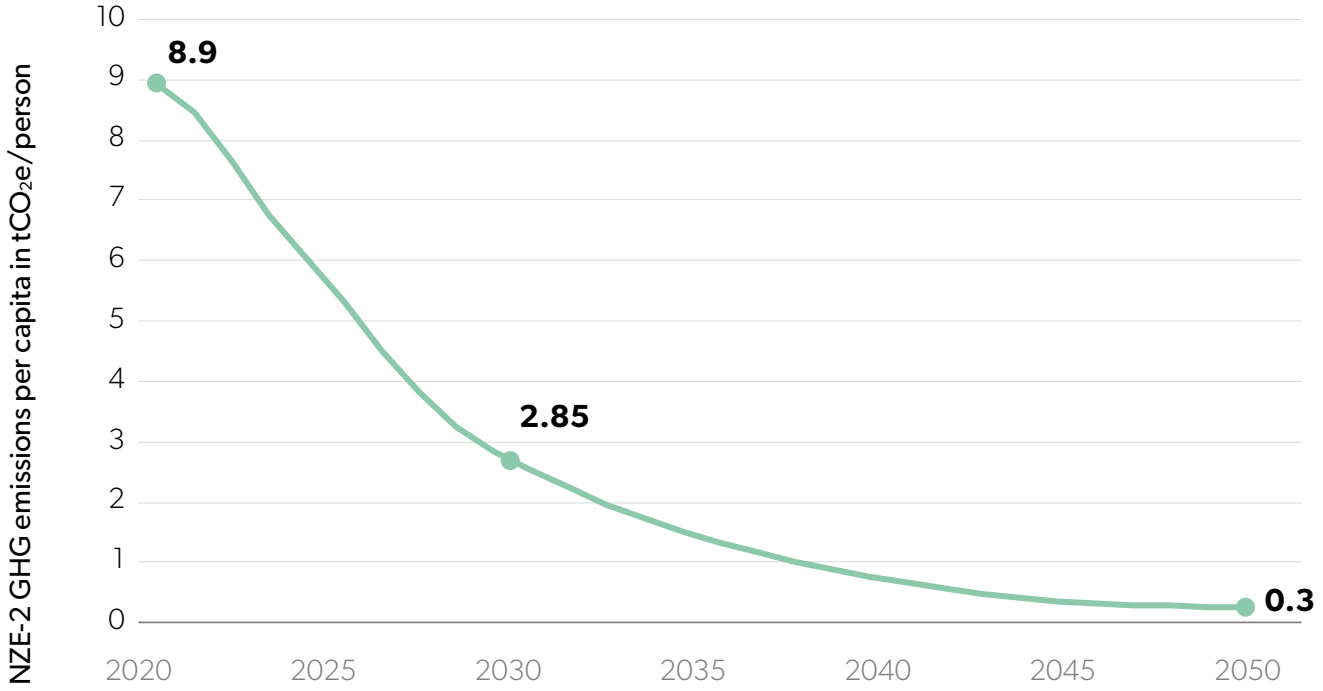


Figure 26 NZE-2 Scenario per capita emissions, 2021-2050.

[22] C40 1.5 degrees Celsius Climate Action Plans. https://www.c40.org/what-we-do/raising-climate-ambition/1-5c-climate-action-plans/

Figures 27 and 28 are Sankey diagrams, which track energy flows from source (on the left) to end use (middle section) to useful energy or conversion losses (on the right). The width of each section is proportional to the quantity represented.

The two Sankey diagrams highlight the magnitude of the transformation over the next 27 years in Saint John:

- Transitioned from a predominantly fossil-fuel powered system in 2021 to a localized, renewable energy-powered system, primarily from solar and wind in 2050.
- The reduction in the share of conversion losses to in 2050 indicates that more of the energy is being used for its intended purposes, reducing the need for additional generation and therefore reducing the overall cost of the energy energy system.

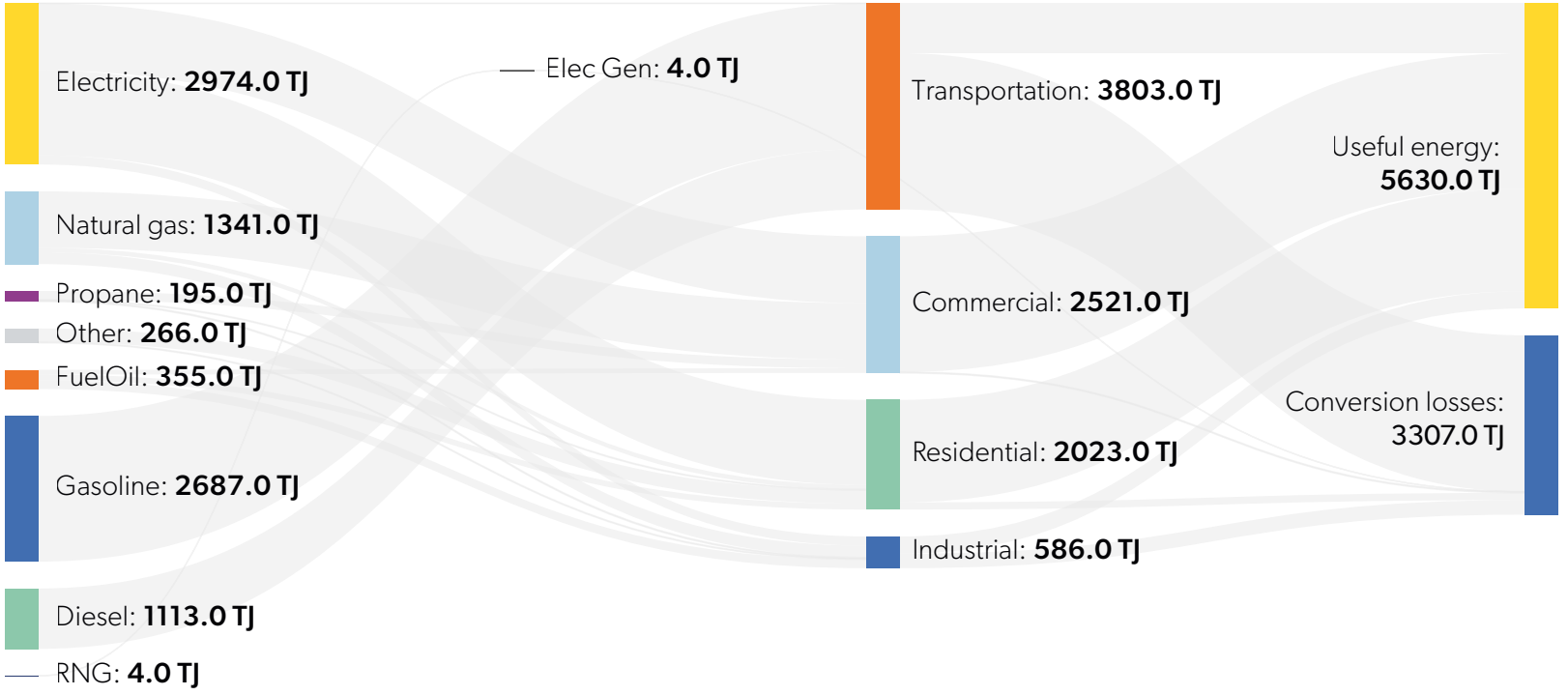


Figure 27 Sankey diagram for baseline year 2021.

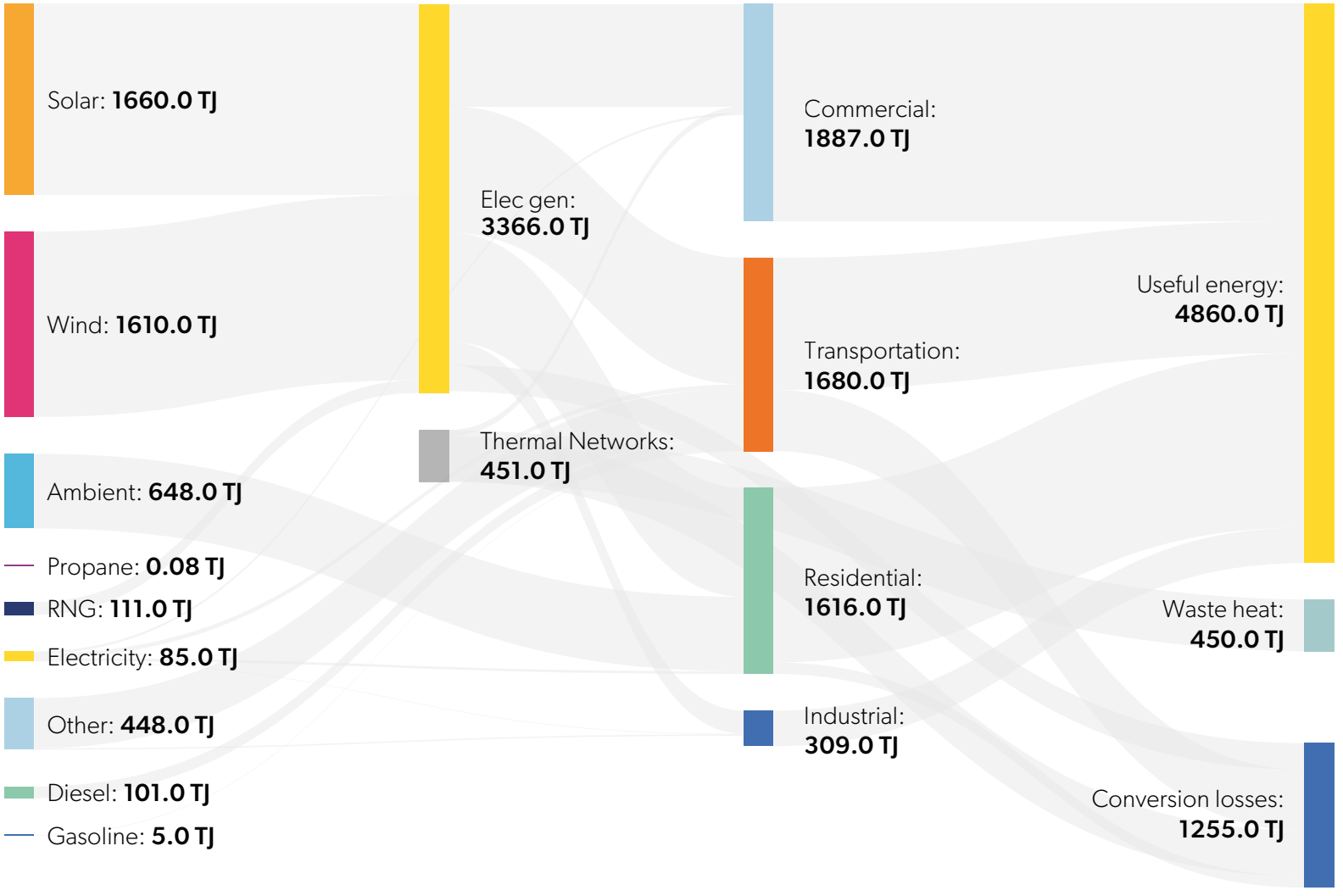


Figure 28 NZE-2 Scenario Sankey diagram for 2050.

5.

Saint John's Economic Opportunity

5. Saint John's Economic Opportunity

This chapter outlines the costs and returns of ActSJ. Projected investments and returns are calculated relative to the BAP Scenario. Implementing ActSJ and decarbonizing the economy will require investments by residents, businesses, institutions, the City, and other levels of government. The actions will begin generating returns in the form of energy savings and avoided carbon taxes immediately, and provide ongoing economic opportunities for the community as demand for clean energy products and services drives technological innovation and job creation.

Costs to the municipality are dependent on the degree to which the municipal government chooses to invest in certain actions and incentivize other sectors. Investigating all financial tools available to the municipal government and other community stakeholders, including individuals, businesses, and other levels of government, will be critical to the implementation as capital costs and upfront investments are a primary barrier to climate action.[23]

[23] The following financial analysis is based on the NZE-2 Scenario and depicts incremental costs compared to the BAP Scenario. The heavy industry sector is not included in the financial analysis, the focus of the analysis is on investments and savings implications of modelled targets for all other sectors of the city.

5.1 Key Financial Concepts

Key concepts that are used to analyze the financial impacts of the pathways are summarized below.[24]

Table 3. Financial concepts.

Concept	Explanation
Costs are relative to the BAP Scenario	This financial analysis tracks projected costs and savings associated with low-carbon measures above and beyond the costs in the BAP Scenario.
Discount Rate	The discount rate is the baseline growth value an investor places on their investment dollar. A project is considered financially beneficial by an investor if it generates a real rate of return equal to or greater than their discount rate. An investor's discount rate varies with the type of project, duration of the investment, risk, and the scarcity of capital. The social discount rate is the discount rate applied for comparing the value to society of investments made for the common good and, as such, it is inherently uncertain and difficult to determine. We evaluate investments in a low-carbon future with a 3% discount rate, aligning with the Government of Canada's long term social discount rate for GHG analysis.[25]

(continued on next page)

[24] Detailed financial assumptions are described in the Data, Methods and Assumptions Manual.

[25] Environment and Climate Change Canada. (2016). Technical update to Environment and Climate Change Canada's social cost of greenhouse gas estimates. Retrieved from https://publications.gc.ca/collections/collection_2016/eccc/En14-202-2016-eng.pdf

(continued from previous table)

Concept	Explanation
Net Present Value	The net present value (NPV) of an investment is the difference between the present value of the capital investment and the present value of the future stream of savings and revenue generated by the investment. Four aggregate categories are used to track the financial performance of the low-carbon actions in this analysis: capital expenditures, energy savings (or costs), operations and maintenance savings, and revenue generation (associated with renewable energy production facilities and some transit actions). Administrative costs associated with implementing programs, as well as any energy system infrastructure upgrades that may be required, are excluded. Similarly, the broader social costs that are avoided from mitigating climate change, such as avoided health costs or avoided damages from climate change, are not included in this financial analysis.
Abatement Cost	The abatement cost of an action is the estimated cost for that action to reduce one metric ton of GHG emissions, calculated by dividing the action's NPV by the total GHG emissions reductions (tCO_2e) resulting from the action. For example, if a project has an NPV of $1,000 and generates 10 tCO_2e of savings, its abatement cost is $100 per tCO_2e reduced.
Amortization	The costs of major capital investments are typically spread over a period of time (e.g., a mortgage on a house commonly has a 25-year mortgage period). Amortization refers to the process of paying off capital expenditures (debt) through regular principal and interest payments over time. In this analysis, we have applied a 25-year amortization rate to all investments.[26]

[26] To manage the complexity of the analysis, a blanket amortization of 25 years was applied across all actions in order to demonstrate the impact of financing the actions.

5.2 The Big Picture: Economic Benefits

From 2023 to 2050, the community of Saint John will receive $2.8 billion in net benefits from implementing this plan. Short term capital investments are necessary to unlock these long-term benefits of energy savings and avoiding carbon tax in all sectors of the city.[27,28]

Table 4. Summary of financial results, undiscounted, 2023-2050. A negative number represents dollars saved (returns are greater than cost), while a positive number represents cost (costs are greater than returns).

Financial estimate	NZE-2 Scenario (undiscounted)	NZE-2 Scenario (3% discount rate)
Total incremental capital investment, 2023-2050	$2.6 billion	$2.0 billion
Savings from investments made between 2023-2050	-$9.3 billion	-$4.8 billion
Net benefit, 2023-2050	**-$6.9 billion**	**-$2.8 billion**
Capital cost to reduce each tonne of GHG	$263	$197
Annual household savings on energy, 2050 over 2020	-$3,540	
Investment $/person year of employment	$153,000	

[27] Using a discount rate of 3% for all incremental investments and savings compared to the BAP Scenario.

[28] Financials for the heavy industry sector were not evaluated in this analysis due to a lack of information about the costs of transitioning industries.

Implementing ActSJ requires a community-wide investment of $93 million annually between 2023 and 2050, or $2.6 billion over the entire period. For comparison, Saint John's GDP was $6.5 billion in 2019;[29] the required annual investment represents less than 1.5% of the city's annual GDP.

This capital investment generates undiscounted savings of $9.3 billion from energy expense savings, and from avoided operations and maintenance costs. These benefits accrue to the community as a whole, including households, businesses, and the City itself.

