Cities in Transition

The role of urban planning in energy policy

IISD REPORT

International Institute for Sustainable Development

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International Institute for Sustainable Development

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Cities in Transition: The role of urban planning in energy policy

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Photo: Ronja Bechauf/IISD

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Executive Summary

Achieving ambitious emissions reduction targets will require more than a transition to renewable energy; it will require a reduction of total energy demand. Current urban design in cities impacts the total amount of energy consumed, as car-centric suburban development leads to higher energy use, as well as various social, economic, and environmental issues.

To address these issues, this research highlights the critical role urban planning can play in reducing our energy consumption and effectively reducing emissions. We explore how transforming urban landscapes into "complete communities" by bringing essential elements of city life closer and more accessible is crucial for reducing energy consumption. Beyond reducing energy use, such an approach enhances quality of life by enhancing well-being and addressing a variety of social and environmental factors.

Key policy barriers to complete communities include opposition from "Not In My Backyard" (NIMBY) organizations, flawed municipal governance systems, and the financial costs of sprawl. Overcoming these challenges is crucial for reducing emissions. Case studies from other cities provide valuable lessons and inspiration to overcome these barriers, demonstrating that bold, innovative strategies can lead to transformative outcomes.

Building off the work of cities, this research applies the International Institute for Sustainable Development's Sustainable Asset Valuation (SAVi) modelling methodology to three potential transportation scenarios in Winnipeg. A car-centric scenario that is compatible with current unsustainable urban sprawl patterns is compared to two sustainable transportation scenarios that include active transportation and public transit, with the aim to facilitate the transition toward complete communities. The SAVi analysis demonstrates that shifting from car-oriented development patterns to sustainable transportation is more economically viable, as indicated by its higher net benefits and positive benefit-to-cost ratio (5.29 as opposed to 0.04 for the car-centric scenario). It simultaneously has numerous positive impacts, such as reduced emissions, traffic accidents, and air pollution costs, while strengthening Winnipeg's economic performance. This shift highlights the financial prudence of sustainable urban planning, making it a win–win solution for both the environment and municipal budgets.

Table of Contents

1.0 Introduction and Purpose of the Study 1

1.1 The Missing Link Between Urban Planning and Energy Policy 1

1.2 The Purpose and Structure of the Report 2

2.0 Research Methodology 4

3.0 The Intersection of Urban Planning and Climate Change Mitigation Policy 5

3.1 What Is Urban Planning? 5

3.2 Why Has Urban Planning Been Excluded From Energy Policy? 5

3.3 Why Reducing our Total Energy Demand Is an Essential Element of Energy Transition 6

3.4 How Urban Sprawl Leads to High Energy Demand and Emissions 7

4.0 The Role of Urban Planning in Creating Climate-Resilient, Inclusive Communities 12

4.1 How Urban Planning Contributes to Climate Change Adaptation 12

4.2 How Settler Colonialism Shaped Urban Design in Winnipeg 13

5.0 The Goal of Creating Complete Communities and Barriers to Making it a Reality 15

5.1 Why Complete Communities Are Key to Reducing Emissions 15

5.2 Three Key Barriers to Complete Communities 17

6.0 Solutions for Creating Cities for People/Complete Communities 22

6.1 Solution 1: Transform land-use planning 22

6.2 Solution 2: Reduce car dependency through active and public transportation 26

6.3 Solution 3: Create fiscal space for climate investments 28

6.4 Solution 4: Shift mindsets toward a low-emission city and lifestyles 31

7.0 The Benefits of Shifting to Sustainable Transportation in Winnipeg: SAVi 32

7.2 Results 35

8.0 Conclusion 42

References 43

Appendix A. Methodology of the SAVi Assessment 54

List of Figures

Figure 1. Car-centric vs complete community 2
Figure 2. Per capita energy use, 2022 6
Figure 3. Per capita CO_2 emissions from fossil fuels and industry, 2022 7
Figure 4. Downtown Winnipeg, early 20th Century 8
Figure 5. Average carbon emissions by transportation type (in grams per km) 10
Figure 6. Comparing the finances of urban sprawl vs. compact development in Winnipeg 19
Figure 7. City of Winnipeg net financial position 2008–2022 20
Figure 8. Illustration of mixed uses and densities in a 15-minute neighbourhood 23
Figure 9. 3D interactive map illustrating Ottawa's new draft zoning bylaw 24
Figure 10. Cycling routes in Oulu 28
Figure 11. CLD of shifting to more sustainable transportation in Winnipeg 34
Figure 12. Visualization of the SAVi scenarios 36
Figure 13. The monetary value of costs and benefits of the car-centric transportation scenario in Winnipeg (discounted at 5%, cumulative 2025-2050) 37
Figure 14. The monetary value of costs and added benefits of the sustainable transportation scenarios in Winnipeg (discounted at 5%, cumulative 2025–2050) 38
Figure 15. Sustainable transportation vs. car-centric scenario (CBA results) 40

List of Tables

Table 1. Scenarios and assumptions of the car-centric and sustainable transportation approaches 35
Table 2. Integrated CBA, discounted at 5% based on the project period 2025–2050 39
Table A1. Assumptions and data sources used in the SAVi assessment of a sustainable transportation approach in Winnipeg 54

List of Boxes

Box 1. What would sustainable, low-carbon cities look like? 1
Box 2. Urban density shapes transportation emissions in Barcelona and Atlanta 9
Box 3. EVs are not the silver bullet for reducing emissions 11
Box 4. Indigenous urban development in Winnipeg 14
Box 5. Zoning reforms in Edmonton 31

Abbreviations and Acronyms

BCR	benefit-to-cost ratio
CBA	cost-benefit analysis
CCPA	Canadian Centre for Policy Alternatives
CLD	causal loop diagram
EV	electric vehicle
FCM	Federation of Canadian Municipalities.
GHG	greenhouse gas
IEA	International Energy Agency
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
NIMBY	Not In My Backyard
O&M	operations and maintenance
SAVi	Sustainable Asset Valuation
TOD	Transit-Oriented Development

1.0 Introduction and Purpose of the Study

1.1 The Missing Link Between Urban Planning and Energy Policy

After 3 decades of climate policy, global carbon emissions are higher than ever (Stoddard et al., 2021). The situation in Canada mirrors the global trend, where total emissions produced in 2022 were higher than in 1990 (Environment and Climate Change Canada, 2024). The failure of energy policy to achieve the emissions reductions required to sustain organized human life on Earth represents a serious concern and underscores the urgent need to integrate innovative and transformative approaches (Intergovernmental Panel on Climate Change [IPCC], 2023).

This research argues that the design of human environments is an essential and overlooked element of emissions reduction policy. It is becoming increasingly clear that achieving our emissions reduction targets will involve not just the decarbonization of our energy supply but also a reduction in total energy demand through a thoughtful redesign of our built spaces (Creutzig et al., 2018).

Box 1. What would sustainable, low-carbon cities look like?

Picture a city where walking, cycling, and public transit are safe, enjoyable, and practical ways to commute to daily activities. Sprawling suburbs have been reimagined as vibrant, complete communities, where homes, schools, workplaces, and amenities are within easy reach. Parking lots have been transformed into productive spaces—local businesses, markets, and green areas—that boost the economy and foster community well-being.

Homes are constructed with sustainable materials and designed to suit regional climates, making them energy efficient and resilient to extreme weather. Streets are shaded with lush vegetation instead of covered in asphalt, providing natural cooling and reducing flood risks by allowing rainwater to be absorbed into the soil. Indigenous design principles honour cultural identity, fostering inclusive, safe, and welcoming spaces for all.

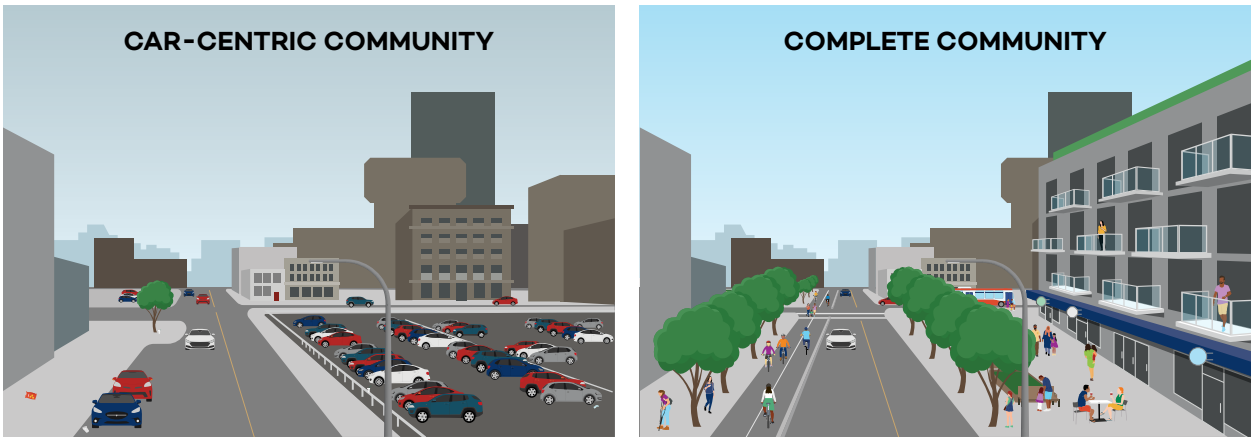
Such cities are more than just visions—they are tangible solutions to pressing climate and social challenges and can be achieved by a range of tangible actions outlined in reports like this.

With over 80% of Canadians living in urban areas (O'Neill, 2024) and similarly high percentages in the United States (Center for Sustainable Systems, 2024), it is imperative to consider how the urban form impacts emissions production. Across North America, the urban sprawl covering the landscape traps the population into patterns of high energy consumption

with car-oriented, low-density development. Effective energy policy must consider how urban planning conditions emissions production (IPCC, 2023).

Beyond energy use, the design of urban spaces has a direct impact on diverse issues, including municipal finances, public health, and various social and environmental issues. Tackling emissions reductions through the lens of urban planning provides the opportunity to not just affect energy policy but also to make tangible improvements in the lives of community members. As an alternative to raising the price of carbon, for example, low-energy urban planning can increase municipal revenue streams, improve physical and mental health for citizens, mitigate biodiversity collapse, and address important social concerns, all while reducing emissions.

Figure 1. Car-centric vs complete community



Source: Authors.

1.2 The Purpose and Structure of the Report

This research highlights the critical role of urban planning in reducing energy demand, thus achieving emissions reductions. The report is structured as follows:

- Chapter 2 describes the research methodology.
- Chapter 3 explains the critical links between urban planning and energy policy, touching on the energy use and emissions created through urban sprawl and the need to reduce energy demand to mitigate climate change.
- Chapter 4 focuses on the role of urban planning in creating climate-resilient cities and the importance of inclusive urban planning to overcome historical marginalization.
- Chapter 5 describes how creating complete communities is key to reducing carbon emissions and dives into key barriers that obstruct achieving this goal in Winnipeg.

- Chapter 6 explores four solutions for creating complete communities in Winnipeg, spanning improved fiscal space, changes in land-use planning, shifts in transportation, and increased public awareness for climate action and sustainable cities.
- Chapter 7 highlights the social, economic, and environmental benefits of shifting to more sustainable transportation in Winnipeg by using the International Institute for Sustainable Development's (IISD's) Sustainable Asset Valuation (SAVi) methodology.
- Chapter 8 presents conclusions and suggests some next steps for research in this area.

2.0 Research Methodology

This research employs a range of quantitative and qualitative methods, reflecting the inherently multidisciplinary intersection of both urban design and energy policy. This integrated approach is critical as it allows the research to draw from a variety of methodologies to address the complexity of the subject matter. While anchored in the science of climate change and the quantitative imperative of emissions reductions, this research recognizes the value of qualitative methods in capturing human and societal dimensions.

First, a literature review was conducted to understand existing frameworks and theories relevant to urban planning and emissions reductions. This review included academic publications and planning and policy documents from the City of Winnipeg and other cities in North America. Interviews were held with key stakeholders, including policy-makers, urban planners, and community representatives, to gather diverse perspectives and ground the research in practical experiences.

This research focuses on the city of Winnipeg, a mid-sized Prairie city in the province of Manitoba, Canada. Winnipeg represents a North American city struggling to adopt progressive urban planning practices and is also home to IISD's headquarters. Settler colonialism continues to shape the social, economic, and spatial situation of the city, and, therefore, the research pays specific attention to the role of urban planning in creating a more inclusive city.

This project also uses the SAVi methodology, which is customized to provide policy-makers and investors with a comprehensive analysis of how much their infrastructure projects will cost throughout their life cycles, considering risks and impacts that are overlooked in traditional valuations. SAVi combines quantitative and qualitative approaches to assess the sustainability of infrastructure projects through a comprehensive economic analysis that integrates a wide range of economic, social, and environmental impacts.

3.0 The Intersection of Urban Planning and Climate Change Mitigation Policy

This section lays the groundwork for recognizing urban planning as a vital component of emissions reduction strategies. It explores why urban planning has historically been overlooked throughout energy policy and highlights the critical importance of reducing total energy demand to meet emissions reduction targets. Reducing emissions through urban planning begins with recognizing how existing infrastructure traps cities in patterns of energy-intensive growth.

3.1 What Is Urban Planning?

Urban planning is the process of designing and managing the use of land, resources, and infrastructure to create sustainable and functional cities. In municipal governments, urban planners play a critical role in shaping how cities grow and develop. Their responsibilities include creating policies and development plans that guide land use, housing, transportation, and public spaces.

