
CONSULTATION PAPER BY
**Manitoba's
Expert Advisory
Council *for the*
Climate and
Green Plan**

A Green Transportation Strategy
for Manitoba
JUNE 2020

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1. Introduction

Manitoba's Climate and Green Plan identified a vision for Manitoba to become the cleanest, greenest, most climate resilient province in Canada. Given that 38% of Manitoba's emissions occur in the transportation sector and that transportation-related infrastructure enables and dictates choices of citizens, consumers, and businesses regarding modes of transportation behaviours and technologies, it is critical that Manitoba develop a framework on adapting its transportation infrastructure to the realities of a low carbon economy.

The Expert Advisory Council to the Climate and Green Plan is seeking to develop options, recommendations and advice to the Manitoba government to tackle the challenge of transitioning to a low carbon system for transportation and infrastructure in the province.

The objectives of this initiative are:

- To outline a practical and realistic path forward for Manitoba's use of existing transportation and infrastructure system.
- To identify ways to build better, greener transportation and infrastructure over the long-term.
- To determine which tools are available to achieve a greener transportation infrastructure.
- To deliver advice and recommendations based on stakeholder engagement and subject matter expert input.

The 2017 Manitoba Climate and Green Plan refers to the following transportation-related greenhouse gas emissions reduction opportunities:

- electrification of Winnipeg transit
- higher biofuels mandates
- public and active transportation
- increase ZEVs in government fleet and enhance infrastructure at government-owned buildings

The Climate and Green Plan Act required the creation of Carbon Savings Accounts. The first Carbon Savings Account (CSA) for 2018 to 2022 was established in June 2019. Based on the independent, evidence-based advice from the Expert Advisory Council, the government committed to achieve a cumulative greenhouse gas (GHG) emission reduction of one megatonne (Mt) during this period. To achieve this target, the Government of Manitoba will establish new and/or enhance existing policies, programs, and measures to reduce emissions. The EAC provided advice on initiatives to achieve the 1Mt reduction target, which span all sectors of the economy, but points to the need to reduce transportation emissions as a critical and immediate step.

2. Expert Advisory Council Mandate

The Expert Advisory Council (EAC) was established under Section 7 of The Climate and Green Plan Act, passed by the Legislature of Manitoba on November 8, 2018.

The EAC is an independent group of experts with a mandate to provide advice and recommendations to the Minister on the Government of Manitoba's Climate and Green Plan. Specifically, under the Act, the Council is to:

- a. provide advice and recommendations to the minister on programs, policies and measures to be included in the climate and green plan;
- b. review progress on the implementation of the climate and green plan, and provide advice on any required changes to the plan; and
- c. provide advice and recommendations to the minister respecting greenhouse gas emissions reduction goals to be established under section 3.

On January 6, 2020, the Minister of Conservation and Climate mandated the EAC to provide advice and recommendations for "a provincial strategy on greening transportation and infrastructure recognizing the transition to a low carbon economy". This advice is to be "comprehensive and holistic", and consider several aspects of government activity, including policies, programs, infrastructure, technology, economic opportunities and consumer interests and activities.

Recommendations are to include short-term actions as well as long-term system transformation, reflecting the Manitoba context of clean electricity, strong trucking and rail sectors within the North American transportation system. The advice and recommendations will build upon recent actions, policy directions, and previous EAC recommendations to reduce emissions through increased use of biofuels and fuel switching opportunities in the transportation sector.

In order to address this mandate, the EAC established a transportation subcommittee to develop recommendations on three subsectors of the transportation sector: on-road vehicles, the trucking industry, as well as rail and aviation. The subcommittee chose these key subsectors based on Manitoba's transportation subsectors, keeping in mind that on-road transportation accounts for 66% of transportation emissions, rail accounts for 9%, while "other" accounts for around 20%. The province has jurisdiction over on-road and off-road vehicles, but shares jurisdiction on rail, aviation, and marine with the federal government.

Given the recent unforeseen experience with the global pandemic and related states of emergencies associated with COVID-19, the advice and recommendations will also consider the effects of the pandemic, societal rules, physical distancing requirements, and the economic impact on the transportation sector.

3. Stakeholder Engagement Process

In order to fulfill this mandate, the EAC has prepared this consultation paper as a way to gather stakeholder feedback and to frame discussions with experts and stakeholders. The paper supports the development of a green transportation strategy for the Province of Manitoba to implement a whole-of-government approach to climate action in the transport sector.

It explains why Manitoba needs a green transportation strategy, and describes the role of the EAC in developing this strategy. It starts with an overview of trends in various jurisdictions that have modernised their transportation strategies and/or have taken steps to reduce emissions in their respective transportation sectors by looking at transportation systems, modes, and related infrastructure. This paper also identifies the main system influences and potential sector-specific interventions that can be used to create a low carbon future for transportation in Manitoba. This includes a discussion of the types of policy tools that are available, recognises that costs should not be a barrier to long-term planning, and encourages stakeholders to identify the types of measures they would like to see undertaken in the province.

Engaging expert stakeholders who have firsthand experience will be vital to informing this strategy. Stakeholder input will inform the development of the Council's analysis and advice to be presented to the Minister. Questions for stakeholder consideration are included throughout this document, and are listed again by theme in Appendix A.

In addition to collecting stakeholder feedback through this document, the EAC will host virtual stakeholder engagement sessions to invite stakeholders to provide additional feedback, ask questions and share comments, and also to engage in discussion with fellow stakeholders.

The EAC has reviewed relevant actions and experiences in other jurisdictions (see Appendix B). The EAC will also undertake transportation-related polling carried out in Manitoba and elsewhere in Canada, the results of which will inform to final strategy. As the strategy is developed, consideration will be given to our recent experiences with COVID-19 and how that has shaped the future of transportation in this province.

4. Local, National, and Global Transportation Trends

Identifying trends in the transportation sector require some assumptions on the scope of the main questions. Given the EAC's role as a provincial advisory body, the assessment will include economic, technological and social considerations, including those on a global scale. Although nation building, national sovereignty, and international trade are often considered primary drivers for transportation infrastructure projects, national projects are outside of provincial government responsibility even though some national considerations may have direct and indirect impacts. These impacts are included for consideration when relevant.

Local

The province has few mechanisms to reduce transportation emissions, and faces a transportation sector dominated by imported petroleum fuels. There are no petroleum refineries in Manitoba, so the province can only reduce transportation emissions by either shrinking the total volume of fuel sales (e.g., fuel-saving retrofits, switching to electric vehicles, higher fuel taxes, or rationing), by reducing the carbon content of petroleum, or by increasing the renewable content requirements in gasoline and diesel fuel.

To date, Manitoba's transportation and infrastructure strategy has focused on reducing emissions from existing fuels within the traditional infrastructure system. Manitoba's two renewable fuel mandates reduces fossil fuels through volumetric blending requirements that fuel suppliers are obligated to achieve. The Ethanol Mandate currently requires 8.5% ethanol in gasoline (E8.5) and the Biodiesel Mandate currently requires 2% biodiesel (B2), renewable diesel (R2), or a blend of both to achieve a 2% minimum renewable content in diesel fuel.

Renewable transportation fuels is one of the most effective short-term GHG emissions mitigation measures for Manitoba's transportation sector. The province is pursuing higher biofuels requirements as a way to reduce transportation emissions in Manitoba, and announced it will increase the Ethanol Mandate to 10% and the Biodiesel Mandate to 5%. The Made-in-Manitoba Climate and Green Plan identified increasing the use of higher blend biofuels (e.g., E15 and B10), depending on the technical and economic feasibility to do so.

Some progress has been made in the field of active transportation and other public transportation infrastructure at the municipal level. For example, the City of Winnipeg contains 60% of Manitoba's population, and this urban centre and commuter hub offers more transportation emissions reduction opportunities than less densely populated regions of the Province. Less than 1% of Winnipeg's emissions arise from transit, whereas 32% are from personal vehicles. This offers special opportunities to reduce transportation emissions for the majority of Manitobans who live in Winnipeg that may not be found elsewhere. As part of the Winnipeg Climate Action Plan, the city's sustainable transportation strategy includes the direction "to directly shift City residents out of single occupancy vehicles (SOV) through sustainable transportation options with lower or no emissions (walking, cycling, public transit, carshare, and carpooling)"¹. This plan sets a target of 17% emission reduction for the transportation sector (relative to 2011 emissions) by facilitating a mode share shift that increases the use of public transit and active transportation networks while reducing dependence on the personal automobile.