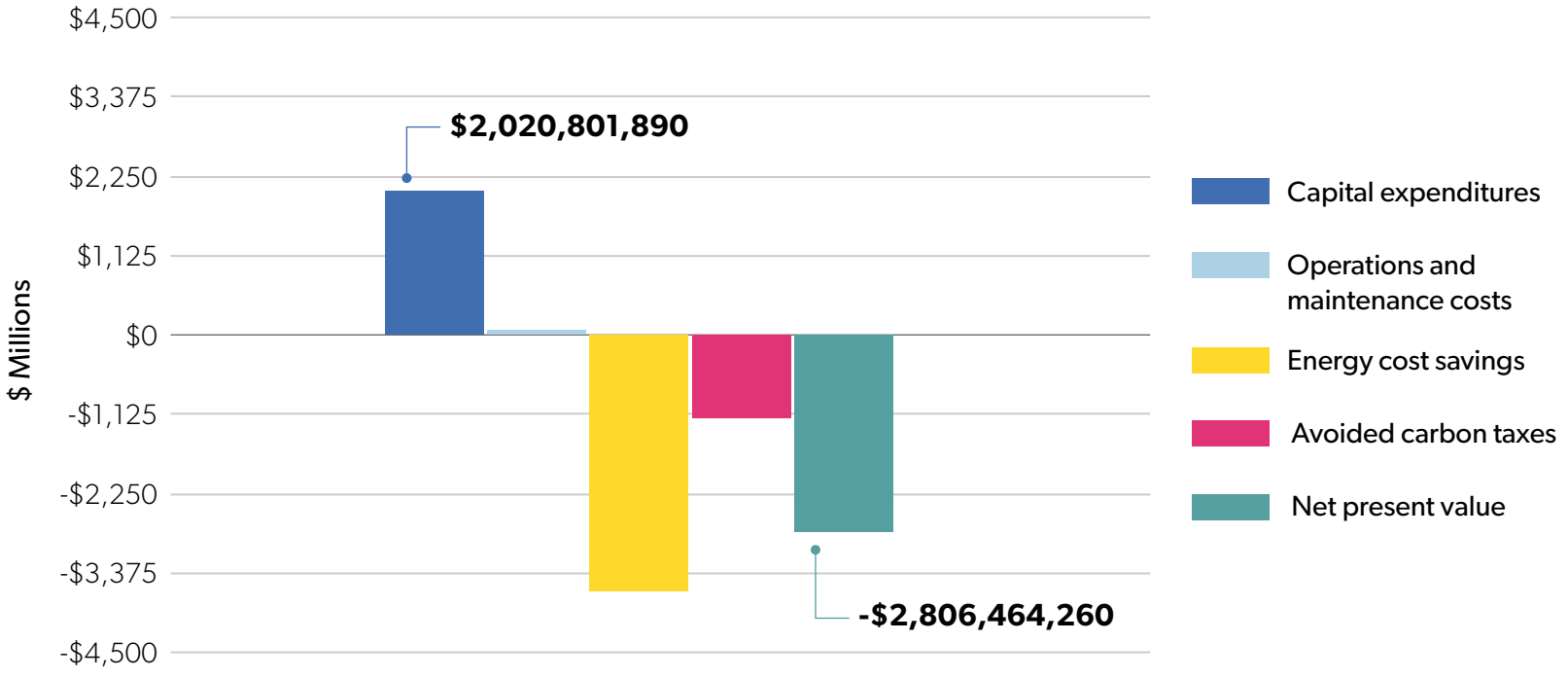


Figure 29 Present values of investments and returns, discounted at 3% (costs are positive and revenue and savings are negative), NZE-2 Scenario, 2023-2050.[30]

[29] Statistics Canada. "Table 36-10-0468-01 Gross domestic product (GDP) at basic prices, by census metropolitan area (CMA) (x 1,000,000)." Accessed July 28, 2023. https://doi.org/10.25318/3610046801-eng

[30] The resulting difference between O&M costs in BAP and NZE-2 Scenario was less than $15,000,000, which causes it to not appear on the graph.

Most of the savings stem from lower energy expenditures which total $3.6 billion (discounted). Lower energy expenditures are achieved with building retrofits and from the switch to active and public transportation modes, which require much less energy and thus reduce energy expenditures. The switch to heat pumps and electric vehicles also lowers energy expenditures as electricity is cheaper than natural gas. Savings from avoided carbon tax expenditures are based on scheduled carbon price increases which culminate in a $170 per tonne price by 2030,[31] and result in an additional $1.2 billion (discounted) community-wide savings for Saint John.

5.3 Investments Unlock Opportunities

The annual incremental costs, savings, and revenue associated with fully implementing the actions in the NZE-2 Scenario are shown in Figure 30 (next page), with capital expenditures shown in the years in which they are incurred. As is characteristic of low-carbon transitions, the capital expenditures in the early years of the transition are greater than the savings and revenues generated, but by 2033, the savings outweigh the costs.

[31] Government of Canada (2023). Update to the Pan-Canadian Approach to Carbon Pollution Pricing 2023-2030. Retrieved from: https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/carbon-pollution-pricing-federal-benchmark-information/federal-benchmark-2023-2030.html

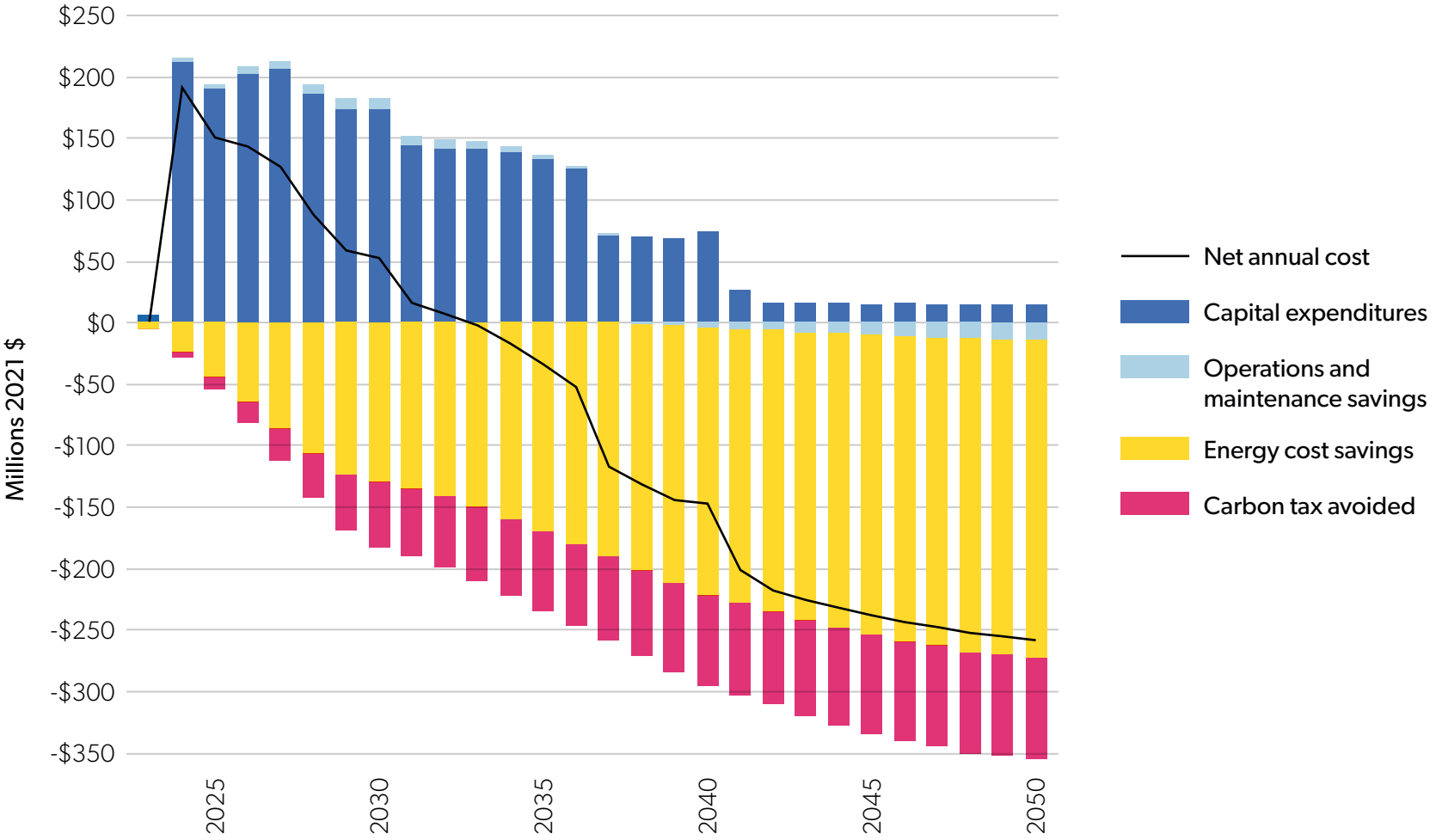


Figure 30 Year-over-year investments and returns, undiscounted, NZE-2 Scenario, 2023-2050. The break-even point occurs in 2033.

Figure 31 shows the annual capital expenditures by sector. The majority of investments are for the residential and commercial building sectors with a large portion dedicated to building energy retrofits, which provide long-term energy savings but entail high upfront costs. The incremental investment in transportation is negligible because the costs of private electric vehicles are projected to reach parity with internal combustion engines as early as 2027.[32]

[32] Additionally, some of the modelled targets involve decreasing demand for vehicle ownership (increasing transit use, increasing biking and walking, etc.) which lead to lower investment and operating costs for the transportation sector.

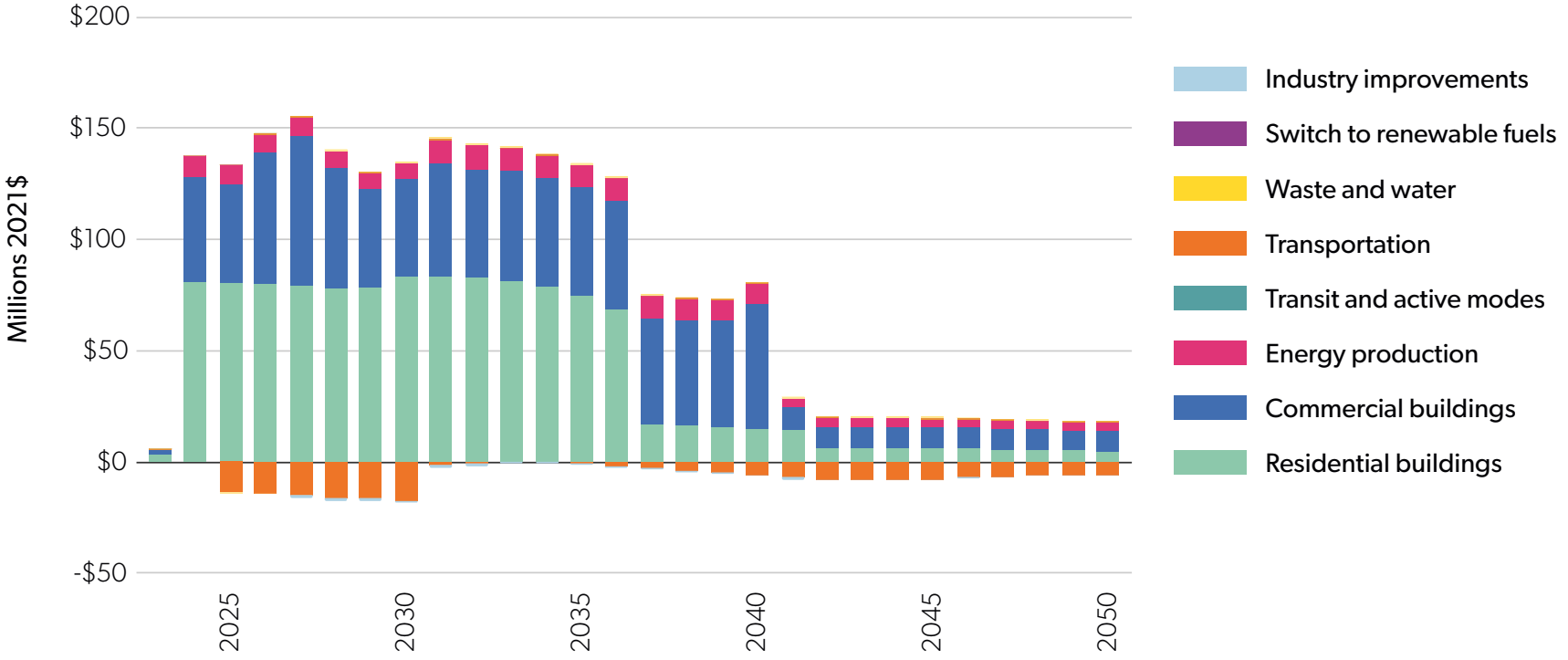


Figure 31 Incremental capital expenditures by sector, NZE-2 Scenario, 2023-2050.

Figure 32 shows the capital investments amortized over 25 years with 3% interest in order to illustrate how financing could influence the financial dynamics of the pathway. Amortization has the effect of reducing the annual capital requirements by nearly 30% for peak investment years, with the result of repayments being phased out beyond 2070.

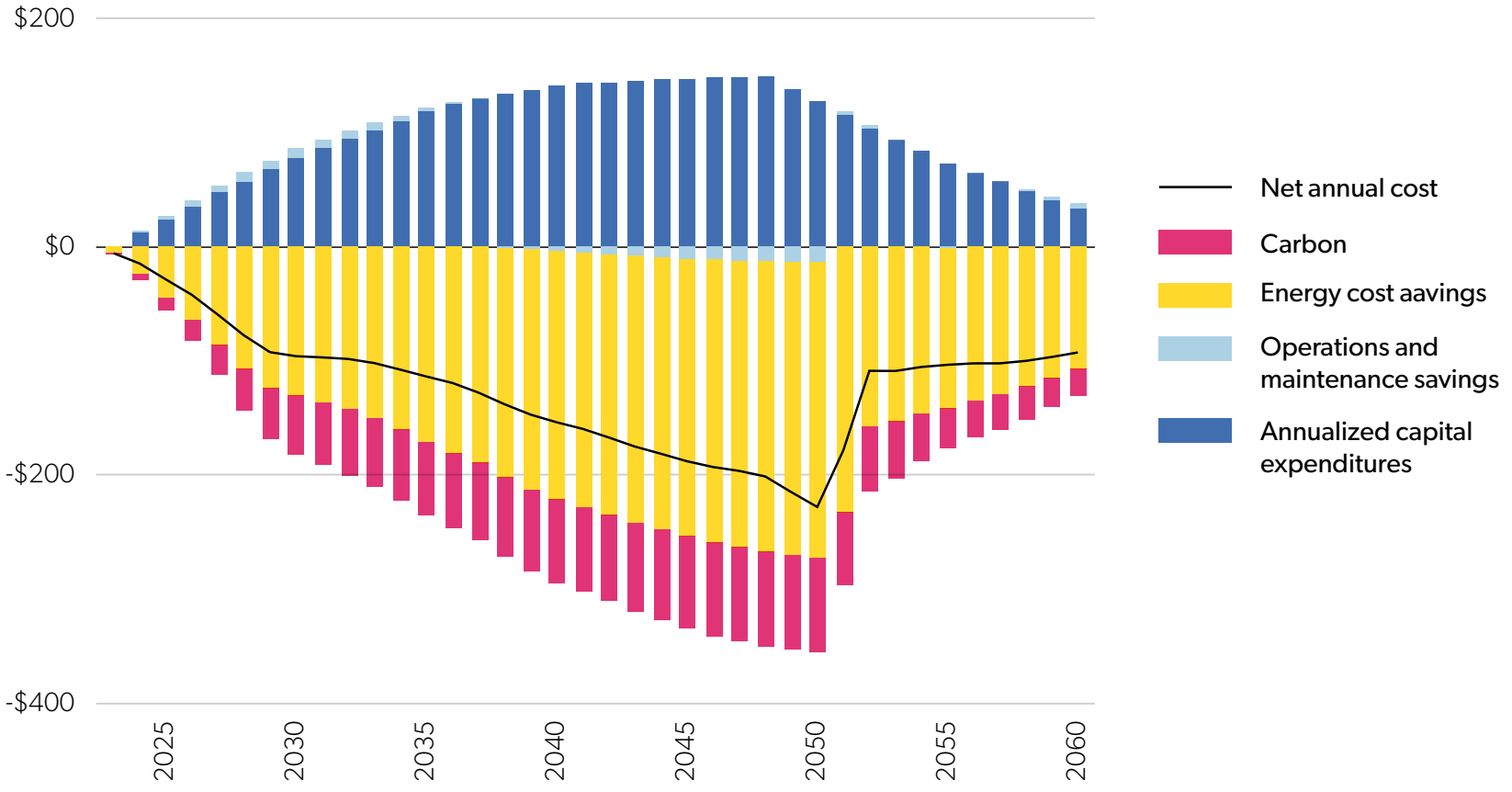


Figure 32 Annual capital expenditures and savings, amortized, NZE-2 Scenario, 2023-2060.

Figure 33 illustrates energy expenditures by sector. All sectors see financial benefits from reduced energy costs through improved energy efficiency and a reduction in total energy demand. Savings on energy are nearly $200 million annually by 2050 and continue beyond 2050, the end of the study period.[33]

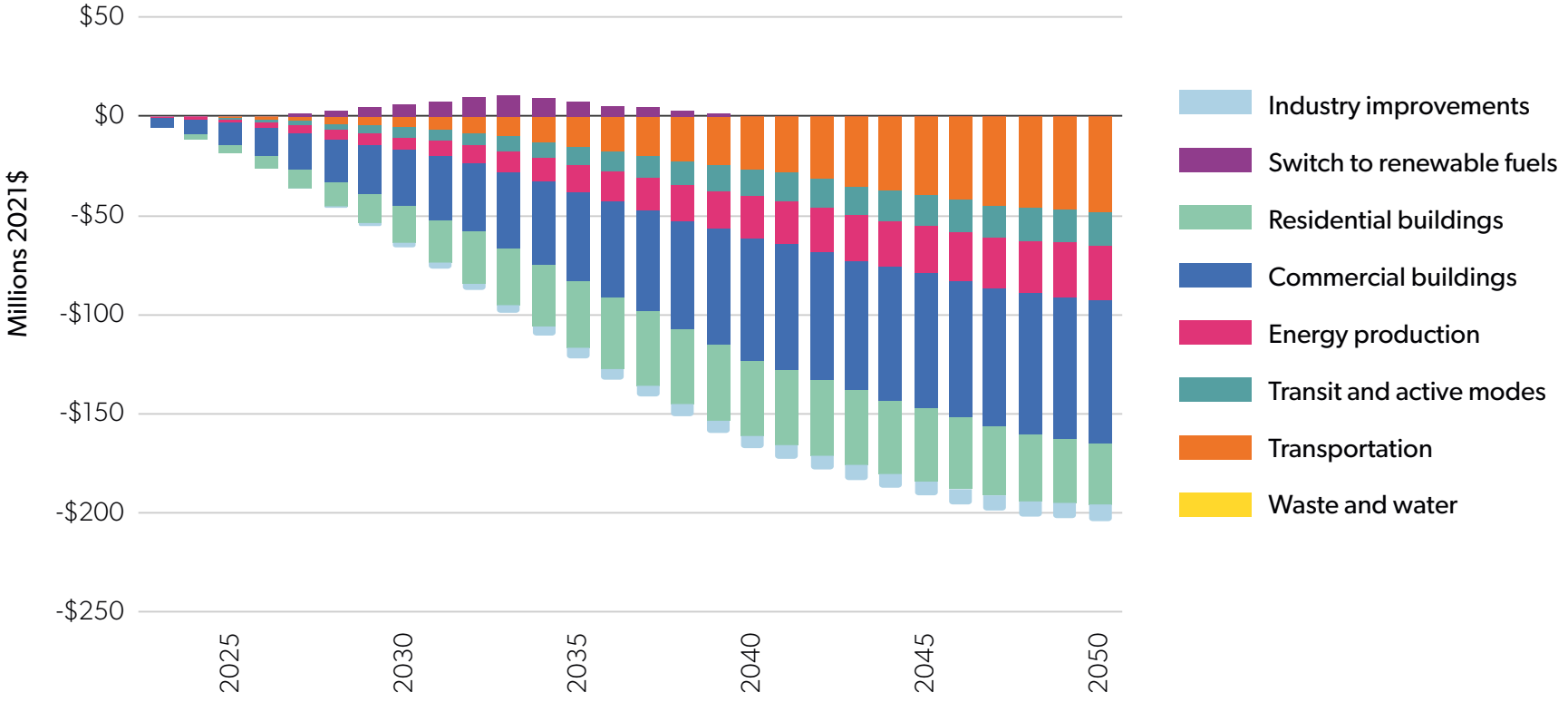


Figure 33 Financial savings from reduced energy expenditures by sector, undiscounted, NZE-2 Scenario, 2023-2050.