3.2 Why Has Urban Planning Been Excluded From Energy Policy?

While the field of urban planning has taken sustainability and emissions reductions into consideration for many years, mainstream climate policy has largely overlooked urban planning. A consideration of urban form is typically absent from major climate change policies; for example, it cannot be found in discussions of carbon pricing in Canada, Biden's Inflation Reduction Act of 2022, and most common net-zero frameworks.

It is important to review why urban planning has been systemically overlooked throughout mainstream climate change policy, even though its impact on carbon emissions is clear (IPCC, 2023; Serkin, 2024). Energy policy frameworks are typically created by economists who have historically set strict boundaries around acceptable energy policy discourse (Buller, 2022; Stoddard et al., 2021). Market-oriented and neoliberal approaches have constrained policy innovation and sidelined systemic approaches to climate action (Keen, 2020). Researcher Adrienne Buller (2022) writes of the effect of neoliberalism on climate policy: "the horizons of what is possible, what we are capable of, and what we are allowed to hope for have been needlessly shrunk."

By treating our urban form as fixed, economists have left themselves with the daunting task of decarbonizing a society with a tremendously high energy demand. Technological solutions like electric vehicles (EVs) have been prioritized over the imperative to decrease overall energy consumption. The result is that the relationship between urban form and energy consumption is left unconsidered in mainstream energy policy discussions.

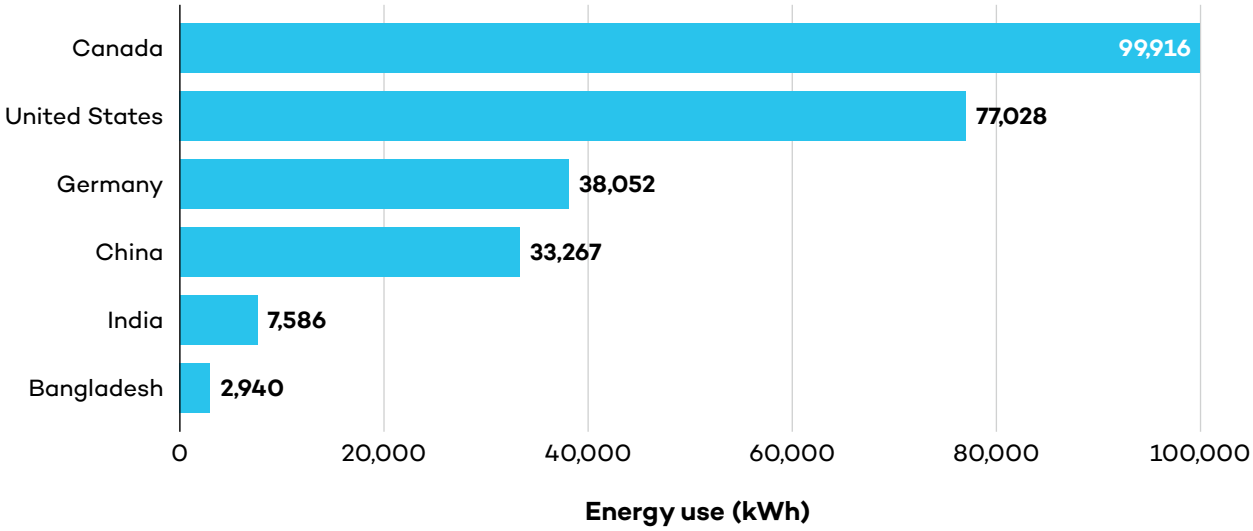
3.3 Why Reducing our Total Energy Demand Is an Essential Element of Energy Transition

A reduction of our total energy demand through the redesign of our landscapes is an essential part of the energy transition because renewable energy technology cannot supply our current energy demand (Crownshaw, 2020). The vast majority of our energy supply in Canada and in most countries around the world remains dependent on fossil fuels—only 12% of Canada's energy is derived from renewable sources (International Energy Agency [IEA], 2023a). Instead of encouraging a reduction in energy demand, energy policy often relies on techno-solutions with questionable records of achieving emissions reductions (Cameron & Carter, 2023; Lee, 2021; Sekera & Lichtenberger, 2020).

A focus on reducing total energy demand is especially relevant in the Canadian context, where energy consumption per capita ranks among the highest in the world (Ritchie et al., 2023b). Total energy consumption is a critical factor to consider as it is the primary driver of carbon emissions (IPCC, 2014). The challenge of energy decarbonization is significantly more difficult if we maintain an extremely high energy demand.

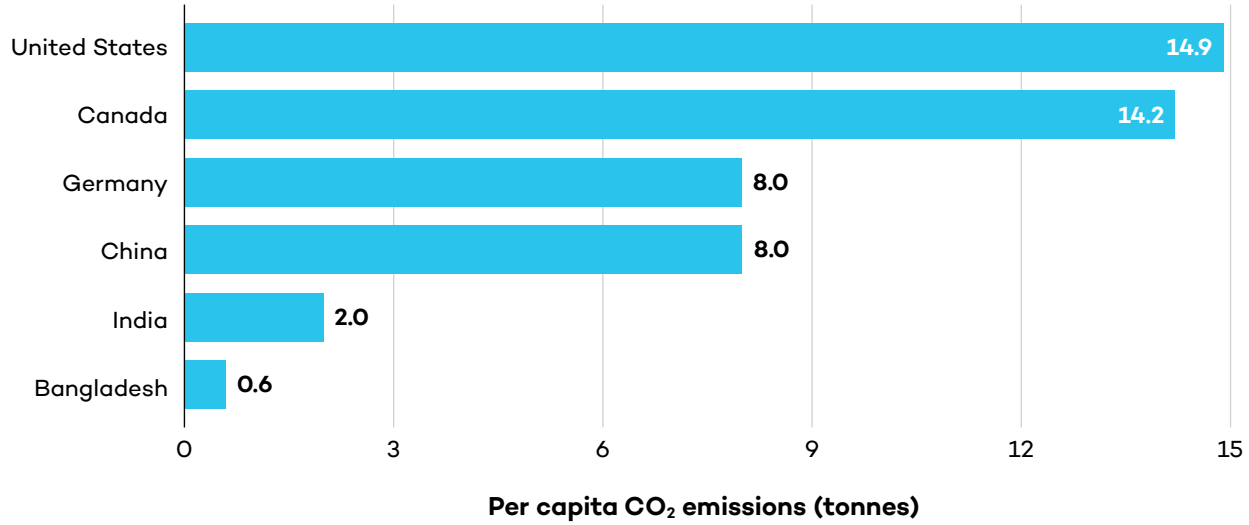
Figures 2 and 3 demonstrate how energy use and emissions are correlated.

Figure 2. Per capita energy use, 2022



Source: Ritchie et al., 2023b.

Figure 3. Per capita CO_2 emissions from fossil fuels and industry, 2022



Source: Ritchie et al., 2023a.

Note: Land-use change is not included.

While investing in renewable energy capacity is clearly an important part of emissions reductions, its limitations as a decarbonizing policy are not commonly discussed. Germany, for instance, generates about 8% of its total energy supply from renewable sources (IEA, 2023b), while Canada achieves around 12% (IEA, 2023a). Despite Canada's higher share of renewable energy generation, the country still produces almost twice the per capita emissions of Germany (14.2 tonnes versus 8 tonnes of CO_2 per person) (Ritchie et al., 2023a). This is largely due to reduced energy consumption in Germany rather than rates of decarbonization (Akenji et al., 2021). Despite their much lower energy demand profile, Germany's per capita GDP is higher than Canada's, and people enjoy a high quality of life.

Finally, the issue of global inequality in emissions production should play a role in our approach to energy policy in Canada. The richest 1% of the global population creates twice as many emissions as the poorest 50% put together (Kartha et al., 2020). Research has demonstrated how intense emissions reductions in a country like Canada must be: citizens in high-income countries must reduce emissions by 91%–95% to align with international climate targets (Akenji et al., 2021).

3.4 How Urban Sprawl Leads to High Energy Demand and Emissions

3.4.1 Background on Urban Sprawl

Urban sprawl, a form of human settlement that dominates nearly all municipalities across North America, refers to a low-density urban environment defined by car dependency and single-

use zoning (Gillham, 2002). This type of development discourages walking and cycling by maintaining low population densities and separating city uses in different areas through zoning bylaws, creating an urban landscape that is hostile to pedestrians and welcoming to fossil fuel infrastructure.

Cities across North America were once filled with dense, walkable communities with impressive public transportation systems often powered by electricity. Since the rise of the automobile over the past 100 years, much of the complete community infrastructure was bulldozed to make room for fossil fuel infrastructure projects (Kay, 1998).

Fossil fuel companies, along with car manufacturers, worked behind the scenes to promote urban sprawl as a key feature of urban planning across North America (Kwinty, 1991; Scott, 2021). Their efforts promoted car-centric infrastructure and suburban expansion, which helped cement dependency on automobiles and fossil fuels, shaping city layouts and transportation priorities in ways that persist today. Between 1969 and 2010, average daily travel distance grew by 85% across the United States (Tomer et al., 2021). These are among the many variables that have promoted sprawl in the North American landscape.

Figure 4. Downtown Winnipeg, early 20th Century

Source: Gary Becker Postcard Collection, with permission.

3.4.2 Energy Requirements of Car-Dependent Urban Sprawl

A growing body of literature highlights the emissions intensity associated with urban sprawl (Ewing et al., 2007; Navamuel et al., 2018; Noy, 2022; Serkin, 2024; Wilson & Chakraborty, 2013). Emissions are produced primarily from energy requirements related to cars and car infrastructure, but also from heating and cooling widely spaced buildings.

Transportation Emissions

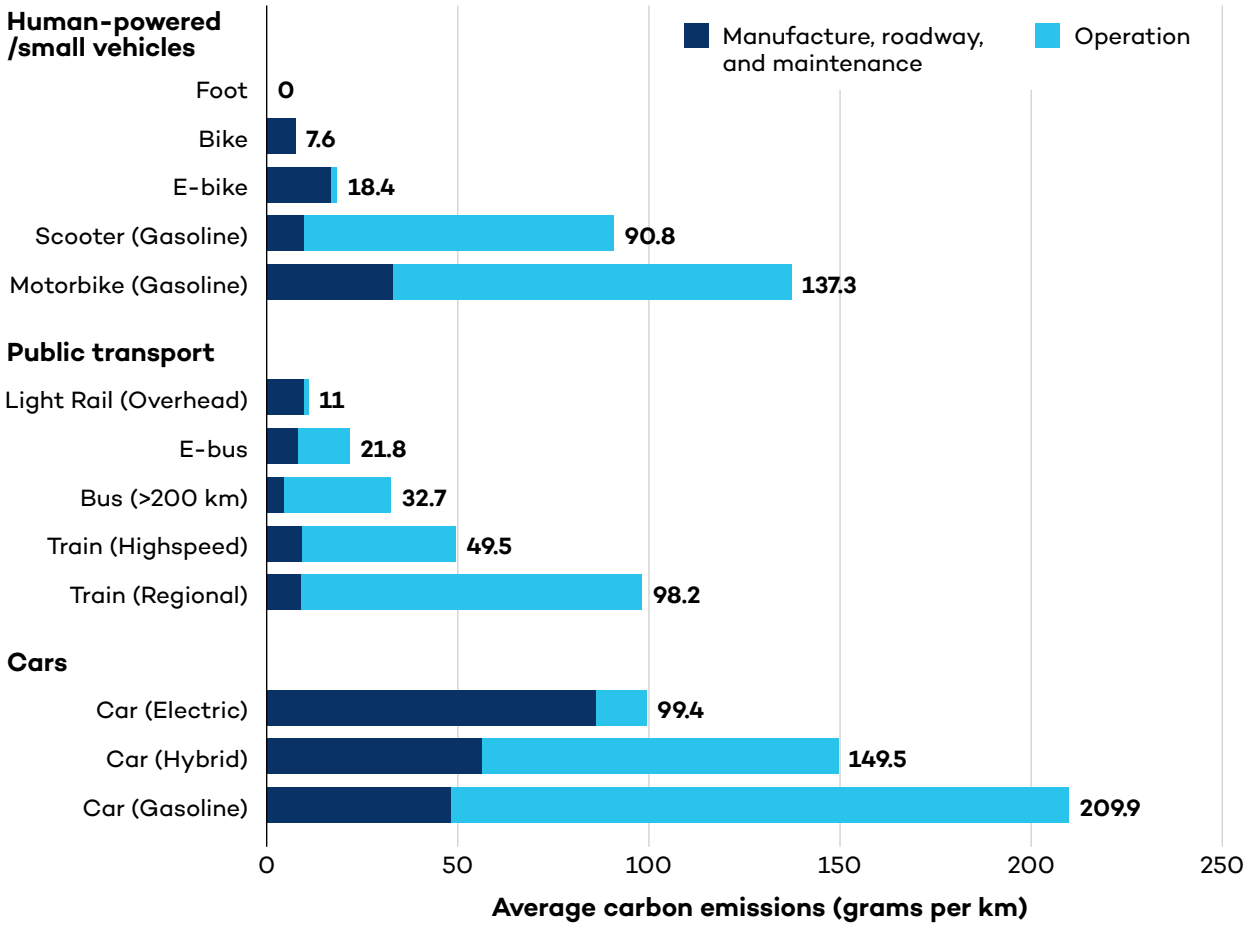
The primary reason why urban sprawl produces such high emissions can be traced to one critical factor: a transportation system that relies on individuals' use of 3,000–4,000 lb vehicles for common travel represents an exceptionally inefficient use of energy (TNMT, 2021). In high-income nations, cars are the single largest contributor to the carbon footprint of transportation (Akenji et al., 2021). For example, car traffic in Texas alone generates roughly twice the emissions of the entire country of Nigeria (Knowles, 2023). Figure 5 illustrates the emissions intensity of personal transportation relative to other option.