¹ City of Winnipeg, Winnipeg Climate Action Plan: Report (May 2018), <https://winnipeg.ca/sustainability/PublicEngagement/ClimateActionPlan/pdfs/WinnipegsClimateActionPlan.pdf>

The 2011 mode shares baseline are:

- 64% Auto-Driver
- 18% Auto-Passenger
- 10% Public Transit
- 8% Walking/Cycling

Winnipeg has over 400km of bicycling facilities (e.g., multi-user paths, shared bus-bicycle lanes, protected bicycle lanes, shared bike-walk lanes, Sunday street closures, etc.). Winnipeg Transit operates approximately 640 buses on 93 bus routes and transports around 50 million passengers every year while traveling an average of 30 million kilometers annually. Integrating transportation services within Winnipeg and across the province is difficult and expensive. For example, the total project cost for Southwest Rapid Transit Corridor, including the transitway, redeveloped Pembina Highway Underpass, and new active transportation infrastructure is budgeted at \$467.3 million.

Considering that the larger Winnipeg Census Metropolitan Area (CMA) generates around 66.5% of the province's GDP², accounts for 68.5% of total provincial employment³, and is home to 61.7% of the provincial population, the strategy should consider the broader capital region area. For example, Winnipeg Transit does not operate outside of the city, and does not service commuters living within the larger footprint of the CMA that includes proximate areas such as Headingly, East St. Paul, and as far north as the south shore of Lake Winnipeg. Intercity transit is even more difficult, as bus lines like Greyhound Canada (and Grey Goose, its subsidiary in Manitoba) ceased operations in Manitoba in 2018.

Manitoba's Transportation and Distribution sector account for a large share to the province's gross domestic product. In Manitoba, growth was strong in four large transportation sub-sectors (2013-2018):

- Rail transportation - 67 per cent growth
- Air transportation – 37 per cent growth
- Farm Product Merchant Wholesalers - 25 per cent growth
- Truck transportation - 22 per cent growth

What problems and opportunities do you see in the current transportation sector in Manitoba?

This growth is link to the City of Winnipeg area advantage as a tri-modal (rail, air, and truck) logistics hub. This logistics hub provides regional service centre that integrates the shipment, storage, collection and distribution of goods to the area and beyond. It has several advantages, including:

- Winnipeg is the only major city between Thunder Bay and Vancouver with direct rail connections to the United States via three Class 1 carriers; CN, CP and BNSF.
- Manitoba is a major hub for CN's transcontinental rail network with key facilities such as the Symington classification yard and CN's Claude Mongeau National Training Centre.
- Winnipeg boasts Canada's second highest number of dedicated cargo flights.

² Statistics Canada. Gross domestic product (GDP) at basic prices, by census metropolitan area (CMA), 2016 (Table: 36-10-0468-01, <https://www150.statcan.gc.ca/t1/tb1/en/tv.action?pid=3610046801>).

³ Statistics Canada. Labour force characteristics by census metropolitan area, three-month moving average, seasonally adjusted (x 1,000), May 2020 (Table: 14-10-0294-02, <https://www150.statcan.gc.ca/t1/tb1/en/tv.action?pid=1410029402>).

- Manitoba is the home to seven of Canada's top 100 for-hire trucking companies, including two of the top 10 trucking firms.
- Smaller ports located across the province can transport smaller numbers of people and goods at cost-effective scales and schedules.

With 6,849 transportation and distribution companies, Winnipeg is a transportation powerhouse and hub for the Canadian prairies. Located in the geographic centre of North America and the Mid-Continent Trade Corridor, Winnipeg is just 112 km (70 miles) from the U.S. border with access to a population of 100 million within a 24-hour drive.

Winnipeg is also home to CentrePort Canada, North America's largest tri-modal inland port and the only trimodal inland port in Canada to provide foreign trade zone (FTZ) advantages. A new Rail Park is planned to occupy 665 acres at CentrePort Canada, and will combine industrial infrastructure with truck and rail access.

The Winnipeg capital region is ideally positioned to build on its role as a goods and warehousing hub and grow into an e-commerce hub due to its central location, tri-modal logistics advantage, and affordable industrial and warehousing space compared to other medium to large Canadian cities. As such, considerable growth opportunities in commercial transportation exist, which Manitoba could use to associate with low carbon economic growth.

National

Canada is the world's second largest geographic jurisdiction. With approximately 37.4 million people, it ranks 39th in terms of population, and 187th in terms of average population density (people per square kilometer). Upwards of 90% of Canadians live within 100 km of the Canada-US border. Over 80% of Canadians live in an urban setting, while around 6 million people live in rural and northern areas with a population density lower than 1000 people per 400 square kilometers. Rural and northern communities employ over four million Canadians and generates around 27% of national GDP. Rural and northern Canada also supplies food, water, energy, and other natural resources to the rest of Canada and for export.

Canada's size and low population density has meant that all levels of government have had an important role in developing the transportation sector. Iconic infrastructure include the national rail system, the TransCanada Highway, and the TransCanada Trail. Building and expanding marine ports and national airlines followed across the southern reaches of the country, and later extended to efforts to open Canada's arctic.

These nation-building exercises were first motivated by ensuring Canadian sovereignty, with subsequent efforts ranging from economic development, national unity/identity, public access, and safety. Most recently, the development of Canada's transportation sector has included effort toward enhancing transportation safety, environmental responsibility, and sustainability. For example, several jurisdictions in Canada have followed global trends and have moved toward higher renewable content requirements in transportation fuels. The federal government currently has a 5% ethanol requirement and 2% biodiesel requirement, and is moving to lower the carbon intensities of all fuel types under its forthcoming Clean Fuel Standard. Manitoba was an early adopter of renewable fuels and continues to lead the country under the proposed higher renewable fuel mandates of 10% ethanol and 5% renewable diesel content.

The direction for the transportation sector in Canada is directed at addressing current and future challenges. Priorities are linked to overcoming economic constraints of existing infrastructure and climate-change related disruptions that are expected to affect the safety, security, and efficiency of moving passengers and goods across the country. In addition, the federal plan seeks to take advantage of increasing trade and travel opportunities offered by new and emerging markets, especially in Asia, Latin America, and Africa.

While provinces and territories have their own reasons to develop their respective transportation and infrastructure system, the “story” of transportation in Canada continues to reflect these historic motivations to various degrees. Communities across the country face different challenges, environmental impacts, and economic costs depending on whether they are northern, rural, or urban areas. Western Canada, for instance, experiences periods of congestion on railways and at ports while heavily populated urban centres in central Canada face congested roadways and slow movement of people and goods. Increasing physical capacity, optimising existing assets, coordinating all supply chain stakeholders, and efficient governance are necessary to maximise economic opportunities.

At the same time, covering the enormous distances in the Canadian countryside poses a major challenge for the introduction of new technologies. For example, transportation infrastructure costs are higher in terms of longer roads between towns and cities, while increased fuel usage and low rural ridership makes inter-city bus services uneconomical. Likewise, transportation of goods involves more travel distance to reach major markets, which increases overall operating costs to the industry.

When we add the uncertainties of climate change disruption to transportation infrastructure (e.g., Churchill rail line, shortened ice road season, weather extremes and roadway integrity, potholes, etc.), we need to consider the effects on provincial infrastructure and higher costs of climate effects on local and national transportation systems. Adapting our transportation system to the impact of climate change is also a challenge as extreme weather events and climate-related environmental impacts (e.g., permafrost thaw, coastal erosion) increase the long-term risks to the national transportation network.

Global

Transportation strategies in other countries are as varied as their economies, geographies, and demographics. In most cases, nations and subnational governments do not provide a single comprehensive strategy, but instead institute piecemeal policies and programs to address sector specific needs. The EAC may thus consider ‘picking and choosing’ policy and program ideas from various other transportation initiatives rather than trying to emulate another jurisdiction’s strategy. Several jurisdictions are considered leaders in greening their transportation sectors, modernising transportation systems to reflect climate challenges, and encouraging efficiencies to increase economic benefits into the near and distant future. A comparative table captures the main approaches identified during the jurisdictional scan (Appendix B).

Early trends in other jurisdictions include energy efficiency for vehicles and reducing the carbon content of petroleum fuels by blending renewable content. As jurisdictions adjusted fuel quality and performance to increase renewable content/decrease carbon intensity of liquid petroleum fuels, they have added the more recent trend to encourage fuel switching (i.e., using alternative energies other than liquid petroleum-based fuels). The most recognisable fuel switching efforts involve the development and adoption of zero emission vehicles (ZEVs), such as battery electric and hydrogen fuel cell vehicles. Governments of several influential jurisdictions such as California, Quebec, British Columbia, and Norway have actively promoted ZEVs in different ways. These often include purchase subsidies and other financial incentives but also through policies that embrace the electrification

of transportation. In the most ambitious jurisdictions, some governments like the United Kingdom, Germany, and others have employed legislation or national targets to require the uptake of ZEVs according to a regulated timeline.