[33] Note: ''switch to renewable fuels'' represents fuel costs for renewable natural gas which is used to replace natural gas use while buildings are undergoing electrification.

5.4 Energy Savings for Households

Household energy expenditures—on natural gas, electricity, gasoline and diesel—are projected to decline by 33% in the BAP, from $4,900 in 2023, to $3,300 by 2050 (Figure 34). In the BAP, these savings mainly result from a decrease in vehicle fuel expenditures due to vehicle electrification following provincial targets, an increase in the substitution of traditional heating equipment by more efficient heat pumps, and decreased heating requirements as the climate becomes milder due to climate change.

In the NZE-2 Scenario, the savings are much greater, and household energy expenditures fall by 66% to $1,660 by 2050. Depending on the business, policy, and financing strategies used in the implementation of the actions, these savings will be partly offset by the incremental capital expenditures required. Investments in building energy retrofits, faster vehicle electrification, increased transit and active trips, high-performance buildings, and renewable energy generation all contribute to significantly reducing average household energy expenditures.

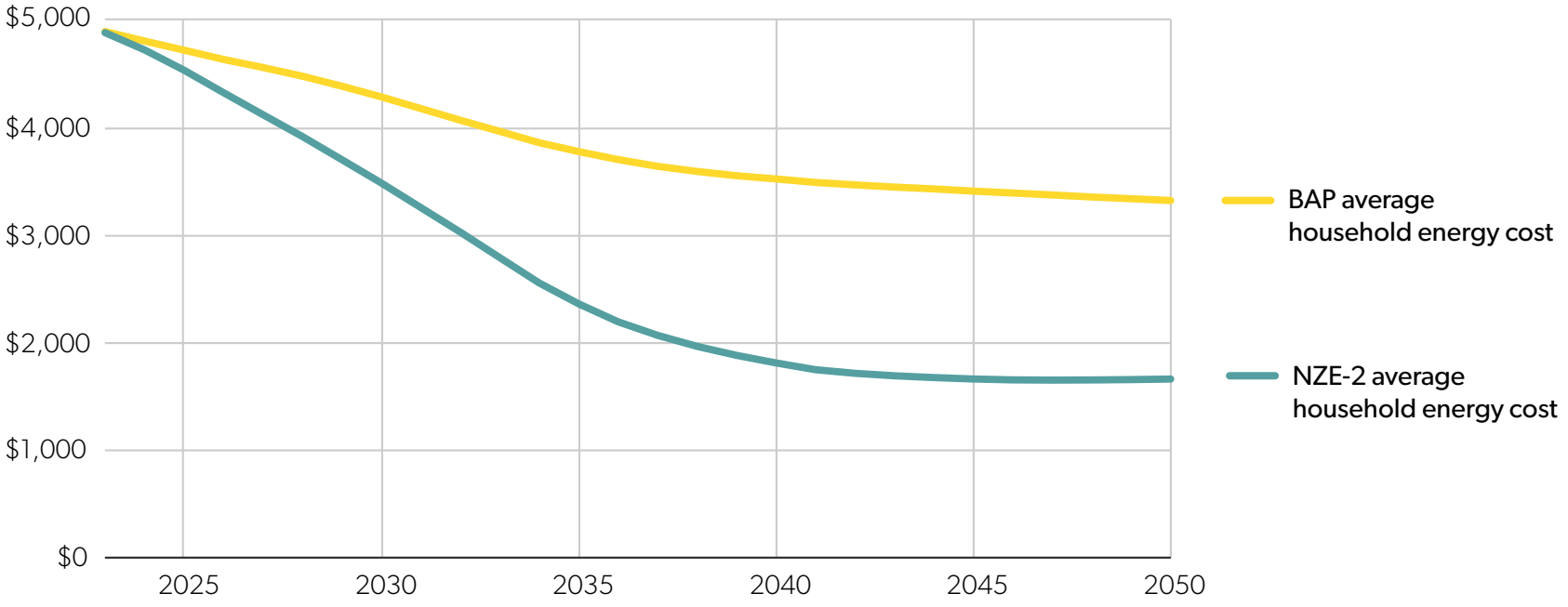


Figure 34 Average household energy costs in the BAP and NZE-2 Scenarios, undiscounted, 2023-2050.

Impacts of Energy Poverty

Households living in energy poverty have low incomes and spend more than 10% of their incomes on powering and heating their homes and other energy costs.[34] These households may struggle to "pay the rent or feed the kids", "heat or eat", or "cool or eat".[35] Low-income and fixed-income residents including single parents, the elderly, and persons with disabilities,[36] may struggle with utility-related debt, shutoffs, inefficient heating systems, and antiquated appliances. Their homes may also lack insulation and proper ventilation, leading to extreme swings in temperatures with the potential negative impacts on their health. Children in these households may experience nutritional deficiencies, as well as higher risks of burns and carbon monoxide poisoning from non-conventional heating sources like propane heaters, wood stoves, and fireplaces. These children also face higher risks for cognitive and developmental behavior deficiencies.[37]

Climate action policies could impose additional financial burden on households already facing poverty. Therefore, it is vital that Saint John design policies and programs that are tailored to jointly combat climate change and energy poverty.

[34] Homeless Hub. (n.d.). "What is Energy Poverty?" Retrieved July 2022 from: https://www.homelesshub.ca/toolkit/what-energy-poverty

[35] Cook, J. T., Frank, D. A., Casey, P. H., Rose-Jacobs, R., Black, M. M., Chilton, M., … Cutts, D. B. (2008). A brief indicator of household energy security: Associations with food security, child health, and child development in US infants and toddlers. PEDIATRICS, 122(4), e867–e875. https://doi.org/10.1542/peds.2008-0286

[36] Hernández, D. (2013). Energy insecurity: A framework for understanding energy, the built environment, and health among vulnerable populations in the context of climate change. American Journal of Public Health, 103(4), e32–e34. https://doi.org/10.2105/AJPH.2012.301179

[37] Ibid.

5.5 Employment and Business Opportunities

ActSJ will create 17,000 person-years of employment, over the BAP Scenario, between 2023 and 2050 (figure 35, next page). These jobs will be created in construction, as well as renewable energy and other growing sectors. At the same time, some jobs will shift (e.g., people shifting from working in the fossil fuel sector to the renewable energy sector), and some jobs will decrease or be eliminated (e.g., combustion engine vehicle mechanics).

Building retrofits represent the largest opportunity for new employment. In order to prepare the Saint John community to take advantage of these opportunities, the City can work with local educational institutions and businesses to offer training in deep energy retrofits and installing high-efficiency equipment. Buildings can also be improved as retrofits take place; for example, the accessibility features of public buildings, commercial and residential buildings, and common areas can be upgraded as a part of retrofit projects.

The transportation maintenance sector shows small losses in total person-years of employment, since electric vehicles require less maintenance than internal combustion engine ones.

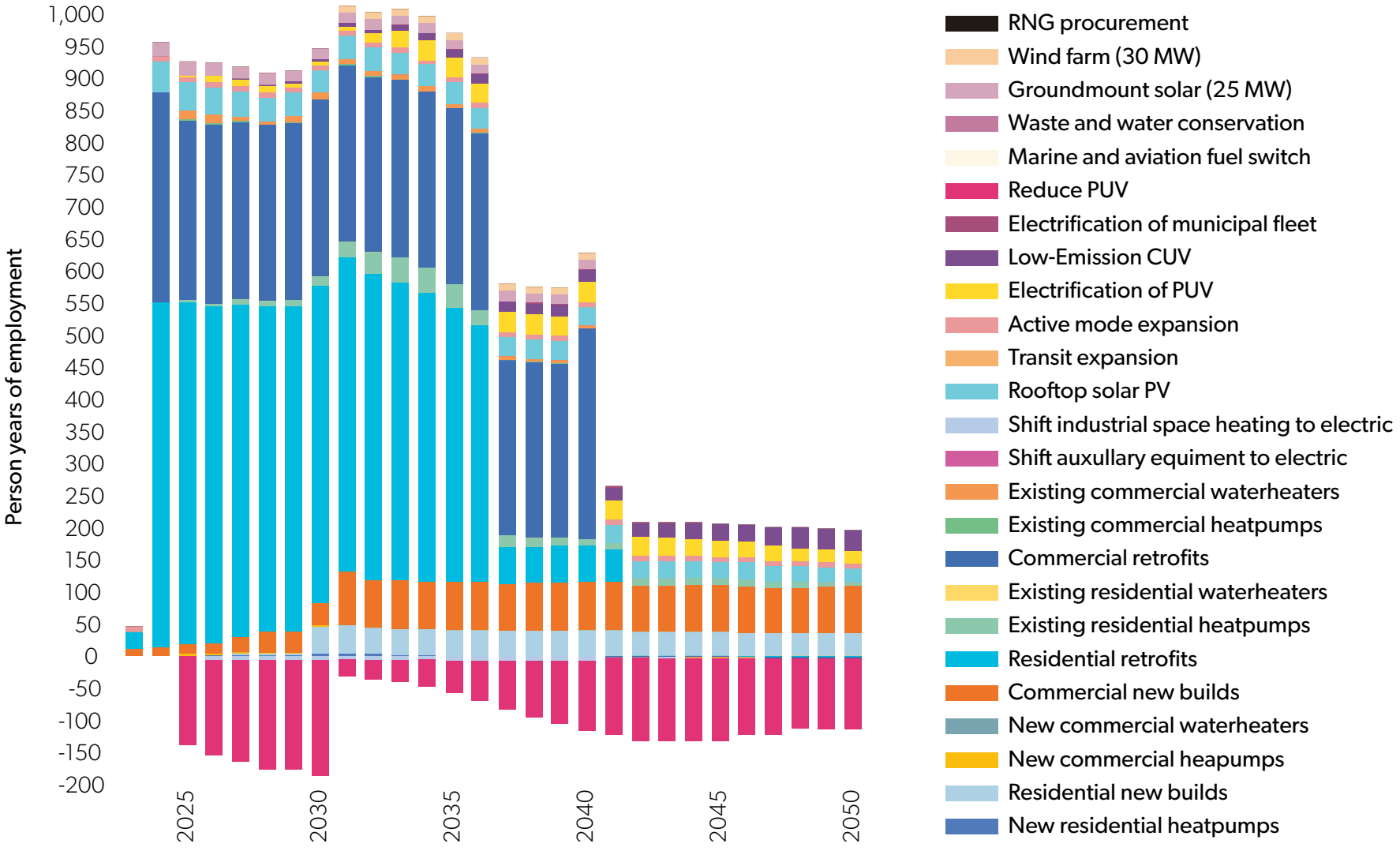


Figure 35 Annual person-years of employment generated in the NZE-2 Scenario, 2023-2050.

5.6 Abatement Costs

The marginal abatement cost (MAC) is the incremental cost of preventing one tonne of GHG emissions. The lower the cost, the more affordable the action and, in some cases, the action can be profitable. The abatement cost is calculated by summing the net present value of capital costs and operating costs over the lifetime of the investments divided by the tonnes of GHGs reduced.

By providing individual costs for actions, MACs can imply that the actions are a menu from which individual actions can be selected. In fact, many of the actions are dependent on each other. For example, energy costs increase without retrofits. To be successful, ActSJ must be implemented in full. Additionally, in order to achieve Saint John's target, all the actions need to be undertaken as soon as possible.

Table 5 (next page) summarizes the marginal abatement costs for modelled actions for ActSJ. The actions with negative abatement costs generate financial returns over their lifetimes. A positive abatement cost signifies a net cost over the span of the project. This comparison provides one way to view the costs and benefits of the implementation of emissions-reducing actions, but should not be the only metric used to evaluate an action.

Table 5. Marginal abatement costs for modelled actions.

Low-carbon action	Cumulative emissions reduction (kt CO_2eq)	Proportion of total reduction	Net present value	Marginal abatement cost ($ / tCO_2eq)
New residential heat pumps	26.39	0.24%	-$8,032,316	-$304
Residential new builds	190.84	1.77%	-$44,484,504	-$233
New commercial heat pumps	226.80	2.10%	-$108,502,604	-$478
New commercial water heaters	17.84	0.17%	-$7,823,403	-$438
Commercial new builds	271.72	2.52%	-$80,280,565	-$295
Residential retrofits	919.19	8.53%	$333,688,095	$363
Existing residential heat pumps	264.28	2.45%	-$67,534,095	-$256
Existing residential water heaters	103.37	0.96%	-$32,687,552	-$316
Central Peninsula district energy	165.67	1.54%	-$171,991,678	-$1,038
Commercial retrofits	826.91	7.67%	-$121,420,303	-$147
Existing commercial heat pumps	265.48	2.46%	-$134,275,372	-$506
Existing commercial water heaters	86.95	0.81%	-$27,285,424	-$314
Shift auxiliary equipment to electric	2.63	0.02%	$1,834,566	$698
Shift industrial space heating to electric	36.69	0.34%	-$59,113,365	-$1,611
Rooftop solar PV	802.78	7.45%	-$305,935,911	-$381

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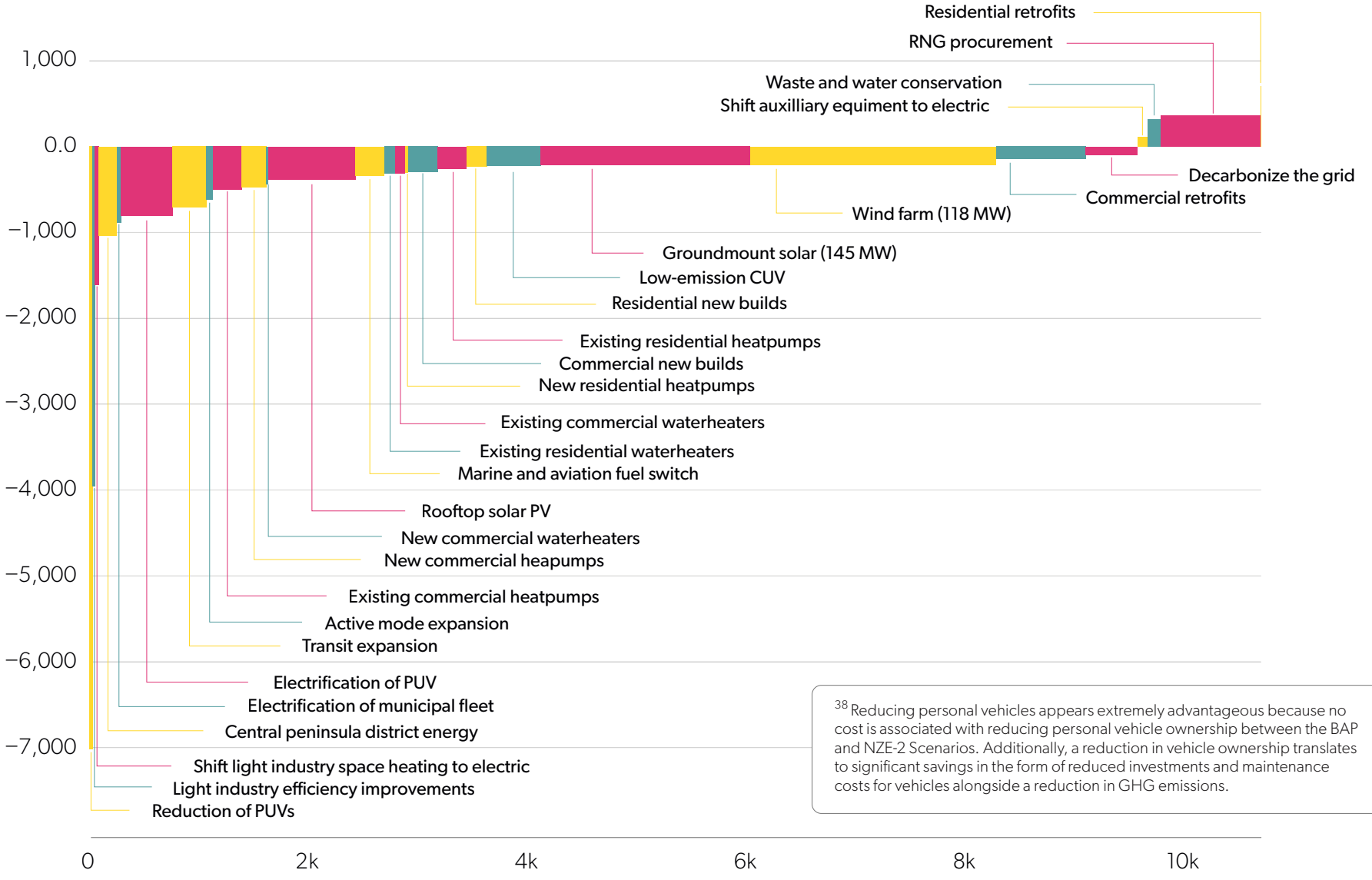
Low-carbon action	Cumulative emissions reduction (kt CO_2eq)	Proportion of total reduction	Net present value	Marginal abatement cost ($ / tCO_2eq)
Transit expansion	311.62	2.89%	-$221,374,839	-$710
Active mode expansion	59.73	0.55%	-$37,164,016	-$622
Electrification of personal vehicles	474.80	4.40%	-$381,658,947	-$804
Low-emission commercial vehicles	495.92	4.60%	-$113,052,718	-$228
Electrification of municipal fleet	36.39	0.34%	-$32,129,212	-$883
Reduce personal vehicle ownership	28.50	0.26%	-$200,029,310	-$7,019
Marine and aviation fuel switch	266.07	2.47%	-$90,097,771	-$339
Waste and water conservation	91.03	0.84%	$9,950,639	$109
Ground mount solar (145 MW)	1,924.73	17.85%	-$419,210,870	-$218
Wind farm (118 MW)	2,262.73	20.99%	-$477,995,587	-$211
RNG procurement	123.22	1.14%	$39,223,355	$318
Decarbonize the grid	475.34	4.41%	-$46,706,508	-$98
Light industry efficiency	22.27	0.21%	-$88,209,337	-$3,961



[38] Reducing personal vehicles appears extremely advantageous because no cost is associated with reducing personal vehicle ownership between the BAP and NZE-2 Scenarios. Additionally, a reduction in vehicle ownership translates to significant savings in the form of reduced investments and maintenance costs for vehicles alongside a reduction in GHG emissions.