Sprawling urban development increases travel distances, as studies show a clear correlation between urban density and transportation emissions (Serkin, 2024; TUMI, 2014). For example, Manhattan, the most densely populated area in the United States, has one of the smallest per capita carbon footprints in the country, whereas its surrounding suburbs rank among the highest (Serkin, 2024). Researchers Kooshian and Winkelman (2011) observe that "suburban lifestyles represent one of the most serious threats to the climate." Some studies suggest that urban sprawl accounts for approximately one third of global emissions (Korn et al., 2024).

Box 2. Urban density shapes transportation emissions in Barcelona and Atlanta

The average resident of the Atlanta, Georgia, area produces more than 10 times the carbon dioxide emissions from transportation as the average resident of Barcelona, Spain, despite both cities having similar populations. The main reason is that Barcelona occupies 162 km^2—less than 4% of Atlanta's 4,280 km^2, allowing residents to easily walk, bike and take public transportation to their destinations (The Global Commission on the Economy and Climate, 2014).

Figure 5. Average carbon emissions by transportation type (in grams per km)



Source: TNMT, 2021.

Building Emissions

Single-family homes typical of urban sprawl tend to consume more energy than multi-unit residential buildings due to larger floor areas and higher exposed surface areas (Ewing & Rong, 2008; Kooshian & Winkelman, 2011; Serkin, 2024). While old or outdated multi-unit residential buildings may not have high levels of energy efficiency, they still have more potential to achieve higher levels of efficiency than single-family homes (Canada Mortgage and Housing Corporation, 2016). Additionally, the median floor area of new homes in the United States expanded by nearly 50% from 1980 to 2008, further increasing energy demand (Ewing & Rong, 2008).

Urban sprawl increases community vulnerability to climate change impacts. Spread-out infrastructure is more susceptible to extreme weather events, such as floods and wildfires. Low-density areas also face greater challenges in providing efficient emergency services and infrastructure resilience (Hamin & Gurran, 2009).

Box 3. EVs are not the silver bullet for reducing emissions

Electric vehicles (EVs) can play a role in reducing transportation-related emissions, however, relying on them as the primary strategy for decarbonization risks overlooking other effective and equitable solutions. Emissions production from the mining, refining, and transportation of clean-energy minerals, the manufacture of vehicles, the construction and maintenance of road infrastructure, and the generation of electricity to fuel the vehicles all must be taken into consideration when assessing the life-cycle emissions profile of EVs. EVs require approximately six times more mineral resources compared with a conventional car (IEA, 2022). The emissions "break-even" point between EVs and vehicles with internal combustion vehicles ranges from 49,000 km to 110,000 km of driving, due to the energy-intensive production of EVs (Volvo, 2021). Some studies even suggest that the long-term emissions impact of vehicle electrification may be negligible (Babaee et al., 2014).

The pace of EV adoption is also insufficient for rapid decarbonization (Winkler et al., 2023). With a global fleet of over 1.4 billion vehicles, EVs accounted for less than 3% of all vehicles on the road as of 2024 (IEA, 2024). Given the average lifespan of cars—15–20 years—transitioning the global fleet to EVs will take decades (Winkler et al., 2023). This slow transition is compounded by the carbon-intensive infrastructure required for roads, which must continually be rebuilt and maintained. Studies estimate the total carbon emissions from road construction to be over 10,000 tonnes/km per lane (Gao et al., 2024). Investment in car-oriented transportation systems constitutes a lock-in of fossil fuel infrastructure.

Charging millions of EVs will require substantial upgrades to aging grid infrastructure, which is already struggling to meet peak demands (Hewitt, 2024). Experts predict that achieving sufficient renewable energy capacity to support widespread EV use will require 2.2 to 3.4 times current generation levels, representing enormous financial and material investments (Canadian Climate Institute, 2022). In Ontario alone, grid upgrades for electrification are projected to cost CAD 400 billion (Penaloza, 2022). Moreover, the electricity needed for EVs will compete with other high-demand sectors that are harder to decarbonize. On the other hand, active transportation infrastructure is highly affordable, generates minimal emissions, and offers numerous additional advantages.

To achieve meaningful reductions in transportation emissions, the focus must shift from electrifying cars to reducing energy demand. A large-scale reduction in car use is essential to meet stringent carbon budgets (Winkler et al., 2023).

4.0 The Role of Urban Planning in Creating Climate-Resilient, Inclusive Communities

4.1 How Urban Planning Contributes to Climate Change Adaptation

Municipalities are responsible for different processes, such as land-use planning and emergency management, and infrastructure, such as waste management and potable water, to make communities safe and desirable places to live. All these municipal processes share concerns about climate change and the increased frequency and/or intensity of climate-related hazards.

4.1.1 Urban Planning and Heat in Cities

Climate model projects are showing that heat waves will likely become more common across the southern Prairie region, leading to negative impacts on industries, ecosystems, and human health. Urban areas are at particular risk of developing what is known as the urban heat island effect, as closely packed buildings and paved surfaces, hallmarks of urban areas such as Winnipeg, trap heat (Climate Atlas of Canada, n.d.). Some of the known impacts of the heat island effect are the following:

- buildings increase their energy consumption from air conditioning, putting additional stress on the energy grid;
- increased energy use elevates air pollution emissions and greenhouse gases (GHGs), including ground-level ozone formation;
- disadvantaged populations that do not have access to air conditioning, such as the elderly, children, people who work outdoors, and people in poor health, are particularly vulnerable to heat stress; and
- hotter pavement and rooftops increase the temperature of stormwater runoff into storm sewers and, hence, water released into streams, rivers, ponds, and lakes, often having a detrimental effect on aquatic ecosystems (Environmental Protection Agency, 2024).

Reducing the heat island effect in urban areas involves planning and implementing strategies such as constructing high-efficiency buildings to minimize reliance on air conditioning and incorporating passive cooling design elements like strategic window placements, green roofs, and urban tree planting around paved areas. As an example, the City of Toronto's Heat Relief Network provides a list of facilities with air conditioning that are open throughout the summer, especially during hot days, for all residents (City of Toronto, 2017).

4.1.2 Urban Planning and Flooding in Cities

As the climate changes across the Prairies, the frequency of flooding, drought, and wildfire events increases, with devastating and often expensive impacts (Sauchyn et al., 2020). Extreme and unpredictable weather patterns resulting from climate change present the most immediate risks to human health, municipal infrastructure, and financial recovery.

Urban sprawl contributes to flooding risks, as extensive concrete areas like roads and parking lots prevent water from naturally infiltrating the ground. Research shows that for every 1% increase in impervious surfaces, annual flood magnitude rises by an average of 3.3% (Blum et al., 2020).

Adaptive design in Winnipeg that accounts for increased severity and frequency of flooding would require coordination with watershed areas to implement resilient infrastructure solutions. This planning would include strategies like preserving, restoring, or creating green infrastructure, such as wetlands and riparian zones, alongside the construction of dikes, floodways, or reservoirs (Government of Manitoba, n.d.-b; Sauchyn et al., 2020).

4.2 How Settler Colonialism Shaped Urban Design in Winnipeg

Discussing colonialism is essential not only because Indigenous Peoples are a central part of the urban fabric of Winnipeg but also because energy policy is inherently intertwined with colonial structures. In Manitoba and globally, the intersection of energy policy and colonialism creates layers of complexity that impact energy transition (Indigenous Climate Action, 2022). For example, while the province of Manitoba has achieved nearly full decarbonization of its electricity load, this has come at the cost of displacing Indigenous Peoples from their land across the north of the province.

The legacy of settler colonialism has profoundly shaped the social and physical landscape in Winnipeg, a city home to over 100,000 Indigenous people. This history is marked by the displacement and marginalization of Indigenous communities, as well as the erasure of cultural spaces to prioritize settler interests (Nejad et al., 2019). Throughout the city's history, the Indigenous population has been organizing and asserting their voices, striving to ensure their communities are represented in the urban landscape (MacKinnon & Mallet, 2023; Toews, 2018). Today, the revitalization of Indigenous culture and placemaking is increasingly evident as Indigenous spaces are being officially recognized by settler governments throughout the city.

One striking example of colonial dispossession tied to the process of suburbanization in Winnipeg is the eviction of the Métis community from Rooster Town (Toews, 2018). This Métis settlement was forcibly cleared in the 1950s from what was then the edge of the city to make room for what is now Grant Park Mall and surrounding residential areas (Toews, 2018). The forced displacement included utility shutoffs and, in some cases, the burning down of homes.

This erasure was part of a broader suburbanization movement in Winnipeg that prioritized the expansion of car-dependent infrastructure and suburban development.

Box 4. Indigenous urban development in Winnipeg

Today, Indigenous governments have become some of the most prominent land developers in Winnipeg. Their developments are not solely driven by economic objectives but are also strategically aimed at addressing Indigenous social needs like housing, community building, and well-being. These initiatives reflect a holistic approach to urban development, embodying what truly equitable places should strive to be. Many of these spaces also demonstrate complete communities that include mixed-use developments, integrating residential, commercial, and recreational areas together.

Key Indigenous developments in Winnipeg in recent years:

- **Manitoba Métis Federation (MMF) development downtown:** In the summer of 2024, the MMF purchased two large office towers in downtown Winnipeg as an investment in downtown revitalization (Bernhardt, 2024).
- **Portage Place:** True North Real Estate Development and the Southern Chiefs' Organization (SCO), representing 34 Anishinaabe and Dakota First Nations across southern Manitoba, are collaborating to build a 15-storey residential project at the Portage Place site (CBC News, 2024).
- **Wehwehneh Bahgahkinahgohn:** Announced in 2022, the SCO will redevelop Winnipeg's historic six-storey, 60,000-m^2 Hudson's Bay building in downtown Winnipeg into an Indigenous hub. The project will include housing, social services, government offices, and cultural spaces (CTV News, 2024)
- **Naawi-Oodena:** Formerly the Kapyong Barracks, this site is being redeveloped by Treaty One Nations into Canada's largest urban reserve. The mixed-use project integrates residential, commercial, and cultural spaces, representing reconciliation, economic opportunity, and Indigenous leadership (Treaty One Development Corporation, 2021)

Urban development in Winnipeg has been shaped by colonial structures that have marginalized Indigenous people. Despite this, Indigenous communities have been reclaiming space and asserting their leadership in the creation of equitable urban environments in the city. These efforts underscore the transformative potential of integrating Indigenous perspectives into city planning.

5.0 The Goal of Creating Complete Communities and Barriers to Making it a Reality

Complete communities are a central component of emission-reduction policy in cities: they are high-density, mixed-use neighbourhoods that prioritize walkability, bikeability, and access to efficient public transportation. These communities minimize energy use while enhancing livability and are central to a low-emissions future. A variety of barriers currently hold back their development in cities.

5.1 Why Complete Communities Are Key to Reducing Emissions

Effective energy policy should aim to create complete communities that enable urban residents to live fulfilled lives without depending on carbon-intensive infrastructure. While there is no single definition, complete communities are typically characterized by compact, mixed-use development, proximity to transit facilities, and high-quality pedestrian infrastructure (City of Winnipeg, 2022c; National Academies of Sciences, Engineering, and Medicine, 2004). The concept of complete communities is closely related to the concepts of cities for people (Gehl, 2010) and transit-oriented development (National Academies of Sciences, Engineering, and Medicine, 2004).

Complete communities are often valued for their contributions to the quality of life, but they also represent inherently low-energy and, therefore, low-carbon urban models. The very features that make cities beautiful and vibrant also tend to reduce carbon emissions. As urban planner Jan Gehl notes, "there are direct connections between improvements for people in city space and visions for achieving lively, safe, sustainable, and healthy cities" (Gehl, 2010). The qualities of safety, public health, and sustainability are interlinked. Walkable and bike-friendly areas are more energy efficient and create more enjoyable, inviting environments. The movement toward complete, people-centred communities should not only resonate with urbanists but also with energy policy-makers, who have a shared an interest in creating low-carbon spaces.

A low-energy urban development pattern is characterized by the following factors (Asarpota & Nadin, 2020; Resnik, 2010; Serkin, 2024; Smart Growth America, 2006):

- high population density
- mixed-use development
- walkable and bikeable neighbourhoods
- access to efficient public transportation

High Population Density

Density plays a critical role in establishing complete communities, as it contributes to economic efficiency for neighbourhoods through increased sharing and, hence, reduced costs of city services and infrastructure (Jacobs, 1961; Serkin, 2024). Dense populations also provide a more reliable customer base for local businesses, a critical part of community economic health. From a low-carbon perspective, density is essential as it enables amenities, workplaces, and services to be situated closer together, reducing the need for extensive travel and making active transportation and public transit viable options.