Finally, the recent experience with the COVID-19 pandemic, states of emergency, and the continued physical distancing that is expected to be required for the foreseeable future, several options to reduce transportation-related GHG emissions may no longer be feasible in the short term, such as options that recommended closer human contact during transportation. This is a new global context for all jurisdictions to consider, and is one that could require a radical re-think of the role of transportation and how we use it.

5. A Low Carbon Transportation Future for Manitoba

Manitoba's greenhouse gas emissions from transportation account for almost 8Mt (38%) of the province's carbon footprint. These emissions come from about 750,000 registered light-duty vehicles, as well as its mature commercial transportation and logistics sector.

Transportation and warehousing is an important sector of the provincial economy, generating around \$6.9 billion in real GDP (7% of Manitoba's economy) and employs over 41,000 people. As Manitoba continues to develop as an international transportation and logistics hub, incorporating green policies into this growing sector will become increasingly important. Transportation demand is increasing and energy use and emissions from transportation activities are forecasted to rise. Increased traffic congestion in Winnipeg will cost the provincial economy over an estimated \$100 million annually in lost time, increased fuel costs and GHG emissions. The economic cost to the province as a whole will be even greater.

Where is Manitoba's biggest opportunity to reduce transportation related emissions?

The provincial government is already involved in numerous transportation-related activities, including funding for public transit, biking and walking trails, biofuels mandates, fuel efficiency incentives for commercial trucks, and converting the government fleet to more highly efficient vehicles. Manitoba's central location, its role as a transportation hub, and the presence of New Flyer International and several large trucking companies put the province in a strong position to further advance economic growth and innovation in the transportation sector. However, recent investments being made in other provinces (e.g., Bison Transport) and the loss of the Centre for Sustainable Transportation and the University of Manitoba's Transportation Institute, demonstrate the urgency to re-invigorate Manitoba's effort to improve private and commercial transportation across the province.

What will transportation in Manitoba look like in five, ten and twenty years?

Manitoba can find better alternatives to those heavily populated, large economy jurisdictions like the United Kingdom and Norway by leveraging the smaller scale of our technology and transportation producers. To achieve this, we can learn some lessons from subnational jurisdictions like California, Quebec, and British Columbia. Specifically, immediate actions include more stringent requirements for low carbon fuels to realise GHG reductions in the short-term combined with the potential to encourage longer-term efforts in fuel switching as a way to replace the consumption of imported petroleum fuels with zero emission vehicles (ZEVs) using emissions-free Manitoba-made hydroelectricity.

Manitoba will also need to consider the long-term transformation of transportation infrastructure. This can include the "hardscape" (e.g., roadways, transit routes, rail lines, marine ports, bike paths, and air terminals, alternative vehicle energy filling/charging stations, etc.) and "softscape" (e.g.,

digital infrastructure to support traffic flow, internet systems to enable autonomous vehicles). These infrastructure question will certainly expand beyond the boundaries of traditional transportation systems, and will likely influence systems that are not typically included in transportation strategies. For instance, the jurisdictional scan revealed a need to consider other related themes, including:

- Land use planning to design efficient transportation networks to capture improvements and other opportunities at various scales of activity, such as:
 - Local communities and municipalities
 - regional land use planning
- Technological development and its application to:
 - Improving traffic flows and reducing emissions
 - Autonomous road vehicles – for efficiency and density
 - Autonomous ships – reducing size, increasing flexibility in the transportation stream
- Active transportation in the form of walking and cycling
- Public transportation and increased ridership and reduced number of single passenger trips

Manitoba generates more clean electricity than its citizens currently use, and exports the surplus to other jurisdictions. How can we use this provincial energy resource to 'green' our transportation system?

In considering a low carbon future for transportation in the province, green policies and programs can be incorporated that contribute to post-pandemic economic recovery efforts. To develop an orderly and achievable green transportation for the future, we should consider the desired purpose, direction, and outcomes of provincial policies and programs. With consistency and determination as a goal, we should also reflect on the fundamental principles of green transportation in Manitoba.

What are the top challenges to reducing transportation emissions in Manitoba?

Policies and Programs

The recommendations for a green transportation strategy will provide an overarching direction for green transportation in the province, and will consider potential policy and program directions, including:

- advance innovation in the transportation sector to re-invigorate Manitoba's transportation leadership and economic development.
- Align with Manitoba's strengths in clean electricity, use of renewable fuels and as a transportation hub that includes heavy duty trucking, freight aviation, rail, and intermodal logistics.
- Incorporate economic instruments, policies and complimentary measures in other sectors to support adoption of GHG reduction measures and adaptation to climate change impacts.
- Government leadership in the design and implementation of innovative policies and programs.

Principles

Comments will be received and considered, and assessed based on these five principles.

- i. Prioritises emissions reductions – The intent of a green transportation strategy is to reduce GHG emissions, with other supporting benefits to be considered as associated benefits and opportunities.
- ii. Evidence-based – Opinions and anecdotes are welcome, but decisions are to be based on verifiable qualitative or quantitative evidence such as data, modelling, and other analysis.
- iii. Technology neutral – No one technology will be privileged over another, with each being evaluated on their potential contribution to achieve desired results.
- iv. Manitoba-focused – Suggestions that identify direct benefits to Manitoba, such as local emissions reductions, improved transportation services, and economic growth, will have priority over benefits that occur elsewhere.
- v. Low carbon economic growth opportunities – Emissions reductions suggestions that support economic development will be sought.

6. Key Action Areas for Green Transportation

A Green Transportation strategy for Manitoba must be one that fulfills the provincial objectives but also integrates with existing transportation networks, modes, technologies, policies, and regulations of other jurisdictions in Canada and the United States. To achieve this, it is useful to consider best practices from leading jurisdictions in Canada and across the world. The different approaches and trends from other jurisdictions summarised in Appendix B and evaluate their potential effectiveness in Manitoba.

Transportation subsectors

Manitoba's transportation sector consists primarily of on-road vehicles. While the vast majority of Manitobans directly contribute to light-duty vehicle traffic, Manitobans also rely on heavy-duty commercial transport trucks to import and distribute products in Manitoba. There is an important role for intermodal linkages, such as trucks delivering or receiving products shipped by rail. There is also a small segment of the transportation sector that concerns rail and aviation within the province (interprovincial and international rail and aviation are under federal jurisdiction).

System Influences

There are three distinct parts of the broader transportation system: vehicle fuels, fuel switching (to alternative, emissions free power trains), and the behaviour of different groups of vehicle users.

i. Fuels

Approximately 95% of all transportation energy used in Manitoba are imported petroleum fuels, which means that the province has very little influence on imported fuels. The exceptions to this includes fuel taxes/carbon taxes, fuel storage regulations, fuel quality, and provincial biofuels mandates. The provincial fuel tax is 14 cents per litre. Provincial retail sales tax does not apply to fuel, but retail fuel sales are subject to the 5% federal GST. There is also federal excise taxes on fuel (10 cents/litre for diesel and 4 cents/litre for gasoline). The federal carbon tax of \$30.00 per tonne (rising to \$50.00 per tonne in 2022) currently applies to fuel use in Manitoba. This equates to xx cents per litre of gasoline and xx cents per litre of diesel. There are no oil refineries in the provinces, and the Husky ethanol plant in Minnedosa is the Province's only biorefinery, which contributes almost all of the ethanol blended in Manitoba. In contrast, there are no biodiesel/renewable diesel manufacturing facilities in Manitoba, so all biodiesel/renewable diesel is imported.

ii. Fuel Switching

Alternative forms of transportation energy have recently become available. Among those currently available in Manitoba are hybrid fuel and battery electric vehicles. Other types of zero emission vehicles (ZEV) are expected to enter the market in the next few years, and notable among these are electric vehicles powered by refillable hydrogen fuel cells instead of rechargeable lithium batteries.

What short and medium-term options exist to reduce/replace fossil fuels with alternative, low carbon transportation energy choices in Manitoba?