Figure 36 Marginal abatement cost curve for the modelled targets in the NZE-2 Scenario.[35]


MOOSEHEAD

6.

Implementing Change

6. Implementing Change

Putting the Plan into Motion

ActSJ details how Saint John can achieve net-zero emissions by 2050. Successfully implementing ActSJ requires coordination and sustained participation from all community members, including residents, businesses, the municipal government, utilities, institutions, industry, and the not-for-profit sector. Saint John will also need support from the Government of New Brunswick, the Government of Canada, and other external funders.

This plan details 15 strategies relating to the six Big Moves and two additional strategies outside of the Big Moves that are necessary to implement ActSJ. These strategies are designed to be initiated within the next one to three years, and completed in the next five years, except where actions explicitly continue into the future. Global climate change science emphasizes the need for immediate and transformative change; the timing of these actions aligns with the speed required to meet local and global GHG emissions targets.

Table 6. Description of implementation indicators.

Strategy	Describes the strategy that helps to achieve the Big Move.
Modelled low-carbon target	Describes the modelled targets supporting the strategy.
GHG impact	Describes the cumulative GHG emissions reduction impact for each strategy compared to the BAP Scenario. • Enabler: Enables the reduction of GHG emissions. • Low: <100 $ktCO_2e$ • Medium: 100–500 $ktCO_2e$ • High: 500–1000 $ktCO_2eq$ • Very High: >1000 $ktCO_2eq$

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Community investment	Community investments are based on the upfront community-wide capital expenditure required for each modelled target beyond the BAP practice. • $: <$5,000,000 • $$: $5,000,000–$25,000,000 • $$$: $25,000,000–$100,000,000 • $$$$: $100,000,000–$500,000,000 • $$$$$: >$500,000,000
Return on investment	Return on investment represents the community-wide savings on capital investments, operating and maintenance costs, energy expenditures, and carbon tax realized in the NZE-2 Scenario versus the BAP Scenario. • $: <$5,000,000 • $$: 5,000,000–$25,000,000 • $$$: $25,000,000–$100,000,000 • $$$$: $100,000,000–$500,000,000 • $$$$$: >$500,000,000
Metrics	The method and measurement unit for monitoring the impact of the action taken. All metrics should be analyzed regularly for actions that are being actively implemented.

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Implementation mechanism	Mechanisms for delivering actions in the city fall broadly into these categories: • **Policy:** Instruments like regulations, policy, and by-laws developed by the City and approved by the City Council. • **Program:** An ongoing effort by the City, with staff and financing to support the effort. • **Initiative:** A study or project undertaken by the City, private sector, not-for-profit sector, or other sectors, individually or collaboratively, with a specific focus and implemented for a set time period. • **Infrastructure:** Investment in physical infrastructure by the City or private sector, not-for-profit sector, or other sectors, individually or collaboratively. • **Advocacy:** Any action in favour of or recommending another body (e.g., level of government, other governments, community partners) undertake an action/policy/program that influences emissions reductions within its jurisdictional control. • **Education:** A defined opportunity to target educational communications and materials to the public, community partners, and other governments related to the specific rationale and benefits of implementing climate actions.
Action	Describes the implementation action supporting the strategy.
City role	Indicates whether the City is leading, supporting or advocating for the implementation action.
Potential partner	Indicates potential collaborative partners for action implementation.
Lead department	Indicates which city department, if any, would be responsible for the action.
Timing	Indicates when the City should start planning on implementing the action. • Start planning for the action immediately. • Start planning for the action in the next 3 years. • Start planning for the action in the next 5 years.

ActSJ

Pathway to Net-Zero

A. Governance and Community Relations

Strategy:

- Whole-organization approach
- Community engagement

1. Decarbonizing Industry

Strategy:

- Improve industrial efficiency
- Decarbonize heavy industries

2. Increasing Use of Active and Public Transportation

Strategy:

- Expand active transportation mode
- Expand public transit services
- Reduce personal vehicle ownership

3. Shifting to Low-emission Vehicles and Transport Fuels

Strategy:

- Electrify transit
- Switch to zero-emissions personal and commercial vehicles
- Switch to low-emissions transport fuel

4. Electrifying and Improving Energy Efficiency in Buildings

Strategy:

- All new construction is net zero
- Deep retrofits for existing buildings
- Switch to clean fuels for building energy use

5. Generating Renewable Energy

Strategy:

- Meet local energy needs through local, renewable, energy generation
- Decarbonize the power grid

6. Reducing Waste

Strategy:

- Reduce amount of waste entering the landfill
- Reduce water consumption

Governance and Community Relations

The City must take a whole-organization approach to implement ActSJ and realize net-zero emissions by 2050. The City will apply a climate lens to all decisions related to city projects and operations while bringing together different city departments and partners around the City's GHG targets. Additionally, the City can convene a working group focused on developing climate literacy initiatives for schools and the public. Finally, the City will apply an equity lens to climate action resilience projects to ensure that everyone can participate and share in the benefits of the transition.

Governance and Community Relations

Strategy	Whole-Organization Approach				
Implementation mechanism	**Action**	**City role**	**Potential partner**	**Lead department**	**Timing**
Program	Develop a carbon budget to align municipal investments with Saint John's climate action goals. A carbon budget sets a cap on how much Saint John can emit and can be integrated into asset management and annual budgets to ensure emissions are considered alongside investment decisions.	City leads	—	Strategic Services, Finance, A&EM	Start planning for the action immediately.
Program	Establish a monitoring, evaluation and reporting system to track and report on ActSJ progress.	City leads	—	Utilities and Infrastructure, A&EM	Start planning for the action immediately.

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Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Initiative	Expand the City's Asset Management and Environmental Performance Division (A&EM) with appropriate staffing and budgetary resources to coordinate ActSJ implementation.	City leads	—	Utilities and Infrastructure, A&EM	Start planning for the action immediately.
Policy	Apply an equity checklist to climate change mitigation projects and programs.	City leads	—	Growth and Community Services	Start planning for the action immediately.
Initiative	Develop financing strategies for actions that will be led by the City.[39]	City leads	—	Strategic Services, Finance, A&EM	Start planning for the action immediately.
Initiative	Establish an ActSJ advisory committee that reports directly to the Mayor and Council and is charged with stewarding the implementation of ActSJ	City leads	Representation from various sectors, non-profit organizations, and private citizens.	General Counsel, A&EM	Start planning for the action in the next 3 years.

[39] Examples of municipal climate action financing strategies are revolving funds, municipal climate action surcharge, money-in-lieu strategy funds, grant funding, and public-private partnerships.

Governance and Community Relations

Strategy	Community Engagement				
Implementation mechanism	**Action**	**City role**	**Potential partner**	**Lead department**	**Timing**
Program	Partner with schools and homeschooling pods to introduce climate literacy programs for children and youth.	City supports	Local schools	Utilities and Infrastructure, A&EM	Start planning for the action in the next 3 years.
Advocacy	Establish a regional Energy Transition Group to advocate for the urban climate change agenda at provincial and federal levels.	City leads	Moncton, Fredericton, and other cities in the region	General Counsel, A&EM	Start planning for the action immediately.
Initiative	Convene a community-based Climate Action Awareness and Education Working Group to work with Asset Management and Environmental Performance Division to increase community participation in ActSJ implementation.	City leads	Multiple partners	Strategic Services, Finance, A&EM	Start planning for the action immediately.
Program	Create a "one-stop shop" information platform on ActSJ initiatives.[40]	City leads	Multiple partners	Growth and Community Services	Start planning for the action immediately.
Initiative	Work with local partners to establish a startup accelerator or incubator program for clean tech and social enterprises.	City supports	—	Growth and Community Services	Start planning for the action immediately.
Initiative	Create a Council of Business Leaders for Climate Action.	City supports	Businesses	Growth and Community Services	Start planning for the action in the next 3 years.

[40] Information shared should be tailored to be actionable for all members of the community. Examples include information on available incentives from all levels of government, list of local businesses that supply energy efficiency and renewable energy equipment and services, guidelines on recycling and reducing waste, case studies from Saint John, ActSJ implementation progress, and others.

Big Move 1: Decarbonizing Industry

In the BAP Scenario, GHG emissions from the industrial sector account for 80% of Saint John's emissions from 2021 to 2050.

The City has limited direct influence on the operational choices of industry. However, the City and the community can encourage, support, and advocate for decarbonization of the industrial sector. The Government of Canada's climate plan, A Healthy Environment and a Healthy Economy, outlines many commitments to "[build] Canada's clean industrial advantage" that align with the ActSJ.[41] The City can engage with other levels of government to support relevant programs and funding.

The City can also host working groups, share best practices, and publicly show support for decarbonizing industry.

[41] "A Healthy Environment and A Healthy Economy" (2020). Government of Canada. Retrieved from: https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/healthy_environment_healthy_economy_plan.pdf.

Big Move 1: Decarbonizing Industry

Strategy	Improve industrial efficiency
Modelled low-carbon target	Industrial efficiency improved 50% overall with more efficient processes and equipment by 2040
GHG impact	Very High
Community investment	—
Return on investment	—
Metric	• # of industrial facilities retrofitted • Electricity and gas consumption

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Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Advocacy	Advocate for support for decarbonizing industries in Saint John from other levels of government.	City leads	Local industries	Strategic Services, Finance, A&EM, General Counsel	Start planning for the action immediately.
Initiative	Create working groups to coordinate industry efforts on their net-zero strategies.	City leads	Local industries	Utilities and Infrastructure, A&EM, General Counsel	Start planning for the action immediately.
Infrastructure	Work with utilities and industry to detect and reduce leaks in the natural gas distribution network.	City supports	Local industries and Liberty Utilities	Utilities and Infrastructure, A&EM	Start planning for the action immediately.
Infrastructure	Work with industry to develop opportunities for utilizing waste heat for co-generation or district energy.	City supports	Local industries	Utilities and Infrastructure, A&EM	Start planning for the action in the next 3 years.

Big Move 1: Decarbonizing Industry

Strategy	Decarbonize heavy industries
Modelled low-carbon target	Heavy industries meet their goal to reduce emissions by 30% by 2030 and reach net-zero by 2050
GHG impact	Very high
Community investment	—
Return on investment	—
Metric	GHG emissions from heavy industries

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Initiative	Convene an Industry Decarbonization Working Group, including city staff, representatives from major industry, and community members, to support industry decarbonization and alignment with ActSJ.	City leads	Local industry	Utilities and Infrastructure, A&EM	Start planning for the action immediately.
Initiative	Work on an equitable transition plan for workers transitioning to the green economy.	City leads	Local industry, provincial government	Growth and Community Services	Start planning for the action immediately.

Big Move 2: Increasing Use of Active and Public Transportation

ActSJ envisions that 35% of trips will be taken by active transportation or transit by 2050. Saint John's existing plans, such as PlanSJ, MoveSJ, and the Public Transit and Fleet Low-Carbon Mitigation Strategy, include transportation improvements that will support and contribute to the ActSJ's target mode shares. ActSJ recommends that the measures identified in these plans are implemented, expanded, and complemented with supporting infrastructure and programs.

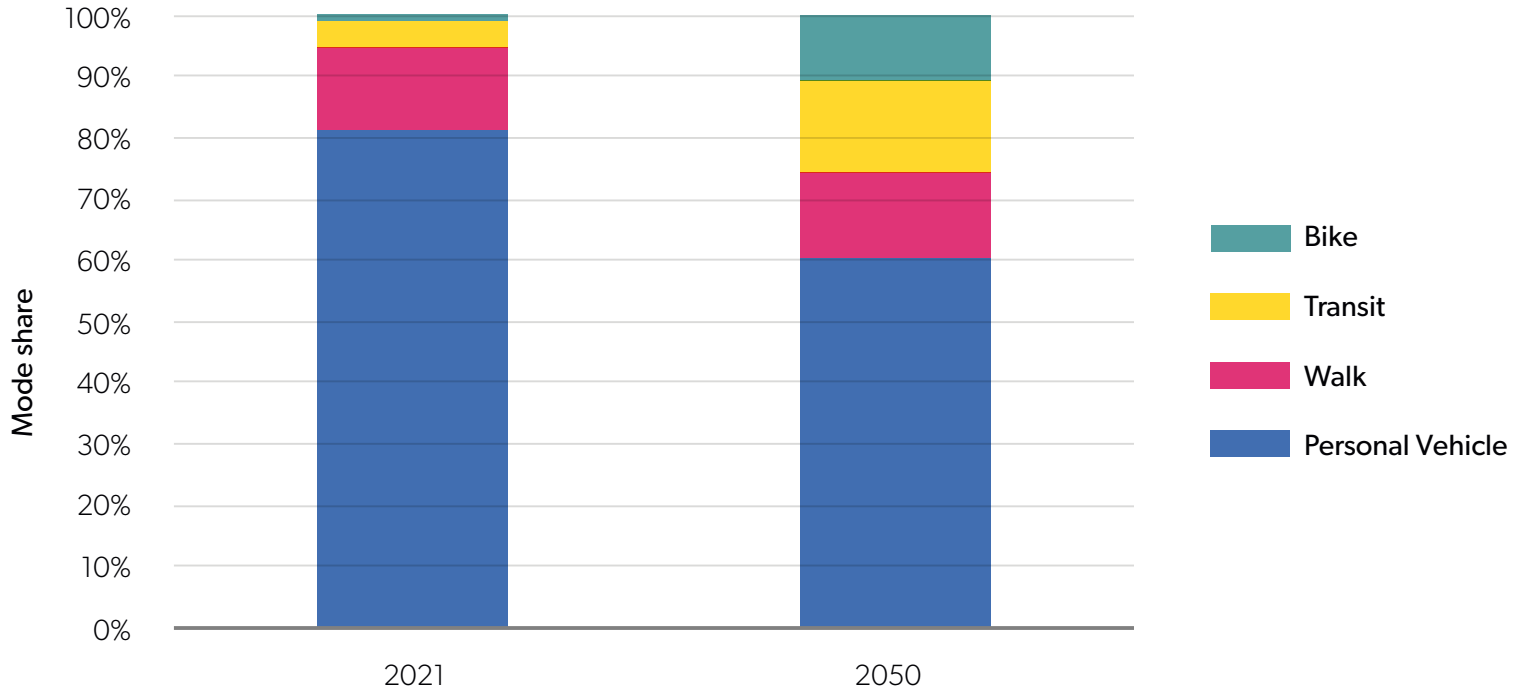

Figure 37 Mode share of trips taken within Saint John in the NZE-2 Scenario, 2021 and 2050.

To meet the ActSJ goal, the City can establish a car-share program, an e-bike share system, and an increase in private e-bikes. Many North American cities have successful car-share programs, including Pogo in Edmonton, Calgary Car Share, and Communauto in Toronto, Ottawa, Montreal, and Quebec City.

Saint John has extensive urban sprawl, with a substantial daily commuter influx for work, which leads to high transport emissions. The City's 10-Year Strategic Plan recommends updating the PlanSJ to integrate the 15-minute City concept to mitigate this problem. The 15-minute City is a planning approach that advocates for structuring neighbourhoods so that basic daily necessities and services like work, school, shopping, healthcare, and leisure are accessible to urban residents within a 15-minute walk or bike ride. Saint John's seniors and lower-income households will particularly benefit from this approach, as it makes it easier for those without access to a private vehicle to access basic services and daily necessities.