Mixed-Use Development

By combining residential, commercial, and recreational spaces within the same area, mixed-use development physically brings services and infrastructure in the community closer together. In its Planning Resource Guide, the Government of Manitoba discusses how clustering various land uses together can help to reduce emissions because of a reduction in the number and length of car trips and increases the viability of low-carbon transportation options (Government of Manitoba, n.d.-a). Emphasizing mixed-use development in communities aligns with Jane Jacobs' vision of arranging diverse neighbourhood uses like pieces on a chessboard, creating a dynamic urban fabric (Jacobs, 1961).

Walkable and Bikeable Neighbourhoods

Communities with mixed-use development and urban density facilitate comfortable active transportation options, such as walking and cycling. These forms of mobility align with natural human movements as our bodies are designed for active, daily activity. Successful cities are designed on a human scale, prioritizing people over cars (Gehl, 2010).

Access to Efficient Public Transportation

Public transportation is an integral element of low-carbon urban planning, as it represents an energy and space-efficient transportation method. It also reduces the need for private ownership. Public transportation naturally complements mixed-use development and urban density, as effective transit systems depend on these factors for optimal service. In densely populated areas, where amenities and destinations are close by, public transportation is both more effective and widely used, allowing for frequent, reliable service that meets community needs (Litman, 2020).

5.2 Three Key Barriers to Complete Communities

Despite the fact that many cities strive to make their communities more dense, walkable, and sustainable, efforts to implement complete communities are blocked by a variety of political and policy barriers.

5.2.1 Opposition from Local Landowners (NIMBY Movements)

"Not In My Backyard" (NIMBY) opposition, often driven by fears of increased congestion, reduced parking, or potential harm to local businesses, often obstructs the development of complete communities (Deweerdt & Fabre, 2022). This issue impacts all aspects of city planning, from governance and finances to minimum parking requirements. While residents should have a voice in shaping their neighbourhoods, the current system allows a small but vocal group of opponents to block sustainable infrastructure projects. This disconnect between planning guidance and public sentiment highlights a governance system overly susceptible to local political pressures. Canadian cities that have successfully implemented pathways toward complete communities have had to invest substantially in public engagement to overcome NIMBY opposition (Climate Caucus, 2024).

5.2.2 Flawed Governance Systems

In Winnipeg, a flawed municipal governance system has been identified as a significant barrier to the creation of complete communities. A key issue with respect to complete communities is the outsized influence of city councillors over project approvals. Under the ward system, area councillors hold significant sway, often prioritizing local concerns over broader city-wide benefits. Decisions are frequently influenced by constituent feedback rather than administrative recommendations (Cook, 2018). Compounding this issue, the approval process is unnecessarily complex, requiring decisions to pass through multiple committees, with elected officials voting at every stage (MNP Consulting, 2020). A 2020 governance review in Winnipeg supports this assessment, noting that most comparable cities delegate greater authority to planning staff and also have a more streamlined review process (MNP Consulting, 2020).

Additional issues within the structure of Winnipeg's governance system include the strong mayoral system that currently centralizes authority to the mayor (Toews, 2017). Shifting to a weak mayoral system would distribute power more evenly between the mayor and councillors, promoting greater collaboration and accountability by requiring broader support for decisions, ultimately decentralizing the decision-making process. Winnipeg's wards have also been criticized for being too large, which prevents effective local representation (Toews, 2017).

5.2.3 The Broken Finances of Sprawl

One of the key barriers to creating complete communities is the severe financial strain on municipal governments caused by urban sprawl. Even though complete communities are

significantly more affordable compared to standard suburban development, the high costs of urban sprawl deplete municipalities' finances and prevent investment in low-carbon infrastructure (Marohn Jr., 2019). This financial strain is evident in Winnipeg, where fiscal pressures have not only undercut sustainable infrastructure investments but also led to the closure of community infrastructure such as bridges, pools, and community centres.

Researchers, urban planners, and policy-makers increasingly recognize that suburban development drains municipal finances (Canadian Centre for Policy Alternatives [CCPA], 2014; Environmental Defence, 2013; Marohn Jr., 2019; Reid-Wainscoat et al., 2024; Thompson, 2013). Low-density, car-oriented infrastructure imposes high costs on municipalities, primarily due to roads and pipe infrastructure, which typically represent more than 80% of municipal expenses. Extending these services to sparsely populated suburban areas places a significant burden on city finances.

While municipal governments across North America are able to fund the initial construction of infrastructure projects, they consistently underestimate the long-term costs of infrastructure maintenance. Maintenance costs accumulate over decades into infrastructure debts that are too large for municipalities to manage. This is not just a matter of having expensive infrastructure, but rather represents a kind of financial crisis for municipalities: cities cannot afford their infrastructure (Marohn Jr., 2019).

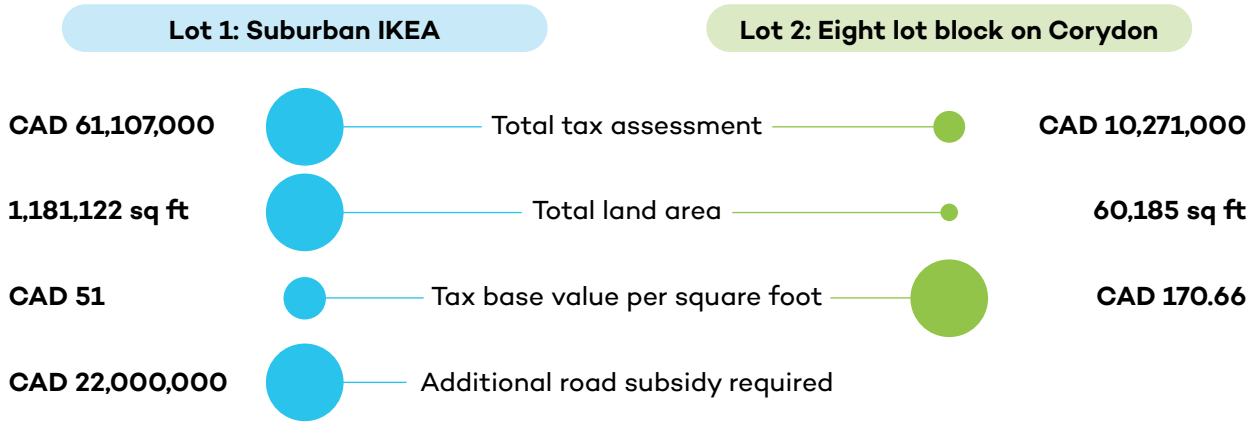
5.2.3.1 How Urban Sprawl Undermines Winnipeg's Tax Revenues

Sprawling developments in Winnipeg are a burden to the city's finances in two major ways: they generate low tax revenues compared to more dense areas, and they incur high long-term infrastructure costs.

The example in Figure 6 highlights the first challenge by comparing the financial productivity of Winnipeg's IKEA and eight small lots on a block on Corydon Avenue between Hugo and Cockburn (City of Winnipeg, 2024a). The more dense, walkable block produces more than three times the tax assessment revenue per square foot than the sprawling IKEA. If the IKEA lot were as financially productive as an average block on Corydon, it would produce an additional CAD 140 million in tax assessment for the city. Moreover, the provincial and municipal governments paid CAD 22 million in subsidies to cover the costs of a required road widening for the IKEA store (Kives, 2017).

On average, the less sprawling neighbourhoods in central Winnipeg generate between 50% and 80% more taxes per hectare than suburbs built on the edge of the city (Bellamy, 2022). This is consistent with the costs of sprawl across Canada, as cities such as Halifax and Calgary have found that urban sprawl costs those cities billions of dollars each year (Environmental Defence, 2013; Thompson, 2013).

Figure 6. Comparing the finances of urban sprawl vs. compact development in Winnipeg

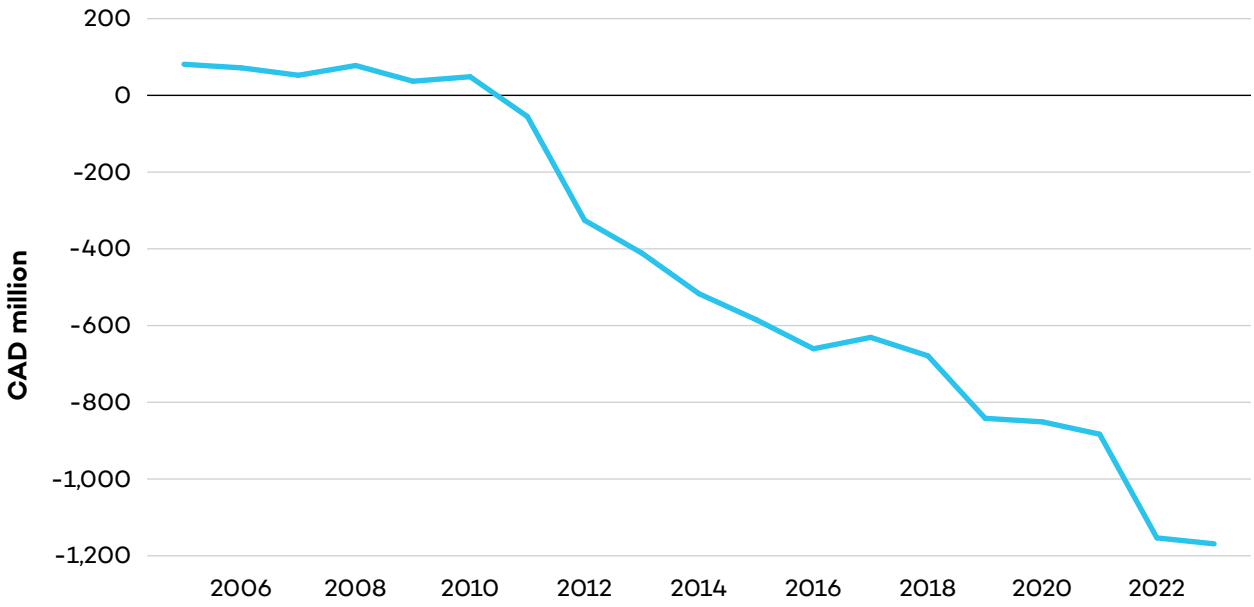


Source: City of Winnipeg, 2024a.

5.2.3.2 How Urban Sprawl Traps Winnipeg Into Unsustainable Infrastructure Spending

Winnipeg's population has increased by 37% over the past 50 years, while its physical area has nearly doubled (City of Winnipeg, 2022c). As a result, each taxpayer now shoulders the financial responsibility for approximately 40% more infrastructure compared to 5 decades ago. In 2022, each citizen of Winnipeg was responsible for 2.5 times more pipe than in the 1940s and 70% more than in the 1970s (Bellamy, 2022).

Figure 7. City of Winnipeg net financial position 2008–2022



Source: City of Winnipeg, 2008–2023.

Under these budget constraints, infrastructure in Winnipeg continues to deteriorate, and the city no longer has the funding to maintain key infrastructure, such as the Arlington Bridge, Kelvin Community Centre, the Norwood pool, the city's tree canopy, and the John Blumberg Softball Complex (Elmwood Guy, 2023). The city has also reduced its annual grant funding to community organizations by 10% across the board, jeopardizing the stability of youth programs and addiction treatment services (CBC News, 2020).

5.2.4 Other Challenges Hindering Complete Communities

Other barriers preventing the establishment of complete communities in our cities are described here.

Zoning Bylaws

Zoning bylaws, often called "land-use bylaws" in Canada, are tools used by municipalities to regulate the types of activities and buildings on different pieces of land (Bronin, 2024). In many Canadian and North American cities, large areas are zoned exclusively for single-family homes, effectively preventing mixed-use neighbourhoods. This zoning makes vibrant city life impossible by physically separating residential areas from workplaces, stores, and services, forcing residents to rely on cars. Adopting zoning strategies that enable complete communities is critical for reducing carbon emissions (Deweerdt & Fabre, 2022; Federation of Canadian Municipalities [FCM], 2022; Government of Manitoba, n.d.-a; Serkin, 2024; Zhang et al., 2018).

Developer Incentives

The private sector, particularly developers, significantly shapes urban landscapes. In Winnipeg, developers face greater logistical challenges with infill projects than with greenfield development (Cook, 2018). Infill requires costly infrastructure adaptation and negotiation with multiple landowners (Cook, 2018). Developers often work in isolation, complicating mixed-use projects, which lenders frequently deem too risky (National Academies of Sciences, Engineering, and Medicine, 2004).

Minimum Parking Requirements

Across North America, minimum parking requirements have long been recognized as a significant barrier to achieving complete communities (National Academies of Sciences, Engineering, and Medicine, 2004). This issue is relevant in Winnipeg, where parking stalls can range between CAD 15,000 and CAD 23,000 to construct, often adding millions to project costs (Cook, 2018). The city of Edmonton's abolition of parking minimums offers a progressive model for addressing this issue while fostering more efficient land use (Climate Caucus, 2024).

6.0 Solutions for Creating Cities for People/ Complete Communities

This chapter explores how Winnipeg could foster the evolution of complete communities that allow residents to live vibrant, low-emission lifestyles while enhancing the city's financial position. Many cities have already taken significant steps to remove barriers to complete communities, offering valuable lessons that Winnipeg can adapt to its context. Drawing from these case studies, this section highlights four solutions that can guide the city toward creating more sustainable urban environments.