A challenge for any new type of transportation energy is the accessibility of alternative energy infrastructure, such as hydrogen filling stations and EV charging stations, but also natural gas or propane filling stations. Companies embracing new types of energy tend to install their own private filling infrastructure, but wider adoption across society will need public access.

iii. Industry, Community & Consumer Behaviours

The way that transportation is adopted and used throughout society is an important indicator of its contribution to economic, environmental, and social outcomes. These built-in behaviours are an important consideration in seeking to foster take-up of alternative green transportation options instead. The convenience of cars by consumers and reliance on trucks by businesses makes wholesale adoption of alternative low-carbon transportation modes more difficult. Our built environment – where we live and work – is currently situated more for high-carbon transportation options. Our transportation behaviours reflect this. Understanding and addressing this behavioural aspect of shifting to low-carbon transportation options is an important aspect of a Manitoba strategy.

What can we do to encourage individuals, small and medium-sized enterprises, larger industries, and others to reduce transportation-related GHG emissions?

Sector-specific Intervention

The EAC is aiming to provide system-wide advice to government. In doing so, it will consider how a low carbon transportation strategy implicates the following four elements: infrastructure, innovation, consumer and industry, and government. These reflect both the context of the current transportation system in Manitoba, as well as the most likely features to create a green transportation system for the future.

First, existing transportation infrastructure involves an existing and interconnected system of all types of vehicles, fuels, and travel hubs (e.g., international and local airports) and corridors (e.g., rail lines and major highways). Addressing our existing assets is an important first step in developing recommendations. Second, innovation in the transportation sector will over time enable the inclusion of alternative modes and pathways for a green future. How fast and deep this innovation occurs in the economy will be crucial to determining successful adoption. Third, understanding consumer behaviour (e.g., decisions to purchase larger SUVs instead of small economy-sized vehicles, preferences for high-carbon intensity fuels instead of clean and renewable alternative energy options) and the role that transportation users can have in supporting a green transportation strategy, is necessary to make sustained progress. Finally, the role for government is an important variable, particular in terms of developing public assets for the transportation system. Typically government actions include common-use infrastructure such as roads and bridges, but they can also include support for other types of infrastructure, innovation, and behaviour change. The actions of government can have a significant influence on the speed and direction of system change.

The following provides working definitions, parameters for action, and identifies questions for consideration for each of these four elements.

i. Transportation Infrastructure

In the broadest interpretation, transportation systems involve three distinct yet linked infrastructure systems.

The first is the vehicle manufacturing and distribution system provides, and related infrastructure includes autobody, engine, and auto parts supply, all of which are private sector activities. Similarly, this might include locomotive, aviation, and marine vehicle manufacturing and distribution, as well as train stations, airports, and marine ports.

The second is the fuel supply system, which includes oil extraction and biomass production, refining, wholesale distribution, blending, and retail sales. It also includes alternative vehicle energy options such as electricity, hydrogen, propane, and natural gas and their respective filling/charging stations. This second system is also primarily a private sector function, with the exception of a handful of government regulations (e.g., taxation, fuel standards, storage permitting, and blend requirements) and services (e.g., electricity generation, natural gas distribution).

How should we define “green transportation and infrastructure” in terms of reducing GHG emissions?

The third involves traditional infrastructure, such as roadways, bridges, public transit, traffic signs, and related rules (e.g., speed limits, weight restrictions, and idling restrictions). Other types of traditional infrastructure can be expanded beyond municipal boundaries, such as park and ride locations and new supporting transit routes. Correlated with this third system are pedestrian and non-motorised transit, such as bike and walking paths, sidewalks, and crossing signals as part of active transportation networks.

ii. Encouraging Innovation

The main challenge to innovation is a “successful” status quo. Under this condition, we have a system that “works” by all normal indicators and expectations, but “doesn’t work” by new and emerging challenges. As such, a future-oriented transportation system based on the current types of vehicles in use and land-use planning practices will continue the status quo, but will not address concerns with sustainability, emissions reduction, efficient use of time and energy, etc. Therefore, encouraging innovation requires that we must first broaden or change the definition of success (i.e., what “works” and what “doesn’t work”), and then motivate/mobilise innovators and investors to change both embedded practices and traditional approaches.

What is the appropriate role for government in the shift toward a green transportation system in Manitoba?

Innovation is more than just a new technology. It can be defined as new technologies, new applications for existing technologies, or more efficient processes. In short, a thing is considered “innovative” if it increases revenue, decreases cost in economic or environmental terms, or is disruptive in shifting consumer and market behaviours.

Innovation can occur in the way people engage with transportation needs (i.e., behavioural shifts), and can also be reinforced for different types of public infrastructure construction (e.g., bike paths, rapid transit) and new business opportunities in the private sector (e.g., EV charging stations, new types of vehicle manufacture, new types of fuels). Some preliminary actions can enable innovation, such as the regulatory framework, communications network to allow and enable the use of autonomous vehicles, favourable investment rules to encourage private sector action.

What innovations are occurring in the transportation sector that will affect low carbon transportation growth in Manitoba?

iii. The Role of Consumers, Companies, and Industries

Transportation is user-driven, but users can only operate within the existing transportation infrastructure and related-services. Demand for types of vehicles, types of fuels, and infrastructure improvements tend to be identified by consumers, companies, and industries. For instance, the Waverley West underpass in Winnipeg was motivated by more suburban residents and the resulting traffic delays at a heavily used railway crossing that interrupted the daily commute.

What role and responsibility do transportation users have in greening the transportation sector?

Commercial transportation companies such as those in the trucking and rail industries rely on diesel fuel and established engine technologies. New fuel types and new energy efficiency technologies often involve new costs or new operational/maintenance requirements. Established companies, particularly those with large investments in vehicles, buildings, and associated assets, often desire to continue with established practices, existing infrastructure, and known costs. Emissions reductions actions that do not align with the existing system are often considered a threat to industry.

Similarly, the auto industry in North America is based on established production methods and familiarity with consumer preferences that were developed over several decades. The emergence of battery electric and hydrogen fuel cell vehicles involves a change to the auto sector, which includes higher unit prices and reduced auto repair and service needs of these zero emission vehicles. This has the potential to upset the traditional sales and service business model of major auto makers.

While the norms and practices of these users groups is more or less static, there is a small but increasing appetite for change as consumers seek emissions-free transport. Likewise, innovative companies are seeking advantages of using alternative powertrains, and entrepreneurs within established industries are seeking competitive advantages to fill these market needs with new types of vehicles.

Each of these innovative activities are motivated by the recognition of climate change and a growing desire for action by individuals, organisations, and entire industries. Public polling is one way to gain insight into the public's willingness to change. The EAC has considered the potential for public polling of Manitobans on their transportation-related preferences, thoughts, and attitudes. Here is what existing results from previous public polling undertaken in Manitoba/Canada show:

For example, a 2018 poll for the Canadian Automobile Association and Bike Winnipeg, conducted by Probe Research, asked Winnipeggers about their cycling habits, problems they face and what they wish to see to improve cycling infrastructure in the city and found that:

- More than 20% respondents said they cycle daily or a few times a week for transportation.
- About 35% of respondents said they would cycle more if infrastructure conditions were right.
- Almost half of respondents said the top priority for the City of Winnipeg should be adding more separated bike lanes on major routes.⁴