Big Move 2: Increasing Use of Active and Public Transportation

Strategy	Expand active transportation mode
Modelled low-carbon target	Invest in active transportation infrastructure to increase the share of active trips to 20% of all trips by 2040
GHG impact	Low
Community investment	$$
Return on investment	$$$$
Metric	% of trips completed by walking and biking.

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Policy	Update MoveSJ to ensure its investments in active transportation align with the active mode share targets identified in ActSJ.	City leads	—	Public Works and Transportation Services	Start planning for the action immediately.

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Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Program	Implement Safe Routes to School Program	City leads	Schools divisions	Public Works and Transportation Services	Start planning for the action in the next 3 years.
Infrastructure	Design and develop mobility hubs that include a transit stop or transfer station, EV charging, e-bike and e-scooter rentals and charging, a car-share pick-up and drop-off location, and a carpooling lot.	City leads	Saint John Energy	Public Works and Transportation Services	Start planning for the action in the next 5 years.
Policy	Update the Municipal Development Plan to align growth policies to support active mode shares identified in ActSJ.	City leads	—	Growth and Community Services	Start planning for the action immediately.
Program	Develop an e-bike subsidy program to incentivize the purchase and use of e-bikes.	City leads	Bike stores	Public Works and Transportation Services	Start planning for the action in the next 3 years.
Program	Introduce a bikeshare program.	City supports	Bike sharing service providers	Public Works and Transportation Services	Start planning for the action in the next 3 years.
Initiative	Develop a biking strategy that achieves the ActSJ mode share targets by addressing issues related to biking, including infrastructure, accessibility, access to bike ownership, and maintenance.	City leads	Bike repair shops, bike shops, biking enthusiasts	Public Works and Transportation Services	Start planning for the action in the next 5 years.

Big Move 2: Increasing Use of Active and Public Transportation

Strategy	Expand public transit services
Modelled low-carbon target	Expand on-demand transit program to increase ridership to 15% by 2050
GHG impact	Medium
Community investment	$$
Return on investment	$$$$
Metric	% of trips completed by transit

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Infrastructure	Expand on-demand transit by offering fixed routes and flexible, on-demand last-mile options to increase ridership.	City leads	—	Public Works and Transportation Services	Start planning for the action in the next 3 years.
Program	Introduce multi-use transit passes for frequent users.	City leads	—	Public Works and Transportation Services	Start planning for the action in the next 3 years.
Advocacy	Advocate for regional, intercity transit services to nearby New Brunswick cities like Moncton and Fredericton.	City Advocates	Other transit departments in the region, regional bus service providers, Regional Service Commissions (RSC)	Public Works and Transportation Services	Start planning for the action immediately.

Big Move 2: Increasing Use of Active and Public Transportation

Strategy	Reduce personal vehicle ownership
Modelled low-carbon target	Reduce personal vehicle ownership by 5% by 2030
GHG impact	Low
Community investment	$
Return on investment	$$$$
Metric	• # of vehicles registered in Saint John • % of trips completed by walking and biking.

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Policy	Align with PlanSJ and Central Peninsula Secondary Plan to intensify infill development.	City leads	—	Growth and Community Services	Start planning for the action immediately.
Policy	Update Municipal Development Plan and Zoning by-laws to center around the concept of the 15-minute City Concept.	City leads	—	Growth and Community Services	Start planning for the action immediately.
Policy	Remove parking minimums within the Primary Development Area.	City leads	—	Saint John Parking Commission	Start planning for the action immediately.
Program	Introduce/increase car parking fees to disincentivize driving in core urban areas.	City leads	—	Saint John Parking Commission	Start planning for the action in the next 3 years.
Initiative	Partner with a car-sharing company (e.g., Communauto) in order to launch a car sharing service in Saint John.	City leads	Car-sharing service providers	Saint John Parking Commission	Start planning for the action in the next 3 years.

Big Move 3: Shifting to Low-emission Vehicles and Transport Fuels

The City of Saint John is taking the lead in greening its municipal fleet. The Public Transit and Fleet Low-Carbon Mitigation Strategy set the goal and recommends a pathway for the City to achieve carbon neutrality for its fleet and transit operations by 2040.

Emissions from private and commercial vehicles remains a challenging and important focus area for ActSJ. Advancing EV adoption is a key solution for reducing transportation emissions. With EV prices dropping and the increasing availability of models suited to northern climates and various commercial and private needs, the rate of vehicle electrification is accelerating. Although the ActSJ target for EVs follows the lead of the Government of Canada, the City can still play a role in accelerating the EV transition through key interventions. The EV market for heavy-duty vehicles as well as aviation and marine transportation sub-sectors require additional stimulus.

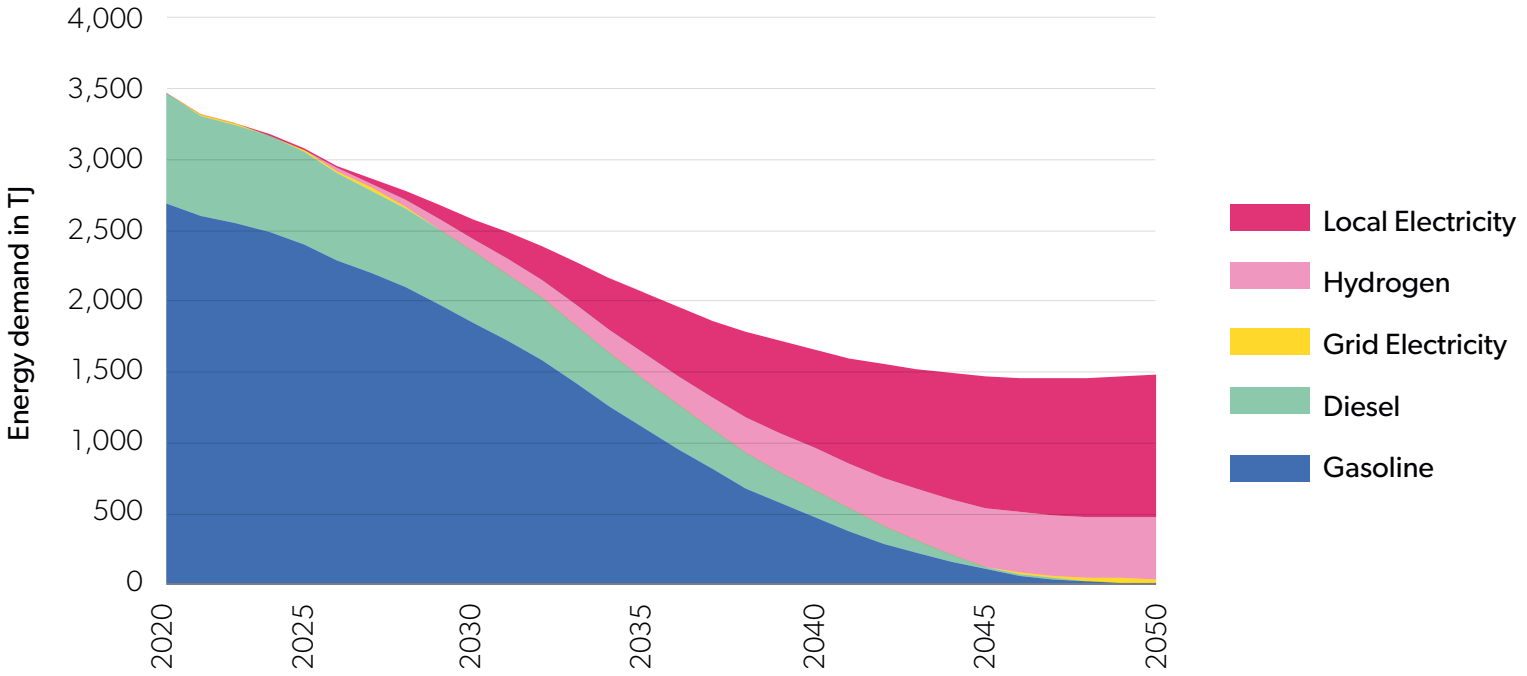

Figure 38 Energy demand for transportation, by fuel type, NZE-2 Scenario, 2021-2050.

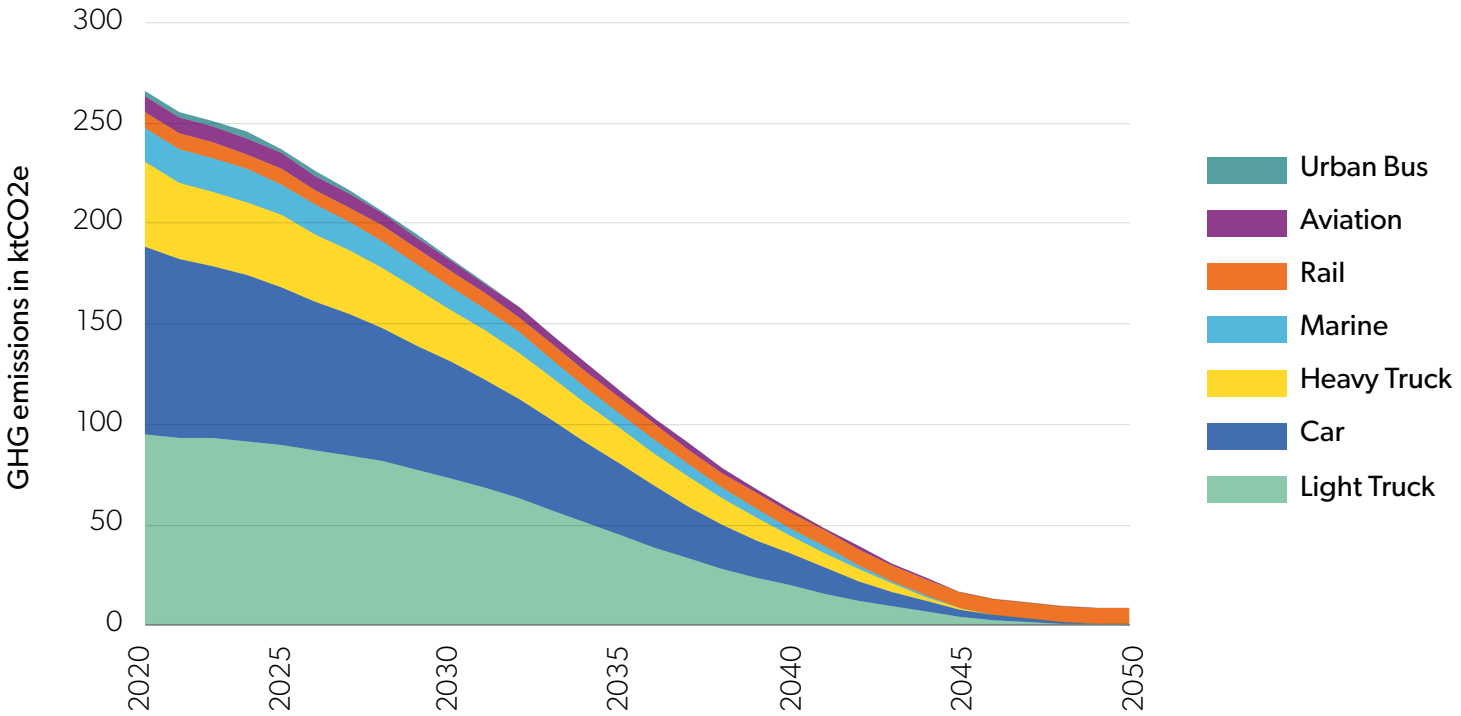

Figure 39 GHG emissions from transportation, by vehicle type, NZE-2 Scenario, 2021-2050.

Big Move 3: Shifting to Low-emission Vehicles and Transport Fuels

Strategy	Electrify transit				
Modelled low-carbon target	100% electric bus fleet by 2032				
GHG impact	Low				
Community investment	No additional investment beyond what is already planned				
Return on investment	No additional return beyond what is already planned				
Metric	# of EV buses				
Implementation mechanism	**Action**	**City role**	**Potential partner**	**Lead department**	**Timing**
Infrastructure	Implement the Public Transit and Fleet Low Carbon Mitigation Strategy to ensure successful integration of EV buses into the Saint John fleet through adequate charging infrastructure, optimized routing, and extensive training for operators and maintenance staff.	City leads	—	Public Works and Transportation Services	Start planning for the action immediately.
Education	Share success stories on the fleet transition (e.g., cost savings, emissions reductions) with Council and general public.	City leads	—	Public Works and Transportation Services, Communication	Start planning for the action in the next 3 years.

Big Move 3: Shifting to Low-emission Vehicles and Transport Fuels

Strategy	Switch to zero-emissions personal and commercial vehicles
Modelled low-carbon target	• 100% of new light-vehicle sales will be zero emissions by 2035 • 100% of new mid-to-heavy-vehicle sales will be zero emissions by 2040
GHG impact	High
Community investment	$$$
Return on investment	$$$$$
Metric	• # of EVs registered in Saint John • # of EV chargers in Saint John and frequency of use

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Policy	Require EV charging stations in new and existing multi-use residential buildings, commercial buildings, and parking lots. Require charging rough-ins in new homes.	City leads	—	Public Works and Transportation Services, A&EM	Start planning for the action immediately.
Infrastructure	Install EV infrastructure at strategic locations in Saint John, either through federal funding or through partnerships with EV service providers.	City leads	EV service providers, Saint John Energy, NB Power	Utilities and Infrastructure, A&EM	Start planning for the action immediately.
Education	Work with dealerships and manufacturers to increase awareness of EVs.	City supports	Auto dealerships and manufacturers	Utilities and Infrastructure, A&EM	Start planning for the action immediately.
Initiative	Coordinate a task force with businesses to electrify their fleets, including with electric vans and cargo e-bikes.	City supports	Local businesses	Utilities and Infrastructure, A&EM	Start planning for the action in the next 3 years.

Big Move 3: Shifting to Low-emission Vehicles and Transport Fuels

Strategy	Switch to low-emission transport fuel
Modelled low-carbon target	• Aviation and marine fuel converted to low-emission fuel like biofuels, green hydrogen, renewable jet fuel by 2045 • Offer renewable shore power for ships when in dock
GHG impact	Medium
Community investment	$$
Return on investment	$$$$
Metric	• % of marine fuel sold that is low-emission • % of aviation fuel sold that is low-emission • kWh of renewable shore power consumption

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Initiative	Deploy electric or alternative fuel vessels at Port Saint John.	City supports	Port Saint John	Utilities and Infrastructure, A&EM	Start planning for the action in the next 5 years.
Initiative	Ensure the airport can support electric and low-carbon fuel options for green aviation.	City supports	Saint John Airport	Utilities and Infrastructure, A&EM	Start planning for the action in the next 5 years.
Initiative	Develop renewable shore power installations at Port Saint John.	City supports	Saint John Energy, Port Saint John	Utilities and Infrastructure, A&EM	Start planning for the action in the next 3 years.

Big Move 4: Electrifying and Improving Energy Efficiency in Buildings

In 2021, residential and commercial buildings generated about 311 $ktCO_2e$ of emissions, about 85% of all building emissions in Saint John. Space heating is the major source of emissions and accounts for half of the energy demand. Electricity accounts for two-thirds of the emissions but half of the energy demand, so that greening electricity (Big Move 5) will be transformative.

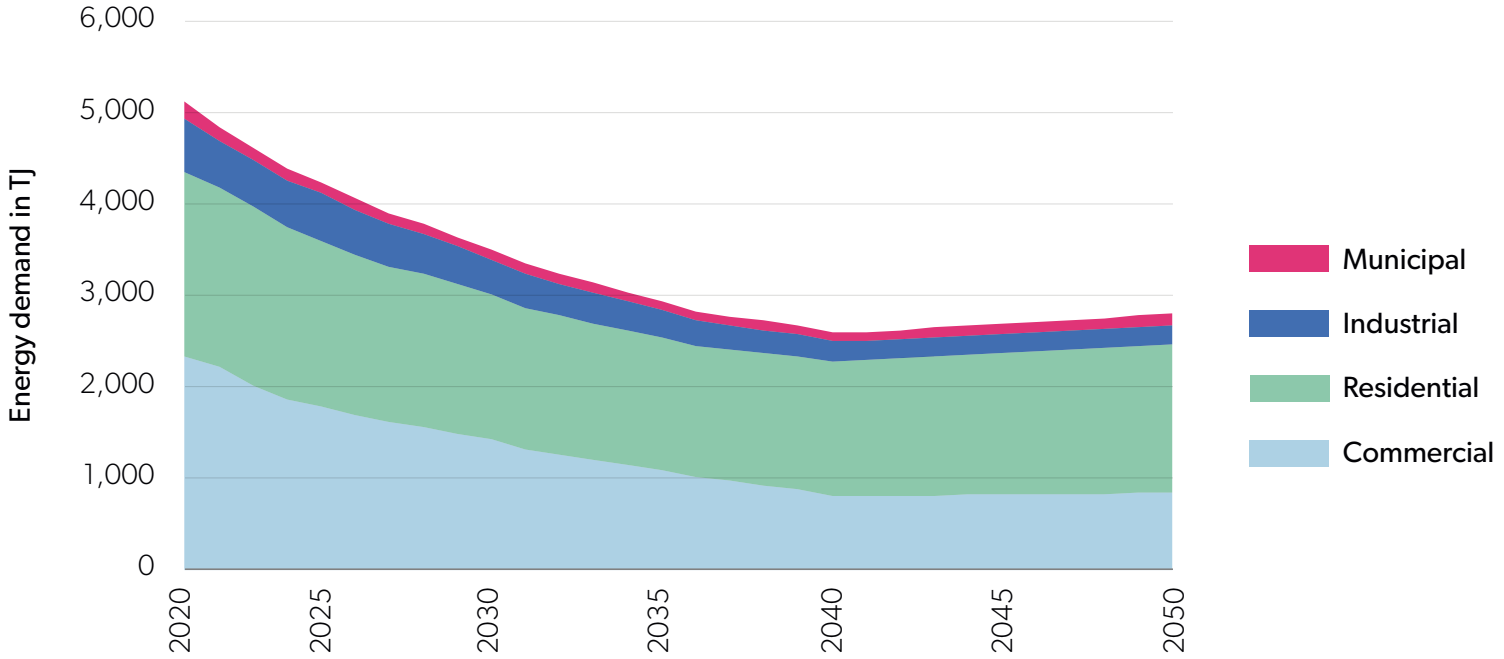

Figure 40 Energy demand for buildings, by sector, NZE-2 Scenario, 2021-2050.