6.1 Solution 1: Transform land-use planning

Recommendations for transforming land-use planning

1. Embrace city-wide zoning reforms that prioritize density and mixed-use development

6.1.1 Embrace City-Wide Zoning Reforms That Prioritize Density and Mixed-Use Development

Winnipeg should swiftly reform its zoning rules to prioritize higher-density and mixed-use development. By allowing higher-density developments and overcoming restrictive single-family zoning, the city can better utilize existing infrastructure while increasing the housing supply. For example, enabling multi-storey buildings with mixed uses—such as commercial spaces on ground floors and residential units above—along key corridors can foster walkable, lively neighbourhoods. Cities such as Edmonton and Ottawa have made such changes to their zoning rules or are currently making those changes, and they can serve as examples for Winnipeg.

The zoning reforms should clearly prioritize infill developments over urban expansion on greenfields in the periphery. Underused spaces such as parking lots and single-storey buildings can be replaced with slightly larger, multi-use structures that expand the tax base without requiring costly infrastructure expansion. Strategically focusing development within areas already served by infrastructure minimizes the need for new investments while reducing emissions. It lowers per capita infrastructure costs and promotes sustainable transportation systems. In addition, this approach protects green spaces from urban encroachment, preserving them for climate adaptation and biodiversity.

6.1.2 Case Study: Creating sustainable neighbourhoods through strategic land-use planning in Ottawa

Instead of accommodating newcomers in sprawling suburbs, the Canadian capital aims to create compact developments that support both environmental sustainability and an enhanced quality of life.

6.1.2.1 Ottawa's Official Plan

Ottawa's new Official Plan, adopted in 2022, lays the foundation for strategic land-use planning that sustainably accommodates the city's growth of 400,000 people by 2050 (City of Ottawa, 2022). The plan aims to handle growth mainly by intensification rather than by greenfield development (see Figure 8), shift trips to sustainable modes of transportation, and create vibrant neighbourhoods through improved urban design tailored to the local context. In addition, the Official Plan includes measures for creating complete communities with benefits for public health and climate adaptation and mitigation.

Figure 8. Illustration of mixed uses and densities in a 15-minute neighbourhood

Source: City of Ottawa, 2022, reprinted with permission.

6.1.2.2 Ottawa's Draft Zoning Bylaw

While the Official Plan provides the vision and high-level framework for spatial planning in Ottawa, a new zoning bylaw is under development to translate the vision into more detailed rules (Ren, 2024). The bylaw, expected to be adopted in 2025, introduces new Neighbourhood (N1-N6) zones, focusing on regulating density, built form, height, and massing rather than specific dwelling types (City of Ottawa, 2024). These zones are designed with an iterative, gradual approach to increase density over time, particularly in areas designated for growth.

The neighbourhood zones are mostly for residential use (yellow on the map) (City of Ottawa, 2024). In more urban areas or close to important street corridors, commercial uses like banks, daycare centres, retail stores, and restaurants are allowed on the ground floor or basement. With this zoning, the city aims to allow a variety of small commercial uses complementing the housing so that residents can conveniently access them by walking, cycling, and using public transit.

Mainstreet zones (purple) encourage pedestrian-friendly, mixed-use developments along city corridors, combining residential dwellings with a wide variety of other uses, such as restaurants, stores, schools, hotels, offices, and medical facilities (City of Ottawa, 2024). These zones prioritize compact, active streetscapes, fostering vibrant public spaces.

Figure 9. 3D interactive map illustrating Ottawa's new draft zoning bylaw

Source: City of Ottawa, 2024, reprinted with permission.

6.1.3 Case Study: Transit-oriented development in Minneapolis

The Minneapolis–Saint Paul metropolitan area, also known as the Twin Cities, encompasses over 15 counties and had about 3.16 million residents in 2020 (Metropolitan Council, 2023). The region's low population density of about 1,000 per km^2 reflects sprawling suburbs dominated by single-family homes, leading to heavy automobile reliance. Cars account for 68% of all trips, contributing to 24% of GHG emissions in Minneapolis (City of Minneapolis, 2020b). While Winnipeg is smaller and has a slightly higher population density, it faces similar challenges with modal splits and climate conditions (World Population Review, 2024b).

6.1.3.1 Transportation Action Plan and Complete Streets

To meet climate goals, improve air quality, and enhance low-cost transportation access, Minneapolis aims to shift travel behaviour. By 2030, the city aims to accommodate 25% of trips by walking, 10% by cycling or scooters, and 25% by public transit while reducing car trips to 20% (City of Minneapolis, 2020a). Investments in transit infrastructure, urban density policies, and safer street designs are central to this strategy. For example, the Complete Streets Policy prioritizes vulnerable road users by designing streets for pedestrians, cyclists, and transit users. It incorporates green infrastructure to manage stormwater, reduce heat, and promote active mobility. Planners can draw on the city's *Street Design Guide* to create streets that safely accommodate light rail, cars, protected bike lanes, sidewalks, and greenery (City of Minneapolis, 2024).

6.1.3.2 Transit-Oriented Development

Regionally, the Metropolitan Council promotes transit-oriented development (TOD) to enhance sustainability and equity (Metropolitan Council, 2018). TOD links public transit to higher-density, mixed-use developments, creating transit demand and efficiency. Since 2004, the Twin Cities have expanded "high-frequency transit" through light rail and bus rapid transit systems, such as the Orange Line BRT, which opened in 2021 and connects Minneapolis to Burnsville (Metro Transit, 2021).

Policies encouraging denser developments have driven significant change. Although only 3% of land lies within half a mile of high-frequency transit, these areas have attracted USD 16.4 billion in new development since 2009, representing 37% of permitted regional development (Metro Transit, 2023). More than 53,000 multifamily units have been built near transit, reducing reliance on single-family homes. TOD has also increased property tax revenues. Land near high-frequency transit, accounting for just 2% of parcels, generates over 25% of the region's tax revenue, with infill developments near stations driving faster revenue growth (Metro Transit, 2024).

6.2 Solution 2: Reduce car dependency through active and public transportation

Recommendations for transportation

1. Optimize urban land and street space for sustainable mobility
2. Manage traffic through space reallocation
3. Reform parking policies
4. Enhance public transportation and integrated planning

Overdependence on individual motorized transportation in urban environments contributes to GHG emissions, air pollution, noise, and traffic accidents. This increases transportation costs for everyone and limits accessibility for non-drivers. It also leads to adverse health outcomes and social inequalities while consuming vast amounts of urban space that could be repurposed for more economically and socially beneficial uses. A combination of policy distortions—such as land-use regulations favouring car-centric development, planning practices prioritizing automobile travel, and pricing mechanisms that fail to account for externalities—has exacerbated these issues. Addressing these issues is essential to creating more sustainable and inclusive urban transportation systems.

Municipal governments can encourage alternatives to private car use by investing in accessible, car-free mobility options, including public transit, active transportation such as walking and cycling, and micromobility solutions like car sharing. This approach requires investing in and developing public and active transportation infrastructure that also accommodates the needs of vulnerable groups who may rely on private vehicles. The transition can begin with reallocating road and parking spaces for sustainable modes of transportation, supported by complementary measures such as road pricing schemes and integrated land-use planning.

Prioritizing sustainable transportation options will lead to more efficient road space utilization, enhance the appeal of non-motorized modes, and improve accessibility to key areas. These efforts will also yield broader benefits, including reduced environmental impacts, improved road safety for non-motorists, and the creation of more attractive and liveable urban streetscapes. Key recommendations to achieve the above objectives include the following:

1) Optimizing urban land and street space for sustainable mobility

Cars dominate urban space relative to their usage. By reallocating space to public transportation, cycling, and walking, authorities can increase mobility options for non-drivers and encourage a shift to space-efficient modes. This transition should accommodate micromobility, such as e-scooters and e-bikes, by expanding cycling infrastructure to enhance safety and appeal.

2) Managing traffic through space reallocation

Strategically reducing road space for private cars, combined with improving layouts for pedestrians and cyclists, can manage traffic effectively. Evidence shows that such measures often reduce congestion as drivers adapt, a phenomenon known as "disappearing traffic." Moreover, reallocating space enhances public areas, boosting retail activity and community support, as it avoids the resistance associated with direct road pricing.

3) Reforming parking policies

Eliminating minimum parking requirements for new developments reduces urban sprawl, lowers housing costs, and supports compact, sustainable urban growth. Parking reforms, such as dynamic pricing, discourage excessive driving, optimize space use, and benefit local businesses by increasing parking turnover. Similarly, ending employer-paid parking subsidies can reduce car commutes, especially when public transit or micromobility alternatives are offered as benefits.

4) Enhancing public transportation and integrated planning

Improving the quality and reliability of public transportation is crucial for encouraging a modal shift. Measures such as peak pricing can manage demand and fund better services, reducing both crowding and road congestion. Long-term strategies should integrate transportation and land-use planning, promoting compact urban development that aligns transit networks with high-density corridors. Relaxing restrictive land-use regulations, like height limits, can further support densification and reduce car dependency.

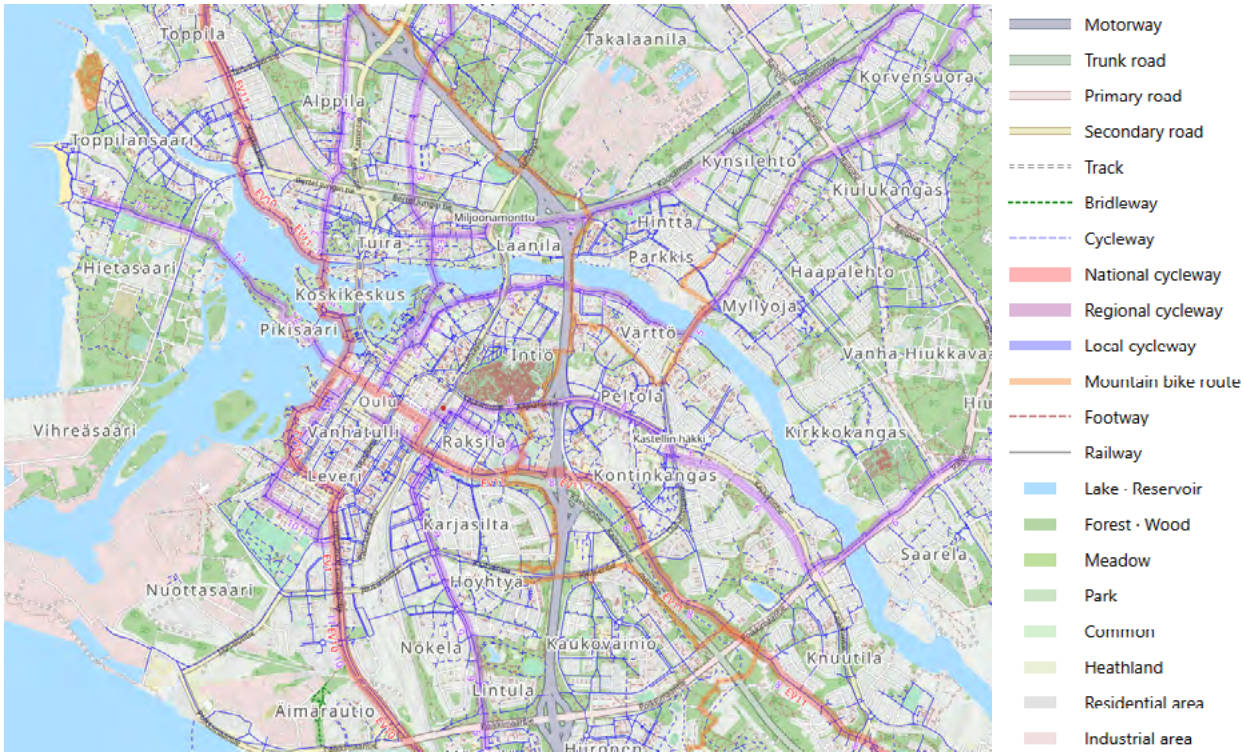
6.2.1 Case Study: Winter cycling in Oulu, Finland

Oulu, a city of about 212,000 residents near the Arctic Circle, is globally renowned as the winter cycling capital of the world. Despite facing cold winter conditions similar to Winnipeg and snow covering the ground for 5 months a year, cycling remains a popular mode of transportation throughout the year (Ives, 2023). Even in the coldest months, approximately 12% of all journeys in Oulu are made by bicycle (Ives, 2023), with a year-round average of 18% for cycling and 20% for walking (City of Oulu, 2023). In contrast, walking and cycling combined only accounted for 7% of all work trips in Winnipeg in 2016 (City of Winnipeg, 2024a)

Oulu fosters walking, cycling, and public transportation in an effort to achieve carbon neutrality by 2035. The city invests in all-season cycling infrastructure based on its city strategy and sustainable urban mobility plan (City of Oulu, 2023). The city's cycling network spans over 600 km (373 miles) and largely consists of protected bike lanes, which is particularly important when snow covers road markings (see Figure 10 illustrating the cycling network). To facilitate cycling in winter, the snow-clearing services in the Finnish city prioritize cycling paths, with major routes cleared early in the morning to ensure that they are accessible for commuters even after heavy snowfalls (Swanson, 2016). Urban planners in Oulu have also focused on creating a compact city layout, where most destinations are within cycling distance.

The experience of Oulu demonstrates that winter cycling is possible with the right infrastructure and maintenance. Key lessons for Winnipeg include prioritizing the maintenance of cycling infrastructure, designing a connected network that links key destinations, and promoting winter cycling as a normal, accessible option.

Figure 10. Cycling routes in Oulu



Source: Authors, with maps from OpenStreetMap.com.