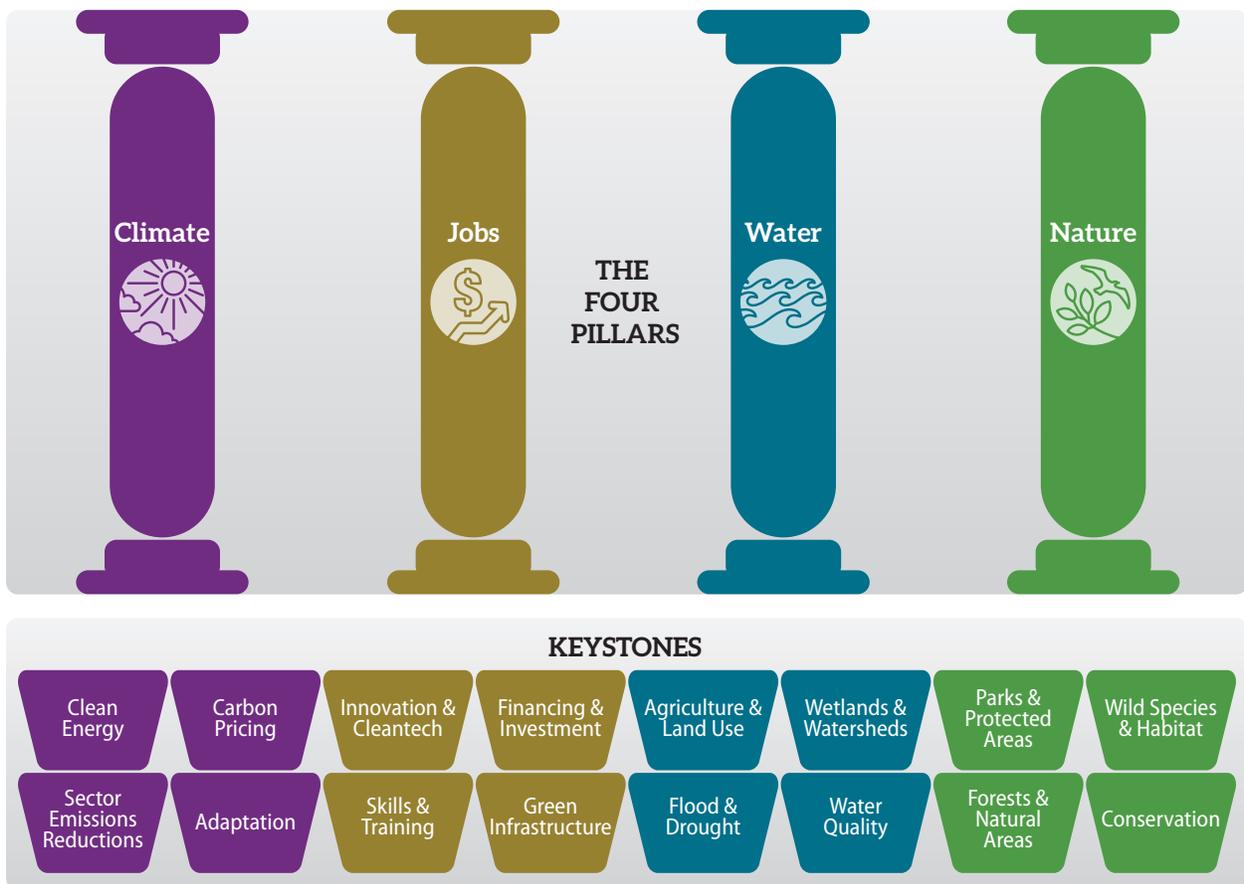
⁴ More Winnipeggers cycling than ever before, poll suggests, CBC News, July 24 2018, <https://www.cbc.ca/news/canada/manitoba/winnipeg-cyclists-poll-caa-1.4759579>

This example provides insight into how the EAC could consider behavioural analysis in the framework development. In addition, the EAC will consider whether COVID-19 and the resulting changes in our society increase the need for further public opinion research to gauge the impact of the pandemic on transportation habits, views, and preferences.

WHAT BEHAVIOURAL ISSUES ARE MOST RELEVANT TO SHIFTING MANITOBANS TO A LOW CARBON TRANSPORTATION FUTURE?

iv. The Role of Government

The Manitoba government committed to taking a leadership role to climate change in the 2017 Climate and Green Plan, which sets out a comprehensive and integrated approach to climate action based on four pillars and sixteen keystones. This plan sets out how the government will approach carbon reduction and building a low-carbon future for the province.



Active transportation (i.e., human powered travel, such as walking, bicycles, scooters, skateboards, roller blades, and others) provides both emissions reductions and health benefits. How can we increase the use of active transportation across the province?

In doing so, the government can undertake a range of approaches and specific actions for developing a green transportation strategy. Identifying what these should be is part of this consultation. The role for government in this strategy needs to be consistent with the Climate and Green Plan, lead to measurable emissions reductions, and be financially and environmentally sustainable. Choosing specific priorities to enable this strategy must be considered.

Efficiency Manitoba, the province's new crown corporation for energy efficiency, can also play an important role in providing programming support and helping to promote consumer behavioural changes.

7. Developing Recommendations for Government Action

There is no single policy solution to address the complex challenges associated with greening Manitoba's transportation sector. Instead, it is best to consider a series of actions and policy instruments that can collectively achieve our goals. These can range from symbolic and voluntary to interventionist and mandatory (see Appendix C). We need to choose what works best to move us forward. In doing so, we need to identify who is best positioned to lead in each action, whether it be governments, industry, or people.

The EAC will provide recommendations and advice for a green transportation strategy that leads to sustained emissions reductions and positions Manitoba for a low-carbon economic future.

What type of policies and programs should the province consider? Would you prefer clear provincial rules and requirements? Would voluntary measures, regulatory requirements, or other approach result in quicker, more effective, outcomes?

The financial implications to government, industry and consumers matter in this analysis. They can vary from expenditures and foregone revenues for government; cost per tonne of carbon, capital costs, and operational costs/savings for industry; and retail energy costs, vehicle purchase prices, vehicle retrofits, excise and consumption taxes for consumers. While financial analysis of the costs associated will help determine feasible options for a provincial green transportation and infrastructure strategy, they are dependent on the scope of recommendations and types of projects suggested.

Transforming our transportation sector will include different costs for different types of projects that will fall within different time frames, and the affordability of these transformational projects will need to be determined in future budgets. Further research on this is required, and will involve input from other departments, crown corporations, municipalities, government reporting entities, and key stakeholders. Examples of costs are provided in the appendix (see Appendix C). Nevertheless, these potential costs should not be a barrier to developing recommendations at the outset. Economic feasibility will be determined alongside technical evaluation of future initiatives.

Municipal/regulatory planning

Including municipal governments will be necessary in order to locate and install successful infrastructure to support the shift toward a green transportation system in Manitoba. Consideration will be given to Bill 48 (The Planning Amendment and City of Winnipeg Charter Amendment Act) and Bill 49 (The Building and Electrical Permitting Improvement Act) and its influence on planning and the built environment in Manitoba communities.

How can the province work with municipal governments to create green transportation and infrastructure systems?

Low carbon economy opportunities/growth opportunities

Manitoba's transition to a low-carbon economy and greener transportation sector will lead to new economic opportunities within the province. The specific opportunities will be driven by the decisions made and the programs and policies implemented. New employment opportunities will fall into the general categories of constructing new hard infrastructure, new services driven by the new technologies and innovations, and existing services provide on new platforms.

What are the technologies and/or sectors that Manitoba could pursue to advance a greener transportation system?

In addition to job opportunities, a transition to greener transportation in a low-carbon economy will create new business opportunities. Entrepreneurs will identify new niches that they can fill and develop new companies to serve these needs. Opportunities for private sector investment will also be created from shifting the paradigm toward green transportation. Potentially, firms that are established and grow in Manitoba will find opportunities beyond our borders, thereby creating employment and GDP in province while enabling other jurisdictions to green their transportation as well. Consideration will be given to Bill 23 (The Vehicle Technology Testing Act) and its role in enabling automated driving and related technologies across the province.

How can Manitoba utilise its current position as a regional transportation logistics cluster to integrate better technologies, processes, and regulations?

Alignment with other provincial priorities

Policy recommendations need to be tested against other provincial priorities for economic development and job creation. Existing economic development initiatives are already underway, including agricultural, rural, and northern development plans. In addition, proposed legislation to create a capital planning region (Bill 48) indicates the province's intention to greater coordination on municipal matters, including the role for transportation and related emissions reductions. Considering how transportation networks span Canada and the rest of North America, there is a benefit to work with both federal and other provincial governments in ways to support and build upon Manitoba priorities.

Should Manitoba seek to align provincial efforts to foster a green transportation sector with other provinces and territories in Canada?
If so, what might this look like? If not, what benefits would Manitoba have of "going it alone"?

8. Conclusion

The need for a new approach to transportation and infrastructure in Manitoba is clear, and the opportunity to develop a long-term strategy to reduce transportation emissions may never be better. Stakeholders are encouraged to provide input to the EAC for its consideration. We invite you to participate in one or more of our dedicated consultation sessions.

Appendix A

Consultation questions (by theme)

Definitions

- How should we define “green transportation and infrastructure” in terms of reducing GHG emissions?

Challenges

- What problems and opportunities do you see in the current transportation sector in Manitoba?
- What are the top challenges to reducing transportation emissions in Manitoba?

Transportation/Energy Options

- Active transportation (i.e., human powered travel, such as walking, bicycles, scooters, skateboards, roller blades, and others) provides both emissions reductions and health benefits. How can we increase the use of active transportation across the province?
- Manitoba generates more clean electricity than its citizens currently use, and exports the surplus to other jurisdictions. How can we use this provincial energy resource to help ‘green’ our transportation system?
- What short and medium-term options exist to reduce/replace fossil fuels with alternative, low carbon transportation energy choices in Manitoba?
- What innovations are occurring in the transportation sector that will affect low carbon transportation growth in Manitoba?