In the NZE-2 Scenario, GHG emissions from buildings drop off rapidly as electricity is decarbonized, heating is switched to heat pumps, and building retrofits ramp up.

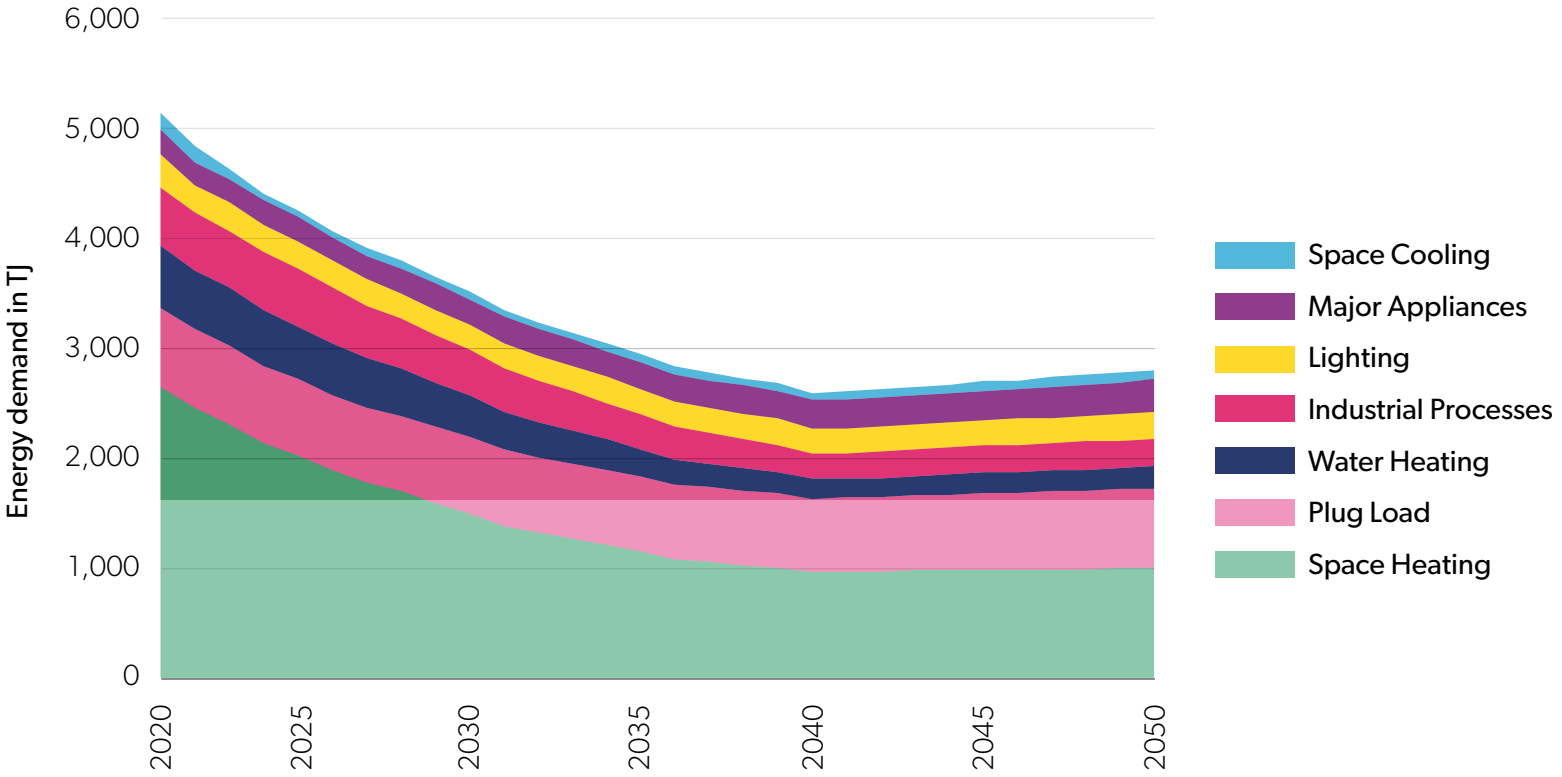

Figure 41 Energy demand for buildings, by end-use, NZE-2 Scenario, 2021-2050.

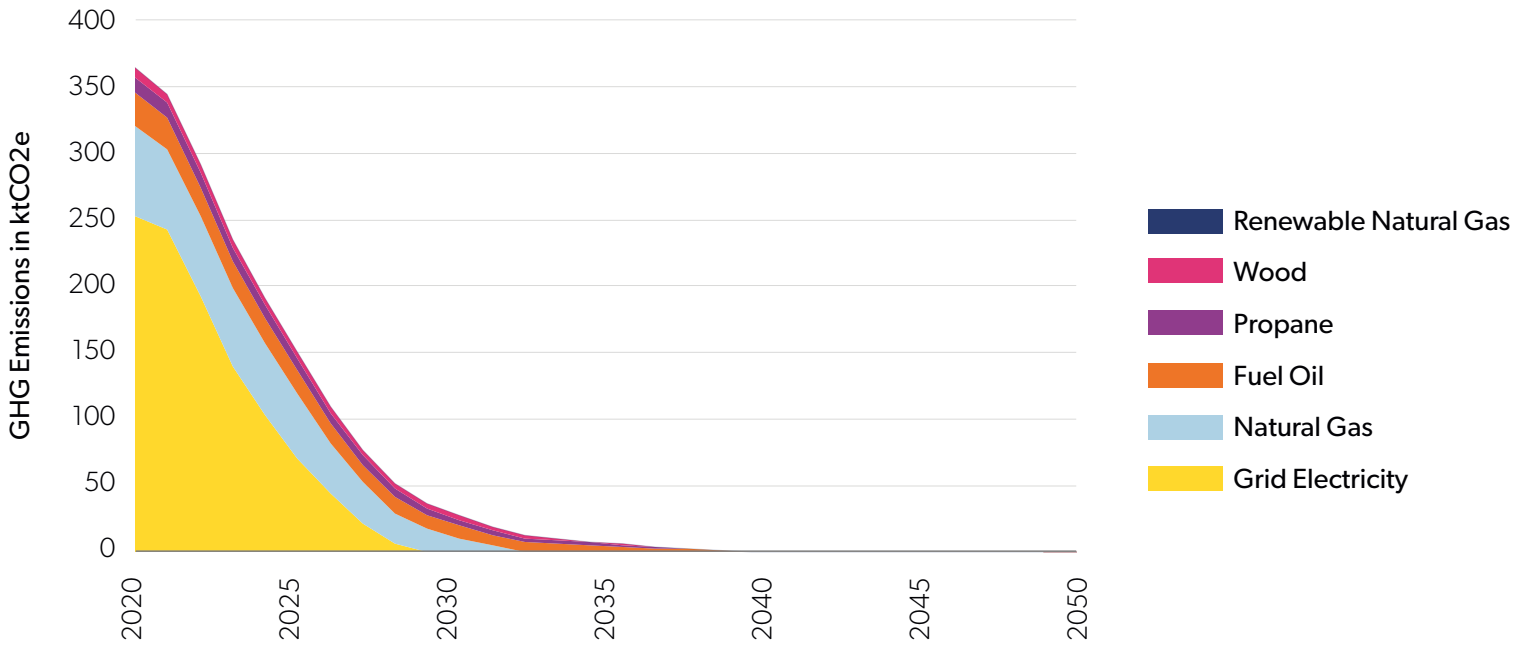

Figure 42 GHG emissions for buildings, by fuel type, NZE-2 Scenario, 2021-2050.

Implementing deep retrofits in Saint John involves a unique set of challenges.

About 19% of households in Saint John are low-income;[42] Saint John has an even higher incidence of energy poverty of over 34%.[43] Households living in energy poverty may have to choose between heating their homes or other necessities like food or health expenses. Additionally, deep retrofits, which have high upfront costs, are out of reach for these households; yet, with rising energy prices, they stand to gain the most from these upgrades. The City must design initiatives to address this equity issue to ensure that no households are left out of the net-zero transition.

Renters would also benefit from affordability initiatives. About 34% of houses in Saint John are renter-occupied[44] and this statistic is even

[42] Canadian Urban Sustainability Practitioners (CUSP). "Energy Poverty and Equity Explorer." Accessed July 16, 2023. https://energypoverty.ca/mappingtool/

[43] When a household spends 6% or more of their income on home energy needs, they are considered to be living in energy poverty. From CUSP, 34% of households in Saint John were identified to be in this category, with 6% of households in extreme energy poverty where they are spending more than 15% of their household income on energy costs.

[44] Canadian Urban Sustainability Practitioners (CUSP). "Energy Poverty and Equity Explorer." Accessed July 16, 2023. https://energypoverty.ca/mappingtool/

higher in high-density areas. In the Central Peninsula, over 80% of homes are rentals. Landlords lack incentives to upgrade their buildings and appliances as they do not necessarily benefit from the comfort and savings of an energy-efficient building, while tenants do not typically have a say in their landlord's investment decisions. Furthermore, in rental properties where utilities are included in the rent, tenants have no incentive to reduce energy use because they are not financially impacted.

Saint John has a high prevalence of older buildings: approximately 80% of dwellings in Saint John were built before the 1990s. These buildings typically consume more energy—about 67% more than those built today[45]—and consumption tends to increase the higher the age of the building. For Saint John, with its rich stock of heritage buildings, the problem is complex; standard packages of deep retrofit solutions cannot be easily applied to these buildings. In these cases, retrofit measures must not only be assessed from the lens of energy efficiency and technical maintenance, but also with the goal to preserve and respect the historic value of these buildings.

The City could leverage its status as Canada's first incorporated city to garner the financial support it needs from the federal and provincial governments to bring bespoke renovation solutions to its heritage buildings. Given the complexity of the problem and the resources required, the City could explore initiatives for heritage buildings and advocate to other levels of governments to obtain dedicated financial support in order to achieve successful outcomes.

[45] Carmichael, Bradley T. "Energy Codes: Challenges with Existing Buildings." Hoffman Architects Journal 31, no. 4/2014 (2014).

Rehabilitating Heritage Buildings

The City of Saint John's Practical Conservation Guidelines[46] define rehabilitation as returning a property to a usable state through repair or sensitive changes. The Guidelines make it possible to adapt a heritage building for contemporary use while preserving characteristics that are significant to the property's historic, architectural, and cultural value, thereby prolonging its usable life and value of the embodied carbon content. Rehabilitation also reduces waste associated with demolition.

Rehabilitation is considered to be more forward-looking compared to restoration[47], as it can mean everything from reinforcements to meet expanding energy code requirements to adding new features like a green roof.[48] Rehabilitation aligns well with ActSJ goals to improve energy performance of existing buildings in a way that preserves the City's unique features while reducing waste.

[46] City of Saint John (2020). "The Practical Conservation Guidelines for Saint John Heritage Conservation Areas." Retrieved from https://saintjohn.ca/sites/default/files/2020-11/Conservation%20Plans%20-%20English.pdf

[47] Restoration for heritage building retrofits means returning the building to a past state, which can involve salvage operations, and does not guarantee that the restored building will meet current building code requirements.

[48] Ross, Susan. June 14, 2021. "Addressing Climate Change by Retrofitting Canada's Existing Buildings." Policy Options. Retrieved from https://policyoptions.irpp.org/magazines/june-2021/addressing-climate-change-by-retrofitting-canadas-existing-buildings/

Big Move 4: Electrifying and Improving Energy Efficiency in Buildings

Strategy	All new construction is net zero
Modelled low-carbon target	100% of new residential and commercial buildings are net zero ready from 2030
GHG impact	Medium
Community investment	$$$$
Return on investment	$$$$
Metric	# of net zero ready buildings

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Initiative	Consult commercial and residential developers to identify and address barriers for net zero construction in Saint John.	City supports	Developers, Passive House Canada	Growth and Community Services, Utilities and Infrastructure	Start planning for the action immediately.
Education	Advocate for training and microcredential programs for skilled tradespeople to increase their knowledge and skills around energy efficient building practices.	City leads	Quick Train Canada	Growth and Community Services, Utilities and Infrastructure	Start planning for the action immediately.
Policy	Establish a net-zero building code that will require all new residential and commercial developments to be net-zero by 2030.	City leads	—	Growth and Community Services, Utilities and Infrastructure	Start planning for the action immediately.
Initiative	Provide financial and non-financial incentives to support developers and builders to build to net-zero building code. Examples of incentives are permitting rebates, expedited approval process, tax assistance plans (e.g., short-term partial property tax waiver), and awards programs.	City leads	Developers and builders, provincial government	Growth and Community Services, Utilities and Infrastructure, Finance	Start planning for the action immediately.

Big Move 4: Electrifying and Improving Energy Efficiency in Buildings

Strategy	Deep retrofits for existing buildings
Modelled low-carbon target	100% of existing buildings are retrofitted by 2040 to achieve 50% thermal savings and 20% electricity savings
GHG impact	Very High
Community investment	$$$$$
Return on investment	$$$$$
Metric	# of buildings retrofitted

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Advocacy	Advocate for provincial regulations to enable PACE programs.[49] This will unlock access to federal funding programs like FCM's Community Efficiency Financing and would enable Saint John Energy to expand their Energy Upgrades Loan program.	City leads	Provincial government, other municipalities in New Brunswick	General Counsel, A&EM	Start planning for the action immediately.
Program	Initiate a benchmarking program, similar to Edmonton's Building Energy Benchmarking Program. The program could include a special category for heritage buildings, showcasing best practices suited for Saint John's context.	City leads	-	Utilities and Infrastructure, A&EM, Growth and Community Services	Start planning for the action in the next 5 years.

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[49] PACE stands for Property Assessed Clean Energy, and is a financing program enabling property owners to access low-interest financing for energy efficiency and renewable energy upgrades to their property. The financing is repaid over time through additional charges on the property tax.

(continued from previous table)

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Policy	Mandatory energy use disclosure prior to all building purchase or rental agreements. Disclosure can be in the form of EnerGuide reports, home energy scores, or energy bills for at least 12 months prior.	City leads	-	Growth and Community Services	Start planning for the action in the next 5 years.
Program	Request that Saint John Energy offer retrofit services or partnerships with retrofit service companies (e.g., BlocPower). Ensure program is designed to address issues of split incentives for renters and property owners.	City supports	Retrofit service company, Retrofit Canada, Saint John Energy	Utilities and Infrastructure, General Council, Finance	Start planning for the action in the next 3 years.
Education	Offer energy savings workshops for residents and businesses. These can be tailored to specific groups like low-income households, renters, newcomers, seniors, and young parents.[50] Add value to these workshops by pairing them with programs from SaveEnergyNB (e.g. Renters Energy Savings Kits program).	City leads	NB power, Source 2050, EmpowerMe	Utilities and Infrastructure, General Council, Finance	Start planning for the action immediately.

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[50] See Empower Me's Energy Savings Workshops for an example of equity-centered, energy literacy programs in Alberta and British Columbia. https://empowerme.ca/bc/

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Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Initiative	Partner with Saint John Tool Library to develop citizen-led retrofit programs such as Carbon Coop.[51] The library can provide relevant tools and measurement equipment.[52]	City leads	Saint John Tool Library, Source 2050	Utilities and Infrastructure, General Council, Finance	Start planning for the action immediately.

[51] See Carbon Co-op for an example of how a co-operative model can be used to bring affordable, retrofit solutions for the residential sector. https://carbon.coop/

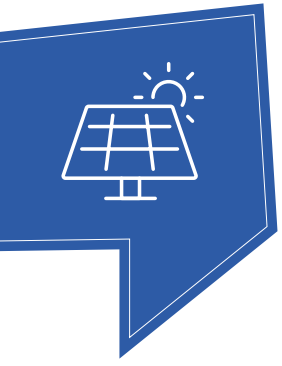
[52] See Town of Drayton Valley's E-CENT Kit or City of Fredericton's Home Energy Kits for examples of home energy measurement toolkit programs initiated by municipalities. https://www.draytonvalley.ca/wp-content/uploads/2021/03/ECENT-KIT-Guidelines.pdf
https://engagefredericton.ca/36103/widgets/149435/documents/101985

Big Move 4: Electrifying and Improving Energy Efficiency in Buildings

Strategy	Switch to clean fuels for building energy use
Modelled low-carbon target	100% of buildings switched to heat pumps and electric water heaters by 2040
GHG impact	Very High
Community investment	$$$
Return on investment	$$$$
Metric	• % of buildings with heat pumps • % of buildings with electric water heater • % of buildings heating with oil or wood

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Program	Expand Saint John Energy's heat pump rental programs for commercial and industrial facilities and add offering hot water heat pumps and solar PV systems to the programs. Include additional support for lower-income and other equity-seeking groups.	City supports	Saint John Energy	Utilities and Infrastructure, General Council, Finance, Growth and Community Services	Start planning for the action in the next 3 years.
Advocacy	Partner with the construction industry on training in heat pumps. This training can be tailored for historically equity-denied groups like the Indigenous community, women, and displaced workers.[53]	City advocates	Quick Train Canada, Iron & Earth	Utilities and Infrastructure, Growth and Community Services	Start planning for the action in the next 3 years.