6.3 Solution 3: Create fiscal space for climate investments

Recommendations for creating fiscal space

1. Implement a mechanism to make infrastructure decisions based on life-cycle costs and social, economic, and environmental benefits
2. Amend the City of Winnipeg Charter to allow a more diverse set of tools to raise money for the municipality
3. Reallocate climate change funding away from techno-solutions and toward urban planning efforts

6.3.1 Implement a Mechanism to Make Infrastructure Decisions Based on Life-Cycle Costs and Social, Economic, and Environmental Benefits

The first step in overcoming the barriers to establishing complete communities is to stop infrastructure investments that generate financial instability. Municipalities must analyze the rigorous return on investment for all infrastructure projects to ensure that new developments contribute more revenue or societal benefits than they cost to maintain. Building neighbourhoods that will ultimately lose more money than they generate for the city is incompatible with a sustainable future. For Winnipeg, this means halting projects like the expansion of Kenaston Boulevard, which prioritizes sprawl and car dependency over more efficient and productive land use. By reevaluating the financial viability of infrastructure investments, cities can begin to redirect resources toward developments that align with the principles of complete communities.

6.3.2 Amend the City of Winnipeg Charter to Allow a More Diverse Set of Tools to Raise Money

Like many cities, the City of Winnipeg is limited in its ability to generate revenue, relying primarily on property taxes. This model of revenue generation has limitations—for example, property taxes do not automatically grow with the economy, meaning the city's revenue remains stagnant even as costs increase (Harney, 2022). Additionally, the Government of Manitoba has reduced financial support for Winnipeg, discontinuing the 50/50 transit operating grant and opting not to invest carbon tax revenues into the city's transit system (Harney, 2022). Across the country, municipal governments have faced a steady reduction in their share of Canadian tax revenue since 1990 (FCM, 2024).

Compared with other municipalities, Winnipeg generates relatively low revenue through taxes and fees. Other Prairie cities in Canada collect, on average, 44% more revenue per capita than Winnipeg (City of Winnipeg, 2018). Since 1998, property taxes in these Canadian cities have nearly doubled—an average increase of 98%—whereas Winnipeg has raised property taxes by only 9% (City of Winnipeg, 2018). Adjusted for inflation, Winnipeg's revenue is lower today than it was 30 years ago, which has led to a continuous cycle of service cuts (Harney, 2022).

The CCPA has suggested four key policy ideas to enhance municipal revenue in the city of Winnipeg. These recommendations generally align with suggestions from other Canadian organizations to enhance the financial position of municipalities (FCM, 2024).

Raise Property Taxes

Winnipeg has one of the lowest property tax rates among Canadian cities, which has contributed to long-term stagnation in municipal revenues. The CCPA recommends an additional 5% property tax increase that low-income households would be exempt from. This would add only CAD 136 to the average property tax bill of CAD 1,857 from 2021. This tax should be earmarked for active or public transportation infrastructure.

Renewed Impact Fee

Suburban developments must pay for their fair share of resources. An impact fee is one of the most effective ways to ensure that the city does not lose money to homes built on the periphery of the city. The City of Winnipeg attempted to implement an impact fee in 2017; however, the fee was overturned in court because they did not clearly explain how the funds would be allocated. This impact fee could be reinstated if this issue were clarified (Harney, 2022).

A Parking Lot Levy

A parking lot levy is a fee on surface parking spaces. This levy would help to reflect the true cost of car infrastructure, which is currently unacknowledged and taken on as a burden by the municipality. By placing a cost on underutilized urban space, the levy would not only help fund essential city services but also encourage landowners to consider more sustainable and revenue-generating uses for their property, such as mixed-use developments (Harney, 2022).

A Commuter Fee

People who commute into the city while residing outside of city limits benefit from city infrastructure but do not pay. A commuter fee is a charge on vehicles crossing into the city to account for their share of infrastructure use. By introducing a commuter fee, Winnipeg could generate an estimated CAD 28.2 million in additional revenue annually. Such a fee could be applied through tolls on major entry points, charges for parking in urban areas, or direct levies on vehicles registered outside the city (Harney, 2022).

6.3.3 Reallocate Climate Change Funding Away From Techno-Solutions and Toward Urban Planning Efforts

Current climate funding often prioritizes techno-solutions such as EV subsidies or carbon capture and storage investments. Redirecting these funds toward creating complete communities would yield far greater emission reductions. For example, the Province of Manitoba offers a CAD 4,000 rebate on purchases of EVs up to CAD 70,000 (Government of Manitoba, 2023). Individuals who choose to walk or cycle instead of using a car produce significantly fewer emissions, yet do not have their lifestyle choices subsidized. Additionally, the e-bike market is vastly outpacing the EV market, offering a more effective solution for displacing fossil fuel use while demanding far fewer municipal resources than EVs (Azhar & Uzair, 2023; Ulrich, 2021). Yet e-bikes receive no significant government subsidies in Manitoba, and bicycle infrastructure is wanting in the city of Winnipeg. This disparity demonstrates a misalignment in policy priorities.

6.4 Solution 4: Shift mindsets toward a low-emission city and lifestyles

Recommendations for changing mindsets

1. Raise awareness for the true costs of infrastructure and the importance of complete communities among key stakeholders

Leveraging urban planning to reduce emissions requires a shift in mindset among policy-makers, property developers, urban and transportation planners, and residents. This shift must include raising awareness of the financial and environmental costs of urban sprawl, which is exacerbated by outdated zoning practices, alongside the benefits of adopting complete communities. Ambitious urban planning projects require a strong political champion to navigate institutional complexities, build public support, and counter opposition from NIMBY groups (National Academies of Sciences, Engineering, and Medicine, 2004).

Decision-makers must understand the challenges posed by sprawling development, including its unsustainable financial burden on municipal budgets and its contribution to GHG emissions. By highlighting the advantages of dense, mixed-use neighbourhoods—such as reduced infrastructure costs, improved access to services, and enhanced quality of life—leaders can be empowered to champion sustainable urban planning. The SAVi assessment in this report offers valuable insights into the diverse benefits of sustainable mobility in Winnipeg.

Box 5. Zoning reforms in Edmonton

The City of Edmonton has recently implemented a series of transformative zoning changes that have set a new standard for progressive urban planning in Canada. These reforms include (Climate Caucus, 2024)

- the elimination of single-family zoning,
- the removal of parking minimums, and
- a city-wide zoning bylaw renewal initiative.

These reforms have established Edmonton as a leader in zoning innovation, demonstrating how municipalities can use regulatory tools to foster more sustainable and economically resilient communities (National Academies of Sciences, Engineering, and Medicine, 2004). This progress was made possible by the ambition and courage of the public sector to take bold action and prioritize transformative change for the future of their city (Mazzucato, 2020).

7.0 The Benefits of Shifting to Sustainable Transportation in Winnipeg: SAVi

This research incorporates insights from the SAVi methodology. SAVi is a customized methodology that provides policy-makers and investors with a comprehensive analysis of how much their infrastructure projects and portfolios will cost throughout their life cycles, considering risks that are overlooked in a traditional valuation. SAVi is based on a combination of systems thinking and various modelling methodologies that aim to integrate a wide range of economic, social, and environmental impacts.

In the context of Winnipeg, SAVi sheds light on the social, economic, and environmental benefits of shifting to more sustainable land-use and mobility patterns. It explores alternative urban planning and mobility approaches, such as non-motorized transportation and public transportation systems, that aim to reduce private vehicle use and encourage a more climate-friendly approach to urban development.

The SAVi assessment includes a qualitative systems map, or causal loop diagram (CLD), showing the main challenges, drivers, and potential solutions to urban sprawl in Winnipeg. It also includes a quantitative analysis that will include different scenarios, data, and assumptions of the impacts of changing mobility patterns in Winnipeg. Finally, an integrated cost-benefit analysis (CBA) is included that will highlight the benefits of a more sustainable urban development approach.

Indicators that will be quantified across current and sustainable mobility scenarios include

- avoided carbon emissions,
- avoided health costs related to reduced air pollution,
- avoided costs of fuel or vehicle use,
- avoided costs of traffic accidents,
- added retail revenue,
- added property value and property tax,
- added public transit fares, and
- added employment and income creation.

A typical SAVi assessment output includes a qualitative model or CLD; the monetary value of economic, social, or environmental added benefits and avoided costs; and a scenario analysis that compares these benefits over time. In the case of transportation-related assessments, this could include the implementation of the “Avoid, Shift, Improve” approach, using a multi-dimensional and systemic approach.

As a first step, the main challenges and drivers of urban sprawl in Winnipeg are identified, drawing on secondary research and local data related to urban planning, infrastructure systems,

transportation, energy, and other key factors. These qualitative indicators are summarized in a CLD. A CLD includes circular causal relations between variables from causal or feedback loops. These can be positive or negative. A negative feedback loop tends toward a goal or equilibrium, balancing the forces in the system. A positive feedback loop can be found when an intervention triggers other changes that amplify the effect of that initial intervention, thus reinforcing it (Forrester, 1961). CLDs also capture delays and nonlinearity.

The creation of a CLD enables the combination of ideas, knowledge, and opinions; highlights the boundaries of the analysis; and allows all stakeholders to achieve basic-to-advanced knowledge of the analyzed issues and their systemic properties. Subsequently, some parameters are selected for quantification, and some intervention actions will be prioritized. Based on the above, three scenarios were developed: one business-as-usual car-centric scenario, one low-ambition sustainable urban planning/transportation scenario, and one high-ambition sustainable urban planning/transportation scenario.

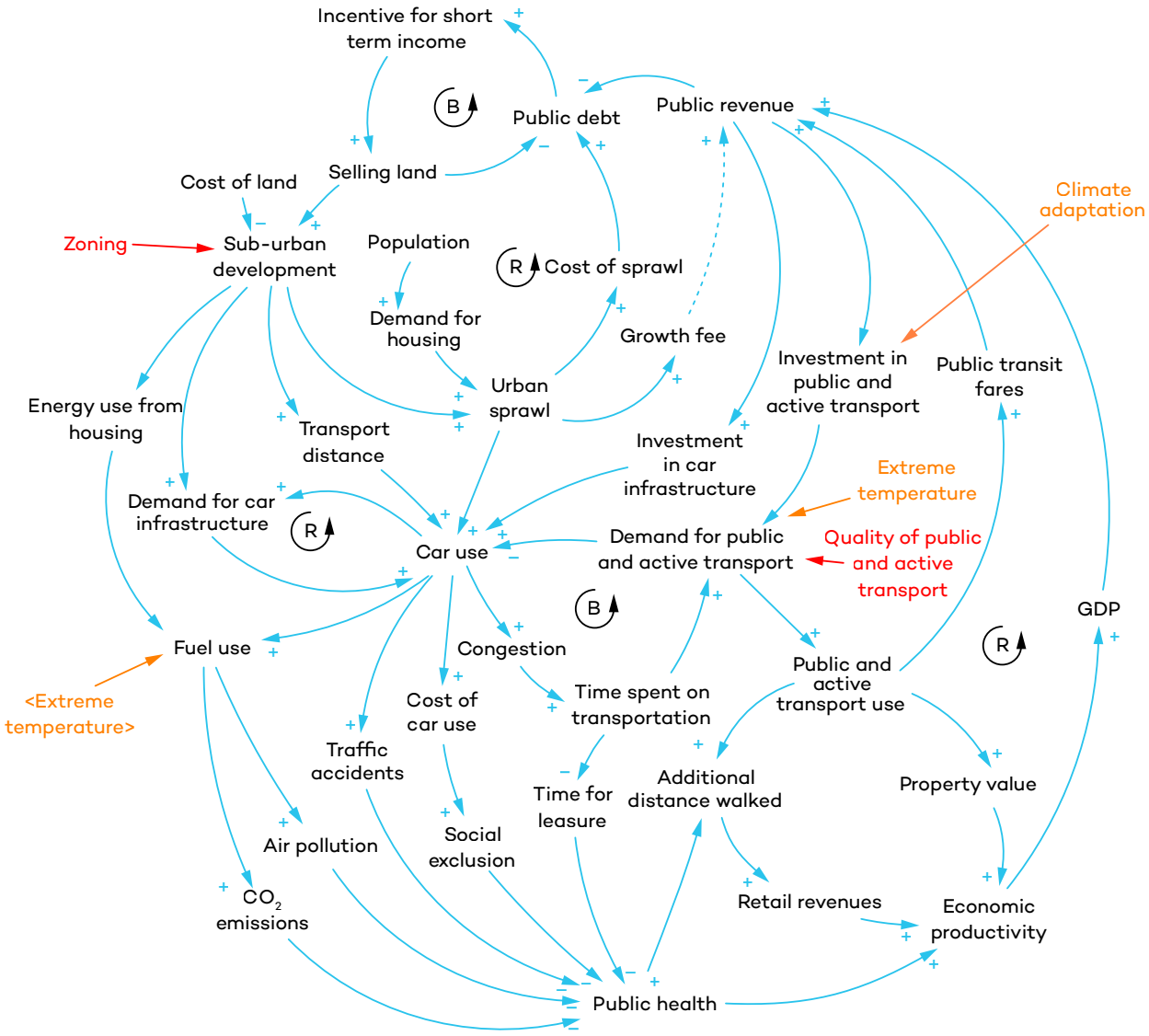
Some of the possible data requirements to better understand the transportation context in Winnipeg include trips/passengers and trip length by transportation mode, modal split, the number of private vehicles circulating, total area impacted by the public transportation system, public transportation ticket prices, number of traffic accidents, employment positions in public transportation, and data related to environmental indicators such as CO_2 emissions and air pollution.