Behaviours

- What role and responsibility do transportation users have in greening the transportation sector?
- What can we do to encourage individuals, small and medium-sized enterprises, larger industries, and others to reduce transportation-related GHG emissions?

Economic opportunities

- What are the technologies and/or sectors that Manitoba could pursue to advance a greener transportation system?
- How can Manitoba utilise its current position as a regional transportation logistics cluster to integrate better technologies, processes, and regulations?

Government

- What is the appropriate role for government in the shift toward a green transportation system in Manitoba?
- What types of policies and programs should the province consider? Would you prefer clear provincial rules and requirements? Would voluntary measures, regulatory requirements, or other approach result in quicker, more effective, outcomes?
- How can the province work with municipal governments to create green transportation and infrastructure systems?
- Should Manitoba seek to align provincial efforts to foster a green transportation sector with other provinces and territories in Canada? If so, what might this look like? If not, what benefits would Manitoba have of “going it alone”?

Future

- Where is Manitoba’s biggest opportunity to reduce transportation related emissions?
- In your opinion, what are the top three priorities for transportation in Manitoba?
- What will transportation in Manitoba look like in five, ten and twenty years?

Appendix B - Jurisdictional Scan

Jurisdiction	Canada	British Columbia	Quebec	Norway	Germany	European Bank for Reconstruction and Development	United Kingdom	Australia	Korea	New Zealand	California
Documents / Sources	Transportation 2030: A Strategic Plan for the Future of Transportation in Canada Transportation Modernization Act (2018)	Clean BC Move Commute Connect, BC's Active Transportation Strategy	Energy Transition Master Plan	National Transport Plan (2018) Oslo Green Transport	Cycling in a Nutshell (2020) Electric mobility in a nutshell (2020)	Transport Sector Strategy – 2019-2040 (2019)	Road to Zero (2018) Grand Challenge Missions (updated 09/2019)	Trends – Transport and Australia's Development to 2040 and Beyond (2016)	Ministry of the Environment Website	Government Policy Statement on Land Transportation (2018) Electric Vehicles website (2019)	Senate Bill 100: The 100 Percent Clean Energy Act of 2018 State Transportation Plan ZEV Promotion Plan
Vision	A safe, secure, green, innovative and integrated transportation system that supports: trade and economic growth, a cleaner environment, and the well-being of Canada's middle class. Built around: Travellers, Safer Transportation, Green and Innovative Transportation, Waterways, Coasts and the North, and Trade Corridors to Global Markets.			At least 40% reduction compared to 1990-levels by 2030. Changes in technology and fuel to account for reductions of 9 Mt CO2, and other types of measures (e.g., freight, public transport, walking, cycling) at around 1 Mt. Objectives of the plan: Constructing new and stopping the deterioration. A better way to build the nation – not just spending more money. Wealth creation and restructuring. A Transport Plan for children- young people feel safe in their local community. The total budget was allocated for roads, railways, coastal areas, aviation, public transport, cycling and pedestrian initiatives, new technology to a greener society, etc.		Promote delivery of sustainable transport systems, which embody market principles, balance economic, environmental and social needs where not complementary and are responsive to the needs of people, industry and trade.	Be a world leader in the design and manufacturing of zero emission vehicles by 2040 (GCM).			Reduce GHG emissions from transportation and support shift to lower emitting modes.	California aims to be entirely green powered by 2045.

Jurisdiction	Canada	British Columbia	Quebec	Norway	Germany	European Bank for Reconstruction and Development	United Kingdom	Australia	Korea	New Zealand	California
Ambitions		<p>Every new passenger vehicle sold by 2040 will be zero-emission, with phased in increased to the ZEV standard (10% in 2025, 30% in 2030).</p> <p>6.0 Mt reduction by 2030 (20% reduction): Approx. 500,000 light duty ZEVs and 140,000 plug-in hybrids. 48% of passenger vehicles remain conventional gas-powered. 40% of diesel and 10% of gasoline from biofuels. Reduce fossil fuel use for transport by 20%. Government vehicles reduce emissions by 40%.</p>	<p>Targets for 2023: Improve the average energy efficiency of Québec society by 1% per year. Reduce total petroleum product consumption by at least 5% compared to the 2013 level.</p> <p>Expected results: Improve the average energy efficiency of Québec society by 1.2% per year. Reduce total petroleum product consumption by 12% compared to the 2013 level. BY 2020/21, 100,000 EVs registered. Increase urban public transit use by 5% per year.</p>	<p>By 2025, all new cars and light vans sold to be zero emission vehicles and all new urban buses to zero emitters or use biogas.</p> <p>By 2030, all new heavy duty vehicles, 75% long distance coaches, 50% of new trucks to be zero emission vehicles. By 2030, 30% blend-in of biofuel in aviation.</p> <p>Within 2030, approximately all goods distribution to be zero emission in city centres. Zero growth of private vehicles in urban centres.</p>		<p>Fund projects with green objectives, move more passengers and freight to rail.</p>	<p>Long term: By 2040, end sale of new conventional gasoline and diesel cars and vans. By 2050, almost all cars and vans to be zero emissions.</p> <p>Interim: By 2030, at least 50%, and as many as 70%, of new car sales and up to 40% of new van sales being ultra low emission.</p>		<p>Provide more electric & hydrogen vehicles for the market and offer more low carbon options for public transportation such as intercity railroad networks.</p>	<p>64,000 electric vehicles on the road by end of 2021.</p>	<p>Reducing ghg to 40% below 1990 levels by 2030 and to 80% below 1990 levels by 2050.</p> <p>By 2020, have adequate infrastructure to support one million ZEVs; By 2025, 1.5M ZEVs on the road and clean, efficient vehicles will displace 1.5B gallons of petroleum fuels annually; By 2025, 200 hydrogen fueling stations and 250,000 plug-in electric vehicle (PEV) chargers, including 10,000 direct current fast chargers. By 2030, there will be 5 million ZEVs on the road in California; and By 2030, improve freight system efficiency by 25%. By 2050, greenhouse gas emissions from the transportation sector will be 80% less than 1990 levels.</p>
Alternative fuels		<p>Low carbon fuel standard to reduce the carbon intensity of its fuels. Increasing the production of renewable transportation fuels to 650 million litres by 2030 (equates to 8% of annual use).</p>		<p>Electrification and hydrogen fuel cell sources are under consideration. Bio4Fuels shall contribute to the break through of second generation biofuels, targeting up to 30% reduction in production cost compared to today's technology.</p>	<p>Technology neutral - supporting both electric and hydrogen options. National Hydrogen and Fuel Cell Technology Programme (since 2007) has the objective to commercialize hydrogen and fuel cell technology as an alternative to fossil fuels.</p>	<p>Elements of climate resilience, low carbon, electrification, alternate fuels are referenced as potential areas of engagement across all regions the bank is involved.</p> <p>Areas of opportunity: Fleet modernization – electrification and alternative fuels.</p>	<p>Increasing low carbon fuels in the UK, reaching 7% of road transport fuel by 2032.</p>		<p>Apply tighter emission standards to diesel vehicles, expand restrictions of driving diesel vehicles, and encourage the use of eco-friendly cars.</p>		<p>Air Resources Board: Charge Ahead California Initiative was established to help place into service at least 1 million ZEVs and near-zero emission vehicles in California by January 1, 2023.</p>

Jurisdiction	Canada	British Columbia	Quebec	Norway	Germany	European Bank for Reconstruction and Development	United Kingdom	Australia	Korea	New Zealand	California
Regulations		Increase tailpipe standards for vehicles sold after 2025. By 2030, increasing the low carbon fuel standard to 20%.	Regulatory changes to provide charging installation in all new buildings. Regulatory change to adapt to new mobility technologies. Minimum renewable content thresholds for natural gas and liquid fuels in Quebec. By 2020/21, Increase renewable fuel content requirements by 2020-21.	2019, 1% blend-in of biofuel in aviation.	Since 2009, regulatory framework to make electric mobility more attractive. Electric Mobility Funding Guidelines – direct funds to local authorities and support R&D. Electric Mobility Act provides special benefits to electric vehicles – parking spaces, charging point, free parking, exempt from some access restrictions.		Ensure regulatory and enforcement regimes provide the levers needed to enable action on shops removing efficiency equipment. Vehicle emission regulations to meet EU standards, post BREXIT. Legislate ability to compel manufactures to recall vehicles for environmental nonconformity, failure or tampering with emission control systems. Possibly require new dwellings to include charge points.			Allow electric vehicles in special vehicle lanes on highways.	State agencies to develop policies that support vehicle-grid integration (VGI). Utilities to develop EV rates to ensure fueling from the grid is affordable. Mandatory building standards for EVSE installation in parking spaces at one- and two-family dwellings. State agencies to: Develop new criteria for clean vehicle incentive programs to encourage manufacturers to produce clean, affordable cars; Update the 2016 ZEV Action plan. Recommend actions to increase the deployment of ZEV infrastructure. PEV charging and hydrogen fueling are affordable and accessible to all drivers.