[53] See Iron & Earth, a not-for-profit organization that delivers programs to transition fossil-fuel workers to the net-zero economy. https://www.ironandearth.org/



Big Move 5: Generating Renewable Energy

Fuel-switching is an important part of net-zero energy transition, where many activities move away from fossil fuels to low-carbon sources, with an emphasis on electricity. The ActSJ envisions more electric space heating, electric vehicles, and electrical processes in industry. A supply of net-zero emissions electricity is essential for that vision, now and in the future. This could either be supplied by the provincial power grid, which is greening under the Clean Energy Strategy policy, or through local generation by Saint John Energy as part of the Zero30 Roadmap.

Renewable natural gas and hydrogen are two alternative fuels that can be considered for use in applications that are difficult or impossible to electrify. Renewable natural gas and hydrogen should be produced locally, and using clean electricity.

Big Move 5: Generating Renewable Energy

Strategy	Meet local energy needs through local, renewable, energy generation[54]
Modelled low-carbon target	• 40 MW of rooftop solar by 2030, 160MW by 2050 • 148 MW of utility scale solar by 2030 • Increase wind power capacity to reach 145 MW by 2030
GHG impact	Very High
Community investment	$$$$$
Return on investment	$$$$$
Metric	• # of renewable energy installations • kWh of renewable power energy generated • kWh of energy stored

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[54] ActSJ strategies will be integrated with the Zero30 Roadmap—Saint John Energy's initiative towards achieving net-zero emissions by 2030.

(continued from previous table)

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Initiative	Work with SJE, NB Power, and the Province to deliver incentive programs for building-integrated solar photovoltaics. Ensure program design addresses equity issues in Saint John related to low-income households and renters.	City supports	Saint John Energy, NB Power	Utilities and Infrastructure, General Council, Finance, Growth and Community Services	Start planning for the action immediately.
Infrastructure	Create microgrids that support distributed renewable energy, energy storage, and demand response programs.	City supports	Saint John Energy, NB Power	Utilities and Infrastructure, Finance, Growth and Community Services	Start planning for the action immediately.
Infrastructure	Implement a zero-emissions district energy project in Uptown Saint John.	City leads	Facilities and businesses in Uptown Saint John	Utilities and Infrastructure, General Council, Finance, Growth and Community Services	Start planning for the action in the next 3 years.
Program	Develop a solar group buy program where one vendor provides bulk solar installations to residential and commercial building owners.	City supports	Saint John Energy	Utilities and Infrastructure	Start planning for the action in the next 5 years.
Infrastructure	Deploy solar projects on municipal buildings.	City leads	—	Utilities and Infrastructure	Start planning for the action immediately.

Big Move 5: Generating Renewable Energy

Strategy	Decarbonize the power grid
Modelled low-carbon target	Power grid is zero emissions by 2030
GHG impact	Medium
Community investment	No direct community investment
Return on investment	$$$
Metric	Grid emissions factor

Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Initiative	Partner with Saint John Energy to take advantage of funding opportunities to deploy emerging technologies for decarbonizing the power grid as part of the Zero30 Roadmap.	City supports	Saint John Energy	Utilities and Infrastructure	Start planning for the action immediately.

Big Move 6: Reducing Waste

The waste, water, and wastewater sector emitted about 22 $ktCO_2e$ of GHG emissions in 2021, which accounts for about 3% of total community emissions. This low level of emissions reflects the work of the City and Fundy Regional Services Commission and the benefits of the landfill gas capture system in place at the Crane Mountain Landfill.

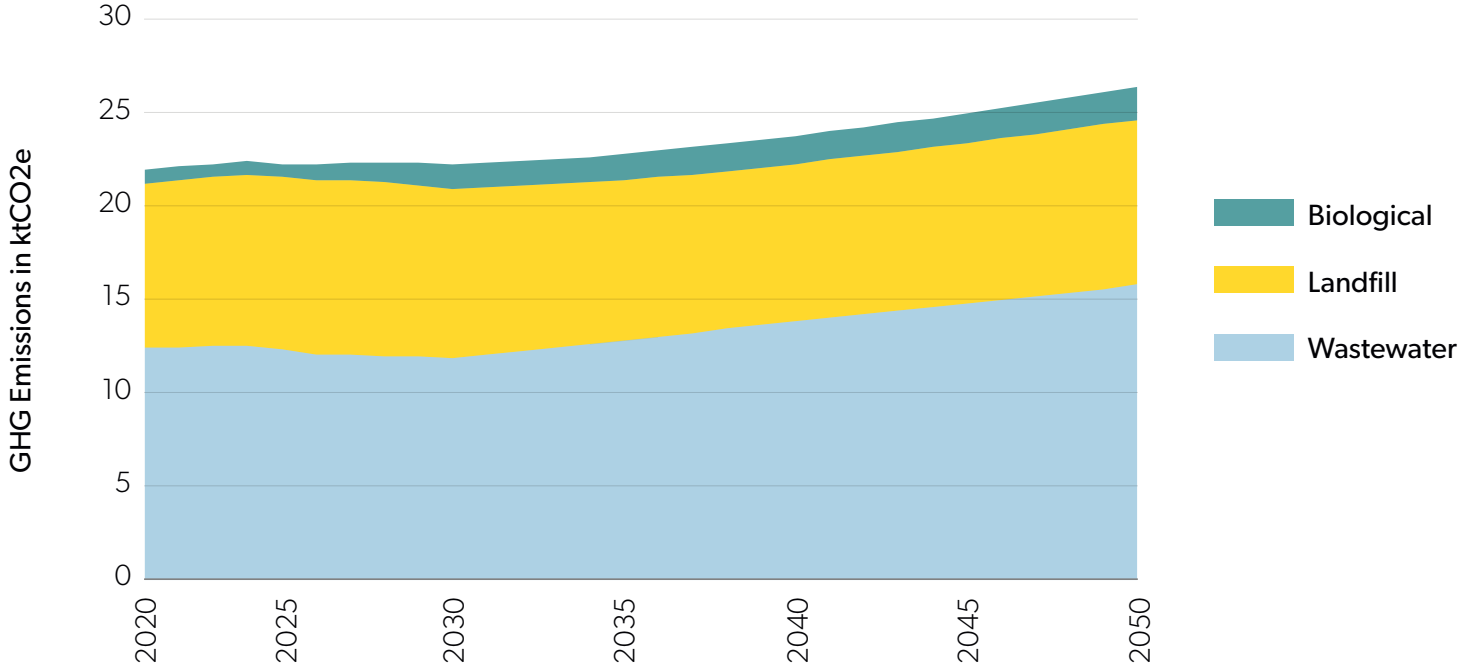

Figure 43 GHG emissions from the waste sector, by source, NZE-2 Scenario, 2021-2050.

As seen in Figure 43, waste emissions will continue to rise in the NZE-2 Scenario. Waste generation is linked to population growth, so strategies to limit waste generation and increase waste diversion are necessary to reduce waste sector emissions.

A further challenge is that the GHG Protocol requires that all waste tonnage received at landfills within municipal boundaries be accounted for in municipal emissions. This means that emissions from waste entering the Crane Mountain Landfill is attributed to Saint John, even if it is generated by other municipalities in the region. While the City of Saint John does not have direct authority over waste generated outside of its jurisdiction, the City can collaborate with Fundy Regional Services Commission to encourage policies in neighbouring municipalities that limit waste generation and divert waste from the landfill.

Big Move 6: Reducing Waste

Strategy	Reduce amount of waste entering the landfill

Modelled low-carbon target	• Decrease waste generation per capita by 20% by 2030 relative to BAP
	• Increase diversion rate to 80% by 2030
	  ° 50% of organic/food waste is diverted by 2030
	  ° 30% of glass, metal, and paper, cardboard, and other paper products are recycled by 2030

GHG impact	Low
Community investment	$
Return on investment	$
Metric	• Volume of waste generated • Volume of waste diverted

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Implementation mechanism	Action	City role	Potential partner	Lead department	Timing
Program	Work with Fundy Regional Service Commission (FRSC) and Crane Mountain Enhancement Inc (CMEI) and other municipalities in the region that dispose of waste at Crane Mountain Landfill to implement waste reduction targets that align with ActSJ.	City supports	FRSC, CMEI, and other surrounding municipalities	Public Works and Transportation Services	Start planning for the action in the next 5 years.
Advocacy	Partner with FRSC to advocate that the province-wide Extended Producer Responsibility Program integrate more products and materials like electronics, appliances, C&D materials, and furniture.	City advocates	FRSC, CMEI, other NB municipalities	Public Works and Transportation Services/ Strategic	Start planning for the action immediately.

Big Move 6: Reducing Waste

Strategy	Reduce water consumption				
Modelled low-carbon target	Water consumption per capita reduced by 30% by 2040				
GHG impact	Low				
Community investment	$				
Return on investment	$				
Metric	• Volume of water treated • Volume of wastewater generated				
Implementation mechanism	**Action**	**City role**	**Potential partner**	**Lead department**	**Timing**
Policy	Require that all new and existing residential and commercial buildings install a water meter.	City leads	Developers	Utilities and Infrastructure (Saint John Water)	Start planning for the action immediately.
Policy	Use the data from water meter installations to design a water conservation policy.	City leads	-	Utilities and Infrastructure (Saint John Water)	Start planning for the action in the next 3 years.

Community-wide Implementation

Achieving ActSJ's targets hinges upon community collaboration and support from the federal and provincial governments. The City will lay the foundation for and facilitate action; businesses and residents need to be involved as well.

What will the City do?

Although the City's municipal GHG emissions account for less than 1% of Saint John's total GHG emissions, it plays a leadership role in the community. From its fleet to its buildings, the City can and should be a leader in reaching net zero. The City's Municipal Deep Energy Retrofit Program for buildings and its Public Transit and Fleet Low-Carbon Migration Strategy for the city fleet are already on this trajectory. The City must also take the actions listed below.:

- Design and implement policies that support ActSJ goals, including a carbon budget, a governance structure and a monitoring and reporting framework.
- Review and update ActSJ every three to five years to monitor progress and reassess actions and evaluate emerging initiatives and technologies for implementation.
- Review and update Council's Strategic Plans and other city policies and plans, including PlanSJ and MoveSJ, to accelerate actions that align with ActSJ goals.
- Continue to develop and implement energy efficiency and decarbonization measures to optimize municipal operations in facilities and fleet.
- Continue to collaborate with Saint John Energy to introduce programs for residents and businesses that support energy efficiency and renewable energy upgrades.
- Advocate for enabling climate policies and regulations, and increased programming and funding for local mitigation efforts by other levels of government.
- Coordinate regionally on collective efforts to reduce emissions from development, transportation, and waste.
- Lead a communications and engagement program to gain community support and participation.
- Coordinate businesses and other levels of government to support community climate action, especially in the industrial sector.

What can community and business institutions do?

Community and business institutions have direct control over a significant share of local emissions. Actions they can take to support ActSJ include, but are not limited to, those listed below.

- Adopt an energy and emissions target aligned with the city target (e.g., set a GHG-reduction target, report on emissions to the City, apply a climate lens to procurement).
- Implement concrete actions to reduce emissions.
- Undertake a deep energy building retrofit.
- Install solar PV.
- Right-size the vehicle fleet and switch to zero-emissions vehicles.
- Provide vehicle charging stations on site.
- Offer remote or hybrid work options.
- Introduce initiatives to reduce waste in the workplace including going paperless, and setting up segregated waste bins for garbage, food waste, and recyclables.

What can residents do?

Residents can also play an important role through actions related to their day-to-day lives, as well as through putting pressure on community and business institutions to change. Actions residents can take to support the plan include, but are not limited to, those listed below.

- Walk, cycle, or use public transport instead of driving.
- Retrofit homes and install solar panels, along with energy storage.
- Participate in a solar garden.
- Purchase a zero-emissions vehicle, such as an electric car or an electric bike.
- Advocate for climate action.
- Reduce household waste.
- Continue to participate in ActSJ governance and implementation by bookmarking the project's webpage and signing up for any public engagement opportunities.

Co-benefits

7.

7. Co-Benefits

In many cases, actions that reduce GHG emissions correspond or directly overlap with actions that create vibrant cities and towns, improve public health outcomes, reduce municipal and state operating and capital costs, and support innovation—these are no-regrets policies.[55] One review of more than a dozen studies on GHG mitigation policies found that the co-benefits of reduced air pollution—a single co-benefit—often equaled or exceeded the benefit of the GHG reduction itself.[56]

Co-benefits and co-harms are effects that result from and are incidental to actions that reduce GHG emissions.

Not all co-benefits or co-harms are equal. For the development of ActSJ, co-benefits and co-harms were evaluated according to the criteria below.[57]

- **Synergies:** Many low-carbon actions have multiple socioeconomic benefits. Examples of these types of actions include transit, improving energy efficiency, and fostering a more compact urban design.
- **Urgency:** Some actions are associated with greater urgency to avoid loss of inertia on action already taken and prevent lock-in effects,[58] irreversible outcomes, or elevated costs. This may occur with road infrastructure decisions, major ecosystems displacement, and urban form. Some low-carbon actions require time to realize their effects, making immediate implementation paramount.
- **Costs:** Acting early is generally less expensive than acting later. This is because delayed action often involves "fixing" high emissions infrastructure rather than making it a low-carbon option from the beginning. Examples include buildings that are initially constructed to low energy efficiency standards and then need to be retrofitted later.
- **Longevity:** Related to urgency, the longevity of planning and development decisions locks cities into their effects for decades, and sometimes centuries. For example, widening a road allows more vehicles to travel and can induce demand for personal vehicles.
- **Equity Impacts:** Low-carbon actions have different impacts on different subsets of the population. Those with lower income levels may be unable to afford new heating and cooling systems in their homes; those with limited mobility may not be able to use transit as easily as the able-bodied; and those living in future generations will inherit the impacts of climate change caused by those who came before them.

Table 7 provides an assessment of the co-benefits and co-harms of implementing the NZE-2 Scenario over the BAP Scenario.

[55] Lamia Kamal-Chaoui and Alexis Robert, "Competitive Cities and Climate Change," 2009, http://www.oecd-ilibrary.org/governance/competitive-cities-and-climate-change_218830433146.

[56] Gao, J., Kovats, S., Vardoulakis, S., Wilkinson, P., Woodward, A., Li, J., ... & Liu, Q. (2018). Public health co-benefits of greenhouse gas emissions reduction: A systematic review. Science of the Total Environment, 627, 388-402.

[57] Adapted from (Fay et al., 2015).

[58] Lock-in effect refers to implementation of a strategy or action that improves performance of an object or activity in the short term but is prohibitive to future change. For example, when quick building retrofits are undertaken, no additional improvements in the equipment installed can be expected over the course of a building's lifetime without considerable additional expense. In this way, lower levels of energy reductions can be locked in for a long period.

Table 7. Summary of impacts.

1. Health

Co-benefits/ co-harms	Buildings	Transportation	Energy	Waste
1.1 Co-benefit: Improved air quality	Energy-efficient buildings with low-carbon heating/cooling systems have fewer drafts, less condensation, and less temperature variation, resulting in greater comfort and better health.	Reduced combustion of gasoline and diesel in vehicles reduces nitrogen oxides (NOx) and particulate matter in the air. This, in turn, reduces respiratory illnesses and flare-ups.	Reduced natural gas combustion in furnaces and industrial processes reduces NOx and particulate matter in the air. This, in turn, reduces respiratory illnesses and flare-ups.	Treating waste to reduce and capture methane reduces odour issues.
1.2 Co-benefit: Increased physical activity and health		Comprehensive, well-maintained, and safe cycling and walking infrastructure results in increased activity, better mental and physical health, lower obesity rates, and lower rates of absenteeism from work.		
1.3 Co-benefit: Reduction in noise pollution	Improved insulation in buildings reduces residents' exposure to exterior noise.	Switching to electric vehicles reduces total vehicle noise as EVs do not produce as much noise as combustion engines.		
1.4 Co-benefit: Improved accessibility		Transit-oriented development provides easier access to transit corridors and hubs.		
1.5: Co-benefit: Improved resiliency	High-performance buildings are less vulnerable to adverse impacts of extreme weather events.		Local solar and wind installations improve energy security as they do not rely on fossil fuel or grid electricity that could be curtailed during severe weather.	

2. Economic prosperity

Co-benefits/ co-harms	Buildings	Transportation	Energy	Waste
2.1 Co-benefit: Increased employment	Retrofitting buildings and building to new higher standards will create a significant number of direct and indirect jobs annually.		Supplying, installing, and maintaining renewable and alternative energy systems, renewable fuels, and energy storage will generate a significant number of new jobs annually.	Waste mining for the circular economy, recycling, and the conversion of waste to fuel will generate new jobs.
2.2 Co-harm: Decreased employment		The large-scale shift to EVs will result in a reduction in overall maintenance requirements for vehicles.		
2.3 Co-benefit: Increased long-term affordability	Initial capital costs for more energy-efficient buildings are more than offset with the resulting long-term savings in energy costs.	EVs have higher initial capital costs than internal combustion engine vehicles; however, in the longer term, they save the owner more money in avoided fuel and maintenance. Increased use of transit and active transportation also costs less than personal vehicle use.	Initial capital costs to replace high emissions heating and cooling technologies are more than offset with the resulting long-term savings in energy costs.	