Historically, it has been observed that as populations grow, housing demand rises, leading to urban sprawl. Urban sprawl generates numerous challenges, including high infrastructure costs that contribute to increasing public infrastructure debt. In pursuit of short-term income to decrease public debt, more land is sold for suburban development, perpetuating the cycle of urban sprawl.

Suburban development is further reinforced by zoning laws in Winnipeg, resulting in higher energy use from housing and increased fuel use, exacerbated by extreme temperatures. Suburban development increases dependence on individual private transportation due to longer travel distances, which, in combination with urban sprawl patterns, leads to higher car use, establishing it as the predominant transportation mode in Winnipeg.

Car use leads to numerous negative economic, social, and environmental impacts. It increases fuel consumption, which leads to high air pollution and CO_2 emissions, both of which harm public health. Car use also increases the cost of car use, leading to a large percentage of household income being spent on transportation, increasing social exclusion, which in turn decreases public health. In addition, car use increases traffic accidents, which further decrease public health. Moreover, low public revenues as a result of urban sprawl increase public debt, which worsens the already existing budgetary problems associated with suburban development and urban sprawl.

Figure 11. CLD of shifting to more sustainable transportation in Winnipeg



Source: Authors.

Addressing the challenges arising from urban sprawl and widespread car use requires increasing public and active transportation demand, which can reduce car use and time spent on transportation, further increasing demand for public and active transportation. Demand for public and active transportation increases the use of public and active transportation, which has positive economic impacts, including higher property prices. Moreover, additional distance walked leads to higher retail revenues while also bringing health benefits from increased exercise.

Finally, public and active transportation use contribute to public revenue through public transit fares. High public revenues reduce the public debt and increase investment in public and active transportation, which increases demand for public and active transportation. Climate adaptation

actions further encourage investment in public and active transportation. However, higher revenues can also increase investment in car infrastructure, further exacerbating the challenges associated with car use and urban sprawl.

7.2 Results

Our assessment shows that more sustainable mobility patterns at the urban level, which include active transportation (cycling and walking) and public transit (more buses), have a wide range of economic, social, and environmental benefits that are usually not considered and valued in traditional infrastructure assessments. A more sustainable transportation strategy focused on active transportation and public transit is expected to have significant added benefits, such as revenues from public transit, job creation, and increased property values and retail revenues, while avoiding costs associated with a car-centric approach. These costs include private vehicle fuel costs, social costs related to traffic accidents, and environmental costs, such as CO_2 emissions and exposure to air pollution.

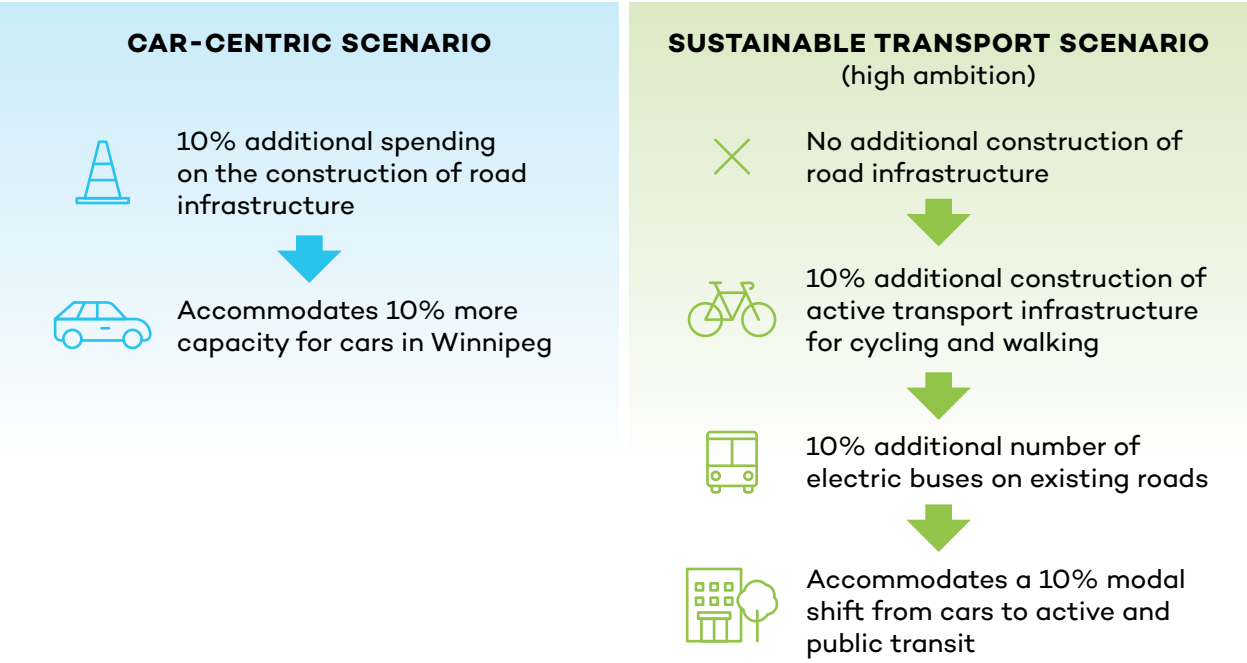
Table 1 shows the three scenarios used in the assessment. A car-centric scenario was compared with two sustainable transportation strategies to demonstrate the principal economic, social, and environmental impacts.

Table 1. Scenarios and assumptions of the car-centric and sustainable transportation approaches

Scenario	Assumptions
Car-centric scenario	10% increase in the construction of road infrastructure (of the total road network in length) that accommodates 10% more capacity for cars in Winnipeg.
Sustainable transportation scenario – low ambition	There is no increase in the construction of road infrastructure. Instead, there is a 5% increase (of the total road network) in the construction of active transportation infrastructure for cycling and walking (in length) and a 5% increase in the number of electric buses on existing roads, accommodating a 5% modal shift from cars to active and public transit.
Sustainable transportation scenario – high ambition	There is no increase in the construction of road infrastructure. Instead, there is 10% increase (of the total road network) in construction of active transportation infrastructure for cycling and walking (in length) and a 10% increase in the number of electric buses on existing roads, accommodating a 10% modal shift from cars to active and public transit.

Source: Authors.

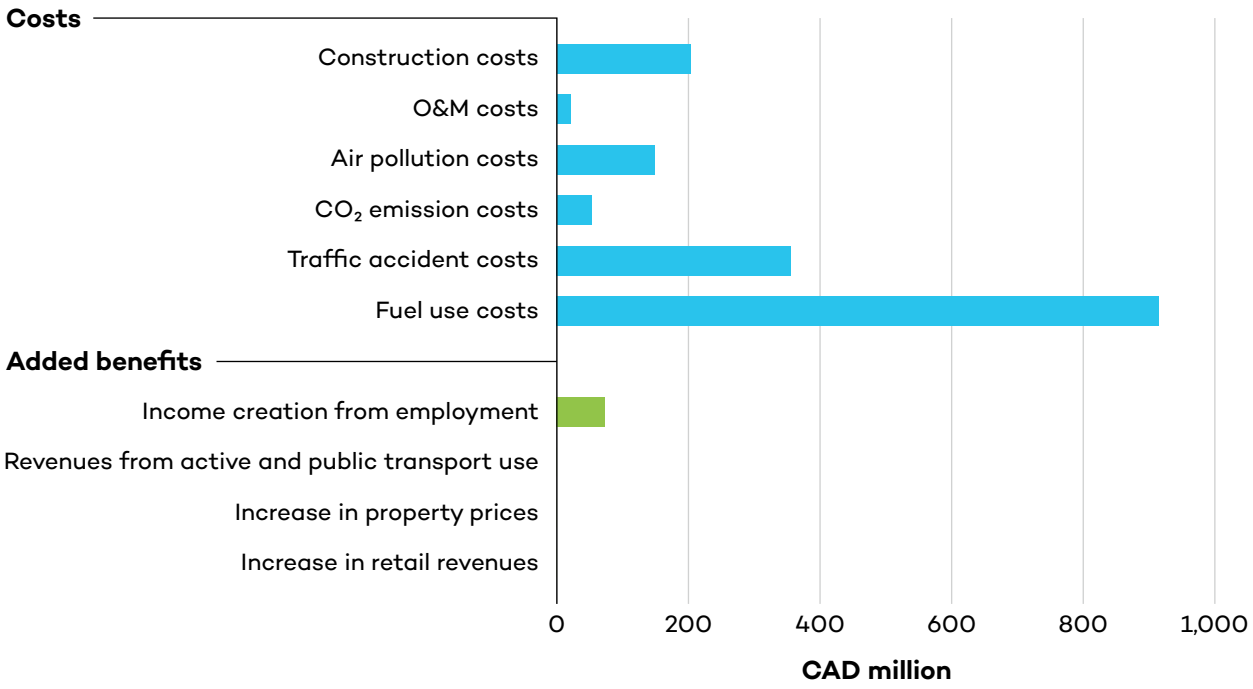
Figure 12. Visualization of the SAVi scenarios



Source: Authors.

Primarily, the results show that a car-centric approach in Winnipeg that consists of 10% increase in the construction of road infrastructure (10% of the total road network in length) will lead to significant economic, social, and environmental costs, including air pollution, CO_2 emissions, traffic accidents, and high fuel costs. In addition, car infrastructure does not have a positive effect on economic indicators such as retail revenues and property prices or any other environmental and social indicators. The only added benefit generated from additional construction of road infrastructure is the employment and income created from both road construction and maintenance. The car-centric scenario leads to negative net benefits and a benefit-to-cost ratio (BCR) of 0.44, indicating that it is not economically viable. Figure 13 shows the cumulative, discounted (at 5%) costs (in blue) and added benefits (in green) of the car-centric scenario, considering a project period of 25 years from 2025 to 2050.

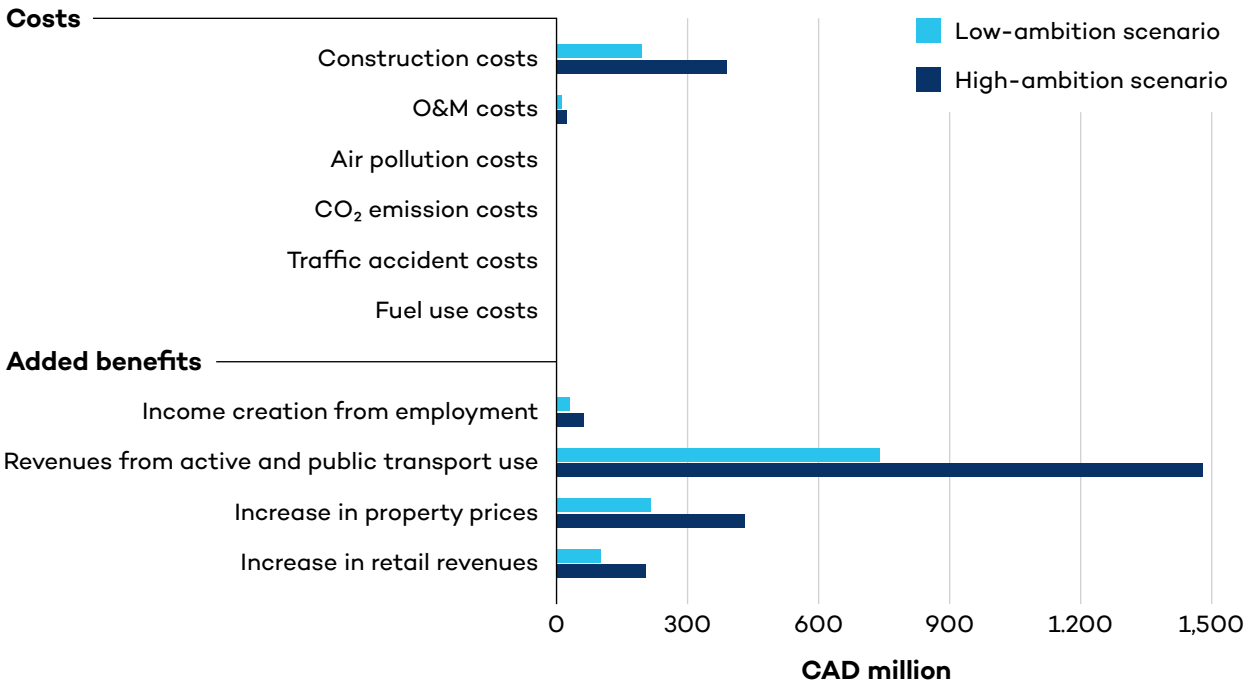
Figure 13. The monetary value of costs and benefits of the car-centric transportation scenario in Winnipeg (discounted at 5%, cumulative 2025-2050)



Source: Authors.

On the other hand, the assessment demonstrates that a more sustainable transportation strategy that prioritizes active transportation and public transit will generate a cumulative, discounted net benefit of CAD 883 million in the low-ambition scenario and a net benefit of CAD 1,766 million in the high-ambition scenario, considering the same 25-year project period. The sustainable transportation scenarios do not result in any costs associated with the car-centric approach and instead generate significant added benefits, such as revenues from active and public transportation, an increase in property prices, and an increase in retail revenues. When accounting for the full range of the sustainable approach's economic, social, and environmental benefits, the results show an integrated BCR of 5.29 for both the low-ambition and high-ambition scenarios. The monetary values of the discounted costs (in blue) and added benefits (in green) of the two sustainable transportation scenarios are shown in Figure 14.