Jurisdiction	Canada	British Columbia	Quebec	Norway	Germany	European Bank for Reconstruction and Development	United Kingdom	Australia	Korea	New Zealand	California
Programming		<p>Incentive programs for vehicle purchase and infrastructure (e.g., up to \$6K of support per person to help with the upfront cost). Encourage / Incentivise active transportation—like the Scrap-It e-bike rebate, Learn to Ride programs and Active and Safe Routes to School.</p>	<p>Financial assistance for charging stations in MURBs, new office buildings, curbside. Financial assistance and pilot projects to promote carpooling, shuttle use, active transportation. Incentive program to increase use of fuel-efficient vehicles. Economic tools to support production and development of bioenergies.</p>	<p>Incentives for zero and low emissions / climate neutrality. Previous benefits offered to electric vehicle owners: No VAT on new cars and no VAT on leasing. Free public parking. Driving in bus lanes. Free access to toll roads and ferries. Lower annual road taxes. Incentives for transferring goods to sea –reduced costs.</p>	<p>Since 2009, over 5 billion euros invested. 300M euros for deployment of electric charging infrastructure: 100M for normal charging, 200M for fast charging. Incentives for vehicle purchase: 4,000 euro for all-electric vehicles, 3,000 euro for externally charged hybrid vehicles. 80M euro/year to fund hydrogen and fuel cell technology. Electric Mobility Act provides special benefits to electric vehicles – parking spaces, charging point, free parking, exempt from some access restrictions.</p>		<p>Extending the Clean Vehicle Retrofit Accreditation Scheme to include vans and black cabs. Consumer incentives for plug-in vehicles to exist post 2020. Support early market for used ultra low emissions vehicles with guidance and funding training.</p>			<p>\$6M (\$5.1) / year fund to encourage / support innovative low emission vehicle projects.</p>	<p>\$42M on 15 pilot projects. \$758M to support large-scale investments to support the electrification of the medium- and heavy-duty sectors in PG&E and SCE service territories and light-duty sectors in SDG&E and PG&E service territories. \$7.35M on 8 transportation electrification programs and test a new EV rate. Support to innovate and accelerate the development and deployment of advanced transportation and fuel technologies; up to \$100 million annually in a broad portfolio of transportation and fuel transportation projects throughout the state. Clean Transportation funding areas include: electric vehicle charging infrastructure, hydrogen refueling infrastructure, medium/heavy duty and natural gas vehicles, biofuels and workforce development. Active Transportation Program directs \$100 million annually from the Road Maintenance and Rehabilitation Account to the ATP. Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Grants. Electric Vehicle Supply Equipment (EVSE) Incentive Program Support - The California Electric Vehicle Infrastructure Project (CALeVIP), provides guidance and funding for local governments and organizations to develop and implement EVSE incentive programs that help meet regional needs for Level 2 and direct current (DC) fast chargers. Electric Vehicle Supply Equipment (EVSE) Loan and Rebate Program.</p>

Jurisdiction	Canada	British Columbia	Quebec	Norway	Germany	European Bank for Reconstruction and Development	United Kingdom	Australia	Korea	New Zealand	California
Taxation		Established dedicated tax on clear gasoline and clear diesel, where all funds are dedicated to public transit, with support from two municipal regions.					Take steps to stimulate adoption of fuel efficient vehicles. Possible changes to Vehicle Excise Duty to incentives to favor fuel efficient vans for new purchases.			Extend road use charge (RUC) exemption until electric vehicles make up 2% of light vehicles (approx. \$510 / year). Review fringe benefit taxation depreciation rates on electric vehicles. Review licencing fees for plug-in hybrid electric vehicles.	Beginning July 1, 2020, ZEV owners must pay an annual road improvement fee of \$100 upon vehicle registration or registration renewal for ZEVs model year 2020 and later. Advanced Transportation Tax Exclusion - The California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) provides a sales and use tax exclusion for qualified manufacturers of advanced transportation products, components, or systems that reduce pollution and energy use and promote economic development. Incentives are available until December 31, 2020.
Government leadership		Develop 5 year plan to reduce emissions from the public sector fleet (10% of passenger vehicles to be ZEVs in 2020, improve charging infrastructure, electric ferries, etc.) By 2030, government vehicles reduce emissions by 40%.		Public agencies should, to largest possible extent, use biofuel, low-or zero emission technology in own, and leased, vehicles and vessels.	74% of federal fleet is battery electric/ plug-in hybrid/ or hydrogen powered. Investing 100M euro in its fleet, in the future 20% to be electric vehicles. Providing funding to local authorities to procure vehicles and necessary infrastructure.	Governments must provide leadership through policy.	25% of the central government car fleet is ultra low emission by 2022, all new car purchases are ultra low emission by default. 100% of the central Government car fleet being ultra low emission by 2030.				
Behavioural			Public awareness and education campaign to inform citizens and dispel myths of EVs.				Take steps to stimulate adoption of fuel efficient vehicles. Education program, with industry, to inform consumers on low emission vehicles (to 2020 at least). Establish Road Transport Emission Advice Group (government/industry/ consumers) for consistent messaging on fuel and tech choices. Establish an Electric Vehicle Energy Taskforce to bring together the energy and automotive industries, in order to plan for future electric vehicle uptake.	Green Vehicle Guide website that allows consumers to compare vehicle emissions and provides basic information on what is an electric vehicle and hydrogen vehicle.		NZ\$M (\$852 thousand) / year x 5 years for electric vehicle information and promotion campaign. Establish electric vehicles leadership group with government (local and national) and industry.	

Jurisdiction	Canada	British Columbia	Quebec	Norway	Germany	European Bank for Reconstruction and Development	United Kingdom	Australia	Korea	New Zealand	California
Other	Recognizes that technologies are changing and this will impact Canada's transportation sector as technologies (e.g. 3D printing, automation, intelligent transportation systems) are adapted and incorporated.	Public transit: invest in rapid transit lines, new buses, upgrades. Active transit: design infrastructure to make walking and cycling safe. \$50M for BikeBC to support cycling infrastructure and tourism. By 2030, province to set target of doubling the proportion of trips taken using active transportation.	Research alternative fuels and lifecycle GHG emissions, with recommendations to support energy transition. Pilot projects: Fleet charging stations. Test bench to introduce hydrogen transportation. Multi-fuel station test. Fast track projects for integrated and shared mobility services. Ensure integrated and interconnected multimodal systems to reduce GHGs on intermodal projects (e.g., rail and maritime services).	By 2025, shore side electrical power and charging power are to be available for ships in major ports. By 2030, 40% of all ships in local shipping are to run on biofuels or be low-/Zero-Emission vessels. New ferries and speed boats are to run on biofuels, low-or Zero-Emission technology. Improved road access to ports and terminal. Transfer from roads to sea and railway. Railways to become more reliable – increased capacity.	Developing 'National Cycling Plan 3.0' with the following objectives: Seamless cycling infrastructure. Vision zero for cycling (safe for everyone). Urban cargo transport for the last mile. Create a country of cycling commuters. Cycling to become intelligent/smart/interlinked (use data for infrastructure planning and traffic management). Cycling to be heart of modern mobility system.	Aim to promote lower emissions transportation with energy efficiency, energy management systems, fleet renewal.	Launch call for evidence on particulate emissions. Technology neutral approach.	Congestion in urban centres can motivate people to active transportation options. Autonomous vehicles may, in the future, be more efficient and reduce emissions.		Improve efficiencies in transportation network with use of technology. Explore bulk purchase of electric vehicles – public and private.	Active Transportation Program was created to encourage increased use of active modes of transportation, such as walking and biking, increasing the proportion of trips accomplished by walking and biking.
Challenges noted					Ticket sales provide less than half of the funds spent on public transport annually. Recognized that people will not purchase electric vehicles in a reasonable time and in close proximity to home/work.	Noted that a challenge to electrification of transportation is absence of policy direction from governments. Battery limitations are a challenge with respect to heavy transportation.		Growth in ridership on public transportation is thought to be driven by population growth. Low population density is negatively impacting cost recovery for public transit.			