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Co-benefits/ co-harms	Buildings	Transportation	Energy	Waste
2.4 Co-benefit: Increased leadership reputation	A requirement for high-performance buildings creates a reputation for the city's developers and builders as having the skills required for innovative and sustainable building.	Less congestion, shorter commutes, more bike and walking infrastructure draw new young residents to the city's reputation of being a more livable community.	Large-scale renewable and alternative energy deployment increase the city's exposure as a climate leader and prepare the local labour force to maintain the energy systems of the future.	The City continues to enhance its reputation for innovative approaches to waste management.
2.5 Co-benefit: Increased social capital		Increased active transportation and transit use promotes more interaction among citizens, improving social cohesion.		
2.6 Co-benefit: Improved environmental capital	More efficient buildings require less energy generation, decreasing the need for new energy generation facilities in green spaces outside the city boundary.		Energy generation within the city boundaries decreases the need to import energy (losing some in the process) and reduces the need for new generation facilities in green spaces beyond the city.	Waste managed as a valued resource results in less methane pollution.

3. Social equity

Co-benefits/ co-harms	Buildings	Transportation	Energy	Waste
3.1 Co-benefit: Quality of life for the elderly improves	Low-carbon buildings are healthier for residents who are more susceptible to illness and are more comfortable.	Sidewalks and cycling infrastructure is developed to be safe for senior citizens to improve their ability to continue to move in their communities.	Heat-pump systems provide air conditioning to all residents, reducing the impacts of heat waves.	
3.2 Co-benefit: Quality of life for children improves	Low-carbon buildings are healthier, meaning the important development that occurs during childhood years takes place in cleaner spaces.	Safe, connected, well-maintained, and well-used bike paths, sidewalks and transit infrastructure make these options better for children.		
3.3 Co-benefits: Increased intergenerational equity and resilience	Low-carbon actions that begin early avoid locked-in emissions and increased costs to fix stranded assets in all of these areas. Action now also ensures changes are made before the worsening impacts of climate change begin to damage outdated infrastructure. This reduces the burden on future generations.			

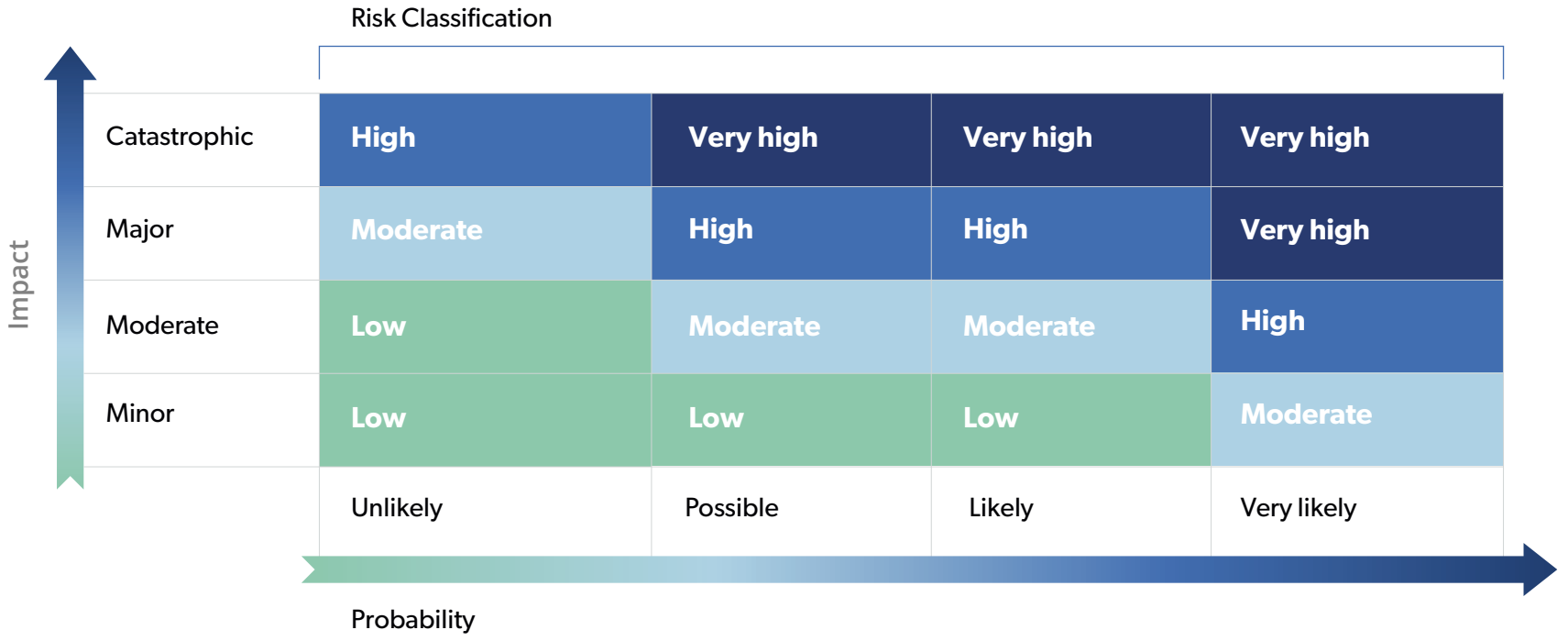
8.

Risks

8. Risks

Implementation risks are inherent in strategies, policies, and actions. Risk is the expression of the likelihood and impact of an event with the potential to affect the achievement of an organization's objectives. This section identifies some potential risks to ActSJ implementation and related mitigation and contingency strategies. Risks are classified according to the risk matrix in Table 8.

Table 8. Risk classification.



The Risk of Doing Nothing

If the CEAP is not implemented, emissions are expected to rise according to the BAP Scenario. This status-quo scenario assumes no major changes are made to new and existing buildings, EV uptake is slower, active transportation and transit shifts are more limited, and renewable energy generation is slower.

Risk	Description	Probability	Impact	Overall risk
Stranded assets	Residents or the City invests in fossil fuel-based infrastructure that must be replaced prior to the end of its useful life, either to meet its GHG reduction commitments or due to changing market conditions as a result of global climate action.	Very likely	Major	**Very high**
Reputation is negatively impacted	The reputation of Saint John is damaged because its climate efforts do not align with what science indicates is required to address climate change.	Possible	Moderate	**Moderate**
Vulnerability to energy price shocks	Residents and businesses are vulnerable to global fossil fuel prices, which will fluctuate in the future.	Very likely	Major	**Very high**
Infrastructure damage from extreme weather	Energy system, buildings, and other infrastructure is damaged from extreme weather events.	Likely	Major	**High**
Cumulative energy expenditures are greater than they would be under strategy implementation	In the long run, the BAP Scenario is more costly than the NZE-2 Scenario.	Very likely	Minor	**Moderate**
GHG emissions increase or stabilize	GHG emissions will continue to increase, imposing a burden on future generations. The cost of future mitigation will also increase, requiring more expensive interventions.	Very likely	Major	**Very high**
Operational costs increase	Opportunities to reduce operational costs are missed, for example from EVs and heat pumps.	Very likely	Moderate	**High**

Operational Risk

Risk	Probability	Impact	Overall risk	Mitigation	Contingency
Limited internal resources or capacity within the City to coordinate ActSJ implementation	Possible	Major	**High**	Conduct a needs assessment analysis and allocate resources (staffing, training, budget) to meet ActSJ requirements.	Outsource work if internal resources are unavailable.
Lack of skilled workers to undertake projects in the ActSJ. Emissions reduction activities are delayed and project labour costs increase.	Very likely	Major	**Very high**	The City convenes a working group with relevant businesses, worker groups, and training organizations to conduct a training needs assessment.	Workers are brought in from other jurisdictions
Industrial sector fails to meet its decarbonization commitments.	Likely	Catastrophic	**Very high**	The City convenes a working group with the industrial sector to provide support for net-zero transition.	The City encourages businesses in the industrial sector to investigate offset possibilities.
Provincial power grid fails to fully decarbonize by 2035.	Likely	Catastrophic	**Very High**	The City collaborates with Saint John Energy to increase local renewable energy and energy storage installations in Saint John.	The City investigates possibilities for offsets to address residual GHG emissions.
Failure to engage the community, causing limited participation in climate actions, including individual projects like retrofits and electric vehicles purchase.	Possible	Major	**High**	The City and its partners continue to build community literacy and gain support through programming and sharing of best practices. The City and its partners provide financial and non-financial support where possible.	
The projected rate of retrofits exceeds the capacities of goods and service providers.	Possible	Major	**High**	Develop pilot projects to test contractors and begin briefings with relevant companies immediately so that they have time to scale up.	Partner with a “one-stop shop” like Blocpower.

Technical Risk

Risk	Probability	Impact	Overall risk	Mitigation	Contingency
Delayed deployment of technologies and fuels, like renewable natural gas and green hydrogen, used to model NZE-2 Scenario.	Possible	Major	**High**	The City monitors development of ActSJ projects to assess potential intervention measures.	Import renewable fuel.
Electrification reduces energy system redundancy, making operations more vulnerable to disruption in the event of power outages.	Likely	Major	**High**	Buildings and energy design for redundancy. For example, battery storage included in the building retrofit program.	Microgrids installed in targeted nodes to create additional resiliency.
Electrification increases peak electricity demand, increasing expenditures on electricity.	Likely	Major	**High**	Saint John Energy continues to develop and deploy demand management strategies. Smart vehicle charging programs are developed.	

Market-Price Risks

Risk	Probability	Impact	Overall risk	Mitigation	Contingency
Increased labour and equipment costs, supply chain delays causing project costs to increase beyond the point of affordability.	Possible	Catastrophic	**Very High**	For each project, include a contingency budget and create a risk management plan.	Extend the planning horizon.
Fossil fuel price declines, challenging the business case for individual projects.	Possible	Moderate	**Moderate**	Efficiency gains in the building stock as a result of retrofits and the efficiency of heat pumps will decrease the energy required overall, effectively hedging against this risk.	

Regulatory Risks

Risk	Probability	Impact	Overall risk	Mitigation	Contingency
The province revises Clean Energy Strategy targets, causing the provincial power grid to remain partly supplied by fossil fuels beyond 2035.	Likely	Catastrophic	**Very High**	The City advocates against this revision.	The City collaborates with Saint John Energy to mitigate the impact of this revision.
Federal government revises carbon pricing regulations.	Possible	Major	**High**	Implementing energy efficiency measures will decrease energy requirements, effectively hedging against this risk.	

Governance Risks

Risk	Probability	Impact	Overall risk	Mitigation	Contingency
Lack of leadership and follow through stalls implementation.	Likely	Major	**High**	Create a Council/Community Steering Committee with the mandate for implementation. Publish annual report for transparency	
Pushback from departments/ community causes delays or scope is reduced to address concerns.	Likely	Major	**High**	The City continues to provide a clear rationale and transparency in terms of its direction and outcomes. Engagement and communication will be critical to ensure ongoing community support.	
Unforeseen events impact the nature of government operations.	Very likely	Major	**Very high**	Council and staff embed consideration of climate action into their budgeting and planning processes so it is a default, rather than optional, approach	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9.

All Hands on Deck

9. All Hands on Deck

ActSJ is a continuation of efforts beginning with Saint John's Municipal Energy Efficiency Program (MEEP) in 1996 and launches the City on its pathway to net-zero emissions by 2050. The ActSJ demonstrates that the strategies and actions that drive emissions reductions are also good for the community. They contribute to a healthy economy, a more equitable city, and a place that continues to thrive in the future.

ActSJ sets forth an ambitious vision. To make it a reality, all segments of the community, including the City, residents, businesses, and institutions, will have to collaborate. Heavy industries, as the largest emitters in Saint John, will play a huge role and need to be committed to making their own net-zero emissions plans a reality. Together, the entire Saint John community can create a sustainable, low-carbon city that is prepared to confront the challenges of the future, while also being economically, environmentally, and socially responsible.

To successfully implement ActSJ, the City must dedicate staff time and annual budgetary resources. It must also collaborate with community stakeholders to work towards positive, equitable implementation of low-carbon actions. In the short term, the City can determine financial tools, potential funders, project champions and leaders, partnerships, and governance structure for each action and implementation mechanism. The City must also define the specifics of its role in the implementation process and clearly communicate how the community can participate in this transition.

Furthermore, the City must make a firm commitment to ongoing monitoring, reporting, and evaluation mechanisms for ActSJ and its individual implementation actions. Reviewing and updating ActSJ every three to five years will enable the City to track progress on actions and dynamically reassess and reprioritize actions as conditions change over time. Regularly engaging with the community on progress ensures the City is transparent and accountable, and will help keep the City aligned with emerging needs and advancements. Ramping up collaborative efforts and community participation is key to making significant progress towards net-zero Saint John by 2050.

A.

Appendixes

Appendixes

Appendix A: Key Terms

Abbreviations

A&EM	City of Saint John Management and Environmental Performance Division
BAP	Business-as-Planned Scenario
BAU	Business-as-Usual Scenario
CCUS	Carbon capture, utilization and storage
CEAP	Clean Energy Action Plan
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalents
CDD	Cooling degree days
CH4	Methane
CWG	Community Working Group
DE	District energy
GHG	Greenhouse gas emissions
GPC	Global Protocol for Community Scale Greenhouse Gas Emissions Inventories
GWP	Global warming potential
HDD	Heating degree days
IPCC	Intergovernmental Panel on Climate Change
LCS	Low Carbon Scenario
MAC	Marginal abatement cost
NPV	Net present value
VKT	Vehicle kilometres travelled

Glossary

Term	Definition
Baseline	the starting point to measure changes in the amount of emissions produced over time
Carbon-free grid	an electricity grid where the power that is generated and distributed comes from only renewable sources
Carbon sequestration	the process of capturing and storing carbon from the atmosphere through natural or anthropogenic methods
Consumption-based emissions	emissions from the volume of goods consumed by a population
CO_2e (Carbon dioxide equivalents)	a single unit of measurement that allows for the impact of releasing different greenhouse gasses into the atmosphere to be evaluated on a common basis. Carbon dioxide equivalents are calculated using Global Warming Potential factors that represent the impact of each greenhouse gas type (such as methane (CH4) and nitrous oxide (N2O) relative to that of carbon dioxide
Decarbonize	to eliminate the release of GHGs into the atmosphere from a process or system. This includes swapping out any fossil fuel sources for renewable energy
GHGs (Greenhouse gasses)	compound gasses that trap heat and emit longwave radiation in the atmosphere causing the greenhouse effect
Heat pump	a highly efficient heating and cooling system that transfers thermal energy from the ground or air to warm a building during winter and cool it during the summer
Net zero	a balance between the amount of greenhouse gasses released and the amount taken out of the atmosphere
Net zero building	a building that is highly energy-efficient and produces on-site, or procures, carbon-free and or renewable energy in an amount sufficient to offset the annual carbon emissions associated with its operations, or simply eliminates carbon emissions altogether
Renewable energy	a naturally-occurring energy source that is not finite or exhaustible. It includes sources such as sunlight, wind, and geothermal heat
ZEV (Zero Emissions Vehicle)	a vehicle that does not produce tailpipe emissions or other pollutants from the onboard source of power

Key Energy and Emissions Units

GHG emissions

1 $MtCO_2e$ = 1,000 $ktCO_2e$ = 1,000,000 tCO_2e

One megatonne of carbon dioxide equivalents is equal to one million tonnes of carbon dioxide equivalents.

Energy

1 MJ = 0.001 GJ

1 TJ = 1,000 GJ

1 PJ = 1,000,000 GJ

1 GJ = 278 kWh

1 MWh = 1,000 kWh

1 GWh =1,000,000 kWh

Appendix B:
Avoid, Reduce, Replace, Remove, Offset Paradigm

Although there are many decarbonization initiatives a city can pursue, they typically fall into one of five strategic approaches: Avoid, Reduce, Replace, Remove, and Offset.

- **Avoid** strategies are important to use as much as possible both for financial reasons and to avoid overtaxing individual fuel sources. Avoid strategies also often come with significant co-benefits, such as better health, less absenteeism, and even a greater sense of community and safety.
- **Reduce** strategies include traditional energy efficiency improvements, such as improving insulation and reducing heat loss by replacing old windows and automated doors.
- **Replace** initiatives include switching from fossil fuels to non-emitting fuels. These approaches are necessary and often involve new technologies such as solar photovoltaic (PV) systems, but they can be costly.
- **Remove** initiatives include using natural systems or technologies that sequester greenhouse gases. The most common projects involving natural systems are tree-planting initiatives and increasing and protecting wetlands and other ecosystems that naturally sequester CO_2. The most familiar technology in this category is carbon capture, use, and sequestration (CCUS). This involves the physical capture of carbon generally produced during the combustion of fossil fuels in industrial or building heating contexts and then the storage of that carbon in solid forms, such as soap products, or by sequestering it in pipelines or underground caverns.
- **Offsets** involve paying another entity for taking eliminated emissions that the City of Saint John is not currently able to eliminate from its own inventory. It is priced as a cost per tonne of CO_2e and is intended to compensate the receiving entities for investments required to eliminate those emissions. Offsets are regarded as a "last resort" only to be purchased when all other methods of local emissions reduction have been exhausted.

Avoiding the use of high-carbon energy altogether is the top priority, followed by reducing the amount of energy used through efficiency improvements, then switching to zero-carbon energy sources to satisfy the remaining demand. Offsets should only be used to address remaining emissions. They should also only be purchased until a better option is found. This Plan contains examples of all of these approaches.

Annex Reports

Annex I: Engagement Summary

Annex II: Modelling Data, Methods, and Assumptions

City of Saint John

Community Energy Action Plan

November 2023

ActSJ

Pathway to Net-Zero