Figure 14. The monetary value of costs and added benefits of the sustainable transportation scenarios in Winnipeg (discounted at 5%, cumulative 2025–2050)



Source: Authors.

The greatest benefit of the sustainable transportation approach consists of the revenues from public transportation use, amounting to a cumulative, discounted CAD 740 million in the low-ambition scenario and CAD 1,480 million in the high-ambition scenario by 2050. These values simply represent revenues from the purchase of bus tickets from public transportation users. In addition, investment in active and public transportation infrastructure will improve walkability and safety for pedestrians and cyclists in Winnipeg. This will likely lead to increased property prices, valued at CAD 216 million in the low-ambition scenario and CAD 431 million in the high-ambition scenario. The shift from cars to active and public transportation modes will increase walkability around retail establishments—and hence, retail spending, especially in the city centre. The increase in retail revenue due to additional retail spending expected from active and public transportation users will lead to a cumulative CAD 102 million in the low-ambition scenario and CAD 205 million in the high-ambition scenario.

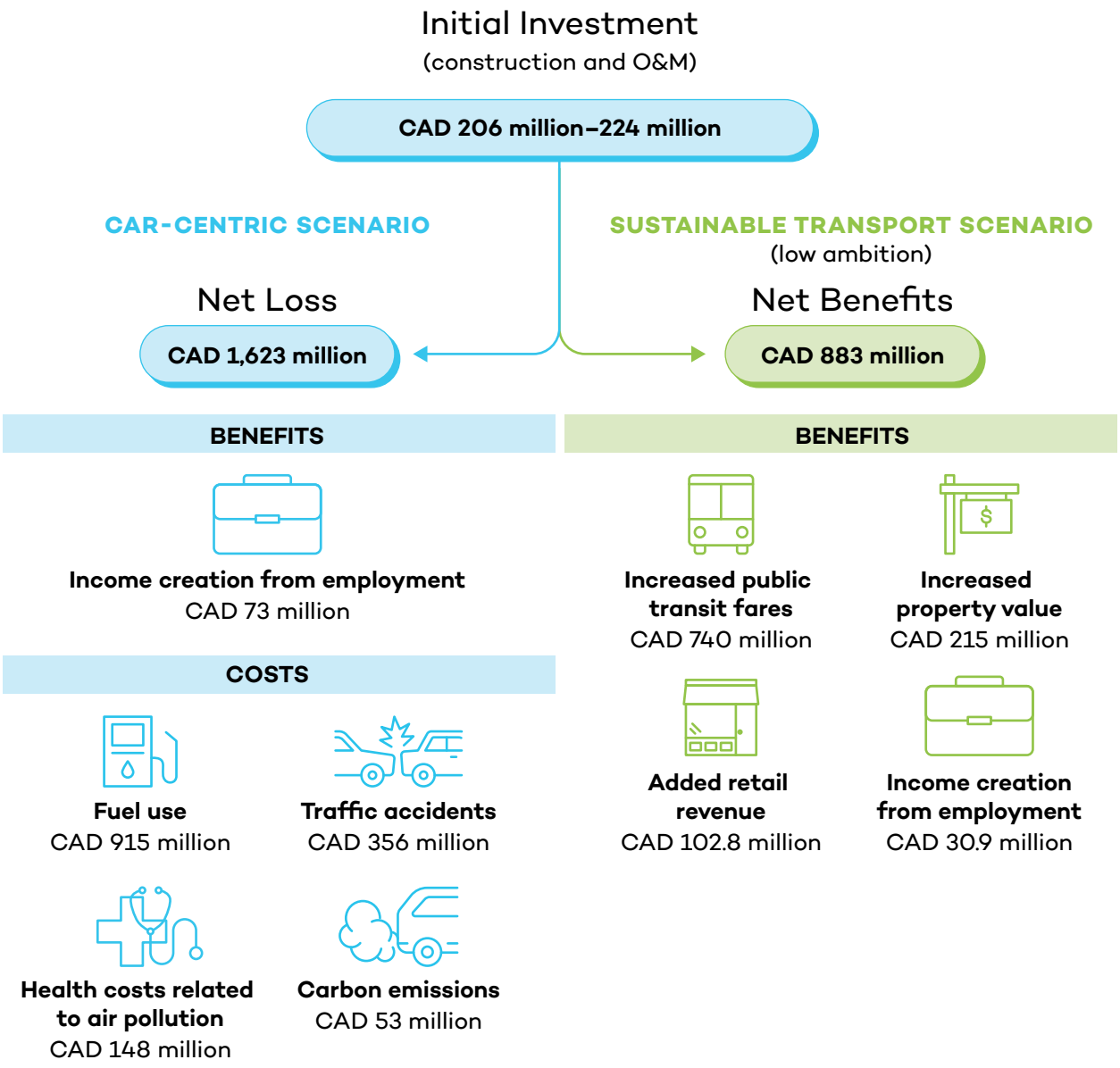
The final results for the car-centric scenario and the two sustainable transportation scenarios are summarized in the integrated CBA in Table 2. It is an integrated analysis because, in addition to the investment costs of the different strategies (construction and operations and maintenance [O&M] costs), the valued economic, social, and environmental costs and added benefits are integrated into the analysis.

Table 2. Integrated CBA, discounted at 5% based on the project period 2025–2050

Discounted at 5%, cumulative 2025 to 2050 (in CAD million)	Car-centric scenario	Sustainable transportation scenario	
		Low ambition	High ambition
Total investment			
Construction costs	203.0	194.5	389.0
O&M costs	21.1	11.4	22.9
Total costs			
Air pollution costs	148.3	-	-
CO_2 emission costs	52.8	-	-
Traffic accident costs	356.0	-	-
Fuel use costs	915.1	-	-
Total added benefits			
Income creation from employment	73.3	30.9	61.8
Revenues from active and public transportation use	-	740.0	1,480
Increase in property prices	-	215.7	431.4
Increase in retail revenues	-	102.8	205.6
Total added benefits	73.2	1,089	2,178
Total costs (indirect, investment and costs)	1,696	206.0	412.0
Net benefits	**(1,623)**	**883.4**	**1,767**
Benefit-to-cost ratio	**0.04**	**5.29**	**5.29**

Source: Authors.

Figure 15. Sustainable transportation vs. car-centric scenario (CBA results)



Source: Authors.

Integrated valuations like the SAVi assessment provide a fuller picture of the long-term effects of urban sustainable transportation strategies by integrating these values into the traditional calculations of BCRs. This assessment demonstrates that advancing sustainable transportation strategies requires identifying, assessing, and valuing these societal added benefits and avoided costs so that city planners and project developers can advocate for their implementation and financing. It is critical that policy-makers design and implement processes to recognize and account for these

wider values so that decisions are made that deliver transportation investments that provide the greatest benefits to society while minimizing their environmental and social impacts.

8.0 Conclusion

This research aims to lay the groundwork for a renewed approach to emissions reductions by incorporating design considerations into energy policy. It represents a paradigm shift away from neoliberal, market-oriented climate solutions toward more tangible and community-oriented approaches. Embracing complete communities can enhance quality of life while reducing energy demand. IISD's SAVi methodology was used to demonstrate the financial and environmental benefits of a move toward complete communities.

Beyond emissions, this research addresses issues of settler colonialism, recognizing that urban planning in Canada often reflects historical patterns of displacement and the exclusion of Indigenous Peoples.

Opportunities for continued research include a more rigorous scientific assessment of low-energy urban design principles (Owens, 1986), leading to place-specific design suggestions to repair sprawl with low-energy complete communities (Tachieva, 2010). Future research could also explore how agricultural systems might be woven into the fabric of daily life—from cities to suburbs to smaller communities (Smaje, 2020). Low-energy design principles from permaculture, for example, could inform planning to create truly sustainable communities (Holmgren, 2012; Mollison, 1997).

Ideally, this research empowers people working in climate and energy spaces to realize the impact of the built environment on emissions. Climate and energy policy must go beyond simple decarbonization and focus on transforming urban landscapes to enable people to lead fulfilling lives while using less energy.

However our future of abundance is envisioned, it must include low-energy landscapes. Achieving this vision will require collaboration among diverse organizations, including grassroots community groups, urban planners, and municipal governments. Phasing out fossil fuels will require us to design our sustainable future.

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Appendix A. Methodology of the SAVi Assessment

Table A1. Assumptions and data sources used in the SAVi assessment of a sustainable transportation approach in Winnipeg

Added benefit or avoided cost	Parameters for calculating direct costs, added benefits, and avoided costs		
	Indicator	**Value**	**Data source**
Construction costs	Total km of roads in Winnipeg (for the car-centric scenario)	Sum of 1,939 km of regional roads and 5,396 km of local roads	City of Winnipeg, 2018.
	Cost per km of road in Southern Manitoba (for the car-centric scenario)	CAD 340,000	Institute de Politiques du Nord, 2019.
	Cost per metre of cycling infrastructure (for the sustainable transportation scenarios)	Average of CAD 610 for multi-use paths, CAD 1,700 for protected bike infrastructure, CAD 55 for painted/buffered bike lanes, and CAD 210 for neighbourhood greenways	Winnipeg, 2024b.
	Cost per metre of walking infrastructure (for the sustainable transportation scenarios)	Average of CAD 370 for collector sidewalks and CAD 430 for arterial sidewalks	Winnipeg, 2024b.
	Number of buses in Winnipeg (for the sustainable transportation scenarios)	640	Winnipeg Transit, 2018.
	Cost of electric bus fleet with depot charging (for the sustainable transportation scenarios)	CAD 446 million for 300 EV buses	Wright, 2021.

Added benefit or avoided cost	Parameters for calculating direct costs, added benefits, and avoided costs		
	Indicator	**Value**	**Data source**
Operations and maintenance (O&M) costs	Average cost of maintenance per km of road in Manitoba (for the car-centric scenario)	Sum of CAD 1,238 per km per year of routine maintenance and 1,650 per km per year of winter maintenance	Applied Research Associates, 2008.
	O&M costs of EV buses, including tire, oil change, and repairs (for the sustainable transportation scenarios)	EUR 4,700 per vehicle	Potkány et al., 2018.
Avoided air pollution costs	National estimates of premature deaths from traffic-related air pollution (TRAP): Nationally and in Manitoba	1,200 persons in Canada and 38 persons in Manitoba	Government of Canada, 2022.
	National estimates of the economic cost of premature deaths from TRAP	CAD 9 billion in Canada	Government of Canada, 2022.
	Population of Manitoba	1,484,135 persons	World Population Review, 2024a.
	Population of Winnipeg	776,900 persons	City of Winnipeg, 2024c.
Avoided CO_2 emission costs	Transportation emissions by cars in Winnipeg	664,082 tonnes CO_2	City of Winnipeg, 2022c.
	Cost of CO_2 emissions per tonne	CAD 80	Government of Canada, 2023b.
Avoided traffic accident costs	Number of traffic accidents per severity per year in Winnipeg	25 fatalities and 4,117 Injuries	City of Winnipeg, 2022a.
	Value of statistical life per casualty type	CAD 8,149,775 per fatality and CAD 37,488 per injury	Government of Canada, 2023a.

Added benefit or avoided cost	Parameters for calculating direct costs, added benefits, and avoided costs		
	Indicator	**Value**	**Data source**
Avoided fuel use costs	Annual person trips – Car	826,953,083 passenger trips	City of Winnipeg, 2022a.
	Car occupancy rate	1.3 persons per vehicle	City of Winnipeg, 2024c.
	Average vehicle travel distance per person	12.8 km	City of Winnipeg, 2024c.
	Fuel consumption of average vehicle/car (per 100 km)	8.90 litre per 100 km	Canada Energy Regulator, 2019.
	Fuel price in Winnipeg	CAD 1.27 per litre	Natural Resources Canada, 2024.
Income creation from employment	Construction worker average salary	CAD 44,849	Talent, 2025.
	Road O&M worker average salary	CAD 54,368	Glassdoor, 2025.
	Percentage increase in jobs created in active transport transportation infrastructure compared to road transport transportation infrastructure	46%	Government of Canada, 2024.
	Number of buses in Winnipeg	640	Winnipeg Transit, 2018.
	Discretionary spending in Canada	24%	Owens, 1991.
	Annual person trips – Car	826,953,083 passenger trips	City of Winnipeg, 2022c.
Revenues from public transportation use	Transit fares in Winnipeg	Average of CAD 3.25 for full fare per trip and CAD 2.75 for youth/ senior fare per trip	Winnipeg Transit, 2025
	Total number of properties in Winnipeg	315,465 properties	Statistics Canada, 2021.

Added benefit or avoided cost	Parameters for calculating direct costs, added benefits, and avoided costs		
	Indicator	**Value**	**Data source**
Increase in property prices	Average value per property in Winnipeg	CAD 380,200	Nesto, 2024.
	Increase in property value as a result of active transport	5%	Song & Knaap, 2003.
	Construction worker average salary	CAD 44,849	Talent, 2025.
Increase in retail revenues	Discretionary spending in Canada	24%	Owens, 1991.
	Annual person trips – Car	826,953,083 passenger trips	City of Winnipeg, 2022c.
	Increase in retail revenues from the shift from car to active transport	42%	Rabl & Nazelle, 2012.

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