Jurisdiction	Canada	British Columbia	Quebec	Norway	Germany	European Bank for Reconstruction and Development	United Kingdom	Australia	Korea	New Zealand	California
Heavy Vehicles			Work with centre for innovation in logistics and sustainable supply chains to reduce emissions from road transport and goods handling. Develop new approaches and technologies for new business models for collective / shared delivery (e.g., load optimization, interoperable intelligent transport systems, etc.).	More load per transport. Utilization of larger, modular trailers to reduce costs.	Funding is provided to assist with purchase of electric or hydrogen drive trains for bus and freight transport.	Battery limitations are a challenge with respect to heavy transportation.	Introduce voluntary target of 15% ghg reduction by 2025 over 2015 level. Launch research project with Highways England to identify and assess emissions technologies for HDV. Work with industry to develop low emission standard for trucks. Undertake further emissions testing of the latest natural gas HDVs to gather evidence that will inform decisions on future government policy and support for natural gas as a potential near-term, lower emission fuel for HGVs.			Road use charge exemption for heavy vehicles until they account for 2% of fleet.	Air Resources board : developed programs and policies to reduce emissions from on-road heavy-duty diesel vehicles through the installation of verified diesel emission control strategies (VDECS) and vehicle replacements. By 2030, deploy over 100,000 zero emission freight vehicles and associated equipment, maximizing the number of vehicles powered by renewable energy. 2040, all public transit agencies must transition to 100% zero-emission bus fleets.
Electric Vehicle Infrastructure		Invest in electric and hydrogen fueling infrastructure.	Increase the number of charging stations. Increase the installation of fast charging stations over five years. Work on new charging solutions for EVs.				Launch £400 million Charging Infrastructure Investment Fund to help accelerate charging infrastructure deployment. Make charge points available at motorway service areas and large fuel retailers, through Automated and Electric Vehicles Bill. Increasing the grant level of the Workplace Charging Scheme from £300 per socket to 75% of the purchase and installation costs of a charge point capped at a maximum of £500 per socket. Reviewing the provision of residential charge point infrastructure for those who have communal parking facilities, or do not own their own home. Investing £4.5 million in the On-street Residential Charge point Scheme until 2020. Local planning policies to incorporate facilities for charging electric vehicles. Consulting on amending Building Regulations to require relevant charging provision in new non-residential buildings.			Government agencies to coordinate activities and support development of public charging infrastructure.	California public utilities commission reviewing \$1B infrastructure program. California Public Utilities Commission (PUC) must establish strategies and metrics to maximize the use of PEV grid integration for a ten-year plan.

Jurisdiction	Canada	British Columbia	Quebec	Norway	Germany	European Bank for Reconstruction and Development	United Kingdom	Australia	Korea	New Zealand	California
Electric - other						<p>Challenges for electrification include: Government leadership/policy. Lack of charging infrastructures. Funding to expand.</p> <p>Bank identified: Support for urban and long distance charging infrastructure as area of interest.</p> <p>Areas of opportunity: Renewal of light duty fleets. Fleet modernization – electrification and alternative fuels.</p>	<p>Last mile deliveries, gathering further evidence of any key network connection infrastructure barriers, which may prevent further uptake of ultra low emission vehicles, specifically for fleet operators.</p> <p>Electric vehicle charge point design competition. Determine whether any significant gaps in charging infrastructure provision appear over the medium term, and considering whether there may be a case for direct central government support in areas of market failure, which may include rural areas.</p>				
Support for local action							<p>Fulfilling a £48m ultra low emission bus scheme funding round to accelerate uptake and deployment of supporting infrastructure. Launching a second round of funding for local authorities to roll out dedicated taxi charging infrastructure. We will make available a minimum of £6 million to support more local areas to make the switch. Setting out definitions of ultra low and zero emission vehicles that local areas may adopt. Running a series of roadshows across the UK on best practice approaches to driving the uptake of ultra low emission vehicles.</p>				

Appendix C

Types of policy recommendations

There are several types of policy recommendations that can contribute to a green transportation and infrastructure strategy. They range in terms of the degree of government intervention. A main premise of policy recommendations is the recognition that no single response is sufficient to address multi-faceted policy challenges like transportation and infrastructure. Instead a combination of policy measures is needed to respond to several, sometimes contrasting, conditions in order to achieve the desired outcomes. This is especially true for climate policies, which tend to influence other policy areas that have an effect on environmental, economic, societal, technological, and institutional outcomes.

Advocate/Representational policies include leadership statements or other symbolic forms of public endorsement, such as a notional target for EV market share by a given year or a public commitment (verbal or financial) to transform the transportation sector according to a given set of goals (e.g., GHG reductions, economic growth).

Public awareness policies include all efforts to provide information and education of green transportation so that user-groups can make their own decisions to regarding their transportation needs and how they match with societal objectives. Examples include safe cycling practices and anti-idling campaigns. They can be more involved and extend outward to target specific individuals and groups, such as arranging test drives of alternative power train vehicles as a way to increase awareness on a person-by-person basis.

Self-regulation is a common method that enables industries and sectors to encourage the use and development of best practices, product standards, and other quality assurance measures. These might include permitting automobile companies to determine their own fleet fuel efficiency as a way to reduce emissions or setting minimum performance requirements on transportation fuels. These requirements can be adopted in legislation by provincial governments, but can also be vetted and approved by federal agencies (e.g., Canadian General Standards Board, Standards Council of Canada).

Private-sector action can involve engaging the self-interest of individuals and businesses to support broader government goals. Cost savings (e.g., through energy efficiency and curtailment) can motivate individuals to reduce household expenses. Occasionally this can involve opening and/or supporting competition for businesses to pursue market opportunities that were once in the public domain or, in some cases, have not yet fully emerged.

Public spending is the most direct and immediate way to stimulate a shift toward a green transportation sector. Whether they involve direct incentives, public infrastructure investment, tax expenditures (tax credits), or deferred revenues (tax holidays), public investment has historically been a critical contribution to major system changes (e.g., national railroad, TransCanada Highway, national air services, TransCanada Trail, provincial utilities and telecommunications services, and national and northern internet services, to name a few).

Taxation as a policy measure is always an important policy tool, and has recently influenced the role of governments to tackle climate change. The concept has manifested as practical applications of the federal carbon tax, provincial green levy, vehicle taxes, fuel taxes, toll fees, etc.

Public ownership as a policy decision involves government intervention into the economy, and can include government fleet transformation, public/crown corporation ownership of EV charging stations, public management of ports and other types of transportation infrastructure.

Legislation/regulation is a fundamental policy domain that provides the clearest statement and direction of government intention. For example, statutory systems are used when prohibiting undesirable practices and technologies or requiring minimum performance measures on green transportation and infrastructure. The Climate and Green Plan Act is an example of a critical statutory policy decision to enable Manitoba to pursue its Climate and Green Plan.

Appendix D

What will it cost?

The table below outlines some general cost projections based on previous energy and infrastructure projects. These costs are often historic, and will change depending on the specific details of given projects (e.g., width and depth of highway, type of technology, cost of borrowing money, etc).

Further research and analysis is needed to provide accurate cost estimates of potential public and private investment into a green transportation and infrastructure system for Manitoba.

Item	Cost	Unit
4 lane high speed divided highway	\$36 M	kilometer
Roundabout (rural)	\$2.8 M	project
Active transportation pathways	\$1 M	kilometer
Arlington rail yard relocation	\$1-2 B	project
Arlington bridge replacement	\$330 M	project
Waverley underpass	\$100 M	project
Centreport Canada (total project)	\$460 M	project
CentrePort Canada Way (highway only)	\$212 M	project
Centreport Canada railyard (rail only)	\$100 M	project
Churchill rail line and port repair	\$117 M	project
Southwest Rapid Transit Corridor	\$467 M	project
Public transit electric bus (purchase)	\$1 M	bus
Public transit electric bus - rapid charging system	\$210,000	three buses
Public transit electric bus - depot charging system	\$220,000	three buses
Home EV charging system – level 2	\$1,000 - \$1,500	unit
Workplace EV charging system – level 2	\$4,000	unit
Public DC fast charging system – level 3	\$50,000 - \$100,000	unit
Renewable fuels – biodiesel/HDRD	1.2 – 6.7 cents	litre (retail)
Renewable fuels – ethanol	0 – 1.5 cents	litre (retail)
Renewable fuels – blending infrastructure	\$10 M (biodiesel/HDRD) \$2 M (ethanol)	fuel terminal (MB has two fuel terminals and SK has one that supplies MB)